WATER SUPPLY ASSESSMENT FOR THE SIERRA VISTA SPECIFIC PLAN

Prepared By

City or Roseville

Environmental Utilities Department

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INTRODUCTION

PURPOSE

Senate Bill 610 requires a City or County to request and the public water system to prepare, an assessment of the availability of water supplies for certain large development projects. Such a water supply assessment (WSA) is performed in conjunction with the land-use approval process associated with the project and must include an evaluation of the sufficiency of the water supplies available to the water supplier to meet existing and anticipated future demands, including the demand associated with the project over a twenty-year horizon that includes 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 assessment should indicate whether the 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 and should provide a detailed description of the efforts being undertaken in the basin to eliminate the long-term over draft condition.

If the WSA concludes that additional water supplies are necessary, the public water supplier must submit plans for acquiring the additional water supplies, setting forth the measures that are being undertaken to acquire and develop those supplies. The future water supply projects and programs discussion may be based upon proposed methods of financing, estimated costs, information related to federal, state and local permits and the estimated timeframes within which the public water system expects to be able to acquire the additional supplies.

PROJECT DESCRIPTION

This WSA is prepared for the proposed Sierra Vista Specific Plan (SVSP), an approximately 2,064 acre mixed use development project proposed in Placer County, California, south and west of the City of Roseville, Figure 1. The project site is located approximately 6 miles west of Interstate 80 and State Route 65, 10 miles northeast of the City of Sacramento, 10 miles east of State Route 99, 5 miles west of downtown Roseville, and 4 miles east of the Sutter County line. The proposed project site is west of Fiddyment Road and north of Baseline Road and extends west from Fiddyment Road to approximately ½ mile west of the intersection of Watt Avenue and Baseline Road.

PROJECT AREA CHARACTERISTICS

The SVSP is currently undeveloped annual grasslands that were historically used for seasonal cattle grazing. The project area is located within the Curry Creek watershed. The Curry Creek watershed totals approximately 16.5 square miles and slopes from east to west. The elevation in the upper watershed is approximately 120 feet, decreasing to approximately 45 feet in Sutter County. The land formation within the project area is generally composed of rolling topography with mild slopes. The elevation of the project area is approximately 155 feet above mean sea level (msl).

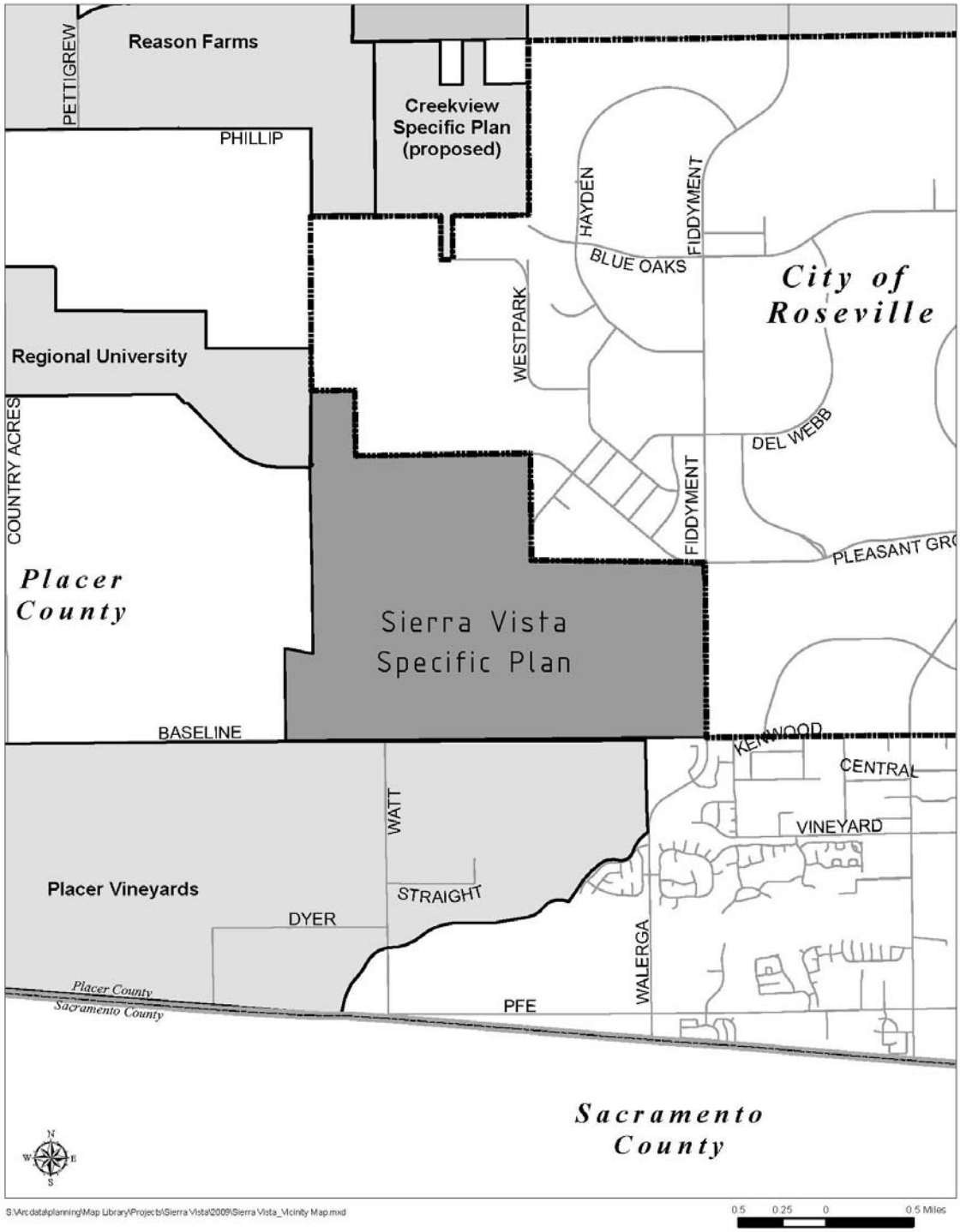
PROJECT BACKGROUND AND HISTORY

Pursuant to the California Environmental Quality Act (CEQA), the City is preparing the Sierra Vista Specific Plan Environmental Impact Report (EIR) that evaluates the environmental impacts of the proposed SVSP. Information from this WSA is used in the analysis of project impacts in the Public Utilities section of the EIR. The EIR includes extensive analysis of the potential environmental impacts of the water supply strategy for the project.

The SVSP EIR examines the potential effects of a proposed project that includes: 1) amending a 2,064-acre area, immediately west of the City of Roseville (City) corporate boundaries, north of Baseline Road, west of Fiddyment Road in unincorporated Placer County into the City's jurisdiction (annexation); 2) expanding approximately 373 acres, of the City's Sphere of Influence (SOI) over a small portion of the western boundary), and 3) adopting the Sierra Vista Specific Plan (SVSP) and associated entitlements.

The Sierra Vista Specific Plan (SVSP) is a proposed specific plan project that would include development of a mix of land uses, including 6,650 residential units, approximately 216 acres of commercial and office uses, approximately 61 acres of public/quasi-public, 267 acres of open space uses, and 97 acres of parks. The majority of the proposed project site is within the City's SOI, which was expanded in 2004, as part of the West Roseville Specific Plan (WRSP) annexation.

FIGURE 1

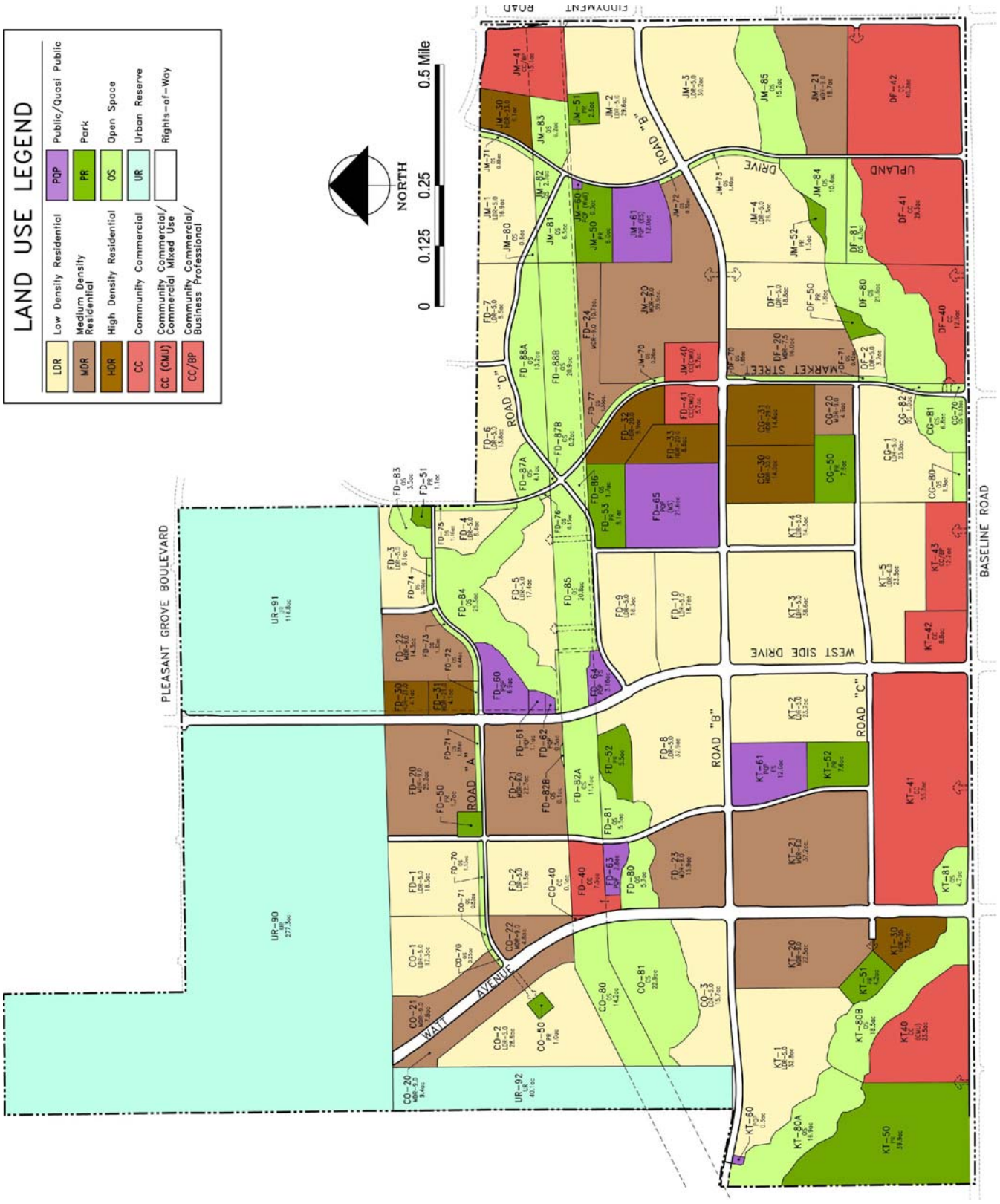

Reason Farms
PETTIGREW
Creekview Specific Plan (proposed)
PHILLIP
HAYDEN
FIDDYMENT
BLUE OAKS
City of Roseville
WESTPARK
Regional University
COUNTRY ACRES
DEL WEBB
FIDDYMENT
PLEASANT GR
Placer County
Sierra Vista Specific Plan
BASELINE
KENWOOD
CENTRAL
VINEYARD
WATT
Placer Vineyards
STRAIGHT
DYER
WALERGA
Placer County
Sacramento County
PFE
Sacramento County
N
W
E
S
S:\Arcdata\planning\Map Library\Projects\Sierra Vista\2009\Sierra Vista_Vicinity Map.mxd
0.5 0.25 0 0.5 Miles

Concurrent with the WRSP annexation, the City's SOI was amended to align with the boundary of the 5,500-acre Memorandum of Understanding (MOU) Transition Area between the City and Placer County. The MOU Transition Area was established in 1997 to foster cooperative land use planning between each jurisdiction, and applies to the land area two miles west of Fiddyment Road and north of Baseline Road. The approval by the Local Agency Formation Commission (LAFCO) of the SOI expansion constituted recognition by both the City and Placer County that the remainder of the MOU Transition Area was a likely future growth area for the City. The MOU sets forth additional requirements for processing project approvals, including submittal of certain information, input by the Placer County Board of Supervisors regarding annexations, adherence to minimum development standards, and mitigation of traffic impacts. Approximately 373 acres of the SVSP are west of the City's MOU and SOI boundary, and therefore, one action of the proposed project would also include a SOI amendment.

PROPOSED PROJECT

The SVSP project proposes to annex the property into the City of Roseville and change the adopted land use and zoning presently in Placer County. The Placer County General Plan currently designates most of the project site as Agriculture/Timberland, 80-acre minimums. The SVSP is designated in the Placer County Zoning Ordinance as Farm Combining Building, Site, 80-acre (FB-X-80). The SVSP would change the existing General Plan and Zoning from farm uses on approximately 2,064 acres to allow a mix of commercial, business professional, and residential land uses with up to 6,650 residential units. The summary of the proposed land use designations are graphically illustrated on Figure 2.

Figure 2


LAND USE LEGEND
LDR
Low Density Residential
MDR
Medium Density Residential
HDR
High Density Residential
CC
Community Commercial
CC (CMU)
Community Commercial/ Commercial Mixed Use
CC/BP
Community Commercial/ Business Professional
POP
Public/Quasi Public
PR
Park
OS
Open Space
UR
Urban Reserve
Rights-of-Way
NORTH
0
0.125
0.25
0.5 Mile
PLEASANT GROVE BOULEVARD
ROAD "A"
ROAD "B"
ROAD "C"
ROAD "D"
WEST SIDE DRIVE
MARKET STREET
BASELINE ROAD
WATT AVENUE

As shown on Figure 2, Sierra Vista Specific Plan's proposed land use plan includes low, medium, and high density residential uses; community commercial; commercial mixed-use; commercial/business professional mixed-use; public/quasi-public; parks and recreation areas, open space, and paseos; landscape corridors; urban reserve areas; and roadways. At buildout, the proposed project would provide approximately 6,650 dwelling units, generate a population of approximately 16,891 persons, based on the City of Roseville's General Plan assumption of 2.54 persons per household. The project would also add approximately 2,235,000 square feet of commercial and employment uses, resulting in approximately 4,966 jobs, assuming one job per 450 square feet of commercial/office space. The Sierra Vista Specific Plan also includes 432 acres of Urban Reserve Area. While this WSA includes the Urban Reserve area, no development is proposed on those parcels. The Sierra Vista Specific Plan's proposed land use designations, applied zoning districts, acreages, and total dwelling units are summarized in Table 1.

TABLE 1
SVSP LAND USE SUMMARY

Land Use Designation		Applied Zoning Districts	Acres	Units
Residential Neighborhoods				
LDR	Low Density Residential	RS/DS	502.4	2,524
MDR	Medium Density Residential	RS/DS and R3/DS	250	2,221
HDR	High Density Residential	RS/DS and R3/DS	67.9	1,650
	Subtotal		*820.3*	*6,395*
Commercial and Employment				
CC	Community Commercial (Commercial Mixed-Use)	CMU/SA	34.9	255
CC/BP	Community Commercial/ Business Professional (Mixed-Use)	CC/SA	27.3	--
CC	Community Commercial	CC and GC	153.7	--
	Subtotal		*215.9*	*255*
Open Space/Public				
P/QP	Public/Quasi-Public	P/QP	60.7	--
P/R	Parks and Recreation	P/R	90.6	--
OS	Open Space	OS	266.9	--
OS	Paseos	OS	14.0	--
UR	Urban Reserve	UR	432.2	--
	Subtotal		*864.4*	--
Roadways and Landscape Corridors			*163.5*	--
TOTAL			**2,064.1 Acres**	**6,650 DU**

DESCRIPTION OF THE CITY OF ROSEVILLE SERVICE AREA

The City of Roseville is located in Northern California's Central Valley, 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, 5, & SJWD) are either serviced by gravity, require boosting or are served by adjacent water agencies that have sufficient pressure to serve these areas. The proposed SVSP would be included in Pressure Zone 4.

SCOPE OF WATER SUPPLY ASSESSMENT

This WSA discusses historic water supplies, current water supplies, and additional sources of supply that will be available to serve planned future growth. 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 demand.
- 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.
- 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 SVSP project contains information derived from several sources including:

- *TM-1 – Unit Water Demand Factor Verification and Water Demand Evaluation and Update, MWH*, September 2006
- *Sierra Vista Potable Water Master Plan,* HydroScience Engineers, Inc. , April 2009 and as amended July 2009
- *TM-1 Sierra Vista Specific Plan Water Conservation Plan,* HydroScience Engineers, Inc. , July 2009
- *Sierra Vista Recycled Water Master Plan,* HydroScience Engineers, June 2009 and as amended July 2009
- *SVSP Feasibility Analysis,* April 2007
- *West Roseville Specific Plan FEIR,* February 2004
- *City of Roseville Urban Water Management Plan,* Brown and Caldwell, 2006
- *Placer Groundwater Management Plan,* PCWA 1998
- *Western Placer County Groundwater Management Plan,* MWH ,August 2007
- *Water Forum Agreement Final EIR,* November 1999
- *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*
- *Groundwater Impact Analysis for Proposed Reasons Farms Land Retirement Plan, MWH, June 2003*
- *PCWA's Integrated Water Resources Plan,* Brown and Caldwell, August 2006
- *TM 5a – Market Assessment for Recycled Water Distribution System,* RMC, Updated February 2008

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. Water Code Sections 10910 – 10915 delineate the specific information that must be included in the WSA.

This WSA is structured in way that clearly shows which portion of the Water Code Section is being satisfied by stating the section number and title. Additional information is provided where it is useful in the understanding of the proposed Project, its water demands, and its 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 Sierra Vista Specific Plan (SVSP) is subject to CEQA.

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 SVSP.

Section 10910(c)(1) Determine if the most recent Urban Water Management Plan (UWMP) includes projected water demand associated with the project.

The 2005 UWMP dated March 2006, which was adopted by City of Roseville's Council Resolution 06-108, identifies current and projected water supply and demand through 2030 based on General Plan buildout. Because the proposed project is an annexation, water demands for the SVSP were not included in the 2005 UWMP. The 2005 UWMP will 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 can cover an acre of land at a depth of one foot and equals 325,828 gallons. Total water

demand for buildout of the City's existing General Plan and the SVSP was developed using the City's unit demand factors and applying those factors to the proposed land uses for the plan area.

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 in instances when recycled water is not available. Potable water demand needs are typically met by surface water supplies and supplemented by groundwater supplies for backup during emergency or surface water shortage conditions. Recycled water is tertiary treated wastewater and is a component of the overall water demand that can be used for irrigation. Net potable demands are calculated by subtracting estimated recycled water demands from the total water demand of the City.

The City's unit water demand factors are based upon actual customer water meter usage 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 re-confirm the unit demand factors using a longer history of available water meter data from City customers. This study, *TM-1 – Unit Water Demand Factor Verification and Water Demand Evaluation and Update by MWH, September 2006* is provided in Attachment 1 of this WSA. The study re-confirmed the appropriateness of the unit demand factors developed in 2002. These factors are provided in Table 2.

TABLE 2

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

The total water needed for buildout of the City's existing General Plan and the SVSP was determined by applying the demand factors in Table 2 to proposed land uses in the SVSP and the Urban Reserve parcels. Finally, a two percent factor is added to account for water system losses.

General Plan Buildout Demands

At buildout of the City's current General Plan, water demands are estimated to reach 58,582 AFY. Table 3 provides a summary of these demands.

TABLE 3

GENERAL PLAN BUILDOUT WATER DEMANDS

Project Land Use	Water Demand (AFY)
Low Density Residential	23,655
Medium Density Residential	7,135
High Density Residential	3,520
Commercial	6,418
Commercial Business Park	2,423
Industrial	1,532
Light Industrial	3,644
Public/Quasi Public	971
Parks	5,990
Rail Road	70
Schools	2,076
Open Space	0
Water Demand	**57,434**
2% of Losses (a)	1,148
Total Water Demand	**58,582**

SVSP Water Demands

Development of the SVSP area would include residential, commercial, business professional, and school uses that would require water. Water demand for the Urban Reserve parcels were assumed at no more then one unit per parcel and assigned the City's lowest density residential unit demand factor of 728 gallons per day per dwelling unit. The total water demand for the Project, as summarized in Table 4 below, is estimated to be 3,612 AFY. This amount includes 4,252 AFY for the SVSP, 3 AFY for the Urban Reserve parcels, 86 AFY for system losses (2% of total demand) and a water demand reduction of 729 AFY for water conservation measures.

The SVSP has included significant water conservation measure 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.

The Sierra Vista Potable Water Master Plan dated April 2009 by, HydroScience Engineers, Inc, and as amended July 2009 (included as Attachment 2) to include information from TM #1 – Sierra Vista Specific Plan Water Conservation Plan dated July 6, 2009 by HydroScience Engineers, Inc (included as Attachment 3) provides the calculations showing the demands for the project and the estimated water saving expected from the conservation measures identified for inclusion in the SVSP.

TABLE 4

SVSP WATER DEMANDS

Project Land Use	Water Demand (AFY)
Low Density Residential	1,696
Medium Density Residential	804
High Density Residential	327
Commercial Mixed Use	144
Park	303
Open Space	0
Public/Quasi Public	213
Community Commercial	412
Commercial Business Park	71
Landscape Corridor	235
Paseo	47
Urban Reserve (Richland and Chan)	3
Major Roads	0
Water Demand	**4,255**
2% for Losses (a)	86
SVSP Water Conservation Reduction	-729
Total Water Demand	**3,612**

(a) Losses: SVSP = 85 AFY and UR = 1 AFY

Development of the SVSP in combination with projected water demand for buildout of the City would be 62,194 AFY (58,582 AFY + 3,612 AFY).

Section 10910(c)(2) If demands are included in most recent UWMP; incorporate information from the UWMP in the WSA.

As indicated above, a water demand for the project site was not included in the City's 2005 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.

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 water, and 3) groundwater in dry years or in times of emergency. Each are 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, and the Citrus Heights Water District. Interties are connections between existing distribution systems that can be used to deliver water between districts 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 USBR from the Central Valley Project (CVP) supply from Folsom Lake; a 10,000 AFY contract and two 10,000 AFY contract options 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 5, summarizes the City's water contracts.

TABLE 5

CITY OF ROSEVILLE SURFACE WATER CONTRACTS

Contracted Water Supply Source	Contract Amount (AFY)
USBR (CVP supply)	32,000
PCWA (MFP supply)	30,000
SJWD (wet year only – MFP supply)	4,000
Total Contracted Supplies	**66,000**
Available Supplies: Normal/Wet Years	58,900
Available Supplies: Driest (Critically Dry) Years	39,800

The City of Roseville is a signatory to the Water Forum Agreement (WFA), which provides a framework for future surface water and groundwater supplies in the region through the year 2030. Although water contract entitlements total 66,000 AFY, the City's diversions from the American River are limited by the Water Forum Agreement (WFA). 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 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 is limited 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. It is important to note that during driest years, the City agreed to a requirement that an additional 20,000 AFY of water be made available for release down the American River by PCWA through re-operation of their Middle Fork project. This 20,000 AFY of re-op water is not a portion of the City's contracted supply of 66,000 AFY and is described further herein. 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 with similar release requirements from PCWA In driest years, per the City's WFA, the maximum diversion from the American River is limited to 39,800 AFY. In below average to dry years, the City may divert an amount between 58,900 and 39,800 AFY from the American River based on unimpaired flow into Folsom Lake.

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. City baseline diversions in 1995 were 19,800 AF. Because annual municipal and industrial (M&I) 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 as part of the Water Forum to offset a portion of the demand in drier and driest years by facilitating the release of up to 20,000 AF (the difference between 39,800 AF and 1995 levels of 19,800 AF) of water down the American River. The City is working with PCWA on a re-operation plan for drier and driest years from PCWA's Middle Fork Project (MFP) that will allow the release of up to 20,000 AFY of raw water down the American River to offset increased diversions above 1995 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 by the WF purveyor specific agreement as discussed above.

Based on over 107 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, 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 dry-year and critically dry (driest)-year deficiencies.

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 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 include the Dry Creek wastewater treatment plant (DCWWTP) and the Pleasant Grove wastewater treatment plant (PGWWTP). Both plants produce a Title 22 quality effluent that is available for recycled water applications. Recycled water for this project will be provided from the Pleasant Grove WWTP.

The City prepared the South Placer Regional Wastewater and Recycled Water Systems Evaluation (Systems Evaluation, June 2007) which delineates the 2005 regional wastewater service area boundary

(2005 SAB) and provides baseline and projected characterizations of its regional wastewater and recycled water systems. The 2005 SAB includes areas within Roseville, Rocklin, Loomis, and portions of Granite Bay and unincorporated Placer County. Chapter 6, Recycled Water Systems Evaluation, of the Systems Evaluation report was conducted to assist in the ongoing expansion of a regional water recycling system. The goal of utilizing recycled water supplies is to promote responsible water supply management by beneficially reusing available tertiary treated recycled water for irrigation use 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 within and outside of the City limits. Of this amount, approximately 2,040 AFY are 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 1,785 AFY for a total recycled water demand of 3,825 AFY at buildout of the City's existing General Plan (RMC TM 5a, Market Assessment for Recycled Water Distribution System, updated February 11, 2008). Recycled water is expected to be available in all hydrologic year types.

As documented in the *Sierra Vista Recycled Water Master Plan,* HydroScience Engineers, June 2009 and as amended July 2009, the project recycled water demand, after implementation of water conservation measures totals 563 AFY of recycled water at buildout. A copy of the Recycled Water Master Plan is included as Attachment 4 to this document. When considering buildout of the existing General Plan in a addition to the Project, a total of 4,388 AFY is available to offset total water demands at buildout. This includes 3,825 AFY within the existing City General Plan area and 563 AFY of recycled water usage within the SVSP area. The use of recycled water as an assured water supply source reduces total water supply needs for the build out of the City and the Project to 57,806 AFY (62,194 AFY – 4,388 AFY RW supply).

Groundwater

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. The City's WFA recognizes the extraction of up to 6,600 AFY of groundwater during the drier and driest WFA hydrologic year types. The City is pursuing an aquifer storage and recovery (ASR) program. Although not included in this Project, ASR would allow the City to store treated drinking water in the aquifer for use when needed. Under such a program, surface water could be injected into the aquifer during wet times (wet years or during the rainy season), and then the City's groundwater wells could pump stored water during drier times or be used 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 and other state agencies in developing

its ASR program. This has included the injection of potable water taken from the City's distribution system into the aquifer and subsequent extraction and delivery to City water customers. Prior to this testing program for ASR, the last time the City relied on groundwater was during drought conditions experienced in 1991. 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 four groundwater well facilities which are capable of delivering approximately 12,000 AFY of water supply if run full time for the entire year. A more realistic production is 33 AF per day when utilized for short term water supply. These wells are maintained primarily as a backup water supply and for improving water supply reliability. The City has plans to expand its groundwater well network. Seven groundwater well sites are available in the City for construction of new wells. Future wells will be designed to include provisions for ASR. Once built, the City's groundwater facilities would allow for delivery of up to 73 AF per day or 27,500 AFY if run on a continuous basis.

Water Demands

Water demand is the amount of water required to service a customer on an average 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 for the plan area.

The City's unit demand factors are based upon actual customer water meter usage 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 re-confirm the unit demand factors using a longer history of available water meter data from City customers. This study, *TM-1 – Unit Water Demand Factor Verification and Water Demand Evaluation and Update by MWH, September 2006*, re-confirmed the appropriateness of the unit demand factors developed in 2002. These factors were provided previously in Table 2.

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 demand 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 outside irrigation use.

Potable demands are calculated by subtracting estimated recycled water demands from the total water demand.

Existing and Buildout Water Demand

The City's total water demand in 2008 was 36,559 AFY. Of this demand approximately 2,040 AFY was met through recycled water supplies. At buildout of the City's General Plan, water demands are estimated to reach approximately 58,582 AFY of which 3,825 AFY will be met through recycled water supplies.

SVSP Water Demands

Development of the SVSP area would include residential, commercial, business professional, and school uses that would require water. The potable water demand for the project was determined utilizing unit water demand factors identified in Table 2 and applying those factors to proposed land uses in the SVSP and the Urban Reserve parcels then subtracting recycled water supplies and estimated savings from planned water conservation measures. In calculating water supply, a two percent factor is added in to account for water system losses. For purposes of the CEQA project level analysis, development within the Urban Reserve parcels was assumed at no more then one unit per parcel and assigned the City's lowest density residential unit demand factor of 728 gallons per day per dwelling unit.

The SVSP 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.

TM #1 – Sierra Vista Specific Plan Water Conservation Plan dated July 2009 by HydroScience Engineers, Inc (included as Attachment 3) provides the calculations showing the estimated water saving expected from the conservation measures identified for inclusion in the SVSP project.

The total water demand for the Project is estimated to be 3,612 AF/year as described previously in Section 10910(c)(1). Development of the SVSP in combination with projected water demand for buildout of the City would be 62,194 AFY (58,582 AFY + 3,612 AFY). Total water demands for the City and the project at buildout are summarized in Tables 3 and 4, above.

Water Supply vs. Water Demand

The City of Roseville currently supplies surface water for municipal and industrial (M&I) uses. This requires firm surface water contract amounts to ensure that proper supplies are maintained for the residents and businesses relying on this supply of water. The estimates in the 2005 UWMP update show that in normal water years the City of Roseville has sufficient water to meet its customer's needs through 2030. Table 6 provides a comparison of projected water supply vs. projected water demand through 2030. In times of drought and water shortage, the urban demand is expected to decrease by a minimum10 percent as a result of increased conservation awareness and regulations. Water available from surface water supplies would be supplemented with use of recycled water and groundwater. It is expected that if supply were to be reduced due to shortage consistent with reductions identified in the WFA, existing supply is sufficient to meet existing City-wide demands.

Table 6

Water Demand – Supply Availability for Current General Plan

Year	Normal Year demand, Acre-feet/year	Surface Water Available (Normal) Acre-feet/year	Recycled Water Available Acre-feet/year
2009	38,912	58,900	2,540
2010	40,254	58,900	2,628
2011	41,864	58,900	2,733
2012	43,474	58,900	2,838
2013	45,084	58,900	2,943
2014	46,695	58,900	3,048
2015	48,305	58,900	3,153
2016	49,271	58,900	3,216
2017	50,237	58,900	3,279
2018	51,203	58,900	3,342
2019	52,169	58,900	3,405
2020	53,135	58,900	3,468
2021	53,667	58,900	3,503
2022	54,198	58,900	3,538
2023	54,729	58,900	3,572
2024	55,261	58,900	3,607
2025	55,792	58,900	3,642
2026	56,350	58,900	3,678
2027	56,908	58,900	3,715
2028	57,466	58,900	3,751
2029	58,024	58,900	3,788
2030	58,582	58,900	3,825

Normal / Wet Years

Assuming the City and SVSP buildout by 2030 and as described in the previously in this document, water demands would total 61,194 AFY. When considering total recycled water supplies of 4,388 AFY

the resultant surface water supply need would be 57,806 AFY. 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 like recycled water and groundwater. Recycled water offsets the use of surface water supplies by reducing the City's reliance on American River supplies by filling 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 American River (surface water) 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.

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 pattern scenarios. The first scenario considers water supply cut backs per the City' WFA (reference Figure 3). The second scenario considers reasonably foreseeable USBR water supply cutbacks as a result of current Operations Criteria and Plan (OCAP) discussion.

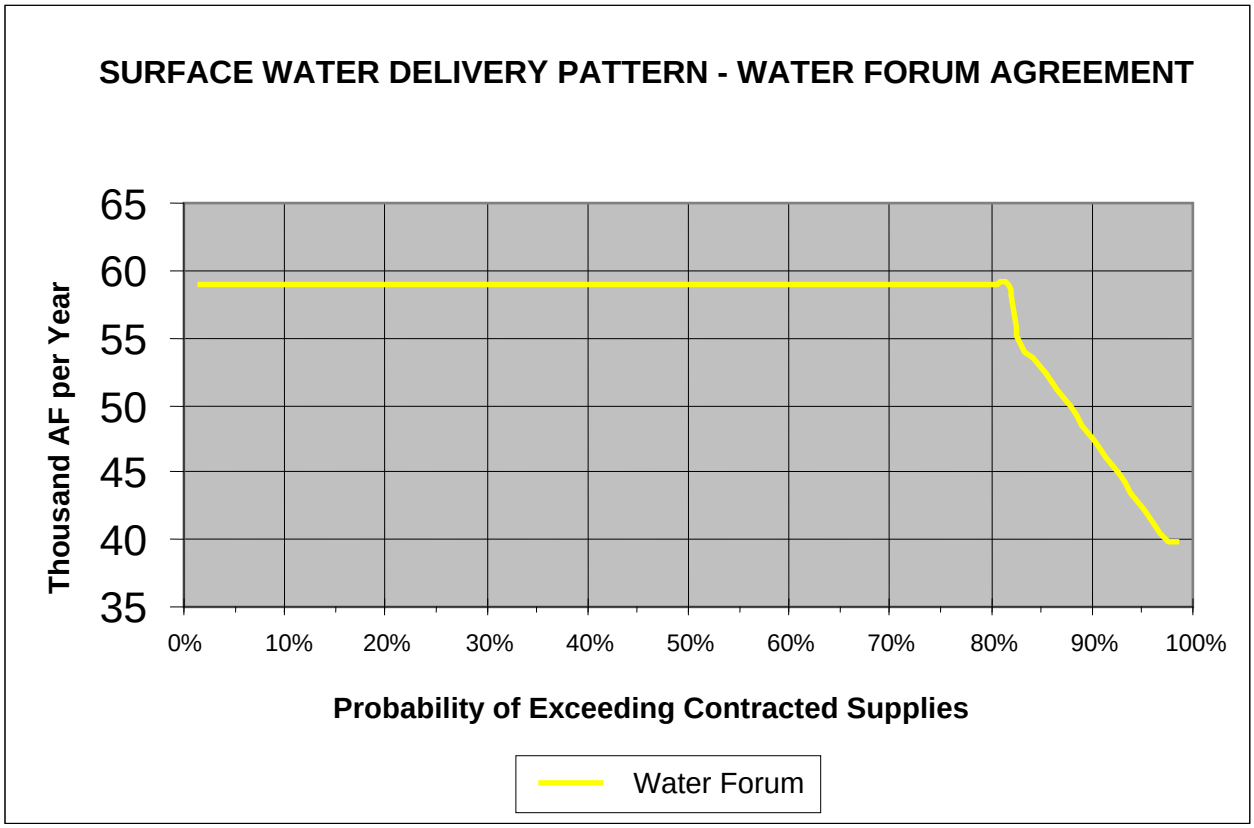
Water Forum Agreement Delivery Pattern

The City participated in the Water Forum, a regional stakeholder effort concerned with the protection of the Lower American River and reliable water supplies. The Water Forum resulted in the development of purveyor specific agreements that outline how suppliers 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 5. Based on over 100 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, quantities from 58,900 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 and the dry year supply) is needed to make up for the dry-year and driest-year deficiencies. Figure 3 depicts the expected pattern of surface water supply deliveries to the City based upon historic hydrologic data under its Water Forum Agreement (WFA). The analysis completed for the Water Forum EIR projects full deliveries occur approximately 83 percent of the time.

Figure 3



USBR OCAP Delivery Pattern

The OCAP describes the operations of the Central Valley Project and 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 5 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 CVP is operated by the United States Bureau of Reclamation (USBR) while the State Water Project (SWP) is operated by the California Department of Water Resources (DWR). 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 their portion of the shared water and also jointly share in the obligations to protect beneficial uses. A Coordinated Operations Agreement (COA) between the CVP and SWP was developed and became effective in November 1986 as signed by USBR and the DWR.

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.

The operation of CVP/SWP is described in a document known as the Operations Criteria and Plan (OCAP). As 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) produced a formal Biological Opinion analyzing the impact of OCAP implementation on ESA-listed species (including the delta smelt). In effect, the ESA authorizes USFWS to require changes to the OCAP for the protection of the delta smelt and other federally listed species.

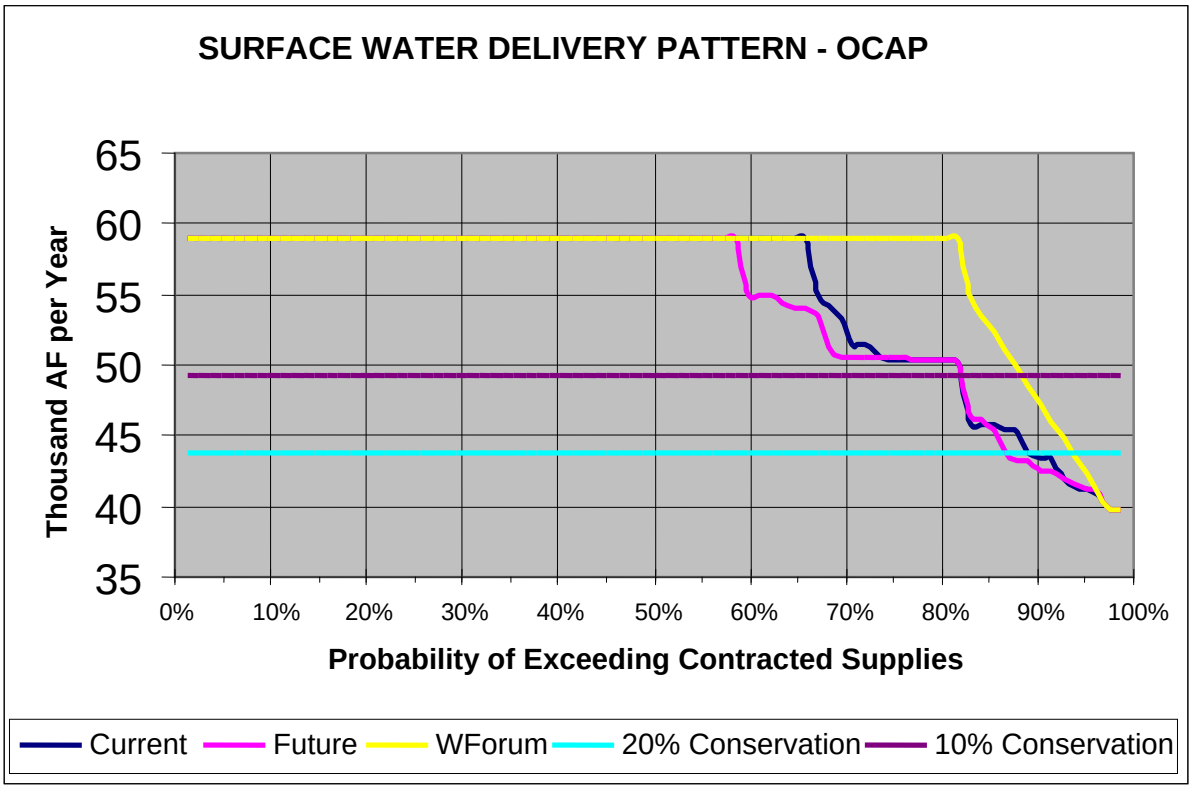
In 2005, USFWS issued a Biological Opinion for an updated OCAP, and concluded that CVP/SWP operations did not jeopardize delta smelt populations. However, that opinion was struck down by a federal judge (Judge Wanger) following a lawsuit filed by environmentalists. USFWS was ultimately ordered to revise their Biological Opinion. The court also severely restricted CVP and SWP pumping in the Delta (Wanger Decision) 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.

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 (USBR). 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. 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



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-five (45) percent of the time shortages in surface water supplies can be mitigated through implementing water conservation Stages 1 and 2 (between 10% and 20% conservation) outlined in the Roseville Municipal Code (RMC) Section 14.09. This is the area between the purple 10% line and the aqua 20% line. Thirteen (13) percent of the time surface water deliveries will fall below a level where mitigation can be accomplished through 20% conservation efforts and supplemental supply from groundwater. 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.

Supplemental Supplies

In drier and driest years, regardless of delivery pattern, 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 were two (2) critically dry (driest)

years and thirteen (13) drier years where City demands would need to be adjusted downward to conform to available surface water supplies under the City's WFA. .

Table 7 depicts the impacts of the Water Forum Agreement and shows estimated surface water shortfalls during historical drier and driest years assuming City buildout demand 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 a critically dry (driest) years such as occurred in 1924 and 1977, the City would need to make up 19,100 AF of water supply. In drier years as the amount of surface water availability to the City increases from 39,800 AFY to 58,900 AFY, based upon the unimpaired inflow, the anticipated shortfall decreases from 19,100 to 0 AFY.

TABLE 7

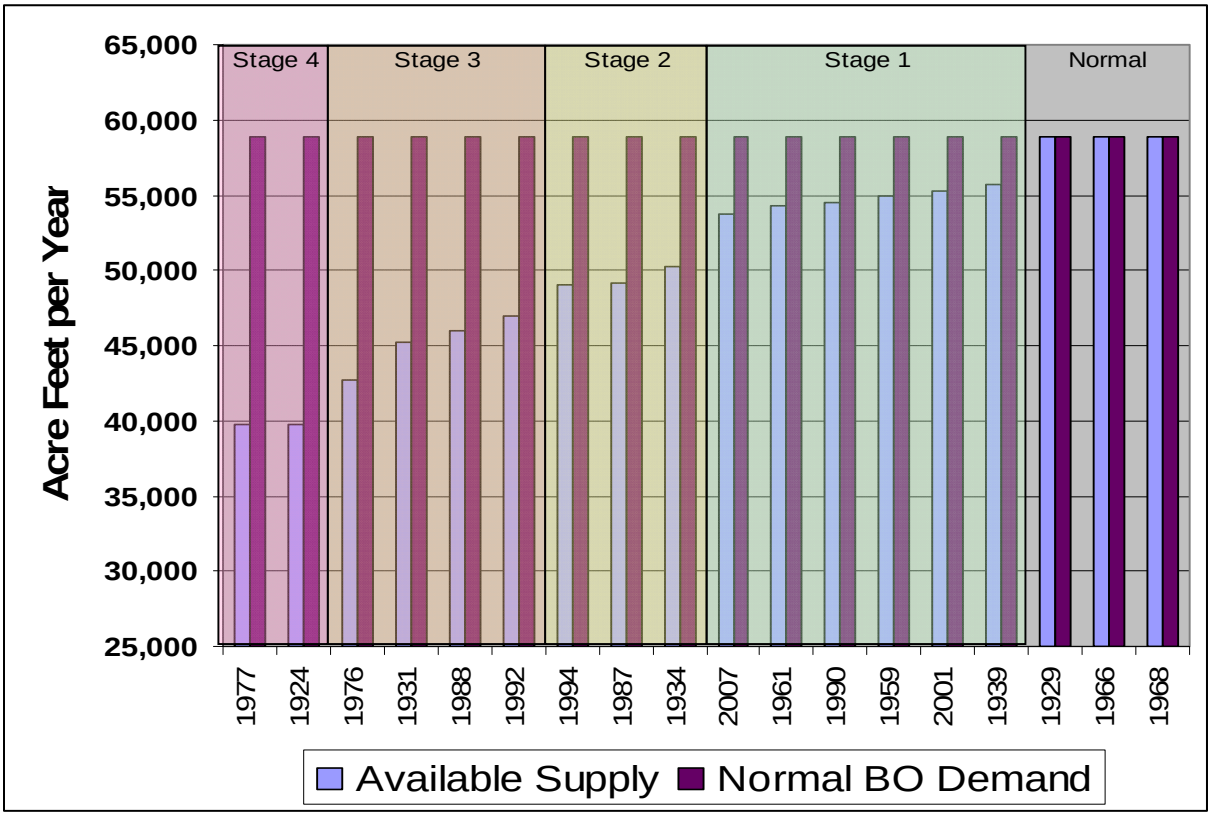
WATER FORUM AGREEMENT IMPACTS ON HISTORIC AMERICAN RIVER HYDROLOGIC DRY AND DRIEST YEAR RECORDS

Year	Year Type	Annual AF	Unimpaired Inflow AF	Available Water Supply AF	Normal Demand AF	Shortfall AF
1977	Driest	520,190	289,740	39,800	58,900	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
1934	Drier	1,084,000	699,700	50,208	58,900	8,692
2007	Drier	1,128,924	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	54,954	58,900	3,946
2001	Drier	1,185,375	845,617	55,275	58,900	3,625
1939	Drier	1,006,140	858,220	55,713	58,900	3,187
1929	Normal	1,255,100	952,600	58,900	58,900	0

Figure 5 graphically shows how the estimated shortfall determined in Table 7 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



The normal buildout demand for the City plus the SVSP is estimated to be 62,194 AFY (58,582 AFY + 3,612 AFY). The net potable water demand is 57,806. This is calculated by subtracting anticipated recycled water usage at buildout with the Project from the buildout water demand (62,194 AFY – 4,388 AFY = 57,806 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.

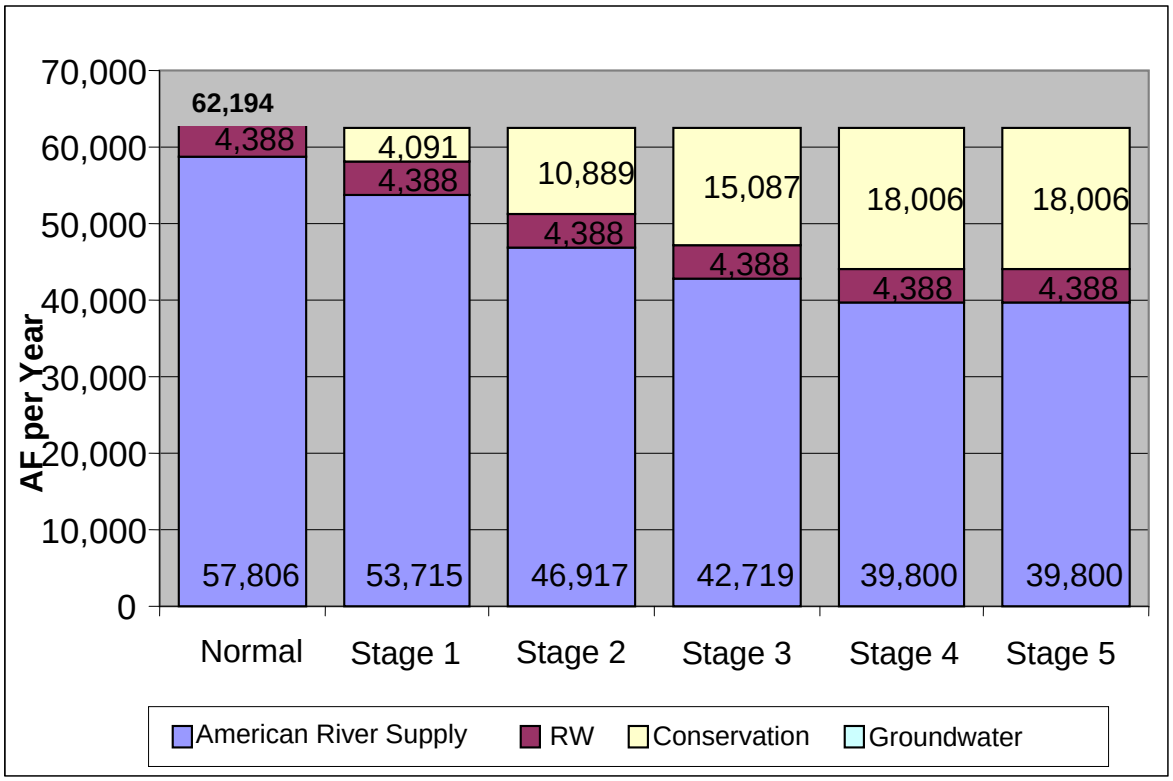
In dry and driest years, the City would need to make up the difference between 39,800 AFY and 58,900 AFY (0 AFY to 19,100 AFY). This would be done through implementing conservation measures as identified in the RMC and supplementing available supplies with groundwater. As explained earlier, the RMC identifies five drought stages with varying degrees of reduction (10% to 50%). Table 7 and Figure 5 compares projected build out demands to available supplies based on 100 years of hydrologic record of the American River. The full history is contained in Attachment 5 to this WSA. The hydrologic record

indicates that there were two (2) critically dry (driest) years and thirteen (13) 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 would necessitate the implementation of 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 the drier years depending on the level of surface water supply shortfall.

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 RMC, groundwater would not be needed to supplement supplies. This is depicted in Figure 4 below.

FIGURE 6

DRY AND DRIEST YEAR SUPPLY SCENARIOS
STAGED WATER CONSERVATION



Notes: AR: American River Supply; RW: Recycled Water

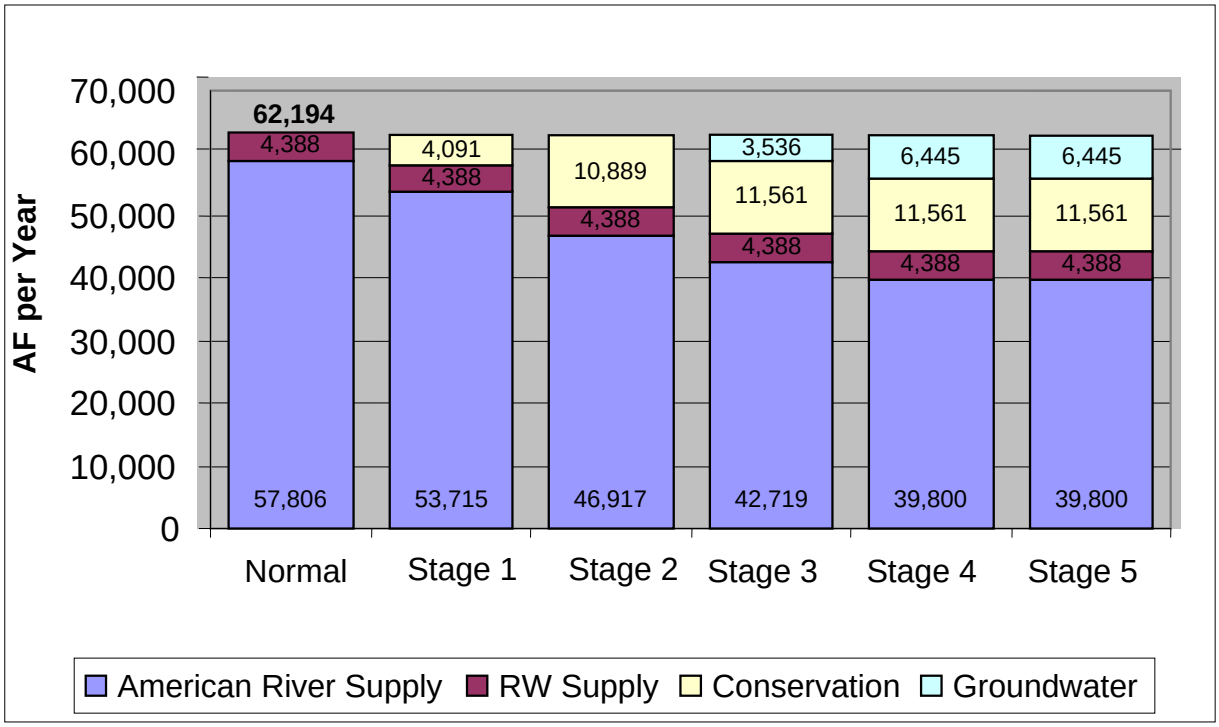
However, to ensure a highly reliable water supply for the City, this WSA assumes only a 20 percent reduction of surface water demands through conservation (20% of 57,806 AFY = 11,561 AFY). The 100 years of hydrologic data includes both the 1977 and 1924 droughts of record. This record provides a good picture of what could be anticipated as future unimpaired flows in the American River. The

record indicates that there would be 15 years out of 100 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 15 years out of 100 when supplemental supplies are required to meet demands and assuming only a 20 percent reduction in water demand through conservation efforts, only 6 years would require groundwater pumping to make up for shortfalls in surface water supplies. The total amount of groundwater extracted over the life of the Project (based on the 100 year hydrologic record and the need to pump groundwater in only 6 of 100 years) would be 26,363 AF. The annual amount varies depending on the year type, but ranges from a high of 6,445 AFY to a low of 0 AFY and is depicted in Figure 5 below.

FIGURE 5
DRIER AND DRIEST YEAR SUPPLY SCENARIO
20% WATER CONSERVATION



In addition to groundwater to supplement surface water supplies during drought conditions, the City has identified groundwater as an emergency backup supply for the recycled water system to bolster reliability. It is assumed that 8.4 AFY of groundwater could be required during emergencies such as a plant outage to backup the recycled water system. This is based upon 1.3 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 project (assumed to be the hydrologic record of 100 years) up to 168 AF of groundwater could be required. This would result in a total extraction of groundwater over 100 years of 26,531 AF.

OCAP Scenario

Of the 15 out of 100 years when supplemental supplies are required to meet demands and assuming only a 20 percent reduction in water demand through conservation efforts, 13 years would require groundwater pumping to make up for shortfalls in surface water supplies. The total amount of groundwater extracted over the life of the Project (based on the 100 year hydrologic record and the need to pump groundwater in only 6 of 100 years) would be 48,559 AF. The annual amount varies depending on the year type, but like with the WFA scenario ranges from a high of 6,445 AFY to a low of 0 AFY and as previously depicted in Figure 5. An additional 168 AF of groundwater is expected to be extracted during the analysis period of the project (100 years) to supplement recycled water supplies for emergency conditions such as a plant outage. Thus for the life of the project (assumed to be the hydrologic record of 100 years) under the OCAP Scenario, total extraction of groundwater over 100 years would total 48,727 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 Attachment 6. Included are:

- United States Bureau of Reclamation Long term water supply No. 14-06-200-3474A
- PWCA Water Supply Contract dated 20 November 1991
- 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

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 CIPs for 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 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.

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 list of permit requirements for proposed facilities will be identified after the City's review of improvement plans. Possible permit requirements include grading permits, tree permits and other local, state or federal permits are identified in the environmental document for the SVSP project.

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 is valid through 2011 but Roseville has agreed to early re-negotiation of this contract as required in the Central Valley Project Improvement Act (CVPIA) of 1992. This contract is currently being re-negotiated with USBR with objective of solidifying this water supply for an additional term. Roseville has established a need for the contract amount of 32,000 AF to move forward in negotiations but is awaiting USBR negotiations to resume.

The State Department of Public Health and the 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 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 WFA is available for review online at http://*www.watefforum.org/AGREE.HTM*.

Section 10910(f)(1) ***Review any information contained in the UWMP relevant to the identified groundwater supply for the proposed project.***

Because the SVSP is an annexation, water demands for this project were not included in the 2005 UWMP. Section 4.2 for the 2005 UWMP does include 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 the Folsom Lake. Although restrictions on groundwater use are not identified in the Water Forum Agreement, its use was only projected to be in times of drought and water shortage. Studies produced for the Water Forum estimated that groundwater will only be required approximately 17 percent of the years. As documented in Section 10910 (c)(3) and (c)(4), above, the City now estimates groundwater would be used in up to 6 of 100 years under the WFA Scenario or up to 13 of 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.***

Placer, Sutter, and Sacramento counties are situated in the North American sub-basin located in the eastern central portion of the Sacramento Groundwater Basin. The North American sub-basin is defined by the Bear River on the north, the Feather River and Sacramento River on the west, the American River on the south, and on the east by the Sierra Nevada Range. The sub-basin encompasses 351,000 acres (548 square miles). 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 that passes 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 groundwater 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 interbedded 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 pumped for agricultural and urban uses. According to the PCWA Integrated Water Resources Plan (IWRP) prepared by Brown and Caldwell dated August 2006 indicates a potential safe yield of 95,000 AFY for the basin. The safe yield is defined as the amount of groundwater that can be continuously withdrawn from a basin without adverse impact and is commonly expressed as an annual average in acre-fee per year (AFY). The IWRP also estimated average annual agricultural and urban demands in Western Placer County have been about 97,000 AFY. Under these pumping conditions the groundwater levels at the southern end of the basin have been stable since about 1982 and at the northern end of the basin, the levels have risen slightly. These stable

groundwater levels indicate that groundwater pumping is currently in balance with the natural groundwater recharge rate.

Groundwater elevations are 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 Creek just west of Fiddyment Road in the City's West Roseville Specific Plan Area. 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.

Section 10910(f)(3) Describe the amount and location of groundwater pumped by the public water system for the past five (5) years.

With the exception of the City's Aquifer Storage and Recovery (ASR) demonstration project, the City has not pumped groundwater from the basin for the past five years. Use of groundwater is part of the City of Roseville's current water supply planning, but it is only used for short-term back-up supply during dry years. As of December February 28th, 2008, the City had injected 178 AF of surface water into the groundwater basin and extracted 440 AF as part of phase one of the demonstration project. Phase two consisted of injecting an additional 830 AF of treated surface water and extracting 2,140 AF for delivery to water customers. No other extractions have occurred during this timeframe.

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 to the recycled water system. Based upon the estimated water demand for the project, and as shown in Figure 7, a maximum of 6,445 AFY of groundwater maybe required during drier and driest hydrologic year types. Over the life of the project and as described in Section 101910(c)(2) above, under the OCAP Scenario, a total of 48,727 AF of groundwater would be required. This includes groundwater to supplement surface water supplies during drought conditions to meet City plus project buildout and 168 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 will be used as the primary source of supply to service the project. During normal/wet hydrologic year types (87% of the years) groundwater is not required to meet water system demands. During 13% of the years (over a 100 year period and under the OCAP Scenario) up to 6,445 AFY or a lifetime draw of 48,727 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 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. 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 and the PCWA August 2006, Integrated Water Resources Plan study indicates a potential safe yield of 95,000 AFY for the basin based on current groundwater level stability at these pumping levels.

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 Attachment 7. 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 that 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 was assumed to be accomplished by fallowing land at 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,
- 3,851 AFY of groundwater "banked" and available for other uses, based strictly on mass balance of water in system. (6,483 AFY – 2,632 AFY)

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 it is estimated that under the OCAP, there historic hydrologic data indicate there would be 13 years out of 100 when groundwater could be required to supplement reduced surface water supplies. In 87 out of 100 years, groundwater would not be required. The analysis calculates the volume of water that as a result of land retirement from Reason Farms is "banked" or saved and compares that against the volume of groundwater anticipated to be extracted over the same time period (100 years). This analysis is summarized below.

Using 3,851 AFY of banked groundwater available for beneficial use as a result of land retirement at Reason Farms and applying it over the time of the hydrologic record when water supplies are not reduced (87 of 100 years) projects a 335,037 AF of saved groundwater over time (3,851 AFY x 87 years). Extracting the projected groundwater needs for the City and the SVSP over this same time period under the more conservative OCAP scenario (48,727 AF) results in a net storage of groundwater of 286,310 AF (335,037 AF – 48,727 AF). This is an average annual groundwater savings of 2,863 AFY over 100 years. Under these conditions the groundwater basin is expected to increase as a result of eliminating rice farming at Reasons Farms. Because the proposed project is expected to use less water than that identified as available from groundwater banking, impacts to the groundwater basin are not anticipated. This is described in Table 8 below.

TABLE 8
GROUNDWATER SUPPLY NEEDS AT BUILDOUT CONDITIONS
USBR OCAP DRY YEAR SCENARIO

GROUNDWATER USE	GROUNDWATER DEMAND (AFY)	GROUNDWATER OVER PROJECT LIFE (100 YEARS)	COMMENT
Dry year supply to supplement surface water	6,445	48,559 AF	Groundwater required in 13% of all years. Reference Impact 14.12.1-2
Recycled water emergency backup supply	8.4	168 AF	Assumes 1.37 mgd for a period of two days under emergency conditions when recycled water is not available. It is further assumed emergency conditions would occur once every five years for a total groundwater need of 168 AFY for the life of the project (100 years).
Total Groundwater Needs	**6,453.4 AFY**	**48,727 AF**	
Banked Groundwater from Retirement of Reason Farms	**3,851 AFY**	**335,037 AF**	Banking occurs in 87 of 100 years.
Net Groundwater Banked		**286,310 AF**	

The City of Roseville is currently utilizing multiple water sources including surface water, recycled water and groundwater to serve existing and future customers. 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 will have sufficient water to meet projected water demands for the Sierra Vista Specific Plan project in addition to meeting the existing service area's planned future demands. This determination is based on the information provided in this WSA.

APPENDIX H-2

ATTACHMENT 1
TM-1 – UNIT WATER DEMAND FACTOR VERIFICATION AND WATER DEMAND EVALUATION AND UPDATE

City of Roseville
Evaluation of Potential Water Supplies and Water Delivery Strategy for the MOU Area

TM 1 – Unit Water Demand Factor Verification and Water Demand Evaluation and Update

September, 2006

MWH

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Section 1. EXECUTIVE SUMMARY

In 2005, the City of Roseville (City) initiated two new annexation plans in the City/Placer County Memorandum of Understanding Transition Area (MOU Area): the Creek View Specific Plan (CVSP) and Sierra Vista Specific Plan (SVSP). In order to implement the annexation plans, City staff was requested to evaluate the City's ability to provide long-term reliable water supplies to the annexed areas without negatively impacting the City's existing and future customers in terms of water supply reliability and the cost of water service delivery.

In response to the City's need for a water supply evaluation, the City initiated a study to re-confirm the unit water demand factors using the most recent meter data from City customers that includes a longer history than the previous analysis completed by MWH in February 2002. The purpose of this technical memorandum is to verify the unit demand factors established/adopted in the previous studies and to update the City's water demand estimates based on the findings from the recent meter data and the most recent land uses information. The information generated in this technical memorandum (TM) will be used to develop a reliable and sound water supply strategy for the annexation of the two new specific plans.

The new meter data covers the period from January 2001 to April 2005. Unit water demand factors were evaluated for various residential and commercial land use categories and compared to the unit factors developed/used in the past; see **Table 1-1** and the notes below the table for definitions of the land use categories. In summary, the analysis of the longer history of residential meter data compares fairly well to the unit water demand factors developed from the results of the one-year record of residential meter data obtained in year 2002 by MWH. The most noticeable differences between previous and current unit water demand factors were observed for the Commercial Land Use Category.

The unit demand factors used in the 2002 Phase II Report TM 7 (TM 7) were essentially a "compromise" between the MWH (2002) water demand factors developed from limited meter data and those documented in the City's 1993 Water Supply Master Plan, titled, *General Plan Update Water System Study* (Spink, 1993) (Spink Study). With State mandated plumbing devices installed in the homes constructed after year 1992 (post-92 homes) and the inception of the metering program in commercial and some residential properties in year 2000, the water demand factors developed from meter data were approximately 25 percent lower than predicted in the Spink Study. Later, the City asked MWH to compare these two sets of unit demand factors to the unit demand factors for the vicinity areas in the region. Statistical analyses were performed on the unit water demand factors for the vicinity areas, and resulted in a third set of water demand factors that were ultimately adopted by the City.

The methodology and process of developing the third set of the unit water demand factors were documented in the technical memorandum titled "Task 1 - Unit Demand Factors Revision" by MWH in November 2002. This set of unit water demand factors were used in TM 7 to evaluate the water demand for the City and MOU Area except for the pre-92 homes, whose demands were evaluated still using the Spink (1993) unit water demand factors to represent the higher water uses in older homes.

Using the same methodology in data handling, aggregation of customer accounts into primary land use categories and subsequent statistical analyses, the longer history meter data verifies and validates the unit water demand factors used in TM 7. Results also show that there is no significant difference in water demand factors between newer (post-92) and older (pre-92) homes as a result of the City's meter retrofit program. As a result, this TM recommends using a composite set of residential unit water demand factors in place of the current system of having one set of unit water demand factors for pre-92 homes and another set for post-92 homes.

Using the TM 7 unit water demand factors, a "Conservative" Scenario was selected to evaluate the water demands for the City and MOU Area. The water demand estimates for the "Conservative" Scenario are included in **Table 1-2** (the WRSP has been annexed into the City boundary but its demand calculation is shown separately for the sake of comparison).

Table 1-1. Water Demand Factors Developed from Recent Meter Data and Those Developed/Adopted in Previous Studies

RESIDENTIAL LAND USE CATEGORY	DEVELOPED FROM RECENT METER DATA (GPD/DU) [1]	DEVELOPED/USED IN PREVIOUS STIDIES		
		Phase II Report TM 7 (GPD/DU)	MWH (2002) (GPD/DU) [2]	Spink (1993) (GPD/DU)
LDR1 (<3.5 DU's/Acre)	833	728	818	922
LDR2 (3.5 to 5 DU's/Acre)	567	600	560	760
LMDR1 (>5.0 to 6.0 DU's/Acre)	501	521	515	685
LMDR2 (>6.0 to 8.0 DU's/Acre)	424	430	438	566
MDR (>8.0 to 12.0 DU's/Acre	338	323	324	425
HDR1 (>12.0 to 16.0 DU's/Acre)	246	288	218	310
HDR2 (>16.0 DU's/Acre)	179	177	165	190
COMMERCIAL LAND USE CATEGORY	**(GPD/Acre)**	**(GPD/Acre)**	**(GPD/Acre)**	**(GPD/Acre)**
Commercial/Retail	2,063	2,598	2,294	2,678
Business Professional	2,429	2,598	3,207	2,678
Light Industrial	1,205	2,598	1,203	2,678
Industrial	2,232	2,562	2,597	3,124
Railroad Yard	116	109	131	122
Elementary Schools	1,705	3,454	2,143	3,881
High Schools	1,705	4,068	2,788	4,571
Public (Fire Station, etc)	1,705	1,780	2,249	2,000
Park/Recreation	2,554	2,988	2,377	3,881

Abbreviations:

LDR – Low Density Residential
LMDR – Low-Medium Density Residential
MDR – Medium Density Residential
HDR – High Density Residential
GPD/DU – Gallon per Day/Dwelling Unit
DPD/Ac – Gallon per Day/Acre

Notes:

1. Meter data recorded from Jan 2001 to April 2005.
2. Demand factors developed from approximately one year record of meter data from September 2000 to October 2001.

A second scenario, or "Aggressive" Scenario, was also evaluated but not included in the findings of this study because the results did not provide sufficient redundancy in the City's water supply planning to account for uncertainties in the demand estimates due to the small population of a land

use category. The difference between the "Conservative" Scenario and "Aggressive" Scenario was the use of the lower commercial unit water demand factors developed in this study based on the more recent meter data as shown in **Table 1-1**.

Based on the results presented in **Table 1-2**, the total annual average projected water demand for the City and MOU Area is approximately 64,325 AF/Year. The demand for City only (including the WRSP) is estimated to be 57,689 AF/Year (50,056 AF/Year plus 7,633 AF/Year) as opposed to 59,111 AF/year in TM 7 (51,620 AF/Year plus 7,491 AF/Year). The 1,422 AF/Year of reduced water demand (59,111 AF/Year – 57,689 AF/Year = 1,422 AF/Year) can be attributed to the use of a lower water unit demand factor for pre 1992 homes, the meter retrofit program, extensive City water use efficiency efforts, and updated land uses within the City. The total annual average projected water demand for both the SVSP and CVSP areas is estimated to be 6,636 AF/Year (5,380 AF/Year plus 1,256 AF/Year) based on the most recent land use plan information as of May 2006.

Given the projected water demand summarized above and the City's available surface water and groundwater entitlements, recycled water use, Aquifer Storage and Recovery (ASR) Program, and dry year water conservation efforts, a water supply portfolio and strategy will be developed for the City to provide long-term reliable water supplies to the City and the MOU Area. This water supply portfolio and strategy will be discussed in a separate technical memorandum, TM 2.

Table 1-2. City of Roseville and MOU Area Demand Estimate at Build-out – "Conservative Scenario"

Land Use		Gross Area (Acres)				Annual Average Demand (AF/Year)				Max Day Demand (MGD) [2]			
		City [1]	West Roseville [1]	Sierra Vista	Creek View	City	West Roseville	Sierra Vista	Creek View	City	West Roseville	Sierra Vista	Creek View
LDR1	<3.5	1,675	661	-	-	3,684	1,454	-	-	6.6	2.6	-	-
LDR2	(3.5 to 5.0)	5,278	779	496	-	15,991	2,360	1,503	-	28.5	4.2	2.7	-
LMDR1	>5.0 to 6.0	807	38	-	-	2,591	121	-	-	4.6	0.2	-	-
LMDR2	>6.0 to 8.0	557	113	-	65	1,878	382	-	219	3.4	0.7	-	0.4
MDR	>8.0 to 12.0	390	29	609	79	1,412	107	2,204	286	2.5	0.2	3.9	0.5
HDR1	>12.0 to 16.0	153	54	-	73	691	242	-	331	1.2	0.4	-	0.6
HDR2	>16.0	368	51	75	33	1,456	203	299	129	2.6	0.4	0.5	0.2
Commercial/Retail		1,859	48	-	-	5,409	139	-	-	9.7	0.2	-	-
Commercial Mixed Use [3]		-	-	119	29	-		390	95			0.7	0.2
Business Professional		813	19	-	-	2,366	56	-	-	4.2	0.1	-	-
Light Industrial		1,320	80	-	-	3,842	233	-	-	6.9	0.4	-	-
Industrial		569	32	-	-	1,632	92	-	-	2.9	0.2	-	-
Railroad Yard		535	-	-	-	70	-	-	-	0.1	-	-	-
Schools		384	109	68	10	1,617	459	286	42	2.9	0.8	0.5	0.1
Public		427	16	2	10	851	32	4	20	1.5	0.1	0.0	0.0
Park/Recreation		1,512	278	176	33	5,059	931	589	109	9.0	1.7	1.1	0.2
Open Space		1,579	699	-	154	-	-	-	-	-	-	-	-
Road Right-of-way		397	114	-	53	-	-	-	-	-	-	-	-
Urban Reserve		-	-	31	-	-	-	-	-	-	-	-	-
Subtotal		**18,622**	**3,120**	**1,577**	**538**	**48,548**	**6,810**	**5,274**	**1,231**	**86.7**	**12.2**	**9.4**	**2.2**
System Losses (2%)						971	136	105	25	1.7	0.2	0.2	0.0
Demand Adjustment for Rezoned Areas [4]						537	-	-	-	1.0	-	-	-
Demand for additional 1,000 units of homes in West Roseville [5]						-	685	-	-	-	1.2	-	-
Total						**50,056**	**7,633**	**5,380**	**1,256**	**89.4**	**13.6**	**9.6**	**2.2**
Total Demand for City and MOU Area						**64,325**				**114.8**			

Notes:

1. The Sierra View Country Club golf course (192 acres) within the City and the proposed Roseville Energy Park (200 acres) in West Roseville are not included because they use insignificant amount of City's potable water.
2. Assume Maximum Day Demand/Average Day Demand = 2
3. For internal CMU parcels, 50% is assumed for residential, 20% for retail, and 30% for office. For CMU parcels along major roads. 40% is assumed for residential, 40% for retail, and 20% for offices. The composite demand factor for CMU is based on Sierra Vista Land Use information.
4. There are 19 rezoned areas in the City including HP/JMC, Riverside Corridor Redevelopment, Kaiser, Galleria Mall, and other areas.
5. Assume these units are low density single family homes.

Section 2. INTRODUCTION

Significant work has been completed in the evaluation and change in water demand factors for the City of Roseville (City) over the past 5 years. As a result, there is a concerted effort to maintain a vigilance in confirming the current water demand factors over the years to maintain a significant history as demands change over time due to hardened water conservation measures (e.g., low-flow plumbing, meter billing, etc) and changes in customer water use habits through education and awareness. This section provides the setting and objectives of the study.

2.1 BACKGROUND

In June 2005, the City initiated two new annexation and specific plans: Creek View Specific Plan (CVSP) and Sierra Vista Specific Plan (SVSP). These specific plans comprise the remainder area of the City/Placer County Memorandum of Understanding Transition Area (MOU Area). The annexation plans require the City to evaluate its ability to provide long-term reliable water supplies to the MOU Area while maintaining reliable and affordable water service to its existing and future customers within the City limits. The City has adopted the policy that the cost of delivering water supplies to new growth areas such as the MOU Area must not negatively impact the City's existing ratepayers.

In February 2002, in an effort to develop preliminary water supply alternatives for the West Roseville Specific Plan (WRSP) and MOU Area, MWH evaluated the water demand projections based on a limited amount of meter data recorded predominantly for homes built after 1992 (post-92 homes). The meter data indicated with a high level of confidence that water demand factors could be reduced from the City's Water Supply Master Plan completed in 1993 (Spink, August 1993) (Spink Study). In November 2002, the City's Environmental Utilities (EU) staff and MWH completed a water supply strategy memorandum (TM 7 of the Phase II Report) identifying water supply "portfolios" to meet the projected water demands of the WRSP and the adjacent MOU Area under a variety of hydrologic conditions. The water demand reductions were integrated into the water supply "portfolios" understanding that the water demand reductions did not create new water supplies by simply reducing the need for water, but a portion of the "supplies" derived through the water demand reduction can be kept in reserve as a safety factor to protect against the inherent uncertainty of such estimates.

Over the past several years, the City has gained additional operational history with respect to the customer water demands due to the longer period of meter billing data and the greater number of metering accounts. In addition, with meters also installed for homes built before 1992 (pre-92 homes) as a result of City's meter retrofit program, it allows EU staff and MWH to re-evaluate the water demands for older homes. Spink Study unit water demand factors were assumed for Pre-92 homes in the water demand estimate completed in TM 7 of the Phase II Report.

2.2 OBJECTIVE

The objective of this memorandum is to verify and validate the unit water demand factors developed in Task 1 (November 2002) and documented in TM7 based on a larger set of meter data.

The task does not intend to modify the previously established water demand factors, but to provide EU staff the level of confidence in water supply planning for the MOU Area on a near term and long term basis.

Section 3. UNIT WATER DEMAND FACTORS

Land use–based water demands are the preferred means of developing an estimated water demand for existing and new growth areas; the reason being that the demands are geographically placed where the demands are actually occurring. This becomes more apparent if computer modeling of the water distribution system occurs. This section discusses the development of the unit water demand factors.

3.1 OVERVIEW

A number of studies have been completed to evaluate the City's land use water demand factors in the past. The 1993 Spink Study provides water planning criteria for calculating average annual, maximum day, and peak hour demands. The unit water demand factors were developed for a comprehensive list of land use categories. These planning criteria have provided the basis for design and construction of much of the City's water distribution and supply infrastructure as well as the development of the needed water supplies.

In February 2002, MWH evaluated the unit water demand factors based on an approximate one-year record (June 2000 to September 2001) of meter data for post-92 homes and all commercial land uses for a longer period given that commercial accounts were, and still are, metered at the time of connection. The meter data was read and maintained by EU staff mainly for water demand evaluation purposes with the exception of commercial accounts where billing was actually performed based on metered amounts. The analysis indicated that the unit water demand factors were less than those identified in the Spink Study. On average, the residential land use categories showed a 25-percent decrease from the Spink Study unit water demand factors. The unit water demand factors for the commercial/industrial land use categories showed higher and lower values compared to the Spink Study, but the overall average commercial/industrial demand decreased. The variation was attributed to the smaller population of each commercial/industrial classification (i.e., one high water use industry can weight the data heavily) **Table 3-1** shows the unit water demand factors for both studies and then those used in the Phase II Report that were ultimately adopted.

Later, reductions in unit water demand factors for residential areas were confirmed with an extended period of meter data covering the period from June 2000 to Oct 2002[1]. The unit water demand factors were further confirmed and refined by statistically analyzing those demand factors of vicinity areas with similar water demand methodologies in the Sacramento and Placer County areas. In TM 7 of the Phase II Report (November 2002), these revised unit water demand factors (listed in **Table 3-1**, last column) were used to estimate residential water demands for post-92 homes and commercial demands for the City, the WRSP, and the MOU Area. For pre-92 homes, the Spink Study numbers were used because the new unit water demand factors were based on meter data recorded for post-92 homes and considered not applicable to pre-92 homes.

[1] No monthly metering readings available from October 2001 to May 2002. Appropriate interpolation was used to calculate the monthly water consumption for these months.

Table 3-1. Unit Demand Factors Developed in Previous Studies

Land Use		MWH (2002)	Spink (1993)	Phase II Report TM 7
		(GPD/DU)	(GPD/DU)	(GPD/DU)
Residential	LDR1 (< 3.5 DU's/Ac)	818	922	728
	LDR2 (3.5 to 5.0 DU's/Ac)	560	760	600
	LMDR1 (>5.0 to 6.0 DU's/Ac)	515	685	521
	LMDR2 (>6.0 to 8.0 DU's/Ac)	438	566	430
	MDR (>8.0 to 12.0 DU's/Ac)	324	425	323
	HDR1 (>12.0 to 16.0 DU's/Ac)	218	310	288
	HDR2 (>16.0 DU's/Ac)	165	190	177
Commercial		(GPD / Ac)	(GPD / Ac)	(GPD / Ac)
	Commercial/Retail	2,294	2,678	2,598
	Business Professional	3,207	2,678	2,598
	Light Industrial	1,203	2,678	2,598
	Industrial	2,597	3,124	2,562
	Railroad Yard	131	122	109
	Elementary Schools	2,143	3,881	3,454
	High Schools	2,788	4,571	4,068
	Public (Fire Station, etc)	2,249	2,000	1,780
	Park/Recreation	2,377	3,881	2,988

Abbreviations:

LDR – Low Density Residential
LMDR – Low-Medium Density Residential
MDR – Medium Density Residential
HDR – High Density Residential
GPD/DU – Gallon per Day/Dwelling Unit
DPD/Ac – Gallon per Day/Acre

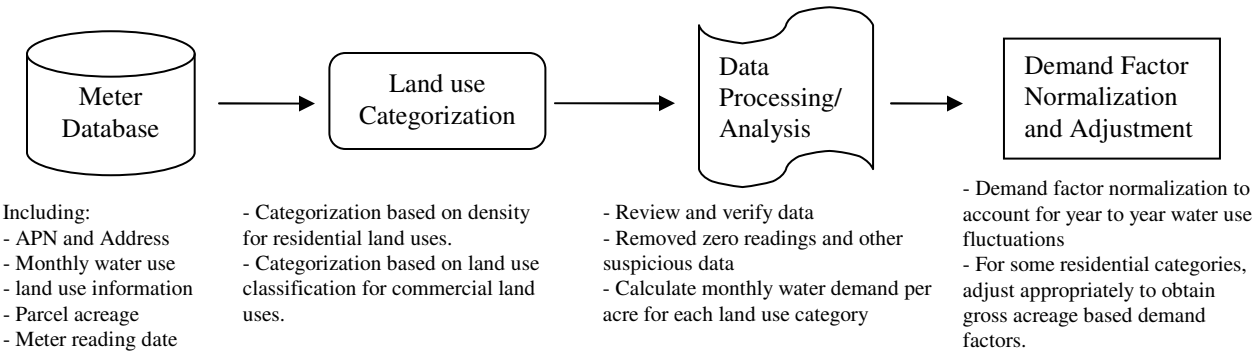
Since completion of the Phase II study in 2002, meters have been installed for homes built before 1992 as part of the City's meter retrofit program. With an average of two years of customer use data, a similar study can be performed to evaluate the water demand factors for pre-92 homes. In 2006, City staff provided a new water use dataset including the meter records for both pre-92 and post-92 homes over the period from January 2001 to April 2005[2]. Meter readings were provided by the City's Department of Finance staff as part of their billing database.

3.2 UNIT WATER DEMAND FACTORS DEVELOPMENT PROCEDURE

The development of unit water demand factors applied the same "exact" methodology as used in the previous meter data analysis including data handling, land use categorization and unit water demand factor normalization. The general procedure for the development of unit water demand factors can be illustrated with the following diagram.

Figure 3-1. Unit Water Demand Factor Development Procedure

[2] Invalid and inconsistent data was found for the first several months during the process of data verification. Therefore, only the data between April 2001 ~ March 2005 was used for unit water demand factors calculation.



3.3 LAND USE CATEGORIZATION

The land use categorization in this study is consistent with previous studies of unit water demand factors. Each record in the meter dataset contains an Assessor Parcel Number (APN), address, existing land use, General Plan land use, parcel acreage, monthly water consumption, and meter reading date information. For the analysis of the existing meter data, the existing land use classification was used to avoid instances where the current use is not consistent with the General Plan (e.g., General Plan land use designation may have been changed or the use currently taking place is likely an older established use that in the future may change). Two large land use groups were divided first: Residential and Commercial.

The Residential group is further divided into seven categories based on the actual density of each parcel in dwelling units (DU's) per acre. Actual densities were calculated using net acreage for each parcel and adjusting the density downward by 20 percent to include right-of-way[3]. This adjustment is necessary because it will result in gross acreage based unit water demand factors that can be applied directly to the land use information of the City and the two specific plans to calculate their water demands in the subsequent tasks, recognizing that the land uses provided for the City and the two specific plans are gross acreage based. The residential categories and their classification criteria are also shown in **Table 3-1**.

Similarly, the commercial land uses are categorized into the land use groups shown in **Table 3-1,** and the existing land use designations were also used for commercial. **Table 3-2** shows the commercial land use categorization.

3.4 NORMALIZATION OF WATER DEMAND

The normalization of unit water demand factors is to account for year to year fluctuations in water demand based on hydrologic conditions and consumer water conservation awareness. Historical data indicates that water use is typically highest in a dry year after multiple wet years because of the time necessary to re-educate consumers. Normalization of data requires assessing what the potential extreme conditions might be and adjusting the factors accordingly to increase the level of confidence in the water system's long term performance.

[3] Typically, the total area of right-of-way is approximately 20 percent of the total area of a single family residential subdivision in the City of Roseville.

Table 3-3 presents the City's total annual water demand, population, and water demand per capita over the past 25 years. Bolded per capita water demands are chosen as the extreme years on which to base future design. Normalizing to the average of these years provides a design reliability to meet water demands in 90 percent of the years. Typically the cost effectiveness of water facilities is significantly reduced if the water system is designed to meet greater than 90 percent of the demand years.

Table 3-2. Land Use Grouping for Commercial Uses

Land Use Group for Unit Water Demand Factor	Existing Land Use Description	Land Use Group for Unit Water Demand Factor	Existing Land Use Description
Business Professional	Business Professional	Park/Recreation	Common Area
	Office Building		Utility Easement
Commercial	Automotive		Club
	Commercial		Fairgrounds
	Commercial Recreation		Golf Course
	Financial Building		Park
	Hotel		Creek Area
	Parking Lot		Landscape Easement
	Restaurant		Open Space
	Retail	Public	Cemetery
	Service Station		Church
	Shopping Center		Convalescent Hospital
	Small Food		Public Building
	Residential and Office		Utility
	Residential and Retail		School
Light Industrial	Light Industrial	Railroad Yard	Union Pacific Railroad
	Light Manufacturing		
	Self Storage		
Heavy Industrial	Heavy Industrial		

The average of water demand per capita in high water use years is 328 gallons per day per capita (gpd/capita) as shown in **Table 3-3**. Therefore, the normalization factors for year 2001 through 2005 are 1.11 (328/296=1.11), 1.06 (328/310=1.06), 1.12 (328/293=1.12), 1.10 (328/299=1.10) and 1.19 (328/274=1.19), respectively.

3.5 UNIT WATER DEMAND FACTORS CALCULATION

Once the meter data was grouped into different land use categories as identified in the previous section, unit water demand factors were developed by statistically analyzing historical water use data.

3.5.1 Unit Water Demand Factors for Residential Categories

This study provides two methods for aggregating residential meter accounts and developing unit water demand factors. The first is a composite scenario of developing water demand factors that does not differentiate between older and newer homes. The second evaluates one set of water demand factors for Pre-1992 homes and another set of water demand factors for Post-1992 homes.

3.5.1.1 Composite Residential Unit Water Demand Factors (Combined Pre and Post - 1992 Homes)

An averaging method was used to calculate the unit water demand factors for residential categories. First, the monthly water uses for each account were adjusted proportionally based on the actual number of days in each metering period. The total monthly water use for each land use category was then calculated, along with the total parcel net acreages. The total net parcel acreages (when summed) varied from month to month because the number of accounts increased significantly over time with the number of accounts with meters becoming greater with each year of new development and meter retrofit. Also, accounts with zero readings or erroneous readings were removed. The historical monthly water demand on a per unit acre basis was computed by dividing the total water use with the total parcel net acreages. **Appendix B** provides the resulting historical monthly water demand per acre, the total monthly water uses and parcel acreages, and the number of metering accounts for each residential category.

The resulting historical monthly water demands were normalized by applying the corresponding normalization factors from above (i.e., the normalization factor is 1.11 for year 2001, 1.06 for year 2002, 1.12 for year 2003, 1.10 for year 2004, and 1.19 for year 2005).

The normalized monthly water demands based on net parcel acreages were then adjusted to obtain gross acreage based water demand factors. For low and medium density residential categories, the normalized monthly data was decreased by 20 percent to obtain a land use-based water demand factor that can be applied to gross acreages. (Typically, the total area of streets accounts for approximately 20 percent of the total area of a residential subdivision by examining several residential subdivisions in the City). No such adjustment is needed for high density residential categories as right-of-way typically accounts for a minimal percentage of the total area of a subdivision.

Table 3-3. City of Roseville Historical Annual Water Demand, Population Data, and Water Demand Per Capita

Year	System Delivery (MG)	Population	Water Demand Per Capita (gpd/capita)
1980	2,621	24,347	295
1981	2,359	25,079	258
1982	2,612	26,127	274
1983	2,979	26,618	307
1984	3,360	27,750	**332**
1985	3,474	28,988	**328**
1986	3,797	29,897	**348**
1987	3,988	31,612	**346**
1988	3,968	34,468	**315**
1989	4,089	37,101	302
1990	4,641	43,900	290
1991	4,808	46,700	282
1992	5,253	49,500	291
1993	5,255	52,500	274
1994	5,818	54,400	293
1995	6,139	56,479	298
1996	6,890	59,804	**316**
1997	7,558	63,479	**326**
1998	6,664	67,338	271
1999	7,876	72,126	299
2000	8,356	80,069	286
2001	8,868	82,087	296
2002	9,683	85,533	**310**
2003	9,691	90,739	293
2004	10,532	96,600	299
2005	10,232	102,191	274
Mean			300
Maximum			348
Minimum			258
Average of High Water Use Years			328

Source: the City of Roseville

Lastly, an average was taken for the normalized and adjusted historical monthly demands to obtain the monthly demand factors. In addition, an average annual demand factor is also calculated based on the sum of demand factors for each of the twelve months in a year. The normalized average annual demand factors resulting from both pre-92 and post-92 homes meter records are shown in **Table 3-4. Figure 3-2** shows the monthly water demand factors for residential categories.

Table 3-4. Average Annual Water Demand Factor for Residential Categories

Land Use	Composite (AF/Year/Acre)	Pre-92 Homes Only (AF/Year/Acre)	Post-92 Homes Only (AF/Year/Acre)
LDR1 (< 3.5 DU's/Ac)	2.50	2.23	2.44
LDR2 (3.5 to 5.0 DU's/Ac)	2.86	2.86	2.90
LMDR1 (>5.0 to 6.0 DU's/Ac)	3.09	3.12	3.07
LMDR2 (>6.0 to 8.0 DU's/Ac)	3.32	3.34	3.54
MDR (>8.0 to 12.0 DU's/Ac)	3.78	3.68	3.79
HDR1 (>12.0 to 16.0 DU's/Ac)	3.85	3.85	3.85
HDR2 (>16.0 DU's/Ac)	4.01	4.01	4.01

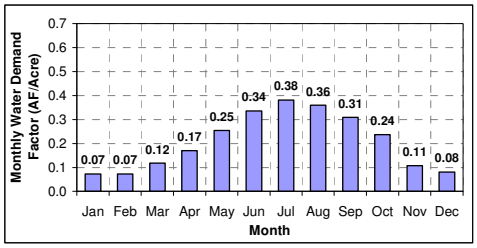
3.5.1.2 Separate Residential Unit Water Demand Factors for Pre-92/Post-92 Homes Only

Since the meter data does not provide information to identify whether a home for a certain account was built before or after year 1992, a GIS tool was developed and utilized to create a separate table that contains APN numbers and a field indicating whether the home was built before or after 1992.

The separation of pre- and post-1992 home construction in GIS was done based on manually setting polygon boundaries of older and newer developed areas. The GIS tool provided the number of dwelling units of pre-92 and post-92 homes within the manually divided polygons. Although the tool did not identify the year each individual home was built, it did identify which polygon consists mainly of pre-92 homes or post-92 homes. If the number of pre-92 homes in a polygon was between 91 ~ 100 percent of the total number of dwelling units, that polygon was considered to consist of predominantly pre-92 homes. Similarly, if the number of post-92 homes is between 91 ~ 100 percent, that polygon was considered to consist predominantly post-92 homes. The distribution of pre-92/post-92 homes within the City is shown in **Figure 3-3**. The unit water demand factors for pre-92/post-92 homes based on the separately created meter data were developed and shown in **Table 3-4**.

Figure 3-2. Composite Residential Monthly Demand Factors (Pre-92 and Post-92 Homes)

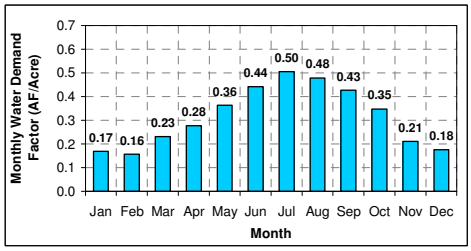
Low Density Single Family Residential (LDR<3.5)



Month	Demand Factor
Jan	0.07
Feb	0.07
Mar	0.12
Apr	0.17
May	0.25
Jun	0.34
Jul	0.38
Aug	0.36
Sep	0.31
Oct	0.24
Nov	0.11
Dec	0.08
TOTAL	***2.50***

2.50 AF/Year/Acre

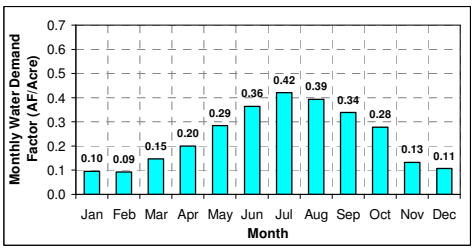
Medium Density Single/Multi Family Residential (MDR 8~12)



Month	Demand Factor
Jan	0.17
Feb	0.16
Mar	0.23
Apr	0.28
May	0.36
Jun	0.44
Jul	0.50
Aug	0.48
Sep	0.43
Oct	0.35
Nov	0.21
Dec	0.18
TOTAL	***3.78***

3.78 AF/Year/Acre

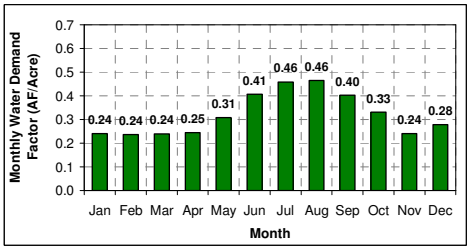
Low Density Single Family Residential (LDR 3.5~5)



Month	Demand Factor
Jan	0.10
Feb	0.09
Mar	0.15
Apr	0.20
May	0.29
Jun	0.36
Jul	0.42
Aug	0.39
Sep	0.34
Oct	0.28
Nov	0.13
Dec	0.11
TOTAL	***2.86***

2.86 AF/Year/Acre

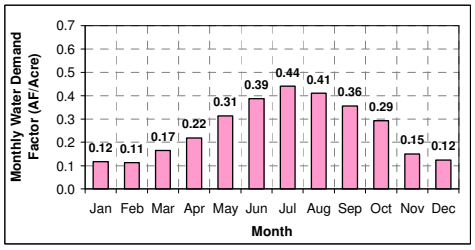
High Density Multi Family Residential (HDR 12~16)



Month	Demand Factor
Jan	0.24
Feb	0.24
Mar	0.24
Apr	0.25
May	0.31
Jun	0.41
Jul	0.46
Aug	0.46
Sep	0.40
Oct	0.33
Nov	0.24
Dec	0.28
TOTAL	***3.85***

3.85 AF/Year/Acre

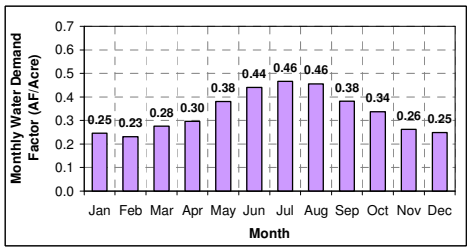
Low to Medium Density Single Family Residential (LMDR 5~6)



Month	Demand Factor
Jan	0.12
Feb	0.11
Mar	0.17
Apr	0.22
May	0.31
Jun	0.39
Jul	0.44
Aug	0.41
Sep	0.36
Oct	0.29
Nov	0.15
Dec	0.12
TOTAL	***3.09***

3.09 AF/Year/Acre

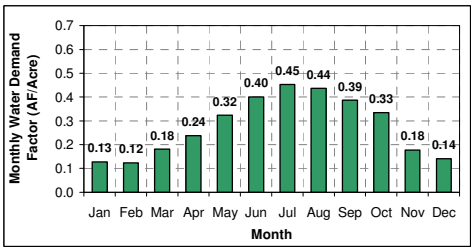
High Density Multi Family Residential (HDR >16)



Month	Demand Factor
Jan	0.25
Feb	0.23
Mar	0.28
Apr	0.30
May	0.38
Jun	0.44
Jul	0.46
Aug	0.46
Sep	0.38
Oct	0.34
Nov	0.26
Dec	0.25
TOTAL	***4.01***

4.01 AF/Year/Acre

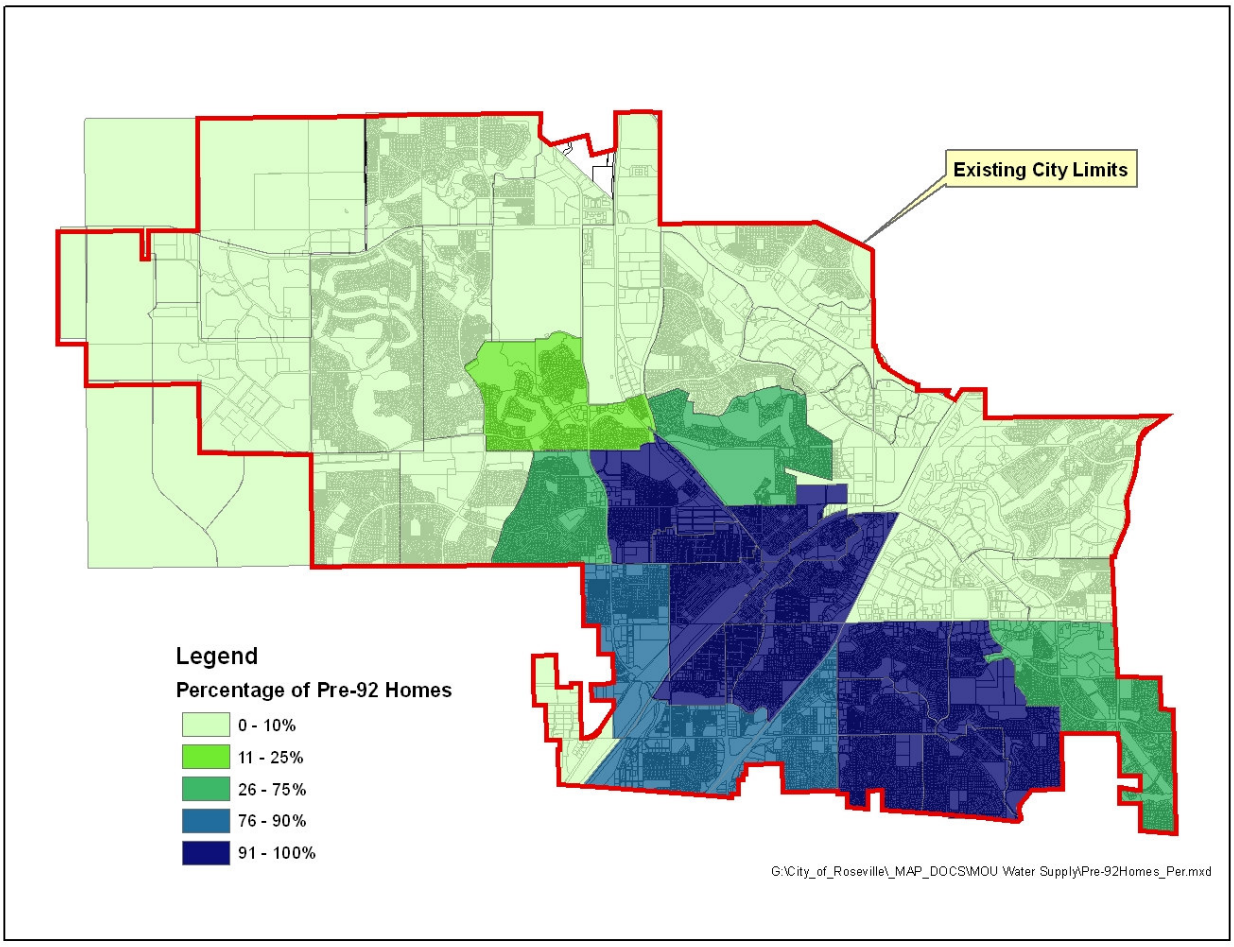
Low to Medium Density Single Family Residential (LMDR 6~8)



Month	Demand Factor
Jan	0.13
Feb	0.12
Mar	0.18
Apr	0.24
May	0.32
Jun	0.40
Jul	0.45
Aug	0.44
Sep	0.39
Oct	0.33
Nov	0.18
Dec	0.14
TOTAL	***3.32***

3.32 AF/Year/Acre

Figure 3-3. Distribution of Dwelling Units of Pre-92/Post-92 in City of Roseville



3.5.1.3 Discussion on Unit Water Demand Factor Results for Residential Categories

Table 3-4 shows that no significant difference exists in unit water demand factors between pre-92 homes and post-92 homes. In earlier studies, it was believed that because state and local building codes require mandatory water conservation plumbing devices to be installed for homes built after year 1992, newer homes use less water than older homes on a per acre basis. With meters installed in pre-92 homes as a result of the City's meter retrofit program starting in July 2001, the water use was expected to decrease in pre-92 homes as well based on the inherent monetary incentive of using less water. The meter retrofit program projects to install meters in all unmetered homes by 2012 with an average installation by City crews of 1,514 meters per year. Therefore, the City's ultimate demand estimate may have been overestimated by using the combination of lower demand factors for newer homes and higher ones (i.e. demand factors in Spink Study) for older homes as recommended in TM 7 and subsequently adopted by the City. Because there is no significant difference between pre-92 homes and post-92 homes in the unit water demand factors, the "Conservative" scenario (defined in the following section of this report) uses the unit water demand factors used for post-92 homes in TM 7 and applied to both pre-92 homes and post-92 homes.

The composite residential unit water demand factors based on this study are summarized in **Table 3-5** (converted from AF/year/acre in **Table 3-4** to GPD/DU) and compared with factors developed in other studies. **Table 3-5** indicates that the unit demand factors developed from the new meter data having a longer metering period are fairly close to those developed from meter data in year 2002. Since the City does not intend to modify the unit water demand factors at the present, the composite residential unit water demand factors were used to evaluate the water demand for the "Aggressive" scenario (defined in the following section of this report) and the results are included in **Appendix A**.

Table 3-5. Unit Water Demand Factors for Residential in GPD/DU

Land Use	This Study (GPD/DU)	Phase II Report TM 7 (GPD/DU)	MWH (2002) (GD/DU)	Spink (1993) (GPD/DU)
LDR1 (<3.5 DU's/Acre)	833	728	818	922
LDR2 (3.5 to 5 DU's/Acre)	567	600	560	760
LMDR1 (>5.0 to 6.0 DU's/Acre)	501	521	515	685
LMDR2 (>6.0 to 8.0 DU's/Acre)	424	430	438	566
MDR (>8.0 to 12.0 DU's/Acre	338	323	324	425
HDR1 (>12.0 to 16.0 DU's/Acre)	246	288	218	310
HDR2 (>16.0 DU's/Acre)	179	177	165	190

3.5.2 Unit Water Demand Factors for Commercial Categories

Similar to the residential categories, averaging was the preferred method used to estimate unit water demand factors for commercial categories. Because of the great variance in water use within a commercial category and the significant number of "zero" reading records[4], there was a need to exclude outlier readings from the average demand calculation. For each category a histogram curve was plotted to identify the distribution of accounts over pre-defined ranges of water uses for each month of a year. The histogram curves are included in **Appendix C**.

For each histogram curve, the weighted average was taken to calculate the average water use for that month. Extremely large readings were also excluded to avoid weighting the data to heavily one way or the other. For this reason, it should be noted that commercial development applications need to be examined on a case by case basis to see if there are any water intensive features such as a lake, other water feature, or high water use. The monthly weighted average was then normalized to obtain the monthly unit water demand factor[5] for each commercial category. The normalized average annual water demand factors in "AF/Year/Acre" are shown in **Figure 3-4**. In **Table 3-6,** the normalized average day demand factors are compared to those obtained in previous studies with units converted to "GPD/Acre".

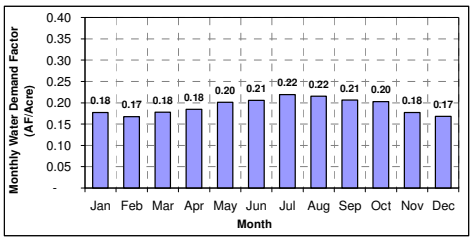
[4] It includes both domestic and irrigation water meter readings to evaluate the gross water demand. "Zero" reading does not mean the account does not record any water use in the past at all. Rather, it means that there is no reading for certain months of a year for some accounts. These zero readings were excluded to calculate the monthly water demand factors in order to avoid unrealistic results by using the averaging method.

[5] Due to the limited number of metering accounts, the average was taken for all data for the same month over the metering period, regardless what year the data was recorded. Therefore, an average normalization factor (arithmetic average of all normalization factors) was applied for the demand factor normalization.

In general, the updated water demand factors for the commercial land uses show a certain degree of reduction for most commercial categories. However, since the updated unit water demand factors for commercial categories are based on a lower level of data resolution compared to residential categories (i.e., there are much fewer number of metered commercial accounts available and a statistically significant variance in water use among the customers within the same commercial category), it is prudent to use slightly more conservative water demand factors for commercial categories. Therefore, the demand factors used in Phase II Report TM 7 are considered valid.

Figure 3-4. Monthly Demand Factors for Commercial Categories

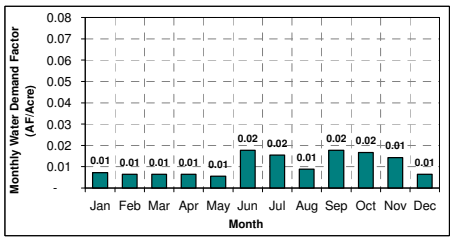
Commercial/Retail



Month	Demand Factor
Jan	0.18
Feb	0.17
Mar	0.18
Apr	0.18
May	0.20
Jun	0.21
Jul	0.22
Aug	0.22
Sep	0.21
Oct	0.20
Nov	0.18
Dec	0.17
TOTAL	2.31

2.31 AF/Year/Acre

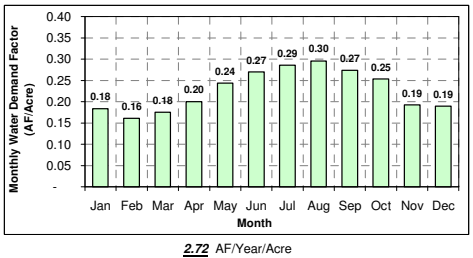
Railroad Yard



Month	Demand Factor
Jan	0.01
Feb	0.01
Mar	0.01
Apr	0.01
May	0.01
Jun	0.02
Jul	0.02
Aug	0.01
Sep	0.02
Oct	0.02
Nov	0.01
Dec	0.01
TOTAL	0.13

0.13 AF/Year/Acre

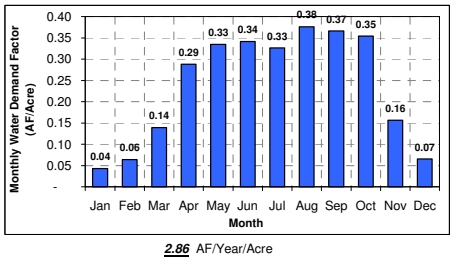
Business Professional



Month	Demand Factor
Jan	0.18
Feb	0.16
Mar	0.18
Apr	0.20
May	0.24
Jun	0.27
Jul	0.29
Aug	0.30
Sep	0.27
Oct	0.25
Nov	0.19
Dec	0.19
TOTAL	2.72

2.72 AF/Year/Acre

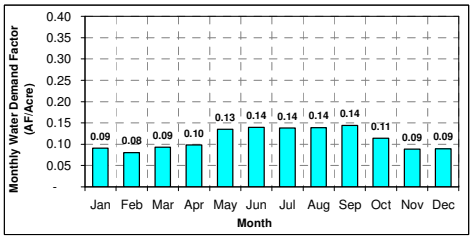
Park/Recreation



Month	Demand Factor
Jan	0.04
Feb	0.06
Mar	0.14
Apr	0.29
May	0.33
Jun	0.34
Jul	0.33
Aug	0.38
Sep	0.37
Oct	0.35
Nov	0.16
Dec	0.07
TOTAL	2.86

2.86 AF/Year/Acre

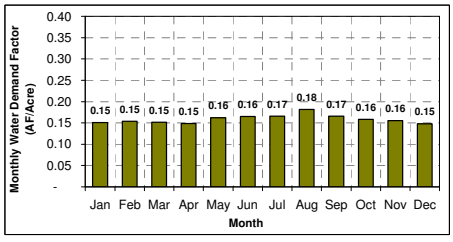
Light Industrial



Month	Demand Factor
Jan	0.09
Feb	0.08
Mar	0.09
Apr	0.10
May	0.13
Jun	0.14
Jul	0.14
Aug	0.14
Sep	0.14
Oct	0.11
Nov	0.09
Dec	0.09
TOTAL	1.35

1.35 AF/Year/Acre

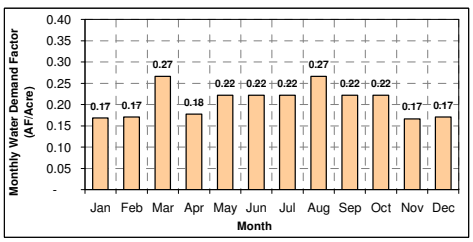
Public



Month	Demand Factor
Jan	0.15
Feb	0.15
Mar	0.15
Apr	0.15
May	0.16
Jun	0.16
Jul	0.17
Aug	0.18
Sep	0.17
Oct	0.16
Nov	0.16
Dec	0.15
TOTAL	1.91

1.91 AF/Year/Acre

Industrial



Month	Demand Factor
Jan	0.17
Feb	0.17
Mar	0.27
Apr	0.18
May	0.22
Jun	0.22
Jul	0.22
Aug	0.27
Sep	0.22
Oct	0.22
Nov	0.17
Dec	0.17
TOTAL	2.50

2.50 AF/Year/Acre

Table 3-6. Unit Water Demand Factor for Commercial Categories in GPD/Acre

Land Use	This Study (GPD/Acre)	Phase II Report TM 7 (GPD/Acre)	MWH (2002) (GPD/Acre)	Spink (1993) (GPD/Acre)
Commercial/Retail	2,063	2,598	2,294	2,678
Business Professional	2,429	2,598	3,207	2,678
Light Industrial	1,205	2,598	1,203	2,678
Industrial	2,232	2,562	2,597	3,124
Railroad Yard	116	109	131	122
Elementary Schools	1,705 [1]	3,454	2,143	3,881
High Schools	1,705 [1]	4,068	2,788	4,571
Public (Fire Station, etc)	1,705 [1]	1,780	2,249	2,000
Park/Recreation	2,554	2,988	2,377	3,881

Note:

[1] Schools are grouped with other "Public & Quasi-Public" land uses to evaluate the unit water demand factor for the reason that typically schools are included in the "Public & Quasi-Public" category in land use maps.

Section 4. WATER DEMAND PROJECTIONS

This section describes water demand estimates for the City and for the SVSP and CVSP at build out. The water demands described here refer to the gross water demand including potable and non-potable water demands. Water demand projections over the period from 2005 to 2030 (build out) are also presented in this section.

4.1 WATER DEMANDS AT BUILD-OUT

The City originally requested that two scenarios be investigated to evaluate the water demands for the City and MOU Area: "Conservative" Scenario and "Aggressive" Scenario. The "Conservative" Scenario uses the residential unit water demand factors that only used for post-92 homes in TM 7 and applies to both pre-92 homes and post-92 homes, as this study indicates that there is no significant difference in water use between pre-92 homes and post -92 homes. The "Conservative" scenario also uses the set of unit water demand factors for commercial used in TM 7. The "Aggressive" Scenario uses the composite residential water demand factors and the considerably lower commercial unit water demand factors developed in this study. This results in a significantly lower total water demand for the City.

After completing the water demand evaluation for the "Aggressive" Scenario, City staff decided to not include this scenario in the findings of this report. The conclusion was that the water demand estimates for the "Aggressive" Scenario did not provide sufficient redundancy in the planning of water supplies to account for uncertainties in the demand estimates. The results of the "Aggressive" Scenario are included in **Appendix A.**

The water demand estimates for the "Conservative" Scenario are included in **Table 4-1** (the WRSP has been annexed into the City boundary but its demand calculation is shown separately for the sake of comparison).

The total annual average demand for the City and the MOU Area is approximately 64,325 AF/Year. The demand for City only (including WRSP) is estimated to be 57,689 AF/Year (50,056 AF/Year plus 7,633 AF/Year) as apposed to 59,111 AF/year in TM 7 (51,620 AF/Year plus 7,491 AF/Year). The 1,422 AF/Year of reduced water demand (59,111 AF/Year – 57,689 AF/Year = 1,422 AF/Year) can be attributed to the meter retrofit program, updated land use applications, and the rezoning efforts in the City. For the rezoned areas, the water demands and demand changes from the original zoning are included in **Appendix A**.

The total annual average demand for both the SVSP and CVSP areas is estimated to be 6,636 AF/Year (5,380 AF/Year plus 1,256 AF/Year) based on the most recent land use information as of May 2006.

4.2 DEMAND GROWTH PROJECTIONS

Demand growth for the City and MOU area were estimated based on the population growth projection data. The City's water supply and water distribution system should be adequate to meet both build-out and interim demands. Particularly, the City will have to provide a reliable long-term

and near-term water supply to the SVSP and CVSP areas without negatively impacting its customers within the City.

Table 4-1. City of Roseville and MOU Area Demand Estimates at Build-out – "Conservative Scenario"

Land Use		Gross Area (Acres)				Annual Average Demand (AF/Year)				Max Day Demand (MGD) [2]			
		City [1]	West Roseville [1]	Sierra Vista	Creek View	City	West Roseville	Sierra Vista	Creek View	City	West Roseville	Sierra Vista	Creek View
LDR1	<3.5	1,675	661	-	-	3,684	1,454	-	-	6.6	2.6	-	-
LDR2	(3.5 to 5.0)	5,278	779	496	-	15,991	2,360	1,503	-	28.5	4.2	2.7	-
LMDR1	>5.0 to 6.0	807	38	-	-	2,591	121	-	-	4.6	0.2	-	-
LMDR2	>6.0 to 8.0	557	113	-	65	1,878	382	-	219	3.4	0.7	-	0.4
MDR	>8.0 to 12.0	390	29	609	79	1,412	107	2,204	286	2.5	0.2	3.9	0.5
HDR1	>12.0 to 16.0	153	54	-	73	691	242	-	331	1.2	0.4	-	0.6
HDR2	>16.0	368	51	75	33	1,456	203	299	129	2.6	0.4	0.5	0.2
Commercial/Retail		1,859	48	-	-	5,409	139	-	-	9.7	0.2	-	-
Commercial Mixed Use [3]		-	-	119	29	-		390	95			0.7	0.2
Business Professional		813	19	-	-	2,366	56	-	-	4.2	0.1	-	-
Light Industrial		1,320	80	-	-	3,842	233	-	-	6.9	0.4	-	-
Industrial		569	32	-	-	1,632	92	-	-	2.9	0.2	-	-
Railroad Yard		535	-	-	-	70	-	-	-	0.1	-	-	-
Schools		384	109	68	10	1,617	459	286	42	2.9	0.8	0.5	0.1
Public		427	16	2	10	851	32	4	20	1.5	0.1	0.0	0.0
Park/Recreation		1,512	278	176	33	5,059	931	589	109	9.0	1.7	1.1	0.2
Open Space		1,579	699	-	154	-	-	-	-	-	-	-	-
Road Right-of-way		397	114	-	53	-	-	-	-	-	-	-	-
Urban Reserve		-	-	31	-	-	-	-	-	-	-	-	-
Subtotal		**18,622**	**3,120**	**1,577**	**538**	**48,548**	**6,810**	**5,274**	**1,231**	**86.7**	**12.2**	**9.4**	**2.2**
System Losses (2%)						971	136	105	25	1.7	0.2	0.2	0.0
Demand Adjustment for Rezoned Areas [4]						537	-	-	-	1.0	-	-	-
Demand for additional 1,000 units of homes in West Roseville [5]						-	685	-	-	-	1.2	-	-
Total						**50,056**	**7,633**	**5,380**	**1,256**	**89.4**	**13.6**	**9.6**	**2.2**
Total Demand for City and MOU Area						**64,325**				**114.8**			

Notes:

1. The Sierra View Country Club golf course (192 acres) within the City and the proposed Roseville Energy Park (200 acres) in West Roseville are not included because they use insignificant amount of City's potable water.
2. Assume Maximum Day Demand/Average Day Demand = 2
3. For internal CMU parcels, 50% is assumed for residential, 20% for retail, and 30% for office. For CMU parcels along major roads. 40% is assumed for residential, 40% for retail, and 20% for offices. The composite demand factor for CMU is based on Sierra Vista Land Use information.
4. There are 19 rezoned areas in the City including HP/JMC, Riverside Corridor Redevelopment, Kaiser, Galleria Mall, and other areas. See demand calculation for these rezoned areas in Appendix A, Figure A-1.
5. Assume these additional units are low density single family homes.

The City's General Plan Fiscal Impact Analysis (MuniFinancial, 2006) provides the population projection for year 2006, 2015, and 2025 for the City and the SVSP and CVSP areas. The population projection for year 2010 and 2020 was interpolated in this report to estimate the City's interim water demand growth in five-year interval. The population and water demand projection were further stretched to 2030 to reconcile the difference in planning horizon for the General Plan and the region's water supply and WFA assuming the City reaches "near" build-out capacity by 2025 and then slowly grows through 2030. The demand growth projection for the City and the SVSP and CVSP areas included is shown in **Table 4-2** and plotted in **Figure 4-1.** Two water demand growth curves are presented in **Figure 4-1,** one is for the City (w/WRSP) only, and the other represents the total water demand growth if the SVSP and CVSP are annexed into the City's boundary. The difference between the two curves is the water demand for the SVSP and CVSP areas. The water demand growth projections will be used to develop the City's water supply strategy on a long-term and short-term basis.

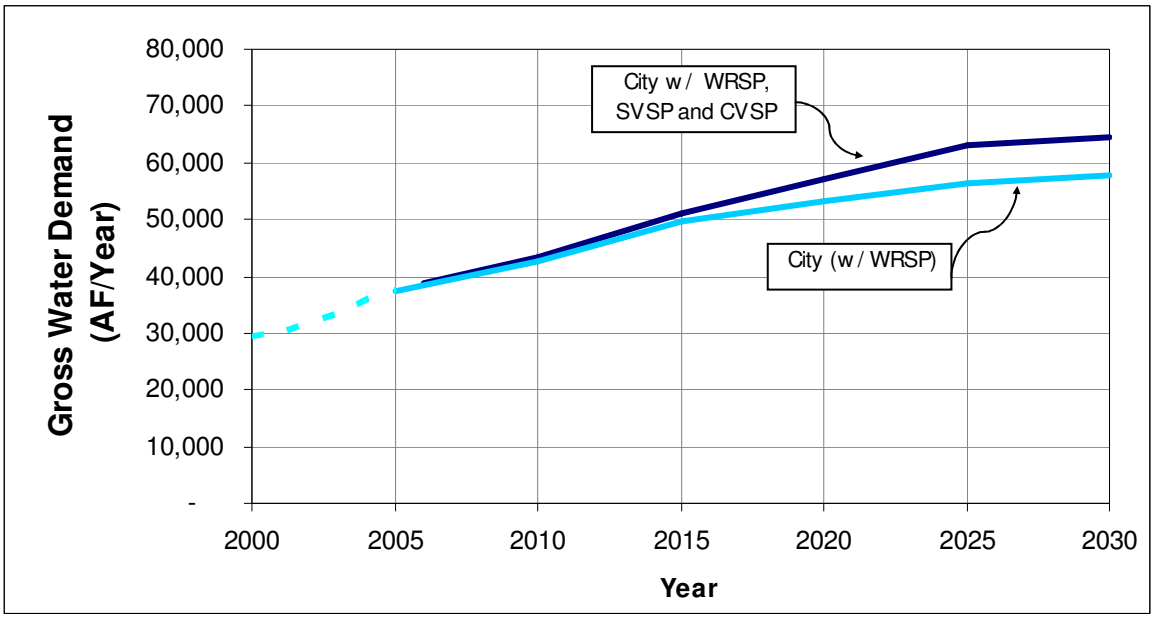
Table 4-2. Table of Water Demand Growth Projection for the City and MOU Area

YEAR	Population Projection [1]	Demand Growth Projection (AF/Year)		
		City (with WRSP)	SVSP and CVSP	TOTAL
2006	104,300	38,648	-	38,648
2010	121,722	42,713	558	43,271
2015	143,500	49,757	1,255	51,013
2020	160,450	53,158	3,881	57,038
2025	177,400	56,558	6,506	63,064
2030	180,948	57,689	6,636	64,325

Notes:

1. Based on the population projection in the City of Roseville's General Plan Fiscal Impact Analysis, February 6, 2006. MuniFinancial.

Figure 4-1. Figure of Water Demand Growth Projection for the City and MOU Area



Section 5. CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the conclusions obtained from the new meter data analysis.

- A composite water demand factor methodology including both pre- and post- 1992 homes is recommended over the existing methodology of using a one set of water demand factors for pre-1992 homes and another set for post-1992 homes. This is the result of the implementation of the City's meter retrofit program by installing meters on older homes.

- The City's water demand was re-confirmed using the composite residential water demand factors and the adopted commercial demand factors in TM 7. Based on this revised set of unit water demand factors, the City's overall water demand decreases by approximately 1,048 AF/year benefiting from the meter retrofit program and some changes in land use applications.

- The City's water demand estimates using solely the unit demand factors for residential and commercial based on the new meter data in this study were considered to be too low and perceived as having an insufficient "safety margin" in the water supply planning for the City and the annexation plans including the SVSP and CVSP.

Section 6. REFERENCES

Brown and Caldwell. 2006. 2005 Urban Water Management Plan.

Montgomery Watson Harza. 2002. Technical Memorandum 1 (Final). *Evaluation of Water System Capacity – Water Demands Evaluation*. February 26.

Montgomery Watson Harza. November 2002. Technical Memorandum : Task 1. *Unit Demand Factors Revision*. November 6.

Montgomery Watson Harza. November 2002. Technical Memorandum : Task 7. *Water Supply Strategy*.

MuniFinancial. February 2006. *City of Roseville General Plan Fiscal Impact Analysis*.

Spink Corporation. 1993. *General Plan Update Water System Study*.

APPENDIX A – OTHER RESULTS OF WATER DEMAND ESTIMATES FOR "CONSERVATIVE" SCENARIO AND "AGGRESSIVE SCENARIO"

Figure A-1. Demand Estimates for "Re-zoned" Area – "Conservative" Scenario

Rezone Area	APN	Parcel Area (ac.)	Original Zoning			Proposed Rezoning			Notes
			Land Use	Land Use Designation	Annual Water Demand (AF/Year)	Land Use	Land Use Designation	Annual Water Demand (AF/Year)	
1	017-115-083-000	17.5	LIGHT INDUSTRIAL	LI	50.9	RESIDENTIAL 100 DU	LMDR1	56.2	
	017-115-084-000	14.3	LIGHT INDUSTRIAL	LI	41.6	RESIDENTIAL 81 DU	LMDR1	45.9	
	017-115-085-000	24.5	LIGHT INDUSTRIAL	LI	71.3	RESIDENTIAL 139 DU	LMDR2	82.6	
	017-115-086-000	39.2	LIGHT INDUSTRIAL	LI	114.1	RESIDENTIAL 224 DU	LMDR2	132.1	
2	017-115-018-000	44.5	LIGHT INDUSTRIAL	LI	129.5	RESIDENTIAL 142 DU	LDR1	97.9	
3	017-370-019-000	13.4	RESIDENTIAL 91 DU	LMDR2	45.2	RESIDENTIAL 86 DU	LMDR2	45.2	
4	015-350-022-000	9.6	COMMERCIAL	COM	27.9	RESIDENTIAL 71 DU	LMDR2	32.4	
5	363-020-036-000	26.4	COMMERCIAL	COM	76.8	RESIDENTIAL 249 DU	MDR	95.6	
6	012-184-008-000	1.4	LIGHT INDUSTRIAL	LI	4.1	RESIDENTIAL 24 DU	HDR2	5.5	
6	012-184-009-000	1.5	LIGHT INDUSTRIAL	LI	4.4	RESIDENTIAL 24 DU	HDR2	5.9	
7	048-460-018-000	1.9	COMMERCIAL	COM	5.5	RESIDENTIAL 33 DU	HDR2	7.5	
	048-460-019-000	7.3	COMMERCIAL	COM	21.2	RESIDENTIAL 130 DU	HDR2	28.9	
	048-460-020-000	7.8	COMMERCIAL	COM	22.7	RESIDENTIAL 139 DU	HDR2	30.9	
	048-460-021-000	7.6	COMMERCIAL	COM	22.1	RESIDENTIAL 135 DU	HDR2	30.1	
	048-460-022-000	7.8	COMMERCIAL	COM	22.7	RESIDENTIAL 138 DU	HDR2	30.9	
8	477-080-005-000	10.7	COMMERCIAL	COM	31.1	Breton Village	LMDR2 + COM	34.2	6.7 acres reidential plus 4 acres commercial
9	363-010-011-000	20.4	COMMERCIAL	COM	59.4	RESIDENTIAL 244 DU	MDR	73.8	
10 (HP/JMC)	017-230-051-000	297.5	HP	LI	865.7	Mixed	Mixed	850.9	Detail Demand Calculation for HP rezone area is included in a seprate table
11	017-162-069-000	9.7	COMMERCIAL	COM	28.2	RESIDENTIAL 125 DU	HDR1	43.8	
12	017-410-019-000	2.3	COMMERCIAL	COM	6.7	RESIDENTIAL 28 DU	HDR2	9.1	
	017-410-020-000	2	COMMERCIAL	COM	5.8	RESIDENTIAL 24 DU	MDR	7.2	
	017-410-021-000	2.2	COMMERCIAL	COM	6.4	RESIDENTIAL 26 DU	MDR	8.0	
	017-410-022-000	2	COMMERCIAL	COM	5.8	RESIDENTIAL 24 DU	MDR	7.2	
	017-410-035-000	5	COMMERCIAL	COM	14.5	RESIDENTIAL 59 DU	MDR	18.1	
	017-410-041-000	1.6	COMMERCIAL	COM	4.7	RESIDENTIAL 19 DU	MDR	5.8	
	017-410-042-000	1.8	COMMERCIAL	COM	5.2	RESIDENTIAL 22 DU	HDR1	8.1	
13	017-115-032-000	19	COMMERCIAL	COM	55.3	RESIDENTIAL 285 DU	MDR+HDR1	77.3	50% MDR plus 50% HDR1
14	363-010-009-000	50	COMMERCIAL	COM	207.8	Convention Center	COM	415.7	Increase from 0.4 to 0.8 FAR
15 (Riverside Redevelopment)	Multiple Parcels	17.3	COMMERCIAL	COM	50.3	CMU	CMU	56.6	CMU Unit Demand Factor for Sierra Vista is assumed for Riverside Redevelopment Area
16	013-123-001-000	0.1	COMMERCIAL	COM	0.3	BP	BP	0.3	
	013-123-002-000	0.1	COMMERCIAL	COM	0.3	BP	BP	0.3	
	013-123-003-000	0.1	COMMERCIAL	COM	0.3	BP	BP	0.3	
	013-123-004-000	0.1	COMMERCIAL	COM	0.3	BP	BP	0.3	
17	017-122-001-000	67	HEAVY INDUSTRIAL	IND	192.3	PUBLIC/QUASI- PUBLIC	PUB	133.6	
18	048-010-030-000	49.2	Kaiser Hospital	COM	93.0	Kaiser Hospital	COM	178.4	Expansion from 378 K to 1.08 M sq. ft. Demand calculation is based on the water meter reading for Kaiser 83,000 gpd (41,000 pgd domestic + 42,000 gpd irrigation). Assume irrigation demand does not change, the demand after expasion = (41,000/378,000)*1,080,000+42,000 = 159,260 gpd
19 (Galleria Mall)	Multiple Parcels	87	COMMERCIAL	COM	262.2	Galleria Mall	COM	424.9	Galleria Mall expansion from 1.1 M sq. ft. (FAR 0.29) to 1.8 M sq. ft. (FAR 0.47)
Subtotal		869.8			2,555.6			3,081.5	
System Loss (2%)					51.1			61.6	
Total Water Demand					**2,606.7**			**3,143.2**	

Rezoning data source: South Placer Reginal Wastewater and Recycled Water Systems Evaluation Project, City of Roseville Sanitary Sewer Model Development Project
TM for Methodology for Adjusting Land Use for Parcels with Approved or Near-Certain Zoning or Development Changes ("Rezone Parcels") (TM No.9b), October 24,2005

Figure A-2. Demand Estimate for HP/JMC – "Conservative" Scenario

Land Use	Designated LU Code	Acreage	Unit Water Demand Factor (AF/Year/Acre)	Demand (AF/Year)
High Density Residential (HDR)	HDR1	62.1	4.52	280.7
Medium Density Residential (MDR)	MDR	88.4	3.62	320.0
Low Density Residential (LDR)	LDR2	0.7	3.03	2.1
Community Commercial (CC)	COM	11.0	2.91	32.0
Business Professional (BP) includes business park and/or new college campus	BP	50.0	2.91	145.5
Parks and Recreation (PR) includes neighborhood parks and parkettes	PARK	13.7	3.35	45.9
Public/Quasi Public (P/QP) includes elementary school, fire station, and municipal well site	PUB	12.4	1.99	24.7
Open Space	OS	45.7	0.00	0.0
Roads	ROW	13.5	0.00	0.0
Subtotal		**297.5**		**850.9**
Systeme Loss(2%)				**17.0**
Total Demand				**867.9**

Figure A-3. City of Roseville and MOU Area Demand Estimates at Build-out – "Aggressive Scenario"

Land Use	Gross Area (Acres)				Annual Average Demand (AF/Year)				Max Day Demand (MGD) [2]			
	City [1]	West Roseville [1]	Sierra Vista	Creek View	City	West Roseville	Sierra Vista	Creek View	City	West Roseville	Sierra Vista	Creek View
LDR1 <3.5	1,675	661	-	-	4,187	1,652	-	-	7.5	2.9	-	-
LDR2 (3.5 to 5.0)	5,278	779	496	-	15,094	2,228	1,419	-	26.9	4.0	2.5	-
LMDR1 >5.0 to 6.0	807	38	-	-	2,494	117	-	-	4.5	0.2	-	-
LMDR2 >6.0 to 8.0	557	113	-	65	1,850	376	-	216	3.3	0.7	-	0.4
MDR >8.0 to 12.0	390	29	609	79	1,475	111	2,301	298	2.6	0.2	4.1	0.5
HDR1 >12.0 to 16.0	153	54	-	73	589	206	-	282	1.1	0.4	-	0.5
HDR2 >16.0	368	51	75	33	1,474	206	302	131	2.6	0.4	0.5	0.2
Commercial/Retail	1,859	48	-	-	4,294	110	-	-	7.7	0.2	-	-
Commercial Mixed Use [3]	-	-	119	29	-		390	95			0.7	0.2
Business Professional	813	19	-	-	2,203	52	-	-	3.9	0.1	-	-
Light Industrial	1,320	80	-	-	1,783	108	-	-	3.2	0.2	-	-
Industrial	569	32	-	-	1,422	80	-	-	2.5	0.1	-	-
Railroad Yard	535	-	-	-	70	-	-	-	0.1	-	-	-
Schools	384	109	68	10	734	208	130	19	1.3	0.4	0.2	0.0
Public	427	16	2	10	815	31	4	19	1.5	0.1	0.0	0.0
Park/Recreation	1,512	278	176	33	4,323	795	503	94	7.7	1.4	0.9	0.2
Open Space	1,579	699	-	154	-	-	-	-	-	-	-	-
Road Right-of-way	397	114	-	53	-	-	-	-	-	-	-	-
Urban Reserve	-	-	31	-	-	-	-	-	-	-	-	-
Subtotal	**18,622**	**3,120**	**1,577**	**538**	**42,805**	**6,281**	**5,049**	**1,154**	**76.4**	**11.2**	**9.0**	**2.1**
System Losses (2%)					856	126	101	23	1.5	0.2	0.2	0.0
Demand Adjustment for Rezoned Area [4]					1,228	-	-	-	2.2	-	-	0.0
Demand for additional 1,000 units of homes in West Roseville [5]						648				1.2		
Total					**44,890**	**7,055**	**5,150**	**1,177**	**80.1**	**12.6**	**9.2**	**2.1**
Total Demand for City and MOU Area					**58,272**				**104.0**			

Notes:

1. The Sierra View Country Club golf course (192 acres) within the City and the proposed Roseville Energy Park (200 acres) in West Roseville are not included because they use insignificant amount of City's potable water.
2. Assume Maximum Day Demand/Average Day Demand = 2
3. For internal CMU parcels, 50% is assumed for residential, 20% for retail, and 30% for office. For CMU parcels along major roads. 40% is assumed for residential, 40% for retail, and 20% for offices. The composite demand factor for CMU is based on Sierra Vista Land Use information.
4. There are 19 rezoned areas in the City including HP/JMC, Riverside Corridor Redevelopment, Kaiser, Galleria Mall, and other areas. See Figure A-4.
5. Assume these units are low density single family homes.

Figure A-4. Demand Estimates for "Re-zoned" Area – "Aggressive" Scenario

Rezone Area	APN	Parcel Area (ac.)	Original Zoning			Proposed Rezoning			Notes
			Land Use	Land Use Designation	Annual Water Demand (AF/Year)	Land Use	Land Use Designation	Annual Water Demand (AF/Year)	
1	017-115-083-000	17.5	LIGHT INDUSTRIAL	LI	23.6	RESIDENTIAL 100 DU	LMDR1	54.1	
	017-115-084-000	14.3	LIGHT INDUSTRIAL	LI	19.3	RESIDENTIAL 81 DU	LMDR1	44.2	
	017-115-085-000	24.5	LIGHT INDUSTRIAL	LI	33.1	RESIDENTIAL 139 DU	LMDR2	81.3	
	017-115-086-000	39.2	LIGHT INDUSTRIAL	LI	52.9	RESIDENTIAL 224 DU	LMDR2	130.1	
2	017-115-018-000	44.5	LIGHT INDUSTRIAL	LI	60.1	RESIDENTIAL 142 DU	LDR1	111.3	
3	017-370-019-000	13.4	RESIDENTIAL 91 DU	LMDR2	44.5	RESIDENTIAL 86 DU	LMDR2	44.5	
4	015-350-022-000	9.6	COMMERCIAL	COM	22.2	RESIDENTIAL 71 DU	LMDR2	31.9	
5	363-020-036-000	26.4	COMMERCIAL	COM	61.0	RESIDENTIAL 249 DU	MDR	99.8	
6	012-184-008-000	1.4	LIGHT INDUSTRIAL	LI	1.9	RESIDENTIAL 24 DU	HDR2	5.6	
6	012-184-009-000	1.5	LIGHT INDUSTRIAL	LI	2.0	RESIDENTIAL 24 DU	HDR2	6.0	
7	048-460-018-000	1.9	COMMERCIAL	COM	4.4	RESIDENTIAL 33 DU	HDR2	7.6	
	048-460-019-000	7.3	COMMERCIAL	COM	16.9	RESIDENTIAL 130 DU	HDR2	29.3	
	048-460-020-000	7.8	COMMERCIAL	COM	18.0	RESIDENTIAL 139 DU	HDR2	31.3	
	048-460-021-000	7.6	COMMERCIAL	COM	17.6	RESIDENTIAL 135 DU	HDR2	30.5	
	048-460-022-000	7.8	COMMERCIAL	COM	18.0	RESIDENTIAL 138 DU	HDR2	31.3	
8	477-080-005-000	10.7	COMMERCIAL	COM	24.7	Breton Village	LMDR2 + COM	31.5	6.7 acres reidential plus 4 acres commercial
9	363-010-011-000	20.4	COMMERCIAL	COM	47.1	RESIDENTIAL 244 DU	MDR	77.1	
10 (HP/JMC)	017-230-051-000	297.5	HP	LI	401.6	Mixed	Mixed	799.5	Detail Demand Calculation for HP rezone area is included in a seprate table
11	017-162-069-000	9.7	COMMERCIAL	COM	22.4	RESIDENTIAL 125 DU	HDR1	37.3	
12	017-410-019-000	2.3	COMMERCIAL	COM	5.3	RESIDENTIAL 28 DU	HDR2	9.2	
	017-410-020-000	2	COMMERCIAL	COM	4.6	RESIDENTIAL 24 DU	MDR	7.6	
	017-410-021-000	2.2	COMMERCIAL	COM	5.1	RESIDENTIAL 26 DU	MDR	8.3	
	017-410-022-000	2	COMMERCIAL	COM	4.6	RESIDENTIAL 24 DU	MDR	7.6	
	017-410-035-000	5	COMMERCIAL	COM	11.6	RESIDENTIAL 59 DU	MDR	18.9	
	017-410-041-000	1.6	COMMERCIAL	COM	3.7	RESIDENTIAL 19 DU	MDR	6.0	
	017-410-042-000	1.8	COMMERCIAL	COM	4.2	RESIDENTIAL 22 DU	HDR1	6.9	
13	017-115-032-000	19	COMMERCIAL	COM	43.9	RESIDENTIAL 285 DU	MDR+HDR1	72.5	50% MDR plus 50% HDR1
14	363-010-009-000	50	COMMERCIAL	COM	165.0	Convention Center	COM	330.0	Increase from 0.4 to 0.8 FAR
15 (Riverside Redevelopment)	Multiple Parcels	17.3	COMMERCIAL	COM	40.0	CMU	CMU	56.6	CMU Unit Demand Factor for Sierra Vista is assumed for Riverside Redevelopment Area
16	013-123-001-000	0.1	COMMERCIAL	COM	0.2	BP	BP	0.3	
	013-123-002-000	0.1	COMMERCIAL	COM	0.2	BP	BP	0.3	
	013-123-003-000	0.1	COMMERCIAL	COM	0.2	BP	BP	0.3	
	013-123-004-000	0.1	COMMERCIAL	COM	0.2	BP	BP	0.3	
17	017-122-001-000	67	HEAVY INDUSTRIAL	IND	167.5	PUBLIC/QUASI- PUBLIC	PUB	128.0	
18	048-010-030-000	49.2	Kaiser Hospital	COM	93.0	Kaiser Hospital	COM	178.4	Expansion from 378 K to 1.08 M sq. ft. Demand calculation is based on the water meter reading for Kaiser 83,000 gpd (41,000 pgd domestic + 42,000 gpd irrigation). Assume irrigation demand does not change, the demand after expasion = (41,000/378,000)*1,080
19 (Galleria Mall)	Multiple Parcels	87	COMMERCIAL	COM	208.1	Galleria Mall	COM	337.3	Galleria Mall expansion from 1.1 M sq. ft. (FAR 0.29) to 1.8 M sq. ft. (FAR 0.47)
Subtotal		869.8			1,648.7			2,852.5	
System Loss (2%)					33.0			57.1	
Total Water Demand					**1,681.7**			**2,909.6**	

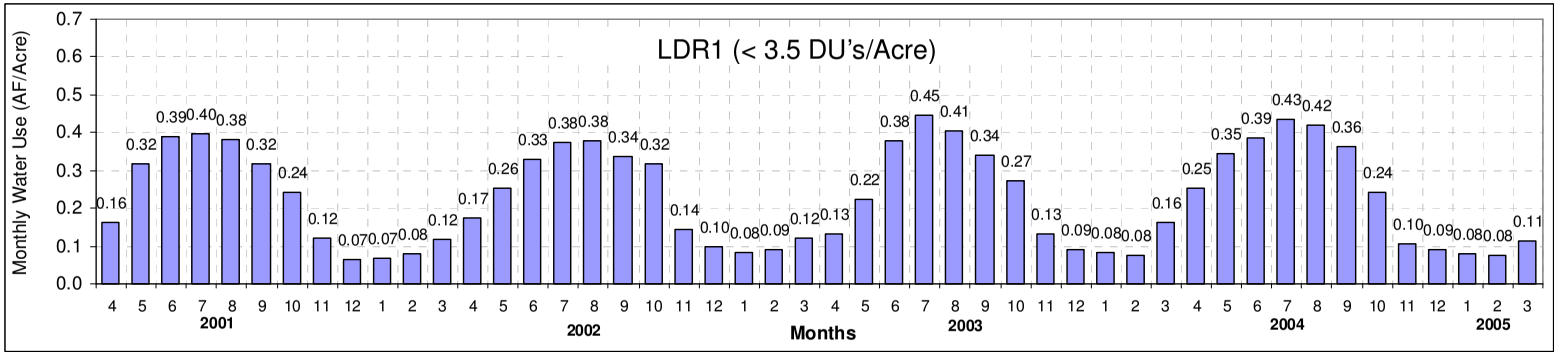
Rezoning data source: South Placer Reginal Wastewater and Recycled Water Systems Evaluation Project, City of Roseville Sanitary Sewer Model Development Project
TM for Methodology for Adjusting Land Use for Parcels with Approved or Near-Certain Zoning or Development Changes ("Rezone Parcels") (TM No.9b), October 24,2005

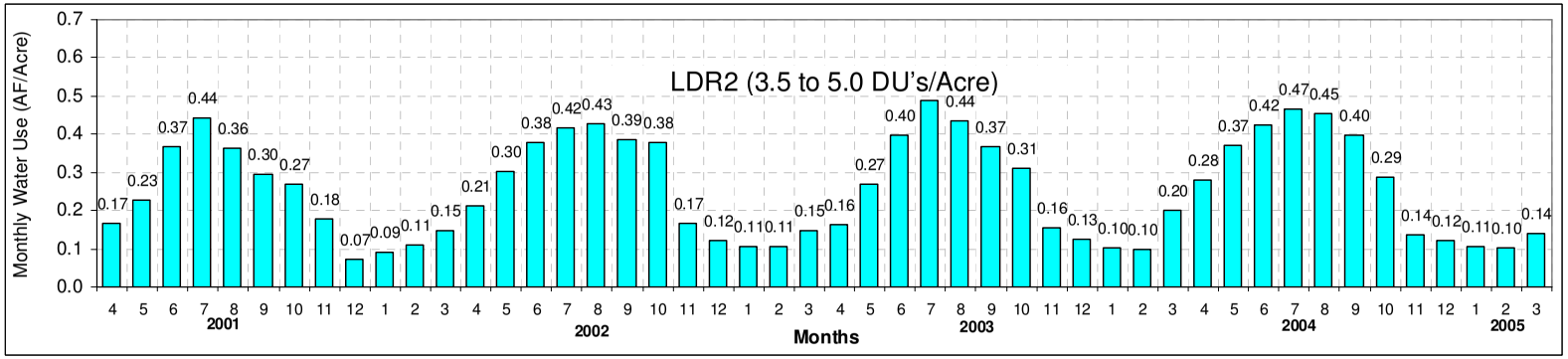
Figure A-5. Demand Estimate for HP/JMC – "Aggressive" Scenario

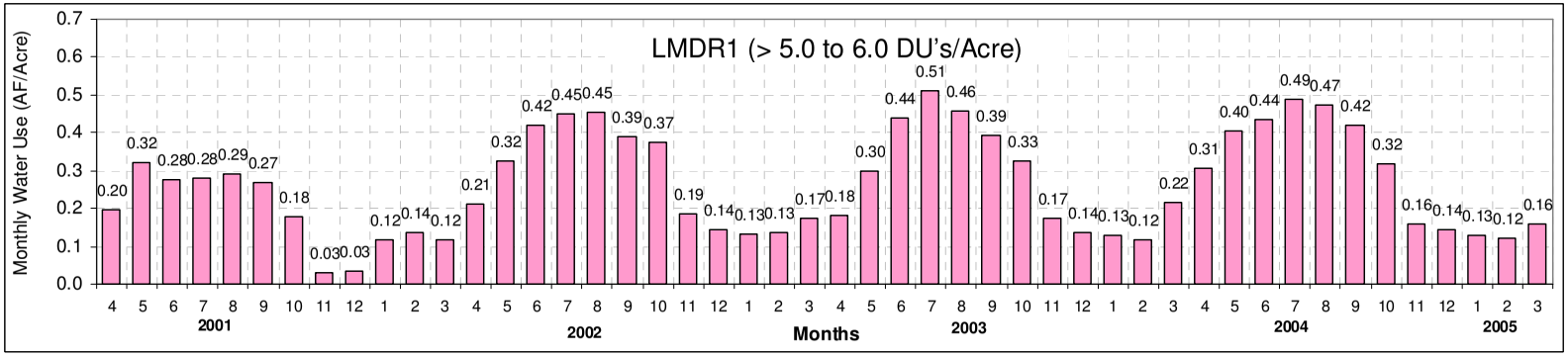
Land Use	Designated LU Code	Acreage	Unit Water Demand Factor (AF/Year/Acre)	Demand (AF/Year)
High Density Residential (HDR)	HDR1	62.1	3.85	239.1
Medium Density Residential (MDR)	MDR	88.4	3.78	334.2
Low Density Residential (LDR)	LDR2	0.7	2.86	2.0
Community Commercial (CC)	COM	11.0	2.31	25.4
Business Professional (BP) includes business park and/or new college campus	BP	50.0	2.71	135.5
Parks and Recreation (PR) includes neighborhood parks and parkettes	PARK	13.7	2.86	39.2
Public/Quasi Public (P/QP) includes elementary school, fire station, and municipal well site	PUB	12.4	1.95	24.2
Open Space	OS	45.7	0.00	0.0
Roads	ROW	13.5	0.00	0.0
Subtotal		**297.5**		**799.5**
Systeme Loss(2%)				**16.0**
Total Demand				**815.5**

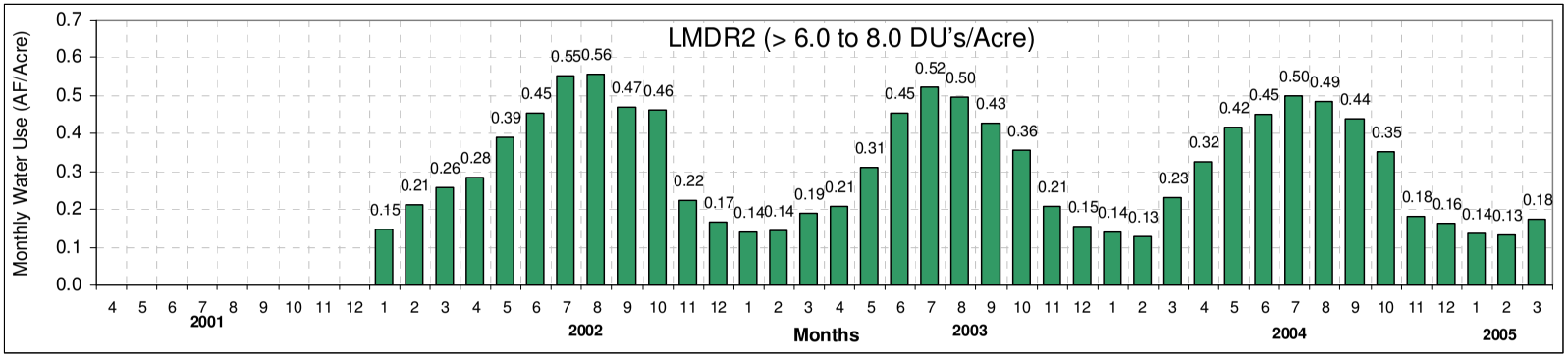
APPENDIX B – RESIDENTIAL UNIT WATER DEMAND FACTORS CALCULATION

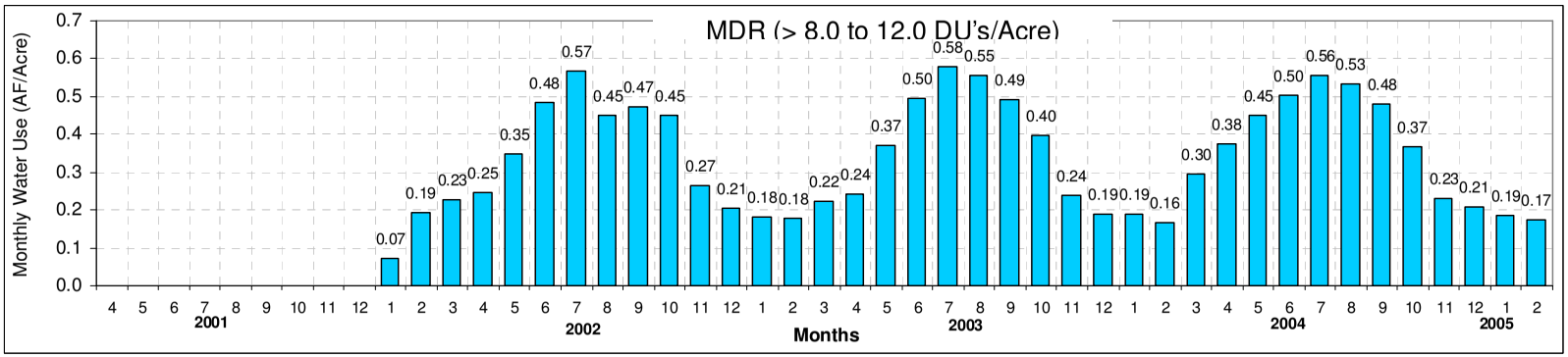
Figure B-1. Historic Monthly Water Demand for Various Residential Land Uses – Pre-92 and Post-92 Homes Combined (AF/Year/Acre)

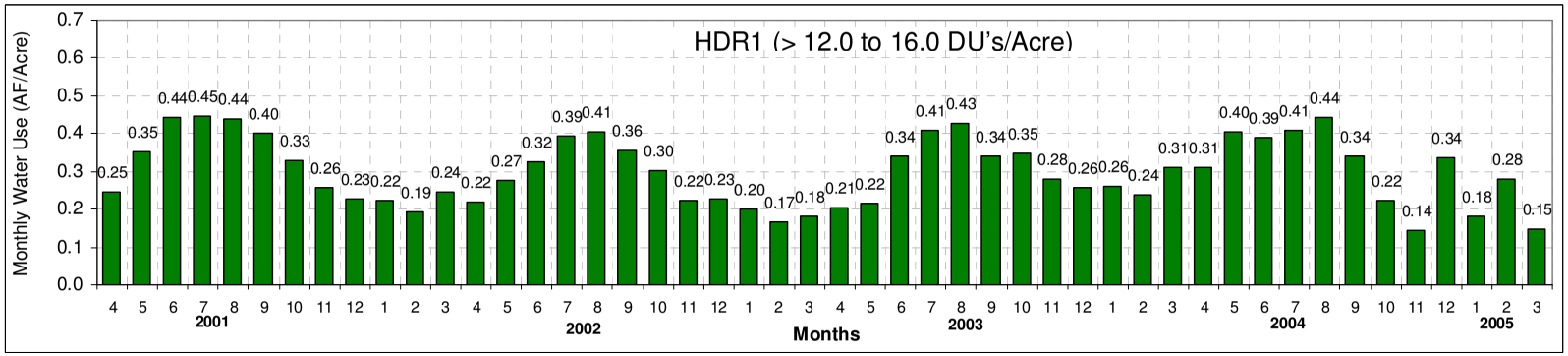







LMDR2 (> 6.0 to 8.0 DU's/Acre)
Monthly Water Use (AF/Acre)
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7
0.15 0.21 0.26 0.28 0.39 0.45 0.55 0.56 0.47 0.46 0.22 0.17 0.14 0.14 0.19 0.21 0.31 0.45 0.52 0.50 0.43 0.36 0.21 0.15 0.14 0.13 0.23 0.32 0.42 0.45 0.50 0.49 0.44 0.35 0.18 0.16 0.14 0.13 0.18
4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3
2001 2002 2003 2004 2005
Months


MDR (> 8.0 to 12.0 DU's/Acre)
Monthly Water Use (AF/Acre)
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7
0.07 0.19 0.23 0.25 0.35 0.48 0.57 0.45 0.47 0.45 0.27 0.21 0.18 0.18 0.22 0.24 0.37 0.50 0.58 0.55 0.49 0.40 0.24 0.19 0.19 0.16 0.30 0.38 0.45 0.50 0.56 0.53 0.48 0.37 0.23 0.21 0.19 0.17
4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2
2001 2002 2003 2004 2005
Months


HDR1 (> 12.0 to 16.0 DU's/Acre)
Monthly Water Use (AF/Acre)
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7
0.25 0.35 0.44 0.45 0.44 0.40 0.33 0.26 0.23 0.22 0.19 0.24 0.22 0.27 0.32 0.39 0.41 0.36 0.30 0.22 0.23 0.20 0.17 0.18 0.21 0.22 0.34 0.41 0.43 0.34 0.35 0.28 0.26 0.26 0.24 0.31 0.31 0.40 0.39 0.41 0.44 0.34 0.22 0.14 0.34 0.18 0.28 0.15
4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3
2001 2002 2003 2004 2005
Months

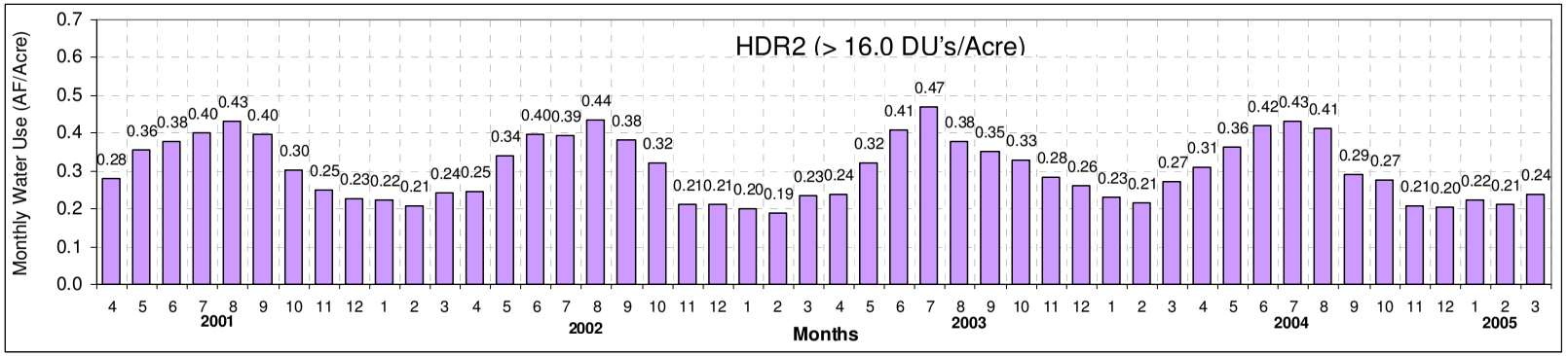

HDR2 (> 16.0 DU's/Acre)
Monthly Water Use (AF/Acre)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.28 0.36 0.38 0.40 0.43 0.40 0.30 0.25 0.23 0.22 0.21 0.24 0.25 0.34 0.40 0.39 0.44 0.38 0.32 0.21 0.21 0.20 0.19 0.23 0.24 0.32 0.41 0.47 0.38 0.35 0.33 0.28 0.26 0.23 0.21 0.27 0.31 0.36 0.42 0.43 0.41 0.29 0.27 0.21 0.20 0.22 0.21 0.24
4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3
2001
2002
2003
2004
2005
Months

Figure B-2. Historical Monthly Water Use for LDR1 (Pre-92 and Post-92 Homes Combined)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	9.74	60.35	0.1614	161
2001.05	32.51	102.03	0.3186	271
2001.06	25.53	65.64	0.3890	179
2001.07	33.34	83.61	0.3987	219
2001.08	33.28	87.49	0.3804	234
2001.09	23.25	72.90	0.3189	193
2001.10	21.50	89.19	0.2410	237
2001.11	13.56	111.23	0.1219	296
2001.12	3.93	60.05	0.0655	163
2002.01	8.66	124.32	0.0697	339
2002.02	7.91	97.99	0.0807	266
2002.03	8.86	75.23	0.1178	208
2002.04	21.67	124.62	0.1739	352
2002.05	30.85	120.84	0.2553	340
2002.06	32.76	99.43	0.3294	283
2002.07	52.95	140.90	0.3758	404
2002.08	51.13	135.40	0.3776	395
2002.09	70.83	210.09	0.3371	678
2002.10	145.14	458.13	0.3168	1,532
2002.11	59.26	410.62	0.1443	1,382
2002.12	39.97	406.97	0.0982	1,370
2003.01	34.67	414.98	0.0836	1,395
2003.02	32.79	362.75	0.0904	1,236
2003.03	59.78	501.37	0.1192	1,711
2003.04	69.77	525.42	0.1328	1,787
2003.05	120.50	536.64	0.2245	1,833
2003.06	201.16	529.01	0.3803	1,803
2003.07	260.66	583.26	0.4469	1,981
2003.08	207.16	510.03	0.4062	1,754
2003.09	191.73	562.63	0.3408	1,913
2003.10	165.23	604.92	0.2732	2,059
2003.11	66.19	505.93	0.1308	1,751
2003.12	49.18	544.13	0.0904	1,848
2004.01	47.30	576.99	0.0820	1,954
2004.02	43.06	564.53	0.0763	1,926
2004.03	94.61	587.51	0.1610	2,005
2004.04	153.12	603.51	0.2537	2,062
2004.05	204.05	591.29	0.3451	2,017
2004.06	243.48	629.26	0.3869	2,147
2004.07	251.17	577.66	0.4348	1,988
2004.08	237.59	565.35	0.4202	1,932
2004.09	260.40	714.52	0.3644	2,431
2004.10	167.97	690.12	0.2434	2,362
2004.11	71.63	687.88	0.1041	2,357
2004.12	70.81	766.73	0.0924	2,627
2005.01	52.64	656.38	0.0802	2,247
2005.02	52.74	685.29	0.0770	2,349
2005.03	80.98	717.02	0.1129	2,460

Figure B-3. Historical Monthly Water Use for LDR2 (Pre-92 and Post-92 Homes Combined)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	0.25	1.52	0.1654	7
2001.05	0.66	2.91	0.2256	13
2001.06	0.73	1.99	0.3652	10
2001.07	1.02	2.32	0.4412	11
2001.08	0.99	2.73	0.3645	12
2001.09	0.71	2.38	0.2970	12
2001.10	0.68	2.55	0.2679	12
2001.11	0.59	3.31	0.1793	15
2001.12	0.22	3.01	0.0733	13
2002.01	1.88	20.73	0.0907	91
2002.02	2.75	25.09	0.1098	97
2002.03	3.96	26.98	0.1468	103
2002.04	10.20	47.78	0.2135	197
2002.05	17.41	57.50	0.3028	237
2002.06	23.32	61.38	0.3799	219
2002.07	37.63	90.00	0.4181	352
2002.08	41.92	97.67	0.4292	375
2002.09	145.81	378.36	0.3854	1,606
2002.10	345.97	916.51	0.3775	3,699
2002.11	142.49	851.50	0.1673	3,399
2002.12	101.79	834.29	0.1220	3,317
2003.01	91.64	862.72	0.1062	3,448
2003.02	83.82	783.66	0.1070	3,068
2003.03	151.25	1,025.98	0.1474	4,186
2003.04	177.42	1,082.71	0.1639	4,480
2003.05	296.41	1,110.37	0.2669	4,593
2003.06	440.81	1,108.57	0.3976	4,547
2003.07	577.76	1,181.19	0.4891	4,886
2003.08	481.86	1,105.12	0.4360	4,504
2003.09	431.07	1,168.93	0.3688	4,761
2003.10	383.01	1,231.94	0.3109	5,031
2003.11	179.43	1,153.96	0.1555	4,696
2003.12	126.87	1,014.07	0.1251	4,159
2004.01	123.59	1,193.55	0.1035	4,837
2004.02	120.70	1,227.75	0.0983	5,019
2004.03	254.24	1,269.25	0.2003	5,167
2004.04	365.12	1,306.04	0.2796	5,312
2004.05	483.94	1,304.82	0.3709	5,295
2004.06	568.24	1,339.03	0.4244	5,459
2004.07	598.47	1,285.34	0.4656	5,248
2004.08	543.06	1,198.58	0.4531	5,047
2004.09	517.42	1,300.49	0.3979	5,233
2004.10	404.25	1,413.65	0.2860	5,783
2004.11	193.70	1,409.09	0.1375	5,755
2004.12	194.33	1,593.79	0.1219	6,254
2005.01	146.64	1,386.50	0.1058	5,679
2005.02	137.63	1,350.35	0.1019	5,839
2005.03	210.20	1,487.84	0.1413	6,129

Figure B-4. Historical Monthly Water Use for LMDR1 (Pre-92 and Post-92 Homes Combined)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	0.03	0	0.1963	1
2001.05	0.05	0	0.3225	1
2001.06	0.05	0	0.2761	1
2001.07	0.05	0	0.2805	1
2001.08	0.05	0	0.2898	1
2001.09	0.04	0	0.2704	1
2001.10	0.06	0	0.1774	2
2001.11	0.01	0	0.0314	3
2001.12	0.03	1	0.0326	7
2002.01	0.54	5	0.1175	32
2002.02	0.90	7	0.1370	45
2002.03	1.15	10	0.1160	63
2002.04	3.67	17	0.2116	126
2002.05	7.30	22	0.3248	146
2002.06	11.63	28	0.4205	192
2002.07	16.22	36	0.4501	239
2002.08	21.43	47	0.4541	314
2002.09	87.70	224	0.3913	1,451
2002.10	138.51	371	0.3737	2,421
2002.11	67.20	360	0.1866	2,366
2002.12	51.98	359	0.1448	2,355
2003.01	48.55	367	0.1321	2,406
2003.02	46.91	349	0.1345	2,298
2003.03	72.73	418	0.1742	2,740
2003.04	80.41	440	0.1826	2,891
2003.05	134.77	448	0.3007	2,924
2003.06	195.77	445	0.4399	2,911
2003.07	243.17	477	0.5103	3,118
2003.08	207.28	453	0.4575	2,968
2003.09	188.80	479	0.3941	3,150
2003.10	158.16	486	0.3257	3,159
2003.11	74.85	429	0.1745	2,970
2003.12	63.45	464	0.1366	2,904
2004.01	61.37	480	0.1279	3,129
2004.02	54.77	473	0.1158	3,097
2004.03	105.88	489	0.2167	3,197
2004.04	153.62	502	0.3058	3,295
2004.05	199.25	494	0.4030	3,234
2004.06	219.48	504	0.4352	3,295
2004.07	241.76	496	0.4872	3,244
2004.08	206.27	437	0.4718	2,851
2004.09	178.21	423	0.4211	2,767
2004.10	164.22	520	0.3160	3,396
2004.11	81.75	514	0.1590	3,388
2004.12	81.65	573	0.1425	3,738
2005.01	62.17	486	0.1279	3,173
2005.02	64.57	530	0.1219	3,472
2005.03	85.12	538	0.1582	3,523

Figure B-5. Historical Monthly Water Use for LMDR1 (Pre-92 and Post-92 Homes Combined)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04				
2001.05				
2001.06				
2001.07				
2001.08				
2001.09				
2001.10				
2001.11				
2001.12				
2002.01	0.62	4.20	0.1466	36
2002.02	1.61	7.65	0.2106	64
2002.03	2.60	10.12	0.2571	83
2002.04	4.22	14.82	0.2846	122
2002.05	7.21	18.55	0.3888	152
2002.06	10.71	23.60	0.4538	200
2002.07	15.50	28.03	0.5530	254
2002.08	17.08	30.70	0.5564	248
2002.09	71.86	152.98	0.4697	1,259
2002.10	159.73	347.18	0.4601	2,844
2002.11	77.32	344.66	0.2243	2,837
2002.12	57.92	345.78	0.1675	2,844
2003.01	49.16	349.49	0.1407	2,871
2003.02	50.32	350.27	0.1437	2,887
2003.03	75.52	398.62	0.1895	3,266
2003.04	90.97	440.88	0.2063	3,628
2003.05	136.93	441.26	0.3103	3,629
2003.06	193.79	427.57	0.4532	3,523
2003.07	242.52	465.40	0.5211	3,823
2003.08	218.07	440.12	0.4955	3,613
2003.09	201.49	471.93	0.4270	3,877
2003.10	167.81	469.80	0.3572	3,846
2003.11	85.27	409.93	0.2080	3,745
2003.12	69.44	451.35	0.1538	3,354
2004.01	65.60	462.89	0.1417	3,788
2004.02	57.83	447.05	0.1294	3,682
2004.03	108.90	471.49	0.2310	3,860
2004.04	158.73	489.19	0.3245	4,032
2004.05	192.57	462.64	0.4163	3,790
2004.06	215.21	477.42	0.4508	3,909
2004.07	226.17	454.21	0.4979	3,739
2004.08	213.26	439.08	0.4857	3,597
2004.09	175.43	400.13	0.4384	3,258
2004.10	170.60	486.71	0.3505	3,996
2004.11	87.36	480.21	0.1819	3,945
2004.12	94.76	588.62	0.1610	4,830
2005.01	54.12	394.71	0.1371	3,243
2005.02	61.96	463.55	0.1337	3,808
2005.03	86.25	491.92	0.1753	4,016

Figure B-6. Historical Monthly Water Use for MDR (Pre-92 and Post-92 Homes Combined)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04				
2001.05				
2001.06				
2001.07				
2001.08				
2001.09				
2001.10				
2001.11				
2001.12				
2002.01	0.08	1.17	0.07	12
2002.02	0.32	1.67	0.19	17
2002.03	0.40	1.76	0.23	18
2002.04	0.66	2.68	0.25	27
2002.05	1.21	3.48	0.35	35
2002.06	2.16	4.47	0.48	45
2002.07	2.31	4.07	0.57	41
2002.08	2.37	5.27	0.45	53
2002.09	9.78	20.64	0.47	216
2002.10	12.62	28.14	0.45	296
2002.11	7.53	28.25	0.27	297
2002.12	5.85	28.49	0.21	299
2003.01	5.59	30.73	0.18	327
2003.02	5.81	32.57	0.18	353
2003.03	8.70	38.89	0.22	412
2003.04	10.21	41.86	0.24	457
2003.05	15.94	42.82	0.37	462
2003.06	21.09	42.41	0.50	451
2003.07	25.98	44.75	0.58	491
2003.08	23.86	43.03	0.55	459
2003.09	21.92	44.72	0.49	491
2003.10	18.64	46.75	0.40	504
2003.11	10.47	43.87	0.24	473
2003.12	8.13	43.25	0.19	468
2004.01	8.40	44.86	0.19	485
2004.02	7.45	45.21	0.16	482
2004.03	13.77	46.57	0.30	503
2004.04	17.84	47.43	0.38	519
2004.05	20.42	45.43	0.45	484
2004.06	23.36	46.49	0.50	502
2004.07	25.82	46.29	0.56	501
2004.08	23.01	43.04	0.53	468
2004.09	18.95	39.54	0.48	437
2004.10	20.98	57.05	0.37	633
2004.11	11.61	50.65	0.23	563
2004.12	11.75	56.62	0.21	628
2005.01	10.38	55.85	0.19	620
2005.02	9.95	57.56	0.17	637
2005.03	13.90	57.81	0.24	639

Figure B-7. Historical Monthly Water Use for HDR1 (Pre-92 and Post-92 Homes Combined)

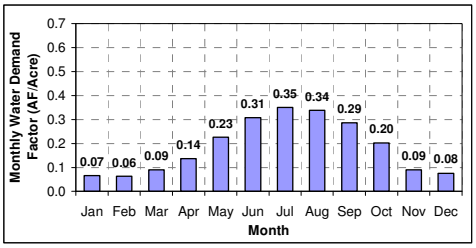
Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	2.46	9.96	0.2465	24
2001.05	3.58	10.20	0.3514	25
2001.06	4.65	10.53	0.4412	27
2001.07	4.47	10.02	0.4456	24
2001.08	4.49	10.20	0.4404	25
2001.09	4.09	10.20	0.4008	25
2001.10	3.34	10.20	0.3277	25
2001.11	2.72	10.58	0.2573	27
2001.12	2.30	10.20	0.2257	25
2002.01	2.26	10.20	0.2219	25
2002.02	1.97	10.20	0.1927	25
2002.03	2.49	10.20	0.2445	25
2002.04	2.23	10.20	0.2192	25
2002.05	2.85	10.37	0.2747	26
2002.06	3.31	10.20	0.3250	25
2002.07	3.58	9.09	0.3943	23
2002.08	4.58	11.30	0.4050	27
2002.09	3.23	9.09	0.3552	23
2002.10	3.37	11.13	0.3031	26
2002.11	2.26	10.02	0.2250	24
2002.12	2.37	10.42	0.2280	26
2003.01	2.06	10.20	0.2022	25
2003.02	1.69	10.20	0.1653	25
2003.03	1.84	10.20	0.1805	25
2003.04	2.09	10.20	0.2052	25
2003.05	2.17	10.02	0.2163	24
2003.06	3.19	9.41	0.3392	25
2003.07	4.68	11.47	0.4077	28
2003.08	3.89	9.09	0.4283	23
2003.09	3.48	10.20	0.3409	25
2003.10	3.94	11.30	0.3489	27
2003.11	2.78	9.92	0.2805	23
2003.12	2.64	10.20	0.2589	25
2004.01	2.66	10.20	0.2606	25
2004.02	2.45	10.20	0.2402	25
2004.03	3.17	10.20	0.3106	25
2004.04	3.16	10.20	0.3099	25
2004.05	4.19	10.38	0.4035	26
2004.06	4.03	10.36	0.3888	26
2004.07	3.79	9.31	0.4074	24
2004.08	5.64	12.75	0.4421	40
2004.09	4.25	12.48	0.3402	31
2004.10	2.32	10.36	0.2244	26
2004.11	2.04	14.30	0.1430	26
2004.12	2.04	6.09	0.3354	24
2005.01	1.86	10.20	0.1825	25
2005.02	1.72	6.09	0.2816	24
2005.03	2.14	14.30	0.1494	26

Figure B-8. Historical Monthly Water Use for HDR2 (Pre-92 and Post-92 Homes Combined)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	7.51	26.99	0.2783	17
2001.05	9.65	26.99	0.3574	17
2001.06	10.26	26.99	0.3800	17
2001.07	10.78	26.99	0.3993	17
2001.08	11.69	26.99	0.4330	17
2001.09	10.77	26.99	0.3990	17
2001.10	9.21	30.51	0.3020	18
2001.11	6.73	26.99	0.2493	17
2001.12	6.11	26.99	0.2262	17
2002.01	6.00	26.99	0.2222	17
2002.02	5.63	26.99	0.2087	17
2002.03	6.53	26.99	0.2419	17
2002.04	6.67	26.99	0.2470	17
2002.05	9.20	26.99	0.3407	17
2002.06	10.69	26.99	0.3961	17
2002.07	10.65	26.99	0.3946	17
2002.08	11.78	26.99	0.4363	17
2002.09	12.17	31.76	0.3832	19
2002.10	8.68	27.11	0.3201	18
2002.11	5.73	26.99	0.2123	17
2002.12	5.76	26.99	0.2133	17
2003.01	5.43	26.99	0.2010	17
2003.02	5.08	26.99	0.1884	17
2003.03	6.29	26.87	0.2341	16
2003.04	6.50	27.11	0.2397	18
2003.05	8.73	26.99	0.3235	17
2003.06	10.94	26.87	0.4072	16
2003.07	12.68	27.11	0.4677	18
2003.08	10.15	26.87	0.3775	16
2003.09	9.51	27.11	0.3509	18
2003.10	8.91	26.99	0.3300	17
2003.11	7.68	26.99	0.2845	17
2003.12	7.03	26.99	0.2603	17
2004.01	6.19	26.99	0.2291	17
2004.02	5.78	26.99	0.2142	17
2004.03	7.39	26.99	0.2737	17
2004.04	8.41	26.99	0.3116	17
2004.05	9.85	26.99	0.3649	17
2004.06	11.29	26.99	0.4181	17
2004.07	11.59	26.87	0.4312	16
2004.08	11.17	26.99	0.4139	17
2004.09	13.37	45.70	0.2926	29
2004.10	7.41	26.99	0.2744	17
2004.11	5.57	26.99	0.2064	17
2004.12	5.49	26.99	0.2034	17
2005.01	6.07	26.99	0.2249	17
2005.02	5.76	26.99	0.2132	17
2005.03	6.41	26.99	0.2373	17

Figure B-9. Unit Demand Factors for Pre-92 Homes Only

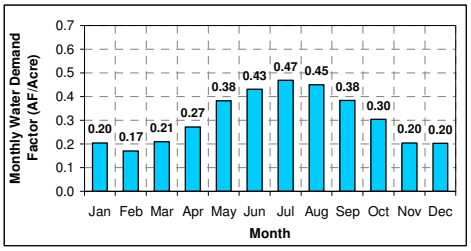
Low Density Single Family Residential (LDR<3.5)



Month	Demand Factor
Jan	0.07
Feb	0.06
Mar	0.09
Apr	0.14
May	0.23
Jun	0.31
Jul	0.35
Aug	0.34
Sep	0.29
Oct	0.20
Nov	0.09
Dec	0.08
TOTAL	***2.23***

2.23 AF/Year/Acre

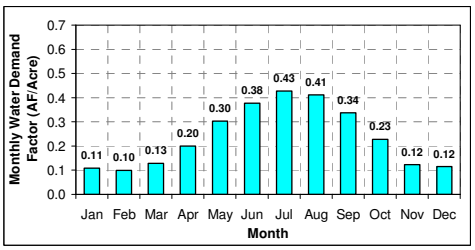
Medium Density Single/Multi Family Residential (MDR 8~12)



Month	Demand Factor
Jan	0.20
Feb	0.17
Mar	0.21
Apr	0.27
May	0.38
Jun	0.43
Jul	0.47
Aug	0.45
Sep	0.38
Oct	0.30
Nov	0.20
Dec	0.20
TOTAL	***3.68***

3.68 AF/Year/Acre

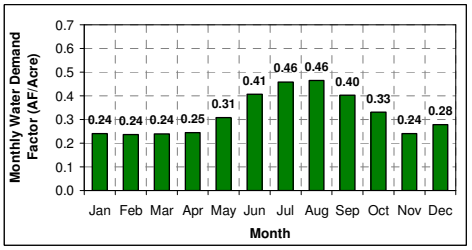
Low Density Single Family Residential (LDR 3.5~5)



Month	Demand Factor
Jan	0.11
Feb	0.10
Mar	0.13
Apr	0.20
May	0.30
Jun	0.38
Jul	0.43
Aug	0.41
Sep	0.34
Oct	0.23
Nov	0.12
Dec	0.12
TOTAL	***2.86***

2.86 AF/Year/Acre

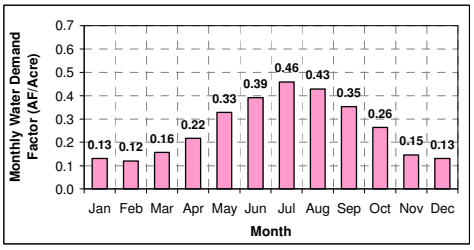
High Density Multi Family Residential (HDR 12~16)



Month	Demand Factor
Jan	0.24
Feb	0.24
Mar	0.24
Apr	0.25
May	0.31
Jun	0.41
Jul	0.46
Aug	0.46
Sep	0.40
Oct	0.33
Nov	0.24
Dec	0.28
TOTAL	***3.85***

3.85 AF/Year/Acre

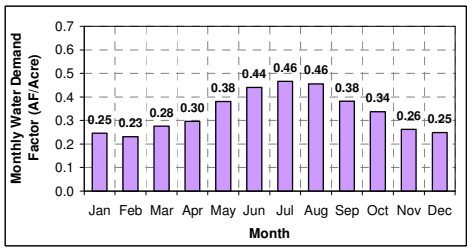
Low to Medium Density Single Family Residential (LMDR 5~6)



Month	Demand Factor
Jan	0.13
Feb	0.12
Mar	0.16
Apr	0.22
May	0.33
Jun	0.39
Jul	0.46
Aug	0.43
Sep	0.35
Oct	0.26
Nov	0.15
Dec	0.13
TOTAL	***3.12***

3.12 AF/Year/Acre

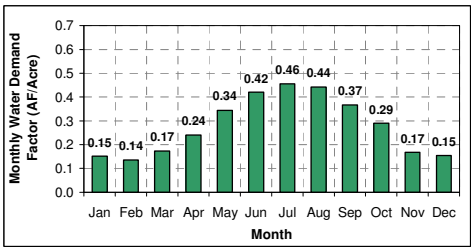
High Density Multi Family Residential (HDR >16)



Month	Demand Factor
Jan	0.25
Feb	0.23
Mar	0.28
Apr	0.30
May	0.38
Jun	0.44
Jul	0.46
Aug	0.46
Sep	0.38
Oct	0.34
Nov	0.26
Dec	0.25
TOTAL	***4.01***

4.01 AF/Year/Acre

Low to Medium Density Single Family Residential (LMDR 6~8)



Month	Demand Factor
Jan	0.15
Feb	0.14
Mar	0.17
Apr	0.24
May	0.34
Jun	0.42
Jul	0.46
Aug	0.44
Sep	0.37
Oct	0.29
Nov	0.17
Dec	0.15
TOTAL	***3.34***

3.34 AF/Year/Acre

Figure B-10. Historical Monthly Water Use for LDR1 (Pre-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	3.98	35.04	0.1136	86
2001.05	13.95	51.25	0.2721	122
2001.06	13.56	37.81	0.3586	92
2001.07	15.13	41.78	0.3622	101
2001.08	15.29	44.09	0.3469	106
2001.09	11.99	36.67	0.3271	90
2001.10	9.43	39.12	0.2410	96
2001.11	6.07	55.41	0.1096	132
2001.12	2.38	35.05	0.0679	87
2002.01	2.85	50.69	0.0562	122
2002.02	2.61	42.49	0.0615	103
2002.03	2.82	35.71	0.0791	87
2002.04	7.24	46.96	0.1542	114
2002.05	10.52	42.85	0.2454	104
2002.06	11.73	38.00	0.3086	94
2002.07	16.05	44.80	0.3583	107
2002.08	16.95	46.93	0.3611	113
2002.09	13.29	42.17	0.3151	115
2002.10	15.54	62.31	0.2494	164
2002.11	7.25	60.11	0.1206	158
2002.12	4.13	50.98	0.0810	136
2003.01	3.96	60.04	0.0660	158
2003.02	3.51	53.00	0.0662	143
2003.03	5.66	67.76	0.0835	189
2003.04	7.35	75.53	0.0974	215
2003.05	12.56	74.84	0.1678	212
2003.06	22.12	67.14	0.3294	191
2003.07	34.41	85.24	0.4037	244
2003.08	27.06	73.63	0.3676	216
2003.09	26.21	88.56	0.2960	263
2003.10	21.77	90.16	0.2415	262
2003.11	8.82	79.19	0.1113	232
2003.12	8.57	84.55	0.1013	249
2004.01	6.08	86.65	0.0702	255
2004.02	5.39	85.62	0.0630	249
2004.03	10.38	94.54	0.1098	284
2004.04	22.26	105.21	0.2115	325
2004.05	33.93	107.13	0.3167	329
2004.06	56.66	155.40	0.3646	505
2004.07	78.66	190.48	0.4129	624
2004.08	67.62	166.09	0.4071	538
2004.09	100.06	298.95	0.3347	991
2004.10	48.88	225.28	0.2170	747
2004.11	20.15	220.61	0.0914	730
2004.12	19.17	226.67	0.0846	754
2005.01	17.82	229.76	0.0776	764
2005.02	17.04	231.11	0.0737	769
2005.03	24.20	239.95	0.1008	796

Figure B-11. Historical Monthly Water Use for LDR2 (Pre-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04				
2001.05				
2001.06				
2001.07				
2001.08				
2001.09				
2001.10				
2001.11				
2001.12				
2002.01				
2002.02				
2002.03				
2002.04				
2002.05				
2002.06				
2002.07				
2002.08				
2002.09	2.43	7.77	0.3124	41
2002.10	3.17	10.05	0.3154	54
2002.11	1.25	9.69	0.1291	52
2002.12	1.03	9.02	0.1140	48
2003.01	2.03	21.82	0.0932	122
2003.02	3.06	27.66	0.1108	155
2003.03	7.33	54.94	0.1333	306
2003.04	9.53	62.11	0.1535	344
2003.05	19.11	65.70	0.2908	363
2003.06	27.27	63.06	0.4325	349
2003.07	40.88	78.53	0.5206	430
2003.08	35.35	76.89	0.4597	422
2003.09	33.95	87.58	0.3877	477
2003.10	27.03	86.23	0.3135	472
2003.11	13.28	80.03	0.1660	437
2003.12	13.36	87.29	0.1531	478
2004.01	12.59	101.34	0.1243	558
2004.02	12.20	113.39	0.1076	629
2004.03	19.65	127.40	0.1543	701
2004.04	38.07	147.75	0.2577	806
2004.05	55.10	150.34	0.3665	820
2004.06	73.12	172.15	0.4247	927
2004.07	105.01	222.84	0.4712	1,190
2004.08	89.47	191.63	0.4669	1,026
2004.09	96.43	252.17	0.3824	1,327
2004.10	51.54	219.85	0.2344	1,170
2004.11	27.64	211.90	0.1304	1,125
2004.12	29.10	235.18	0.1237	1,251
2005.01	28.52	244.50	0.1166	1,301
2005.02	26.02	241.84	0.1076	1,284
2005.03	35.31	266.02	0.1327	1,415

Figure B-12. Historical Monthly Water Use for LMDR1 (Pre-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04				
2001.05				
2001.06				
2001.07				
2001.08				
2001.09				
2001.10				
2001.11				
2001.12				
2002.01				
2002.02				
2002.03				
2002.04				
2002.05				
2002.06				
2002.07				
2002.08				
2002.09	10.78	32	0.3324	221
2002.10	12.76	45	0.2867	303
2002.11	6.10	38	0.1592	261
2002.12	5.61	37	0.1517	252
2003.01	5.62	39	0.1452	263
2003.02	5.51	39	0.1401	267
2003.03	8.29	51	0.1630	341
2003.04	9.34	58	0.1609	388
2003.05	19.92	62	0.3227	413
2003.06	23.53	53	0.4443	352
2003.07	47.11	88	0.5374	587
2003.08	31.23	66	0.4705	442
2003.09	38.38	95	0.4035	637
2003.10	26.76	82	0.3280	545
2003.11	14.66	80	0.1839	533
2003.12	13.23	86	0.1533	574
2004.01	12.87	87	0.1471	582
2004.02	10.02	76	0.1319	503
2004.03	17.66	92	0.1916	613
2004.04	32.09	110	0.2905	735
2004.05	36.85	92	0.4027	602
2004.06	46.62	106	0.4410	698
2004.07	56.41	113	0.4998	738
2004.08	44.69	91	0.4914	597
2004.09	47.73	115	0.4158	755
2004.10	32.96	116	0.2845	764
2004.11	17.05	110	0.1548	727
2004.12	17.86	122	0.1459	806
2005.01	17.56	127	0.1386	834
2005.02	16.09	126	0.1274	831
2005.03	20.67	129	0.1597	851

Figure B-13. Historical Monthly Water Use for LMDR2 (Pre-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04				
2001.05				
2001.06				
2001.07				
2001.08				
2001.09				
2001.10				
2001.11				
2001.12				
2002.01				
2002.02				
2002.03				
2002.04				
2002.05				
2002.06				
2002.07				
2002.08				
2002.09	3.64	11.00	0.3304	87
2002.10	4.91	15.80	0.3110	126
2002.11	2.37	13.34	0.1779	106
2002.12	2.10	12.88	0.1629	102
2003.01	2.12	13.69	0.1546	109
2003.02	2.42	16.06	0.1509	129
2003.03	3.82	20.15	0.1896	161
2003.04	8.72	45.56	0.1913	377
2003.05	14.56	41.68	0.3493	342
2003.06	12.75	26.22	0.4863	211
2003.07	31.75	63.15	0.5027	520
2003.08	17.97	37.07	0.4849	296
2003.09	28.26	67.96	0.4159	557
2003.10	18.02	53.10	0.3393	432
2003.11	10.93	51.92	0.2104	422
2003.12	9.39	51.94	0.1807	422
2004.01	9.03	53.90	0.1676	439
2004.02	5.87	40.43	0.1451	325
2004.03	11.63	56.58	0.2055	461
2004.04	23.65	73.47	0.3219	603
2004.05	18.64	43.78	0.4257	351
2004.06	27.34	58.18	0.4700	473
2004.07	30.03	57.09	0.5260	465
2004.08	27.55	54.20	0.5082	441
2004.09	26.58	62.32	0.4265	508
2004.10	20.61	63.66	0.3237	516
2004.11	10.16	58.29	0.1743	473
2004.12	10.88	63.56	0.1712	515
2005.01	10.39	63.08	0.1647	511
2005.02	9.18	62.26	0.1474	505
2005.03	11.74	67.09	0.1751	543

Figure B-14. Historical Monthly Water Use for MDR (Pre-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04				
2001.05				
2001.06				
2001.07				
2001.08				
2001.09				
2001.10				
2001.11				
2001.12				
2002.01				
2002.02				
2002.03				
2002.04				
2002.05				
2002.06				
2002.07				
2002.08				
2002.09	0.92	2.04	0.45	24
2002.10	1.98	4.89	0.40	57
2002.11	0.96	3.56	0.27	42
2002.12	0.86	3.36	0.26	40
2003.01	0.87	3.87	0.23	46
2003.02	1.22	6.11	0.20	89
2003.03	1.36	5.14	0.26	62
2003.04	3.93	17.10	0.23	231
2003.05	7.15	17.21	0.42	210
2003.06	3.68	6.61	0.56	75
2003.07	15.20	28.41	0.54	353
2003.08	3.38	6.23	0.54	71
2003.09	12.13	28.27	0.43	351
2003.10	5.88	17.56	0.34	214
2003.11	3.95	16.77	0.24	204
2003.12	3.89	16.86	0.23	207
2004.01	4.27	17.78	0.24	218
2004.02	1.78	8.52	0.21	97
2004.03	5.01	19.28	0.26	234
2004.04	10.63	30.20	0.35	372
2004.05	3.99	8.68	0.46	99
2004.06	9.14	19.75	0.46	240
2004.07	10.57	20.48	0.52	247
2004.08	9.46	19.04	0.50	230
2004.09	10.50	26.03	0.40	322
2004.10	10.16	29.82	0.34	367
2004.11	6.02	26.79	0.22	335
2004.12	6.51	28.71	0.23	353
2005.01	6.07	28.92	0.21	355
2005.02	5.05	29.27	0.17	358
2005.03	6.12	30.06	0.20	367

Figure B-15. Historical Monthly Water Use for HDR1 (Pre-92 Homes Only)

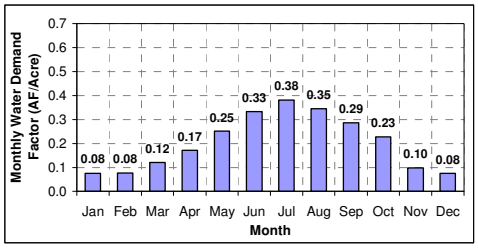
Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	2.46	9.96	0.2465	24
2001.05	3.58	10.20	0.3514	25
2001.06	4.65	10.53	0.4412	27
2001.07	4.47	10.02	0.4456	24
2001.08	4.49	10.20	0.4404	25
2001.09	4.09	10.20	0.4008	25
2001.10	3.34	10.20	0.3277	25
2001.11	2.72	10.58	0.2573	27
2001.12	2.30	10.20	0.2257	25
2002.01	2.26	10.20	0.2219	25
2002.02	1.97	10.20	0.1927	25
2002.03	2.49	10.20	0.2445	25
2002.04	2.23	10.20	0.2192	25
2002.05	2.85	10.37	0.2747	26
2002.06	3.31	10.20	0.3250	25
2002.07	3.58	9.09	0.3943	23
2002.08	4.58	11.30	0.4050	27
2002.09	3.23	9.09	0.3552	23
2002.10	3.37	11.13	0.3031	26
2002.11	2.26	10.02	0.2250	24
2002.12	2.37	10.42	0.2280	26
2003.01	2.06	10.20	0.2022	25
2003.02	1.69	10.20	0.1653	25
2003.03	1.84	10.20	0.1805	25
2003.04	2.09	10.20	0.2052	25
2003.05	2.17	10.02	0.2163	24
2003.06	3.19	9.41	0.3392	25
2003.07	4.68	11.47	0.4077	28
2003.08	3.89	9.09	0.4283	23
2003.09	3.48	10.20	0.3409	25
2003.10	3.94	11.30	0.3489	27
2003.11	2.78	9.92	0.2805	23
2003.12	2.64	10.20	0.2589	25
2004.01	2.66	10.20	0.2606	25
2004.02	2.45	10.20	0.2402	25
2004.03	3.17	10.20	0.3106	25
2004.04	3.16	10.20	0.3099	25
2004.05	4.19	10.38	0.4035	26
2004.06	4.03	10.36	0.3888	26
2004.07	3.79	9.31	0.4074	24
2004.08	5.64	12.75	0.4421	40
2004.09	4.25	12.48	0.3402	31
2004.10	2.32	10.36	0.2244	26
2004.11	2.04	14.30	0.1430	26
2004.12	2.04	6.09	0.3354	24
2005.01	1.86	10.20	0.1825	25
2005.02	1.72	6.09	0.2816	24
2005.03	2.14	14.30	0.1494	26

Figure B-16. Historical Monthly Water Use for HDR2 (Pre-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	7.51	26.99	0.2783	17
2001.05	9.65	26.99	0.3574	17
2001.06	10.26	26.99	0.3800	17
2001.07	10.78	26.99	0.3993	17
2001.08	11.69	26.99	0.4330	17
2001.09	10.77	26.99	0.3990	17
2001.10	9.21	30.51	0.3020	18
2001.11	6.73	26.99	0.2493	17
2001.12	6.11	26.99	0.2262	17
2002.01	6.00	26.99	0.2222	17
2002.02	5.63	26.99	0.2087	17
2002.03	6.53	26.99	0.2419	17
2002.04	6.67	26.99	0.2470	17
2002.05	9.20	26.99	0.3407	17
2002.06	10.69	26.99	0.3961	17
2002.07	10.65	26.99	0.3946	17
2002.08	11.78	26.99	0.4363	17
2002.09	12.17	31.76	0.3832	19
2002.10	8.68	27.11	0.3201	18
2002.11	5.73	26.99	0.2123	17
2002.12	5.76	26.99	0.2133	17
2003.01	5.43	26.99	0.2010	17
2003.02	5.08	26.99	0.1884	17
2003.03	6.29	26.87	0.2341	16
2003.04	6.50	27.11	0.2397	18
2003.05	8.73	26.99	0.3235	17
2003.06	10.94	26.87	0.4072	16
2003.07	12.68	27.11	0.4677	18
2003.08	10.15	26.87	0.3775	16
2003.09	9.51	27.11	0.3509	18
2003.10	8.91	26.99	0.3300	17
2003.11	7.68	26.99	0.2845	17
2003.12	7.03	26.99	0.2603	17
2004.01	6.19	26.99	0.2291	17
2004.02	5.78	26.99	0.2142	17
2004.03	7.39	26.99	0.2737	17
2004.04	8.41	26.99	0.3116	17
2004.05	9.85	26.99	0.3649	17
2004.06	11.29	26.99	0.4181	17
2004.07	11.59	26.87	0.4312	16
2004.08	11.17	26.99	0.4139	17
2004.09	13.37	45.70	0.2926	29
2004.10	7.41	26.99	0.2744	17
2004.11	5.57	26.99	0.2064	17
2004.12	5.49	26.99	0.2034	17
2005.01	6.07	26.99	0.2249	17
2005.02	5.76	26.99	0.2132	17
2005.03	6.41	26.99	0.2373	17

Figure B-17. Unit Demand Factors for Post-92 Homes Only

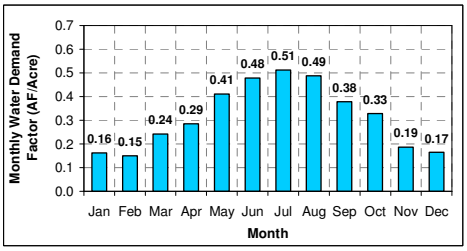
Low Density Single Family Residential (LDR<3.5)



Month	Demand Factor
Jan	0.08
Feb	0.08
Mar	0.12
Apr	0.17
May	0.25
Jun	0.33
Jul	0.38
Aug	0.35
Sep	0.29
Oct	0.23
Nov	0.10
Dec	0.08
TOTAL	***2.44***

2.44 AF/Year/Acre

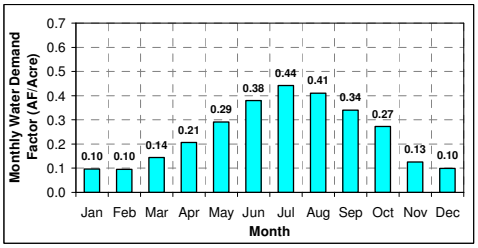
Medium Density Single/Multi Family Residential (MDR 8~12)



Month	Demand Factor
Jan	0.16
Feb	0.15
Mar	0.24
Apr	0.29
May	0.41
Jun	0.48
Jul	0.51
Aug	0.49
Sep	0.38
Oct	0.33
Nov	0.19
Dec	0.17
TOTAL	***3.79***

3.79 AF/Year/Acre

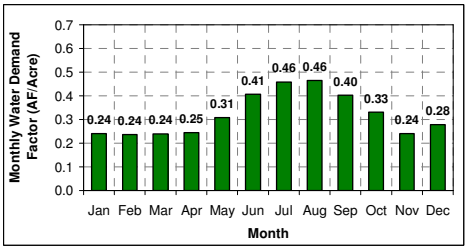
Low Density Single Family Residential (LDR 3.5~5)



Month	Demand Factor
Jan	0.10
Feb	0.10
Mar	0.14
Apr	0.21
May	0.29
Jun	0.38
Jul	0.44
Aug	0.41
Sep	0.34
Oct	0.27
Nov	0.13
Dec	0.10
TOTAL	***2.90***

2.90 AF/Year/Acre

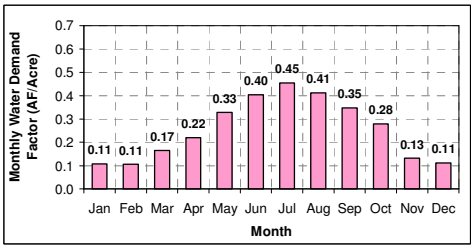
High Density Multi Family Residential (HDR 12~16)



Month	Demand Factor
Jan	0.24
Feb	0.24
Mar	0.24
Apr	0.25
May	0.31
Jun	0.41
Jul	0.46
Aug	0.46
Sep	0.40
Oct	0.33
Nov	0.24
Dec	0.28
TOTAL	***3.85***

3.85 AF/Year/Acre

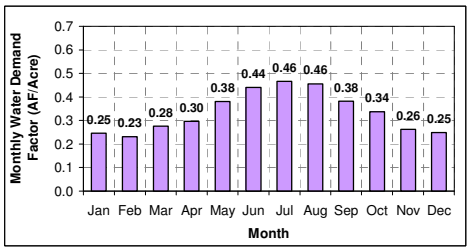
Low to Medium Density Single Family Residential (LMDR 5~6)



Month	Demand Factor
Jan	0.11
Feb	0.11
Mar	0.17
Apr	0.22
May	0.33
Jun	0.40
Jul	0.45
Aug	0.41
Sep	0.35
Oct	0.28
Nov	0.13
Dec	0.11
TOTAL	***3.07***

3.07 AF/Year/Acre

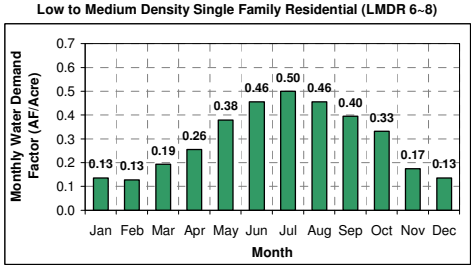
High Density Multi Family Residential (HDR >16)



Month	Demand Factor
Jan	0.25
Feb	0.23
Mar	0.28
Apr	0.30
May	0.38
Jun	0.44
Jul	0.46
Aug	0.46
Sep	0.38
Oct	0.34
Nov	0.26
Dec	0.25
TOTAL	***4.01***

4.01 AF/Year/Acre

Low to Medium Density Single Family Residential (LMDR 6~8)



Month	Demand Factor
Jan	0.13
Feb	0.13
Mar	0.19
Apr	0.26
May	0.38
Jun	0.46
Jul	0.50
Aug	0.46
Sep	0.40
Oct	0.33
Nov	0.17
Dec	0.13
TOTAL	***3.54***

3.54 AF/Year/Acre

Figure B-18. Historical Monthly Water Use for LDR1 (Post-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	0.71	4.01	0.1772	11
2001.05	2.58	8.78	0.2944	23
2001.06	1.64	4.44	0.3699	12
2001.07	2.09	5.97	0.3508	16
2001.08	3.07	8.78	0.3494	23
2001.09	1.12	4.01	0.2783	11
2001.10	1.44	6.40	0.2245	17
2001.11	1.03	8.78	0.1178	23
2001.12	0.25	3.75	0.0668	10
2002.01	0.62	8.78	0.0703	23
2002.02	0.53	6.40	0.0831	17
2002.03	0.44	4.01	0.1084	11
2002.04	1.31	7.10	0.1842	19
2002.05	2.05	8.07	0.2545	21
2002.06	1.56	4.01	0.3877	11
2002.07	2.81	7.35	0.3823	20
2002.08	2.35	6.52	0.3603	18
2002.09	9.41	29.83	0.3156	104
2002.10	14.76	55.23	0.2673	192
2002.11	4.60	41.33	0.1113	145
2002.12	3.67	41.91	0.0877	147
2003.01	3.54	41.33	0.0856	145
2003.02	2.77	27.84	0.0996	99
2003.03	5.47	42.83	0.1276	150
2003.04	5.63	41.36	0.1362	145
2003.05	9.97	43.46	0.2295	153
2003.06	15.83	42.68	0.3707	150
2003.07	19.33	42.99	0.4497	151
2003.08	16.73	42.31	0.3954	149
2003.09	13.97	43.10	0.3242	151
2003.10	12.47	45.97	0.2713	161
2003.11	6.45	52.96	0.1218	185
2003.12	2.44	28.85	0.0846	103
2004.01	3.52	42.42	0.0829	149
2004.02	3.35	42.42	0.0790	149
2004.03	6.86	42.42	0.1617	149
2004.04	10.93	42.95	0.2544	151
2004.05	14.69	42.60	0.3448	150
2004.06	16.08	42.37	0.3795	149
2004.07	17.92	41.59	0.4310	146
2004.08	16.88	42.33	0.3988	149
2004.09	8.27	23.40	0.3532	81
2004.10	10.52	42.96	0.2448	151
2004.11	4.25	42.42	0.1002	149
2004.12	3.72	42.42	0.0876	149
2005.01	3.68	42.66	0.0862	150
2005.02	3.43	42.18	0.0812	148
2005.03	4.80	42.42	0.1131	149

Figure B-19. Historical Monthly Water Use for LDR2 (Post-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04				
2001.05				
2001.06				
2001.07				
2001.08				
2001.09				
2001.10				
2001.11				
2001.12				
2002.01	0.22	2.84	0.0779	13
2002.02	0.39	3.59	0.1092	14
2002.03	0.60	4.11	0.1461	16
2002.04	0.82	3.57	0.2285	14
2002.05	1.04	4.11	0.2534	16
2002.06	2.08	5.69	0.3661	23
2002.07	2.88	5.88	0.4901	25
2002.08	2.97	6.30	0.4706	25
2002.09	35.14	92.76	0.3788	366
2002.10	61.98	190.08	0.3261	714
2002.11	21.06	142.30	0.1480	520
2002.12	16.25	142.74	0.1138	521
2003.01	15.34	143.71	0.1067	530
2003.02	11.73	95.70	0.1225	354
2003.03	22.40	142.82	0.1569	555
2003.04	24.19	144.87	0.1670	573
2003.05	39.63	146.43	0.2706	586
2003.06	62.80	146.92	0.4275	593
2003.07	74.49	146.30	0.5092	594
2003.08	68.83	147.12	0.4678	579
2003.09	55.83	146.89	0.3801	564
2003.10	49.96	162.05	0.3083	617
2003.11	26.12	179.26	0.1457	681
2003.12	10.93	97.07	0.1126	358
2004.01	15.22	145.25	0.1048	554
2004.02	14.12	146.62	0.0963	559
2004.03	27.85	146.96	0.1895	567
2004.04	43.92	146.93	0.2989	570
2004.05	57.05	147.18	0.3876	565
2004.06	63.82	147.68	0.4322	560
2004.07	70.69	144.76	0.4883	548
2004.08	67.37	147.43	0.4570	552
2004.09	31.80	77.31	0.4114	293
2004.10	43.48	146.21	0.2974	548
2004.11	19.63	146.45	0.1340	558
2004.12	16.79	146.28	0.1148	573
2005.01	15.38	143.90	0.1069	586
2005.02	15.00	146.25	0.1026	599
2005.03	19.30	145.10	0.1330	590

Figure B-20. Historical Monthly Water Use for LMDR1 (Post-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04				
2001.05				
2001.06				
2001.07				
2001.08				
2001.09				
2001.10				
2001.11				
2001.12				
2002.01				
2002.02				
2002.03				
2002.04				
2002.05				
2002.06				
2002.07				
2002.08				
2002.09	21.46	57	0.3745	375
2002.10	24.83	76	0.3248	496
2002.11	10.61	68	0.1572	440
2002.12	8.65	67	0.1293	436
2003.01	8.23	68	0.1213	442
2003.02	7.52	58	0.1299	379
2003.03	11.74	68	0.1735	441
2003.04	11.34	67	0.1683	439
2003.05	22.23	69	0.3223	449
2003.06	31.30	68	0.4579	445
2003.07	35.75	69	0.5192	448
2003.08	31.71	69	0.4585	450
2003.09	27.05	69	0.3903	451
2003.10	23.74	77	0.3099	497
2003.11	10.34	70	0.1468	458
2003.12	6.78	59	0.1156	384
2004.01	7.76	68	0.1146	441
2004.02	7.08	68	0.1041	442
2004.03	15.13	69	0.2183	451
2004.04	22.58	69	0.3273	449
2004.05	28.90	69	0.4196	448
2004.06	31.23	69	0.4516	450
2004.07	34.59	69	0.5040	447
2004.08	32.17	69	0.4693	446
2004.09	11.60	25	0.4632	161
2004.10	22.25	69	0.3248	446
2004.11	10.20	68	0.1491	445
2004.12	9.34	68	0.1376	442
2005.01	8.16	67	0.1221	435
2005.02	8.00	68	0.1176	443
2005.03	10.43	68	0.1543	440

Figure B-21. Historical Monthly Water Use for LMDR2 (Post-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04				
2001.05				
2001.06				
2001.07				
2001.08				
2001.09				
2001.10				
2001.11				
2001.12				
2002.01				
2002.02				
2002.03				
2002.04				
2002.05				
2002.06				
2002.07				
2002.08				
2002.09	25.87	58.59	0.4415	481
2002.10	22.77	59.31	0.3839	487
2002.11	12.72	59.31	0.2144	487
2002.12	9.29	58.54	0.1588	481
2003.01	8.94	58.31	0.1534	479
2003.02	9.15	58.11	0.1575	477
2003.03	12.20	58.57	0.2083	481
2003.04	11.94	59.02	0.2023	485
2003.05	23.08	59.76	0.3862	491
2003.06	31.02	59.67	0.5199	490
2003.07	34.81	59.04	0.5897	485
2003.08	30.75	59.00	0.5211	485
2003.09	26.92	59.53	0.4522	489
2003.10	22.27	58.67	0.3795	482
2003.11	11.49	59.10	0.1944	485
2003.12	8.67	58.14	0.1491	478
2004.01	8.39	57.96	0.1447	476
2004.02	7.63	58.60	0.1301	481
2004.03	15.43	59.46	0.2595	488
2004.04	22.20	59.17	0.3752	486
2004.05	27.65	59.17	0.4673	486
2004.06	29.79	58.82	0.5064	483
2004.07	32.10	59.73	0.5375	490
2004.08	29.89	59.20	0.5049	486
2004.09	9.08	18.47	0.4918	150
2004.10	22.18	58.96	0.3762	484
2004.11	11.32	59.12	0.1915	485
2004.12	9.10	58.87	0.1545	483
2005.01	8.44	57.60	0.1465	473
2005.02	7.63	58.13	0.1313	477
2005.03	10.19	58.62	0.1738	481

Figure B-22. Historical Monthly Water Use for MDR (Post-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04				
2001.05				
2001.06				
2001.07				
2001.08				
2001.09				
2001.10				
2001.11				
2001.12				
2002.01				
2002.02				
2002.03				
2002.04				
2002.05				
2002.06				
2002.07				
2002.08				
2002.09	6.42	15.61	0.41	193
2002.10	6.35	15.61	0.41	193
2002.11	3.53	15.54	0.23	192
2002.12	2.92	15.37	0.19	190
2003.01	2.77	15.33	0.18	189
2003.02	2.65	15.26	0.17	189
2003.03	4.02	15.60	0.26	193
2003.04	3.82	15.75	0.24	195
2003.05	6.34	15.69	0.40	194
2003.06	8.24	15.08	0.55	187
2003.07	9.39	15.48	0.61	192
2003.08	8.60	15.26	0.56	189
2003.09	7.12	15.61	0.46	193
2003.10	6.11	15.32	0.40	190
2003.11	3.42	15.42	0.22	191
2003.12	2.81	15.42	0.18	190
2004.01	2.68	15.47	0.17	191
2004.02	2.44	15.42	0.16	191
2004.03	4.74	15.70	0.30	195
2004.04	6.31	15.70	0.40	194
2004.05	8.27	15.85	0.52	196
2004.06	8.26	15.56	0.53	193
2004.07	8.46	15.52	0.55	192
2004.08	8.32	15.58	0.53	194
2004.09	5.07	10.63	0.48	137
2004.10	4.99	15.51	0.32	192
2004.11	2.96	15.36	0.19	190
2004.12	2.95	15.20	0.19	188
2005.01	2.81	15.53	0.18	192
2005.02	2.53	15.37	0.16	190
2005.03	3.73	15.38	0.24	191

Figure B-23. Historical Monthly Water Use for HDR1 (Post-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	2.46	9.96	0.2465	24
2001.05	3.58	10.20	0.3514	25
2001.06	4.65	10.53	0.4412	27
2001.07	4.47	10.02	0.4456	24
2001.08	4.49	10.20	0.4404	25
2001.09	4.09	10.20	0.4008	25
2001.10	3.34	10.20	0.3277	25
2001.11	2.72	10.58	0.2573	27
2001.12	2.30	10.20	0.2257	25
2002.01	2.26	10.20	0.2219	25
2002.02	1.97	10.20	0.1927	25
2002.03	2.49	10.20	0.2445	25
2002.04	2.23	10.20	0.2192	25
2002.05	2.85	10.37	0.2747	26
2002.06	3.31	10.20	0.3250	25
2002.07	3.58	9.09	0.3943	23
2002.08	4.58	11.30	0.4050	27
2002.09	3.23	9.09	0.3552	23
2002.10	3.37	11.13	0.3031	26
2002.11	2.26	10.02	0.2250	24
2002.12	2.37	10.42	0.2280	26
2003.01	2.06	10.20	0.2022	25
2003.02	1.69	10.20	0.1653	25
2003.03	1.84	10.20	0.1805	25
2003.04	2.09	10.20	0.2052	25
2003.05	2.17	10.02	0.2163	24
2003.06	3.19	9.41	0.3392	25
2003.07	4.68	11.47	0.4077	28
2003.08	3.89	9.09	0.4283	23
2003.09	3.48	10.20	0.3409	25
2003.10	3.94	11.30	0.3489	27
2003.11	2.78	9.92	0.2805	23
2003.12	2.64	10.20	0.2589	25
2004.01	2.66	10.20	0.2606	25
2004.02	2.45	10.20	0.2402	25
2004.03	3.17	10.20	0.3106	25
2004.04	3.16	10.20	0.3099	25
2004.05	4.19	10.38	0.4035	26
2004.06	4.03	10.36	0.3888	26
2004.07	3.79	9.31	0.4074	24
2004.08	5.64	12.75	0.4421	40
2004.09	4.25	12.48	0.3402	31
2004.10	2.32	10.36	0.2244	26
2004.11	2.04	14.30	0.1430	26
2004.12	2.04	6.09	0.3354	24
2005.01	1.86	10.20	0.1825	25
2005.02	1.72	6.09	0.2816	24
2005.03	2.14	14.30	0.1494	26

Figure B-24. Historical Monthly Water Use for HDR2 (Post-92 Homes Only)

Month	Total Water Consumption (AF)	Total Parcel Acres	Unit Demand Factor	Total Number of Accounts
2001.04	7.51	26.99	0.2783	17
2001.05	9.65	26.99	0.3574	17
2001.06	10.26	26.99	0.3800	17
2001.07	10.78	26.99	0.3993	17
2001.08	11.69	26.99	0.4330	17
2001.09	10.77	26.99	0.3990	17
2001.10	9.21	30.51	0.3020	18
2001.11	6.73	26.99	0.2493	17
2001.12	6.11	26.99	0.2262	17
2002.01	6.00	26.99	0.2222	17
2002.02	5.63	26.99	0.2087	17
2002.03	6.53	26.99	0.2419	17
2002.04	6.67	26.99	0.2470	17
2002.05	9.20	26.99	0.3407	17
2002.06	10.69	26.99	0.3961	17
2002.07	10.65	26.99	0.3946	17
2002.08	11.78	26.99	0.4363	17
2002.09	12.17	31.76	0.3832	19
2002.10	8.68	27.11	0.3201	18
2002.11	5.73	26.99	0.2123	17
2002.12	5.76	26.99	0.2133	17
2003.01	5.43	26.99	0.2010	17
2003.02	5.08	26.99	0.1884	17
2003.03	6.29	26.87	0.2341	16
2003.04	6.50	27.11	0.2397	18
2003.05	8.73	26.99	0.3235	17
2003.06	10.94	26.87	0.4072	16
2003.07	12.68	27.11	0.4677	18
2003.08	10.15	26.87	0.3775	16
2003.09	9.51	27.11	0.3509	18
2003.10	8.91	26.99	0.3300	17
2003.11	7.68	26.99	0.2845	17
2003.12	7.03	26.99	0.2603	17
2004.01	6.19	26.99	0.2291	17
2004.02	5.78	26.99	0.2142	17
2004.03	7.39	26.99	0.2737	17
2004.04	8.41	26.99	0.3116	17
2004.05	9.85	26.99	0.3649	17
2004.06	11.29	26.99	0.4181	17
2004.07	11.59	26.87	0.4312	16
2004.08	11.17	26.99	0.4139	17
2004.09	13.37	45.70	0.2926	29
2004.10	7.41	26.99	0.2744	17
2004.11	5.57	26.99	0.2064	17
2004.12	5.49	26.99	0.2034	17
2005.01	6.07	26.99	0.2249	17
2005.02	5.76	26.99	0.2132	17
2005.03	6.41	26.99	0.2373	17

APPENDIX C – COMMERCIAL UNIT WATER DEMAND FACTORS CALCULATION

Figure C-1. Histograms for Commercial/Retail

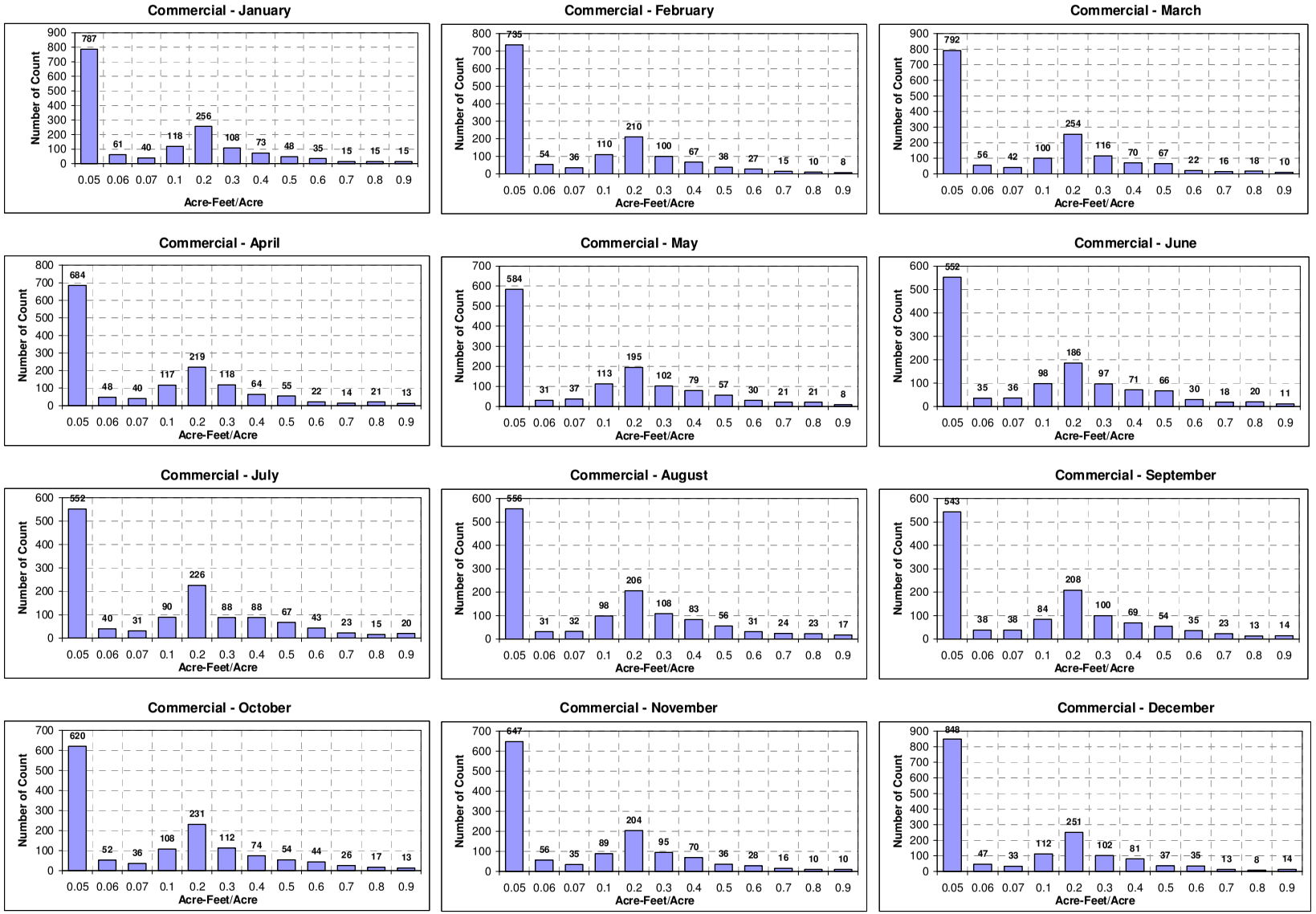


Figure C-2. Histograms for Business Professional

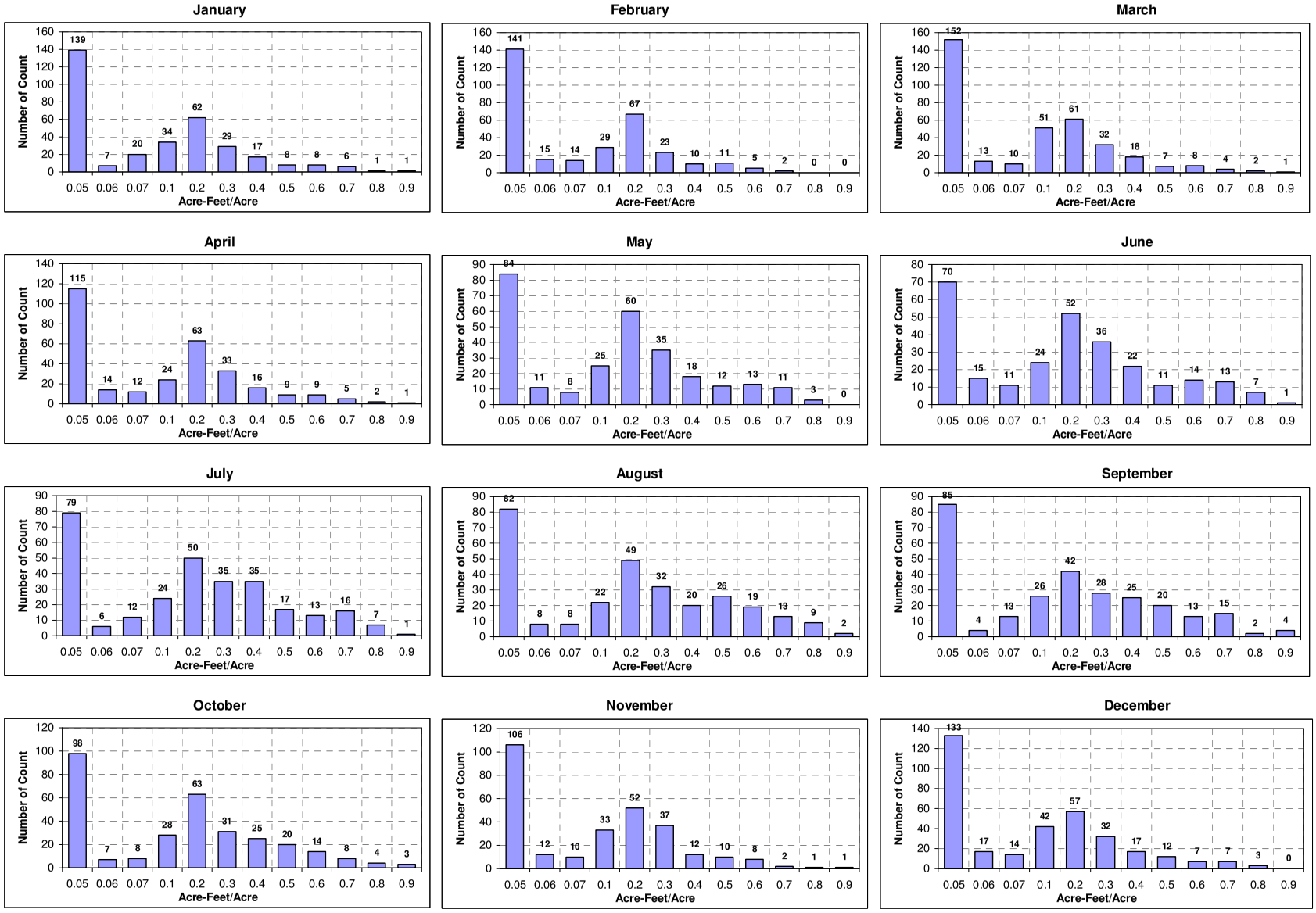


Figure C-3. Histograms for Light Industrial

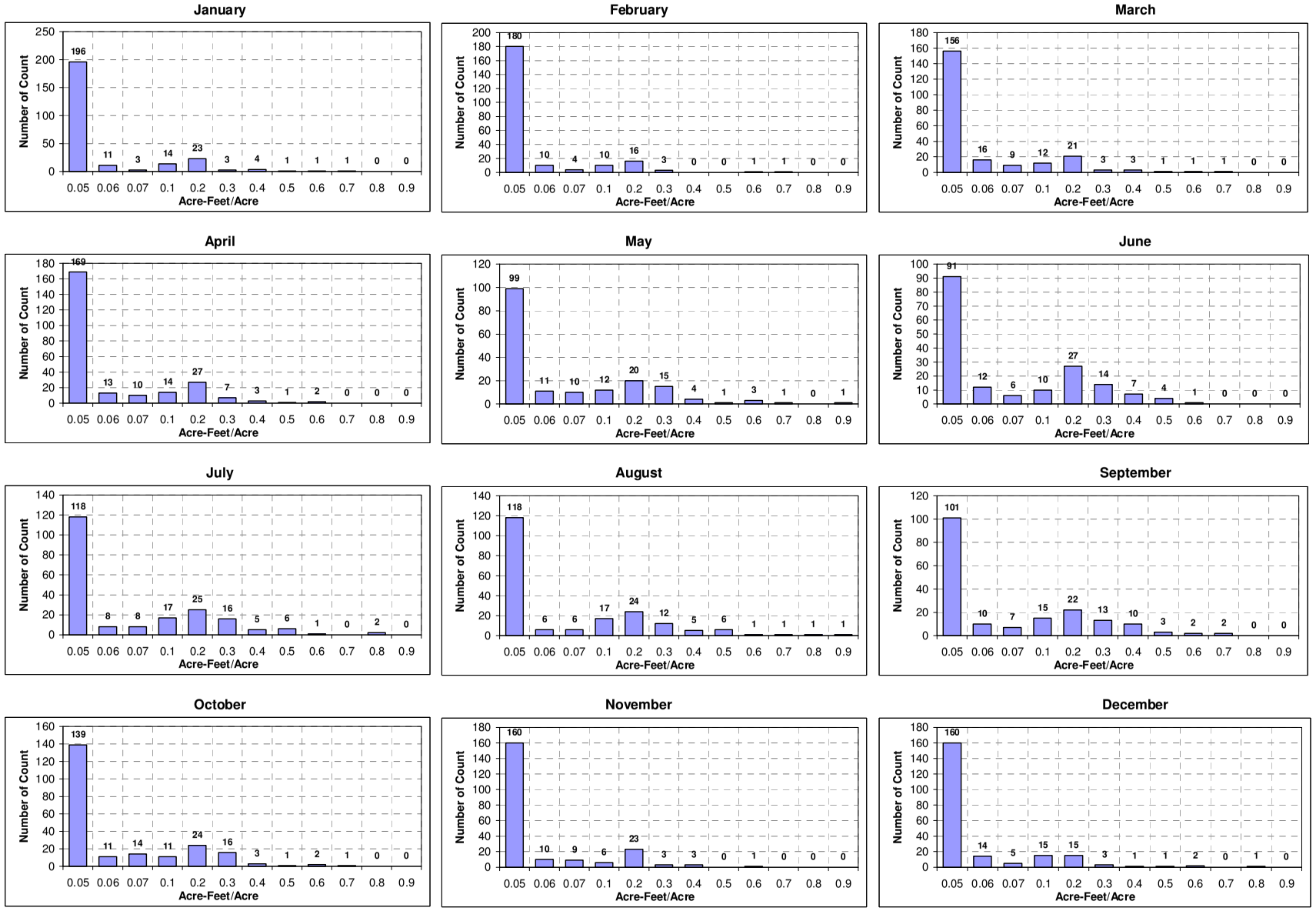


Figure C-4. Histograms for Heavy Industrial

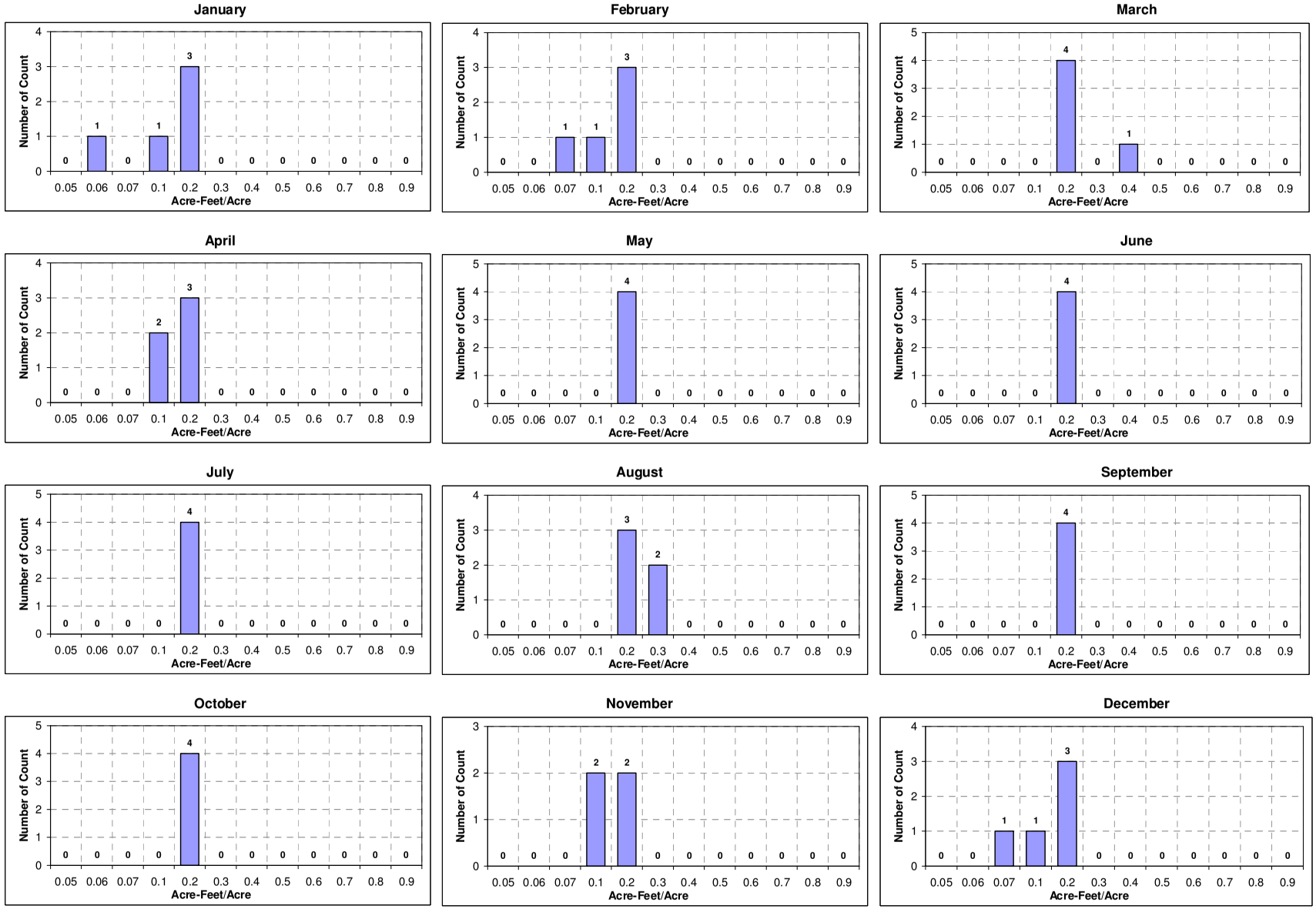


Figure C-5. Histograms for Railroad Yard

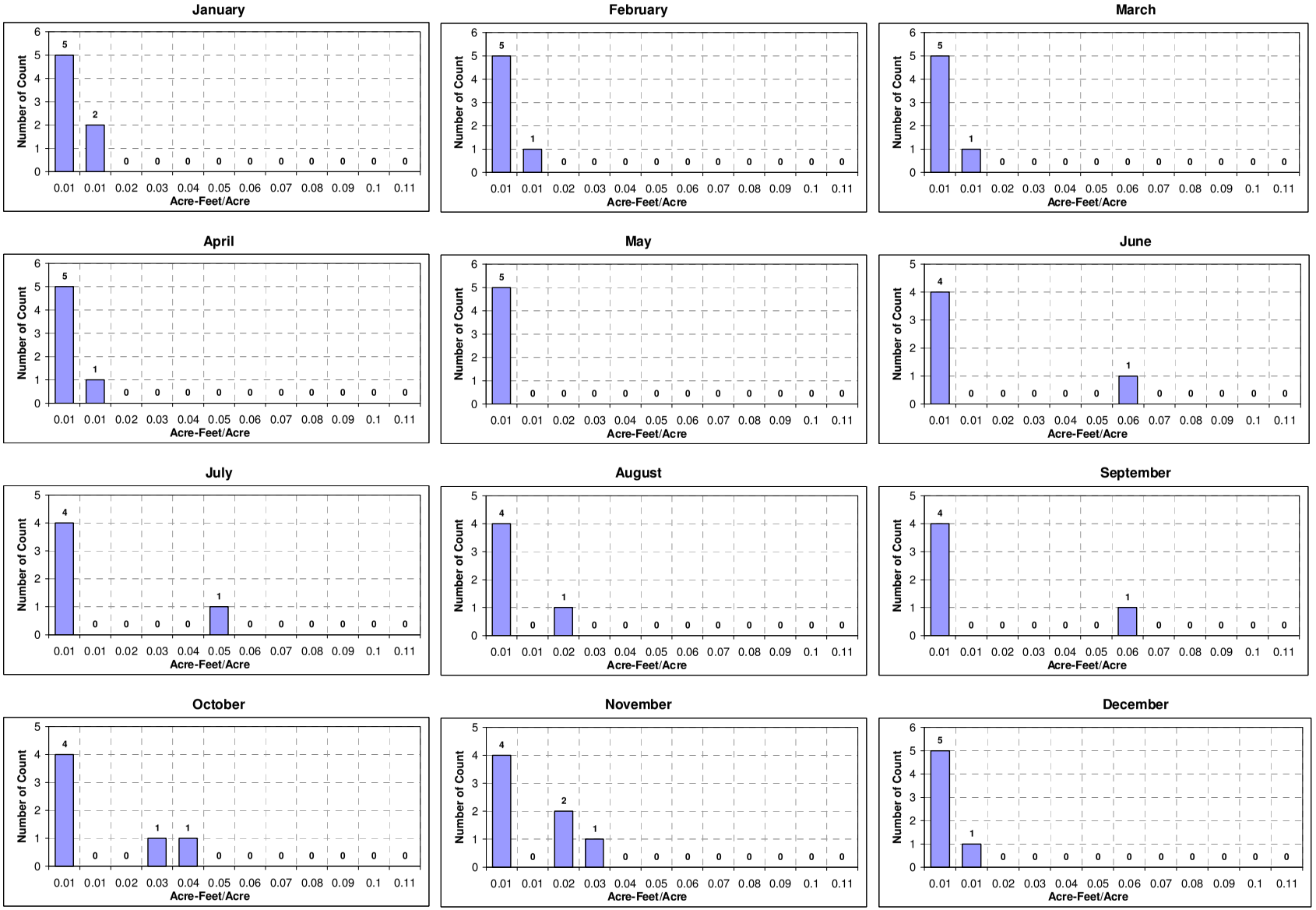


Figure C-6. Histograms for Public

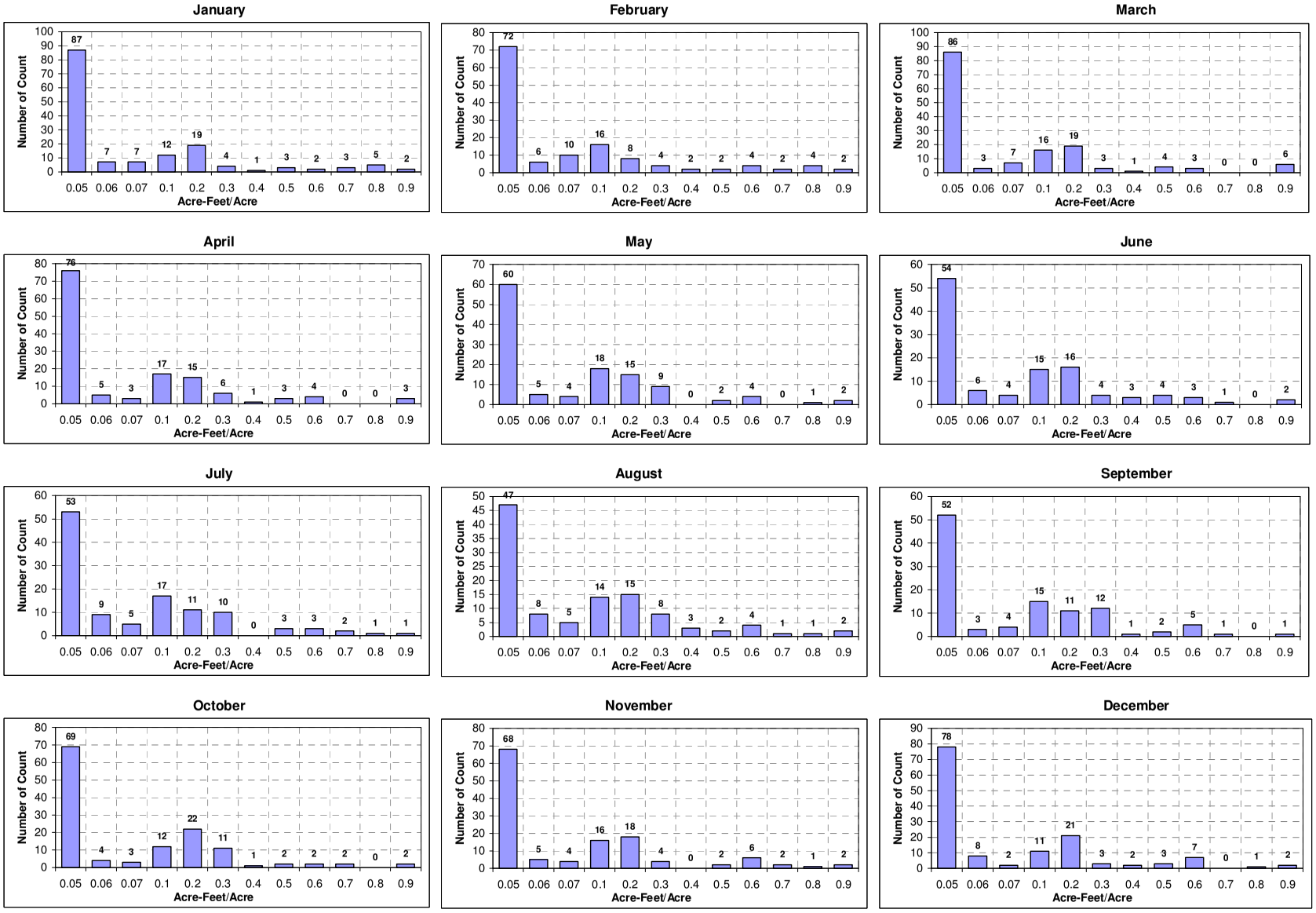
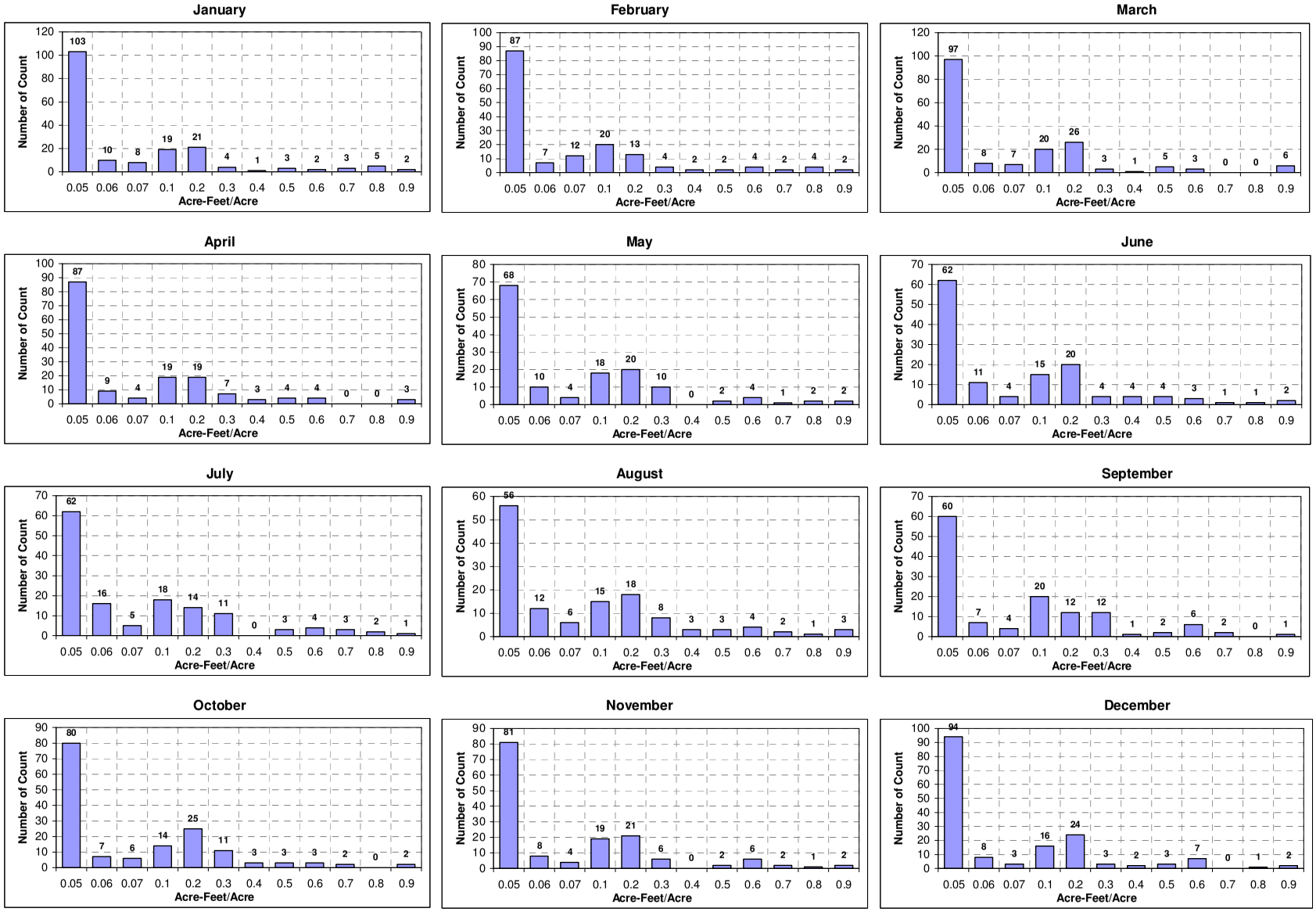


Figure C-7. Histograms for Parks/Recreation



APPENDIX H-2

ATTACHMENT 2
SIERRA VISTA POTABLE WATER MASTER PLAN WITH ADDENDUM

Technical Memorandum

HydroScience Engineers, Inc.

To: Kelye McKinney

From: Kyle Horn

Reviewed by: Curtis Lam

CC: Jeff Jones, Mark Sauer, Mike Smith

Subject: Sierra Vista Specific Plan (SVSP), Potable Water Master Plan Addendum #1

Date: July 10, 2009

This document updates the April 2009 Sierra Vista Specific Plan (SVSP) Potable Water Master Plan to reflect the changes to the SVSP Land Use Plan update dated July 1, 2009. The following table provides a summary of changes to the document. Text formatted in **bold** in the table below reflects the updated portion of text. Updated text in the attached tables is also bolded, along with other numbers that were formatted in bold in the original table.

Page	Document Change
Figure 1-2	Figure 1-2 (attached) reflects the July 1, 2009 SVSP land use plan
P. 5, Table 2-1	Replace Table 2-1 with the attached Table 2-1
P. 6, ¶ 2	Revise text to read: **"**Not adjusting the water use factors to account for recycled water use results in the modeling of potable water demands at a level higher than what they are actually expected to be. For the purposes of this modeling effort, these demands reflect a conservative factor of approximately **13.7% (including water conservation – see SVSP RWMP, Addendum #1, HSe, July 2009)**, since recycled water is expected to comprise approximately **680 AFY** of demand compared to the total water demands of the SVSP **Base plus UR,** which are described below. **These demands include recycled water demand reductions associated with the recommendations of the SVSP Water Conservation Plan (HSe, July 2009).** For more information about recycled water use within the SVSP, the reader is referred to the Sierra Vista Recycled Water Master Plan (HSe, **June** 2009). **Following development of the SVSP Water Conservation Plan (HSe, July 2009), the City asked for the reduced potable water demands to be incorporated into the overall SVSP potable water demands. These potable water demand reductions are shown in Table 2-1. All demands for individual parcels are shown both with and without water conservation in Appendix B.**
P. 6, ¶ 4	Revise text to read: "The potable water demand analysis for the SVSP was conducted based upon the water use factors in Table 2-1 and the **July 1, 2009** SVSP land use plan. The land use designation, acreage, number of dwelling units, unit demand factors, and peaking factors were used to calculate the average day potable water demands."
P. 7, Table 2-2	Replace Table 2-2 with the attached Table 2-2
P. 8, Table 2-3	Replace Table 2-3 with the attached Table 2-3
P. 11, Table 2-4	Replace Table 2-4 with the attached Table 2-4
P. 14, ¶ 2	Revise text to read: "The SVSP booster pump station was modeled with a design capacity of **9,000** gpm at a TDH of 250 ft to meet the SVSP Base plus UR land use plan. For the SVSP Base land use plan, the SVSP booster pump station was modeled with a design capacity of **7,000** gpm at a TDH of 200 ft."

Page	Document Change
Figures 3-3, 3-4, 3-5, 3-6, and Appendix A	Figures 3-3 through Appendix A do not reflect the July 1, 2009 land use plan.
Section 4, general comment	Potable water modeling and fire flow analysis were not re-performed based on the July 1, 2009 land use plan. After analysis of the July 1, 2009 potable water demand summary for the SVSP, it was determined that the changes in land use and subsequent water demands were not sufficient to warrant re-modeling of the SVSP potable water distribution system. The parcels that changed land use designation are centrally located and maintain multiple connections to the potable water system. Additionally, all parcels that were affected by the land use plan update either have decreased fire flow requirements or are located in areas such that a limited flow condition is not expected.

Table 2-1: Potable Water Use Factors

Land Use Designation	Abbreviation	Water Use Factor[1]
Residential		
Low Density Residential (**3.5 to 5 du/ac**)	LDR	600 gpd/DU
Low Density Residential (>5 to 6 du/ac)	**LDR**	**521 gpd/DU**
Medium Density Residential (>6 to 8 du/ac)	**MDR**	**430 gpd/DU**
Medium Density Residential (**>8 to 12 du/ac**)	MDR	323 gpd/DU
High Density Residential (20-30 du/ac)	HDR	177 gpd/DU
Non-Residential		
Community Commercial	CC	2,598 gpd/acre
Commercial Mixed Use	CC (CMU)	177 gpd/DU + 2,598 gpd/acre
Commercial/ Business Park	CC/BP	2,598 gpd/acre
Paseo	P	2,988 gpd/acre
Public/Quasi-Public-A	P/QP	1,780 gpd/acre
Public/Quasi-Public-B	P/QP	2,562 gpd/acre
Public/Quasi-Public-C	P/QP	3,454 gpd/acre
Public/Quasi-Public-D	P/QP	4,068 gpd/acre
Park	PR	2,988 gpd/acre
Open Space	OS	0 gpd/acre
Landscape Corridor	LC	2,988 gpd/acre

Notes:
1. Water use factors are based on the MWH TM1 “Conservative Scenario” (MWH, 2002)

Table 2-2: SVSP Potable Water Use (SVSP Base)

Area Description	Total Acres	Density (du/ac)	Dwelling Units	Acre feet per year	Acre feet per year with water conservation	Average Day Demand[4]	Max Day Demand[4]	Peak Hour Demand[4]
				(AFY)	(AFY)	(GPM)	(GPM)	(GPM)
Residential								
Low Density Residential	**502.4**	**5-6**	**2,524**	**1,695**	**1,424**	**883**	**1,766**	**3,002**
Medium Density Residential	**250**	**7.5-9**	**2,221**	**805**	**666**	**413**	**825**	**1,403**
High Density Residential	**67.9**	20-30	**1,650**	**327**	**313**	**194**	**388**	**660**
Urban Reserve	**432.2**	-	-	0	0	0	0	0
Non-Residential								
Community Commercial	**141.7**	-	-	**412**	**412**	**256**	**511**	**869**
Commercial Mixed Use	**32**	**20-30**	**255**	**144**	**142**	**88**	**176**	**299**
Commercial Business Park	**24.5**	-	-	**71**	**71**	**44**	**88**	**150**
Paseo	**13.9**	-	-	**47**	**47**	**29**	**58**	**99**
Public/Quasi-Public (all) [(3)]	**57.5**	-	-	**213**	**213**	**132**	**264**	**449**
Park	**90.6**	-	-	**303**	**303**	**188**	**376**	**639**
Open Space	**256.6**	-	-	0	0	0	0	0
Landscape Corridor	**70.1**	-	-	**235**	**235**	**145**	**291**	**494**
Roads	**124.7**	-	-	0	0	0	0	0
Total	**±2,064**		**6,650**	**4,252**	**3,826**	**2,372**	**4,743**	**8,064**

Notes:
1. Based on the July 1, 2009 SVSP land use plan for the SVSP.
2. Flow values were rounded off to the nearest value. Due to rounding, the values in this table are not identical to values calculated without rounding.
3. Does not include demands associated with ASR wells.
4. Gpm demands are based on reduced potable water demands due to the recommendations of the SVSP Water Conservation Plan (HSe, July 2009)
5. Water conservation reductions are based on the recommendations of the SVSP Water Conservation Plan (HSe, July 2009)

Table 2-3: SVSP Potable Water Use (SVSP Base plus UR)

Area Description	Total Acres	Density (du/ac)	Dwelling Units	Acre feet per year	Acre feet per year with water conservation	Average Day Demand[5]	Max Day Demand[5]	Peak Hour Demand[5]
				(AFY)	(AFY)	(GPM)	(GPM)	(GPM)
Residential								
Low Density Residential	**639.5**	**5-6**	**3,065**	**2,154**	**1,809**	**1,122**	**2,245**	**3,816**
Medium Density Residential	**342.5**	**7.5-9**	**3,050**	**1,104**	**914**	**567**	**1,133**	**1,927**
High Density Residential	**112.2**	20-30	**2,536**	**503**	**481**	**298**	**597**	**1,014**
Non-Residentia								
Community Commercial	**179.4**	-	0	**522**	**522**	**324**	**647**	**1,100**
Commercial Mixed Use	**45.3**	20	**348**	**201**	**198**	**123**	**245**	**417**
Commercial Business Park	**24.5**	-	0	**71**	**71**	**44**	**88**	**150**
Paseo	**13.9**	-	0	**47**	**47**	**29**	**58**	**99**
Public/Quasi-Public (all) [(3)]	**69.1**	-	0	**252**	**252**	**156**	**312**	**530**
Park	**108.6**	-	0	**364**	**364**	**225**	**451**	**766**
Open Space	**291**	-	0	0	0	0	0	0
Landscape Corridor	**85.4**	-	0	**286**	**286**	**177**	**354**	**602**
Roads	**134.9**		0	0	0	0	0	0
Total	**±2,064**		**9,146**	**5,504**	**4,945**	**3,065**	**6,130**	**10,421**

Notes:
1. Based on the July 1, 2009 SVSP land use plan for the SVSP and the June 2008 land use plan for the Richland and Chan properties.
2. Flow values were rounded off to the nearest gpm.
3. Does not include demands associated with ASR wells
4. Acreage does not add up exactly due to differences in land use plan calculations for Richland.
5. Gpm demands are based on reduced potable water demands due to the recommendations of the SVSP Water Conservation Plan (HSe, July 2009)
6. Water conservation reductions are based on the recommendations of the SVSP Water Conservation Plan (HSe, July 2009)

Table 2-4: Water Storage Criteria

Type	Equation	Volume (MG)
SVSP Base		
Operational	(25%) X (**4,743 gpm**) X (1440 min/day)	**1.71**
Fire Flow	(4 hours) X (4,500 gpm) X (60 min/hr)	1.08
Emergency – Tank	(25%) X (**4,743 gpm**) X (1440 min/day)	**1.71**
SVSP Base Storage[1]		**4.50[2]**
SVSP Base plus UR		
Operational	(25%) X (**6,130 gpm**) X (1440 min/day)	**2.21**
Fire Flow	(4 hours) X (4,500 gpm) X (60 min/hr)	1.08
Emergency – Tank	(25%) X (**6,130 gpm**) X (1440 min/day)	**2.21**
SVSP Base plus UR Storage[1]		**5.50[2]**
Net Additional Storage Required for Urban Reserve		**1.00**

Notes:
1. Emergency storage capacity to be split between the tank and the wells. Only the volume of storage required from the tank storage is presented in **Table 2-4**.
2. Includes operational capacity, fire flow, and emergency volume for the tank, rounded up to the nearest logical tank size

N

ROSEVILLE CITY LIMITS

WEST SIDE DR

PLEASANT GROVE BLVD

MARKET AVE

RICHLAND PLANNED COMMUNITIES

WEST ROSEVILLE SPECIFIC PLAN

CHAN PROPERTY

FIDDYMENT RD

BASELINE RD

LEGEND

LDR	LOW DENSITY RESIDENTIAL
MDR	MEDIUM DENSITY RESIDENTIAL
HDR	HIGH DENSITY RESIDENTIAL
CC/CMU	COMMERCIAL MIXED USE
CC/BP	COMMERCIAL/BUSINESS PARK
CC	COMMUNITY COMMERCIAL
PQP	PUBLIC/QUASI–PUBLIC
PR	PARKS & RECREATION
OS	OPEN SPACE
UR	URBAN RESERVE
P	PASEOS

HydroScience Engineers

FIGURE 1-2

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA POTABLE WATER MASTER PLAN

LAND USE PLAN - SVSP BASE SCENARIO

S:\Common\Projects\219_Sierra Vista\DWGs\Figure 1-2 072009.dwg DATE: 7/02/09

SIERRA VISTA COMMUNITIES

Sierra Vista Potable Water Master Plan

Prepared For: MacKay & Somps Civil Engineers, Inc.

April 2009

HydroScience Engineers

Sierra Vista
Potable Water Master Plan

April 2009

Prepared for

MacKay & Somps Civil Engineers, Inc.

Submitted by

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HydroScience Engineers

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APPENDICES

Appendix A – H2ONET Water Model Junction and Pipe Output Reports

Appendix B – Sierra Vista Detailed Potable Water Demand Summary

SECTION 1 – INTRODUCTION

This Sierra Vista Potable Water Master Plan (Master Plan) was prepared by HydroScience Engineers (HSe) for MacKay & Somps Civil Engineering, Inc. (MacKay & Somps) in support of the Sierra Vista Specific Plan (SVSP). This section summarizes the purpose, background, and scope for this Master Plan.

1.1 Purpose

This document evaluates the methods to supply and distribute potable water to SVSP to meet the potable water demand. The purpose of the Master Plan is to:

- Develop a demand summary for potable water customers within the SVSP;
- Develop a functional and reliable potable water infrastructure; and
- Identify necessary storage and pumping facilities.

1.2 Background

The SVSP is a ±2,064 acre development located in Placer County, California, south and west of the City of Roseville (City). The SVSP is encompassed by the West Roseville Specific Plan (WRSP) to the north, Fiddyment Road to the east, Baseline Road to the south, and open space to the west. A map showing the SVSP and the vicinity is provided as **Figure 1-1**. It is expected that the SVSP will be annexed into the City.

The total SVSP includes two properties that are referred to in this Master Plan as the Richland (UR-2 and UR-3) and Chan (UR-1) properties. Though these properties are not a part of the SVSP, potable water infrastructure within the SVSP is being sized assuming that these areas will be developed in the future. The Master Plan includes a model of the potable water infrastructure both with (SVSP Base plus UR) and without (SVSP Base) these developments so that the extent of improvements required for these two properties are detailed.

The SVSP is currently undeveloped rolling grassland and agricultural lands. The area has topographical elevations ranging from 75 to 125 ft, and generally slopes from east to west.

The SVSP is proposed to include a variety of mixed-use developments, including low, medium, and high-density housing; shopping centers; commercial mixed use and business parks; and schools, parks, paseos, and open spaces. Proposed land uses within the SVSP Base are shown in **Figure 1-2**. **Figure 1-2** is based on the Conceptual Land Use plan as of January 22, 2009. **Figure 1-3** shows the potential development of the Richland property based on the June 2008 land use plan. The Chan property, which is shown on **Figure 1-2**, will become low density residential.

The SVSP was modeled to allow the backbone infrastructure to be phased. Phases may be developed in any sequence provided public safety, health, and welfare issues are

addressed, subject to the approval of the City. Parcel specific improvements will be determined with small lot tentative maps or subsequent entitlements.

1.3 Existing Documents

In order to ensure that this Master Plan is coordinated with other planning efforts, including those for the City and the WRSP, previous studies were reviewed and utilized in the planning and design of the potable water system for Sierra Vista. Each of these studies is summarized below:

City of Roseville Water Model Update (2003): In July 2003, West Yost Associates prepared this document updating the City's water supply projections and infrastructure needs, as well as updating the hydraulic model.

Master Water Study for West Roseville Specific Plan Area (2003): This document identified water supply alternatives, on-site and off-site potable water infrastructure requirements, and potable water demand, for the WRSP in Roseville, CA. Included in the plan are storage, pumping, transmission piping, and supply requirements to deliver water to the WRSP. The study proposed the extension of two 24-inch mainlines to Fiddyment Road from existing mainlines serving the City. A portion of this study included the SVSP, which was referred to as Memorandum of Understanding Area 2 (MOU2).

Technical Memorandum 1: Evaluation of Water System Capacity – Water Demands Evaluation: MWH prepared Technical Memorandum 1 (TM 1) in November 2002, which analyzed the City's potable water system. This TM analyzed historical information, and potable water demand trends developed in the last ten years in order to update/define more accurate unit demand factors, peaking factors, and water demand projections for future City expansion.

General Plan Update Water System Study: A study prepared by the Spink Corporation in 1993 analyzed the potable water system for the City and set guidelines for future expansion projects. The study also analyzed historical data to determine unit water demands, and peaking factors.

Technical Memorandum 1: Unit Demand Factor Verification and Water Demand Evaluation and Update: MWH prepared Technical Memorandum 1 (September 2006) which analyzed the City's potable water system. This TM analyzed and updated the potable water demand factors identified in TM 1 (November 2002). It was recommended by the City that these demand factors be applied to the SVSP. For purposes of the Sierra Vista draft water master plan, the "conservative" demand factors were used to calculate water demands.

Feasibility Analysis Report for the Sierra Vista Specific Plan: The City prepared a Feasibility Analysis in April 2007 to evaluate the impact SVSP will have on the City. This analysis consisted of three technical studies on traffic, water, and fiscal impacts respectively. The water study determined a water supply strategy to reliably provide water to the SVSP and other new urban growth areas, as well as future infill projects. This water supply strategy identified two possible new water sources to meet the City's water supply

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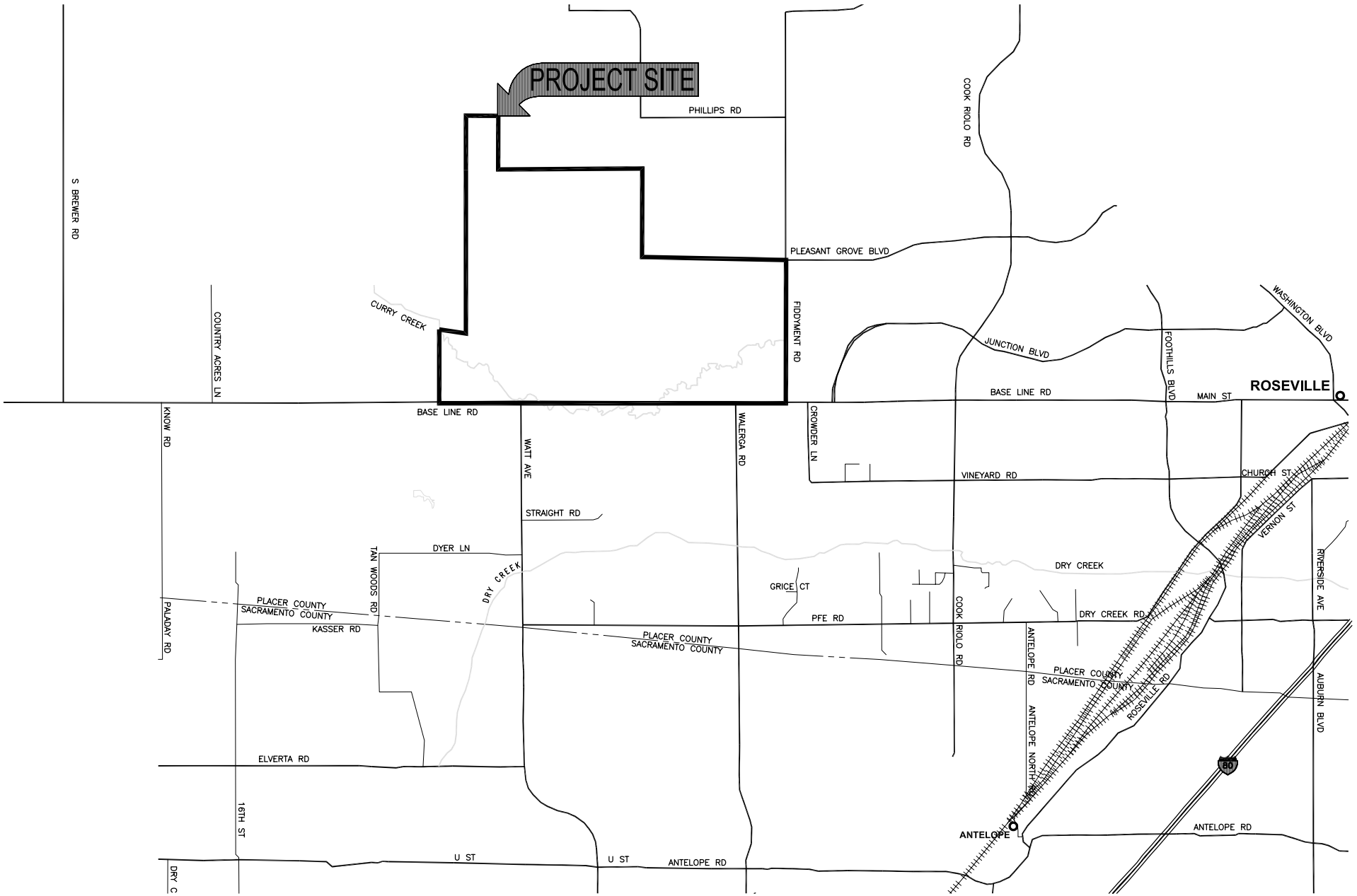

FIGURE 1-1

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA POTABLE WATER MASTER PLAN

PROJECT LOCATION MAP

HydroScience Engineers

N

RICHLAND PLANNED COMMUNITIES

UR-2

UR-3

WEST ROSEVILLE SPECIFIC PLAN

WEST SIDE DR

PLEASANT GROVE BLVD

MARKET AVE

FIDDYMENT RD

BASELINE RD

CHAN PROPERTY

UR-1

LDR-1 LDR-2 LDR-3 LDR-4 LDR-5 LDR-6 LDR-7 LDR-8 LDR-9 LDR-10 LDR-11 LDR-12 LDR-13 LDR-14 LDR-15 LDR-16 LDR-17 LDR-18 LDR-19 LDR-20a LDR-20b LDR-21 LDR-22 LDR-23 LDR-24

MDR-1 MDR-2 MDR-3 MDR-4 MDR-5 MDR-6 MDR-7 MDR-8 MDR-9 MDR-10 MDR-11 MDR-12 MDR-13 MDR-14

HDR-1 HDR-2 HDR-3 HDR-4 HDR-5 HDR-6 HDR-7

CMU: CC (CMU-1) CC (CMU-2) CC (CMU-3)

CC/BP: CC/BP-1 CC/BP-2

CC: CC-1a CC-1b CC-2 CC-3 CC-4a CC-4b CC-5

PQP: PQP-1 PQP-2 PQP-3 PQP-4 PQP-5 PQP-6 ES PQP-7 FS PQP-8 (MS) PQP-9 PQP-10 ES PQP-11 ES

PR: PR-1 PR-2 PR-3 PR-4 PR-5 PR-6 PR-7 PR-8 PR-9 PR-10 PR-11 PR-12 PR-13

OS: OS-1 OS-2 OS-3 OS-4a OS-4b OS-5 OS-6a OS-6b OS-6c OS-7a OS-7b OS-8a OS-8b OS-8c OS-8d OS-9 OS-10 OS-11 OS-12 OS-13 OS-14 OS-15a OS-15b OS-15c OS-15d OS-16

PASEOS: PASEO-1 PASEO-2 PASEO-3 PASEO-4 PASEO-5 PASEO-6 PASEO-7 PASEO-8 PASEO-9a PASEO-9b PASEO-10 PASEO-11 PASEO-12a PASEO-12b PASEO-13 PASEO-14a PASEO-14b PASEO-14c PASEO-15 PASEO-16 PASEO-17 PASEO-18 PASEO-19 PASEO-20 PASEO-21 PASEO-22 PASEO-23 PASEO-24 PASEO-25 PASEO-26 PASEO-27 PASEO-28 PASEO-29 PASEO-30 PASEO-31 PASEO-32 PASEO-33 PASEO-34 PASEO-35 PASEO-36 PASEO-37 PASEO-38 PASEO-39 PASEO-40 PASEO-41 PASEO-42 PASEO-43 PASEO-44 PASEO-45 PASEO-46 PASEO-47

road crossing

LEGEND

LDR	LOW DENSITY RESIDENTIAL
MDR	MEDIUM DENSITY RESIDENTIAL
HDR	HIGH DENSITY RESIDENTIAL
CMU	COMMERCIAL MIXED USE
CC/BP	COMMERCIAL/BUSINESS PARK
CC	COMMUNITY COMMERCIAL
PQP	PUBLIC/QUASI–PUBLIC
PR	PARKS & RECREATION
OS	OPEN SPACE
UR	URBAN RESERVE
P	PASEOS

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FIGURE 1-2

MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA POTABLE WATER MASTER PLAN
LAND USE PLAN - SVSP BASE SCENARIO

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N

PQP-1

OS-1

HDR-1

CC
(CMU-1)

PLEASANT GROVE BLVD

WEST SIDE DR

CC-1

LDR-1

CC-2

MDR-3

HDR-3

HDR-2

MDR-1

PR-1

PQP-2
ES

MDR-2

PR-2

LDR-2

CC-3

MDR-5

LDR-3

MDR-6

CC
(CMU-5)

MDR-7

LDR-4

CC-3

LEGEND

LDR	LOW DENSITY RESIDENTIAL
MDR	MEDIUM DENSITY RESIDENTIAL
HDR	HIGH DENSITY RESIDENTIAL
CMU	COMMERCIAL MIXED USE
CC/BP	COMMERCIAL/BUSINESS PARK
CC	COMMUNITY COMMERCIAL
PQP	PUBLIC/QUASI–PUBLIC
PR	PARKS & RECREATION
OS	OPEN SPACE
UR	URBAN RESERVE
P	PASEOS

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FIGURE 1-3
MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA POTABLE WATER MASTER PLAN
LAND USE PLAN - RICHLAND PLANNED COMMUNITIES

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requirements, 1) acquire 4,000 AFY of additional water from the San Juan Water District, and 2) construct the Sacramento River diversion treatment plant and transmission facilities.

Since the development of the Feasibility Analysis Report for the SVSP, the City has identified alternative water supply strategies for the project. These strategies are detailed in the CEQA document for the SVSP.

1.4 Report Organization

This report provides a description of the potable water facilities required for the proposed SVSP. The sections contained in this report are:

- Section 1 – Introduction;
- Section 2 – Design Criteria and Water Demands;
- Section 3 – Potable Water Supply;
- Section 4 – Results;
- Section 5 – References; and
- Appendices.

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SECTION 2 – DESIGN CRITERIA AND WATER DEMANDS

This section presents the planning criteria, modeling criteria, and assumptions used to develop the potable water demands and to size the water supply infrastructure for Sierra Vista.

2.1 Planning Criteria

The water use factors used in this Master Plan are identified in **Table 2-1**. These water use factors are based on historical data and water use trends developed by MWH in TM1 (MWH, 2002). These water use factors are used to determine the water supply requirements for the SVSP.

Table 2-1: Potable Water Use Factors

Land Use Designation	Abbreviation	Water Use Factor[1]
Residential		
Low Density Residential (5 du/ac)	LDR	600 gpd/DU
Medium Density Residential (9 du/ac)	MDR	323 gpd/DU
High Density Residential (20-30 du/ac)	HDR	177 gpd/DU
Non-Residential		
Community Commercial	CC	2,598 gpd/acre
Commercial Mixed Use	CC (CMU)	177 gpd/DU + 2,598 gpd/acre
Commercial/ Business Park	CC/BP	2,598 gpd/acre
Paseo	P	2,988 gpd/acre
Public/Quasi-Public-A	P/QP	1,780 gpd/acre
Public/Quasi-Public-B	P/QP	2,562 gpd/acre
Public/Quasi-Public-C	P/QP	3,454 gpd/acre
Public/Quasi-Public-D	P/QP	4,068 gpd/acre
Park	PR	2,988 gpd/acre
Open Space	OS	0 gpd/acre
Landscape Corridor	LC	2,988 gpd/acre

Notes:
1. Demand Use Factors are based on the MWH TM1 "Conservative Scenario" (MWH, 2002)

It should be noted that different water use factors were applied to different types of P/QP areas. The P/QP areas were assigned water use factors as described below.

- Public/Quasi-Public-A: Church, recycled water tank site, recycled materials site, potable water treatment facility, fire station, well site
- Public/Quasi-Public-B: Electrical substation

- Public/Quasi-Public-C: Elementary school
- Public/Quasi-Public-D: Middle school

Irrigation of all areas within the SVSP, except for low-density residential and medium density residential, is expected to be with recycled water. In land uses using recycled water for landscape irrigation, potable water demands would be reduced. However, the City asked HSe to model the potable water distribution system assuming that no recycled water was being used. It is expected that once the SVSP model is incorporated into the City model, that the City will adjust the SVSP water use factors to reflect the use of recycled water.

Not adjusting the water use factors to account for recycled water use results in the modeling of potable water demands at a level higher than what they are actually expected to be. For the purposes of this modeling effort, these demands reflect a conservative factor of approximately 19%, since recycled water is expected to comprise approximately 1,023 AFY of demand compared to the total water demands of the SVSP, which are described below. For more information about recycled water use within the SVSP, the reader is referred to the Sierra Vista Recycled Water Master Plan (HSe, 2009).

Potable Water Demands: In order to size the potable water infrastructure within the SVSP, maximum day and peak hour demands are used. These demands were calculated as detailed below.

The potable water demand analysis for the SVSP was conducted based upon the water use factors in **Table 2-1**, and the January 22, 2009 SVSP land use plan. The land use designation, acreage, number of dwelling units, unit demand factors, and peaking factors were used to calculate the average day potable water demands.

Average day potable water demands were calculated based on either the number of dwelling units in residential parcels, or the total acreage for that type of land use. Maximum day potable water demands were calculated by applying a peaking factor to the Average Day Demands (ADD). A peaking factor of 2.0 was applied to the SVSP average day demands as identified in the *Master Water Study for West Roseville Specific Plan Area* (Wood Rodgers, 2003).

The Maximum Day Demand (MDD) is used to size potable water infrastructure such as tanks and reservoirs to meet operational, and fire flow requirements. There must be adequate storage to supply water to the SVSP during fire flow events and when potable water use exceeds the maximum day demand.

The Peak Hour Demand (PHD) represents the highest flow rate the SVSP will require at any time throughout the day. This demand is used to size transmission mainlines. Transmission mainlines must be sized to minimize pressure and head loss while maintaining adequate water transport during peak hour conditions. This demand was calculated by applying a peaking factor of 1.7 to the MDD (Wood Rodgers, 2003).

Table 2-2: SVSP Potable Water Use (SVSP Base)

Area Description	Total Acres	Density (du/ac)	Dwelling Units	Acre feet per year	Average Day Demand	Max Day Demand	Peak Hour Demand
				(AFY)	(GPM)	(GPM)	(GPM)
Residential							
Low Density Residential	484.6	5	2,417	1,624	1,007	2,014	3,424
Medium Density Residential	261.6	9	2,350	850	527	1,054	1,792
High Density Residential	66.1	20-30	1,633	324	201	401	682
Urban Reserve	427.7	-	-	0	0	0	0
Non-Residential							
Community Commercial	153.6	-	-	447	277	554	942
Commercial Mixed Use	34.3	20	255	150	93	186	317
Commercial Business Park	27.3	-	-	79	49	99	167
Paseo	26.1	-	-	87	54	108	184
Public/Quasi-Public (all) [3]	70.7	-	-	265	164	327	556
Park	89.9	-	-	301	187	373	634
Open Space	256.9	-	-	0	0	0	0
Landscape Corridor	43.7	-	-	146	91	181	308
Roads	121.6	-	-	0	0	0	0
Total	**±2,064**		**6,655**	**4,274**	**2,649**	**5,299**	**9,008**

Notes:
1. Based on the January 22, 2009 SVSP land use plan for the SVSP.
2. Flow values were rounded off to the nearest value. Due to rounding, the values in this table are not identical to values calculated without rounding.
3. Does not include demands associated with ASR wells.

Table 2-3: SVSP Potable Water Use (SVSP Base plus UR)

Area Description	Total Acres	Density (du/ac)	Dwelling Units	Acre feet per year	Average Day Demand	Max Day Demand	Peak Hour Demand
				(AFY)	(GPM)	(GPM)	(GPM)
Residential							
Low Density Residential	621.7	5	3,101	2,084	1,292	2,584	4,393
Medium Density Residential	354.1	9	3,179	1,150	713	1,426	2,424
High Density Residential	110.4	20-30	2,519	499	310	619	1,053
Non-Residential							
Community Commercial	191.3	-	0	557	345	690	1,173
Commercial Mixed Use	47.6	20	347	207	129	257	437
Commercial Business Park	27.3	-	0	79	49	99	167
Paseo	26.1	-	0	87	54	108	184
Public/Quasi-Public (all) [3]	82.3	-	0	303	188	375	638
Park	107.9	-	0	361	224	448	761
Open Space	302.8	-	0	0	0	0	0
Landscape Corridor	59.0	-	0	197	122	245	416
Roads	121.6		0	0	0	0	0
Total	**±2,064**		**9,146**	**5,526**	**3,426**	**6,851**	**11,647**

Notes:
1. Based on the January 22, 2009 SVSP land use plan for the SVSP and the June 2008 land use plan for the Richland and Chan properties.
2. Flow values were rounded off to the nearest gpm.
3. Does not include demands associated with ASR wells
4. Acreage does not add up correctly due to differences in land use plan calculations for Richland.

Table 2-2 and **Table 2-3** summarize the potable water use for the SVSP categorized by the type of land use. Each land use designation is summarized to show the total acreage it represents, the number of dwelling units located within it, and cumulative water demand for the ADD, MDD, and PHD scenarios. A detailed potable demand summary and statistical breakdown of each parcel categorized by land use is available in **Appendix B**.

2.2 Modeling

The SVSP potable water hydraulic water modeling was conducted using H_2O NET 8.0 by MWH Soft, Inc. The land use plans identified in **Section 1.2** were used as the SVSP hydraulic model design base to add infrastructure and potable water demands to determine the required potable water infrastructure. Since no information is currently available on pressure or flow capacity for the anticipated tie-in points, the hydraulic modeling was conducted using fixed head reservoirs to simulate the tie-ins. By setting these reservoirs with a fixed head equivalent to the City requirement of 50 psi at the lowest pressure tie-in, the model assumes that there will be adequate water and pressure capacity to serve the SVSP during low flow periods. Peak flow conditions will be met through the on-site potable water tank and pump station.

Traditionally, the City requires developments to plan, design, and construct infrastructure to meet the needs of their development. Thus, a site for potable water to be stored and pumped throughout the SVSP is required within the SVSP. A 2.8-acre parcel (P/QP-5) was included in the land use plan to locate the SVSP potable water storage tank and pump station. P/QP-5 would be located between Watt Avenue and West Side Drive along a yet unnamed road extending from Road “A” to Road “B.” This facility is further described in **Section 3**.

The transmission main infrastructure for the SVSP was intended to follow the major roadway alignments and service all potable water customers based on the potable water demands discussed in **Section 2.1**. Since the SVSP will intertie with Pressure Zone 4 of the City’s potable water system, the diurnal flow pattern for Pressure Zone 4 from the City’s existing potable water model was utilized in the SVSP hydraulic model. This flow pattern encompasses the peaking factors used in determining water demands and better simulates water usage throughout the course of the day.

Additionally, potable water infrastructure within Baseline Road was reduced to the minimum length required to connect to the City’s existing facilities at Baseline Road and Fiddyment Road. Pipelines were modeled in this way to minimize required off-site infrastructure. In addition, it is assumed that there will be no system interties to the south due to the existing system intertie with PCWA at the corner of Baseline Road and Fiddyment Road. The PCWA takeoff will be moved to the furthest west termination of the 24-inch line in Baseline Road in order to minimize parallel facilities in the right-of-way.

The City also requested that two wells, each with an injection and extraction capacity of 2.6 MGD, be located along major transmission pipelines with the SVSP Base. These two on-site injection/extraction wells provide the City with an emergency water supply during dry years or during fire flows, and allow for the eventual use of an Aquifer Storage and

Recovery (ASR) project. A third injection/extraction well will be built as part of the construction of the Urban Reserve in the Richland property.

HSe then worked with the City to identify a potential buildout scenario for serving potable water to the SVSP. For this effort, two land use plans were modeled: the SVSP Base and SVSP Base plus UR. The SVSP Base plus UR land use plan is based on the assumption that the Richland and Chan Properties will be fully developed per the June 2008 land use plan for the Richland property, and assuming development of 143 LDR units (5 DU per acre) on the 28.6 acres of the Chan property to the north of the electrical transmission lines.

Due to the relocation of the recycled water storage tank and pump station to the WRSP and parcel P/QP-1 being converted to open space. It is assumed that the ASR well site that was planned as part of P/QP-1 will be relocated to another parcel within the Richland property. The new location of the well site is to be determined and the adjacent main transmission pipeline will be upsized to 16-inches to serve the well per the City's request. At buildout of the SVSP Base plus UR, there will be three ASR wells within the SVSP area – each with a capacity of 2.6 MGD.

Modeling Criteria: The modeling criteria used to model the potable water distribution system is the same criteria used for the WRSP and all proposed projects within the City. These criteria include infrastructure, maximum day demands, peak hour demands, velocity, minimum and maximum pressure, and fire flow demand requirements. These criteria are summarized below.

Transmission Main Design Criteria: The design of potable water transmission mains requires modeling of water use based on projected land uses and the associated potable water demands to meet two essential parameters: pressure and velocity. Pressure in the transmission mains must stay within a set minimum and maximum range. A pressure minimum during fire flow events is also required to ensure sufficient flow can be attained at the hydrant while maintaining the required pressure throughout the system. A maximum velocity is required in order to minimize head loss in the transmission mains throughout the system. These criteria are summarized below.

- All pipe velocities must remain below 6 ft/s during peak hour;
- System residual pressure must stay between 50 and 90 psi;
- Minimum residual pressure of 20 psi must be maintained at the hydrant during fire flow; and
- Fire flow demands are allocated to each hydrant (junction) within the system based on adjacent land use designation.

Water Storage Criteria: Water storage is required for the SVSP in order to provide water when demands exceed the MDD, and during fire flow events. This water storage requirement is defined in the *Master Water Study for West Roseville Specific Plan Area* and has three major components: operational, fire flow, and emergency storage. These criteria are summarized below.

- Operational: 25% of MDD;
- Fire Flow: Largest fire flow demand for a period of 4 hours; and
- Emergency: 50% of MDD supplied 25% from groundwater storage and 25% from tank storage

It was noted that this water storage criteria is valid for both the SVSP Base and SVSP Base plus UR. Thus, should the Richland and Chan properties be developed, they would need to fund the oversizing of water storage facilities at the site for the SVSP storage tank to the volume specified in **Table 2-3**.

Table 2-4: Water Storage Criteria

Type	Equation	Volume (MG)
SVSP Base		
Operational	(25%) X (5,299 gpm) X (1440 min/day)	1.91
Fire Flow	(4 hours) X (4,500 gpm) X (60 min/hr)	1.08
Emergency – Tank	(25%) X (5,299 gpm) X (1440 min/day)	1.91
SVSP Base Storage[1]		**5.00[2]**
SVSP Base plus UR		
Operational	(25%) X (6,851 gpm) X (1440 min/day)	2.47
Fire Flow	(4 hours) X (4,500 gpm) X (60 min/hr)	1.08
Emergency – Tank	(25%) X (6,851 gpm) X (1440 min/day)	2.47
SVSP Base plus UR Storage[1]		**6.00[2]**
Net Additional Storage Required		**1.00**

Notes:
1. Emergency storage capacity to be split between the tank and the wells. Only the volume of storage required from the tank storage is presented in **Table 2-4**.
2. Includes operational capacity, fire flow, and emergency volume for the tank, rounded up to the nearest logical tank size.

Fire Flow Criteria: Fire flow demands are allocated to all junctions throughout the development in order to ensure that the designed main transmission infrastructure can sustain the required flow at the hydrant while maintaining the minimum residual pressure throughout the system. The minimum residual pressure to be maintained throughout the distribution system is 50 psi. The minimum pressure required at the node flowing is 20 psi. Fire flow demands are broken down into four major categories. These categories are summarized below (Wood Rodgers, 2003), along with the required flow.

- Residential – 1,500 gpm
- Multi-Family – 2,500 gpm
- Commercial/Office – 4,000 gpm
- Industrial/School – 4,500 gpm

Distribution Criteria: All parcels bordering two major right-of-ways shall have a minimum of two stubs provided to those sites. In the hydraulic model, demands for those land uses were split into the two nearest applicable junctions.

2.3 Summary of Assumptions

There are a number of assumptions associated with the SVSP potable water modeling. These assumptions include:

- Pipeline diameters for new pipelines are limited to City standard sizes such as 12, 16, 24-inches, etc;
- All future pipes have a Hazen-Williams roughness coefficient consistent with PVC with a C value equal to 130;
- The peaking factor for MDD is 2.0 of the ADD and the peaking factor for PHD is 3.4 of the ADD, or 1.7 times the MDD (2.0 x 1.7 = 3.4);
- The minimum pressure in the SVSP potable water distribution system is 50 psi during MDD at the lowest pressure node, and 20 psi during fire flow events at the flowing node;
- The SVSP will maximize use of recycled water for irrigation purposes. However, the SVSP potable water distribution system is to be sized to supply potable water to all land uses for all purposes in the event recycled water is not available;
- System interties will provide adequate capacity and pressure to supply SVSP at low flow conditions;
- For purposes of modeling the highest possible water demands and adequate sizing of infrastructure, the two 2.6 MGD ASR wells will operate at a constant rate over a 24-hour period;
- The tank, booster pump station, and one of the injection/extraction wells will be located on a 2.8-acre parcel on P/QP-5;
- Storage facility size is based on the criteria listed in **Section 2.2**;
- Fire flow demand is allocated to each junction based on adjacent land use; and
- Parcel P/QP-1 of the Richland property is assumed to be open space due to the parcel being enveloped by open space and the relocation of the recycled water facilities to P/QP-2 of the SVSP Base.

SECTION 3 – POTABLE WATER SUPPLY

This section provides information on the potable water supply, how it will be supplied to the SVSP, and how it will be distributed within the SVSP.

3.1 Water Supply

For the purposes of this Master Plan, it is assumed that the City can adequately supply potable water to the SVSP through the existing distribution system. To model this, fixed head reservoirs were modeled at the system interties as described in **Section 2.2**. The fixed head of these reservoirs was calculated such that the lowest pressure at any intertie location was equal to the system minimum requirement of 50 psi. This was done to simulate a worst-case scenario.

Once the City imports the SVSP model into the City's buildout potable water hydraulic model, the actual volumes, rates, and pressures for the SVSP water supply can be determined.

To supplement the water supply during driest of years, the SVSP Base will have ASR wells similar to those in the WRSP. These ASR groundwater wells will inject water into the aquifer during wet years to be extracted for use in the dry years. The objective of these ASR wells is to have zero negative impact on the aquifer. The ASR wells are further described in **Section 3.3**.

3.2 System Interties

The SVSP will connect into the City's existing Pressure Zone 4 to receive their potable water. Pressure Zone 4 includes the Del Webb – Sun City area, the WRSP, and areas west of the pressure-reducing valves connecting Pressure Zones 1 and 4. Pressure Zone 4 has an approximate elevation range of 75-140 feet, and includes the SVSP. The City distribution system will supply water to the SVSP through the two system interties with Pressure Zone 4 on Fiddyment Road. The WRSP distribution system will provide water to SVSP through an additional four future points of connection. These six system interties are listed below and shown on **Figure 3-1**.

- The existing 24-inch main in Baseline Road, which currently terminates just east of the SVSP at the south end of the SVSP;
- The existing 16-inch main in Pleasant Grove Boulevard at the northeast boundary of the SVSP;
- The existing 12-inch main in Westhills Drive, which currently terminates just east of the SVSP at the east end of the SVSP;
- The planned 24-inch main in West Side Drive, which will terminate at the north boundary of the SVSP;
- The planned 16-inch main in Pleasant Grove Boulevard; and
- The 12-inch main on Market Street.

3.3 Water Storage and Pumping

Hydraulic modeling of the SVSP showed the on-site potable water demand required 5.0 MG of potable water storage for the SVSP Base and 6.0 MG of storage for SVSP Base plus UR (See **Table 2-3**). The on-site storage tank will serve as the primary source of water to the SVSP during high flow periods such as MDD, PHD, and emergency fire flows. The storage tank and pumping facilities were sized such that the City's existing distribution system needs only provide adequate service for the ADD. The tank will refill during periods of low flow. The storage tank and booster pump station facilities will be located on parcel P/QP-5. A conceptual layout of the P/QP site is included as **Figure 3-2**.

The SVSP booster pump station was modeled with a design capacity of 10,000 gpm at a TDH of 250 ft to meet the SVSP Base plus UR land use plan. For the SVSP Base land use plan, the SVSP booster pump station was modeled with a design capacity of 9,000 gpm at a TDH of 200 ft.

Currently the pump station is modeled to meet the demands of the SVSP as they exceed the ADD. This effectively reduces the impact on the existing distribution system by only requiring the system to supply enough water to meet the ADD and refill the tank over low flow periods. It should be noted that the pump station size and capacity were calibrated using the hydraulic model and all assumptions previously mentioned. These facilities will need to be re-modeled to verify the required pumping capacity of the SVSP booster pump station when the SVSP hydraulic water model is combined with the City's hydraulic water model.

The two on-site injection/extraction wells are included in the conceptual layout to provide the City with a water supply for conjunctive use during dry years or during fire flows, and to allow for the eventual use of an ASR project. Each well was assumed to have an injection and extraction capacity of 2.6 MGD (1,800 gpm). These wells are also a viable option to boost the SVSP distribution system pressure during PHD periods, supply potable water during dry years, and possibly to boost pressure when the tank is refilling. However, though the wells were not modeled in this way, they may be operated in this manner.

The City requested that these wells be located along major transmission pipelines and adjacent to the street. Two well sites were selected within the SVSP for injection/extraction wells in accordance with these preferences and the requirements of the land use plan. One is located at the P/QP-5 site that also contains the SVSP storage tank and pump station. The other is located in the eastern end of SVSP off of Upland Drive. It was noted that the City has required the construction of the ASR wells in the SVSP in support of the City's ASR project. It is further assumed that the third ASR well site planned for parcel P/QP-1 of the Urban Reserve, as shown in **Figure 1-3**, could either remain at that site of be relocated to another location within the Urban Reserve. The potable water pipeline adjacent to the well site will also need to be upsized to 16-inches in diameter.

It is expected that the Owner will provide a graded SVSP potable water tank site with utility stubs to the City. The City will use water fees collected from the SVSP to fund and construct the water storage tank and pump station.

3.4 Water Transmission

The transmission mainline infrastructure is designed to be well looped with multiple system interties between the SVSP, WRSP, and with the rest of Pressure Zone 4. The main transmission backbone is a 24-inch pipe that connects the main 24-inch potable water supply pipeline on Baseline Road with the main 24-inch potable water supply pipeline on West Side Drive. The storage tank and pump station facilities (P/QP-5) would be located between Watt Avenue and West Side Drive along a yet un-named road extending from Road "A" to Road "B". Potable water is pumped out of the on-site storage tank to the SVSP distribution system via a 24-inch mainline, which extends north to Road "A" and south to Road "B," then east to West Side Drive. The on-site pump station was sized to provide adequate pressure and flow to all areas within the SVSP during MDD and PHD. The transmission mainline diameters in the rest of the system decrease away from the main water sources while minimizing head loss and meeting fire-flow demands.

The water transmission infrastructure was modeled in four separate options, as described in **Table 3-1**. The key differences between the models is what land use was modeled, and the location of transmission main infrastructure.

Land Use Plans: The systems were modeled for both the SVSP Base and SVSP Base plus UR land use plans. Differences in the transmission main infrastructure between the SVSP Base and SVSP Base plus UR options included the following:

- Upsizing the 8-inch on the Watt Avenue extension to 12-inches between Road "A" and the Richland property.
- Upsizing the 12-inch in Road "A" from the 24-inch tank service to the Watt Avenue extension to the 16-inch main.
- Construction of distribution pipelines within the Richland/Chan properties

Transmission Pipeline Infrastructure Locations: Two alternative transmission pipeline alignments were modeled. These alignments varied in how far to the west on Baseline Road a 24-inch transmission pipeline was constructed. Extending the 24-inch pipeline in Baseline Road benefits other UGA's, including Placer Vineyards and Regional University, both of which will receive water from PCWA. This 24-inch transmission pipeline was either located on Baseline Road or on the SVSP interior Road "B." Thus, for both the SVSP Base and SVSP Base + UR land use plans, two separate options were modeled.

Table 3-1: Assumptions Incorporated into Modeling options

Option Name	Land Use Plan	Furthest Extent on Baseline Road for 24-inch Transmission Pipeline
SVSP Base (A)	SVSP Base	Upland Street
SVSP Base (B)	SVSP Base	West Side Drive
SVSP Base + UR (A)	SVSP Base + UR	Upland Street
SVSP Base + UR (B)	SVSP Base + UR	West Side Drive

The nodes from which all land uses receive water from all modeled options are shown in **Appendix B** in the right most column for each land use in the demand summary table. These nodes may be different for the (A) and (B) modeled options, depending on the location of that land use and whether a new pipeline was constructed adjacent to that node.

It should be noted that without the development of the Richland/Chan properties, construction of the 24-inch line through that area is still required to supply water to the SVSP Base options.

Figures 3-3, 3-4, 3-5, and 3-6 show the backbone infrastructure required to supply potable water to both the SVSP Base and the SVSP Base plus UR, for both the (A) and (B) transmission pipeline alignments. It was noted that additional distribution system pipelines would be required within or adjacent to each land use area as the plans for those areas are defined. Those distribution pipelines were not included in this modeling effort.

Table 3-1 provides quantity takeoffs for the backbone infrastructure required all of the modeled options.

The primary differences between the SVSP Base and SVSP Base plus UR are as follows:

- SVSP Base plus UR requires a 12-inch pipe for 800 feet along the Watt Avenue extension.
- SVSP Base plus UR requires a 16-inch pipe instead of a 12-inch pipe for ~1,500 feet along Road A just east of Watt Avenue.
- All other pipes are located within the urban reserve.

For the (B) options, the pipeline alignments were modified in a few ways that affect pipeline locations, diameters, and lengths between the quantity takeoffs shown in **Table 3-2**. In total, an additional 4,540 LF of pipeline is required to serve the (B) options compared to the (A) options.

It should be noted that no “fronter” pipeline lengths are included in these quantity takeoffs. “Fronter” pipelines are placed into a distribution system for service connections to individual land use areas to prevent the direct connection of services to transmission mains. These “fronter” pipelines will be quantified and located during the development of improvement plans for each land use area. in **Table 3-2** for the (A) options. These differences are as follows:

- Removal and replacement of a 5,600 LF 24-inch pipeline in Road "B" with a 5,600 LF 12-inch pipeline in the same location.
- Addition of a new 5,600 LF 24-inch pipeline on Baseline Road between Upland Drive and West Side Drive.
- Removal of an 860 LF 12-inch distribution pipeline to CC-BP2. This service was instead drawn off of the new 24-inch on Baseline Road.
- Downsizing of a 2,200 LF 16-inch pipeline on Market Street between Road "C" and Road "B."

Table 3-2: Water Distribution Pipeline Quantity Takeoffs (Linear Feet)

Pipeline Diameter	SVSP Base		SVSP Base plus UR	
	(A)	(B)	(A)	(B)
8-inch	3,300	3,300	2,500	2,500
12-inch	38,600	45,540	50,300	57,240
16-inch	8,600	6,400	12,300	9,900
24-inch	22,600	22,600	22,600	22,600
30-inch	300	300	300	300
Total LF	**73,400**	**78,140**	**88,000**	**92,540**

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SECTION 4 – RESULTS

This section provides results for the supply and distribution system outlined in the Master Plan.

4.1 Modeling Results and Fire Flow Analysis

An extended period analysis was run on the SVSP Base and SVSP Base plus UR land use plans. A summary of these results is provided below.

Modeling Results: The mainline infrastructure for the SVSP development was calibrated and optimized to meet all of the developments calculated demand requirements. These requirements are the calculated MDD, PHD, and MDD plus Fire Flow demands. The infrastructure identified in **Figures 3-3, 3-4, 3-5, and 3-6** maintains pressure and velocity requirements for the full duration of the extended period analysis. The tank and booster pump stations supplement the water provided from the City and are designed to meet the demands of the SVSP as they exceed the ADD. As water demands peak the tank and pump station provide the supplemental water necessary to maintain pressure and velocity in the system without unnecessarily drawing down the existing distribution system. This minimizes the off site impacts SVSP will have on the existing distribution system. Additional analysis will need to be done once this SVSP model is integrated into the city-wide hydraulic model. This additional analysis will determine the available capacity during off peak times to fill tanks as needed. **Figure 3-2** shows the conceptual potable water facility site plan.

H_2ONET provides full output reports for all elements in the network at the conclusion of each successful run of the model. This ensures that pressure and velocity requirements are maintained during the entire analysis at all critical points. A full set of these reports for the SVSP hydraulic modeling effort can be found in **Appendix A**.

Fire Flow Analysis: A full fire flow analysis was conducted to verify adequate flow could be sustained at all junctions (hydrants) throughout the SVSP for all modeled options. Fire flow demands were allocated to each junction within the SVSP Based on the adjacent land use with the highest potential fire flow demand, and the criteria listed in **Section 2.2**. Additionally, the fire flow analysis was run during the peak demand period and low flow condition in order to simulate the most limiting conditions.

Potable water making it onto each parcel must travel through a double detector check valve before reaching a sprinkler system. Between the public water supply and the sprinkler system would be a double detector check valve, which is expected to lower the residual pressure by approximately 10 psi. Including the pressure loss associated with the double detector check valve into the remaining residual pressure calculations, the residual pressure on-site exceeds 20 psi at each of the fire flow junctions with the same exceptions.

The results of this fire flow analysis are summarized in **Table 4-1**.

The modeling for all options showed that ample flow is available at most fire flow junctions while maintaining the required flow pressure of 20 psi at the hydrant. However, some parcels were unable to meet fire flow when all of the fire flow is placed on just one node. City standards allow for fire flow demands to be met by dividing the required fire flow demand into two nodes. This is how the majority of the parcels with deficient fire flows will comply with the overall fire flow requirements.

The following junctions could not meet fire flow requirements for one or more of the modeled options – junctions J-14, J-28, J-68-71, J-79, J-122, J-130, and J-140. Each junction is described below.

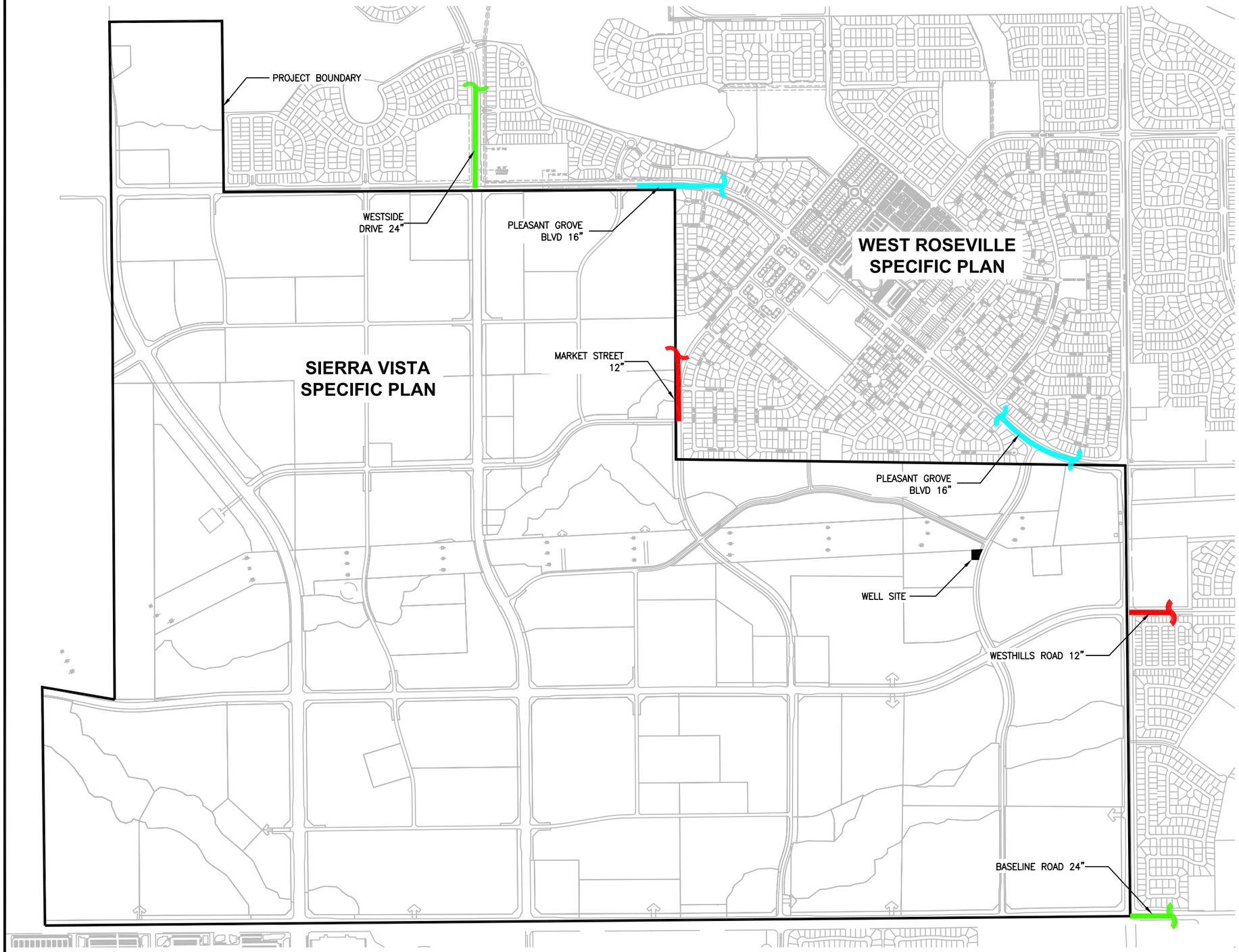
Junctions J-14, J-68 to J-71 and J-79 were, in the (A) models, located on dead-end mainlines predominantly near Baseline Road. It is believed that these nodes are not complying with City fire flow requirements because there was not a distribution pipeline included in the backbone water model on Baseline Road between Upland and West Side Drive. It is expected that each of these junctions will satisfy fire flow requirements once the distribution pipelines for the individual parcels are designed, and the fire flow is divided into two nodes as described above. It is further expected that a 12-inch mainline will connect each of the dead-end mains along the road directly to the north of Baseline Road once development plans for these parcels are created.

Junction J-28 is located on a dead-end main in the backbone model. It is expected that for this junction to meet City fire flow regulations, the fire flow for this land use will also need to be served by existing mains on either Fiddyment Road and Pleasant Grove Blvd. These pipelines were not included in the model.

Junction J-122 serves a land use where all of the fire flow is placed upon one node which does not meet fire flows. However, fire flows comply with all requirements on other nodes that are adjacent to this parcel. It is expected that when the fire flow for this land use is divided into two nodes, this land use will comply with all fire flow requirements.

Junction J-130 is located, in the SVSP Base models, on an 8-inch dead end main. If either the SVSP Base plus UR is constructed, or the MDR-1 and MDR-2 land uses are connected to the distribution system at multiple locations (e.g. on Road “D”), this junction will meet all fire flow requirements.

Junction J-140 is located at the intersection of West Side Drive and Pleasant Grove Blvd. All of the fire flow demands for land use CC-2 was placed on junction J-140 on Pleasant Grove Blvd. It is expected that when the fire flow for this land use is divided into two nodes, this land use will comply with all fire flow requirements.



COLOR CODING LEGEND
PIPE: DIAMETER (IN)

	<=	12
	<=	16
	<=	24

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FIGURE 3-1
MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA POTABLE WATER MASTER PLAN
SYSTEM INTERTIE LOCATIONS

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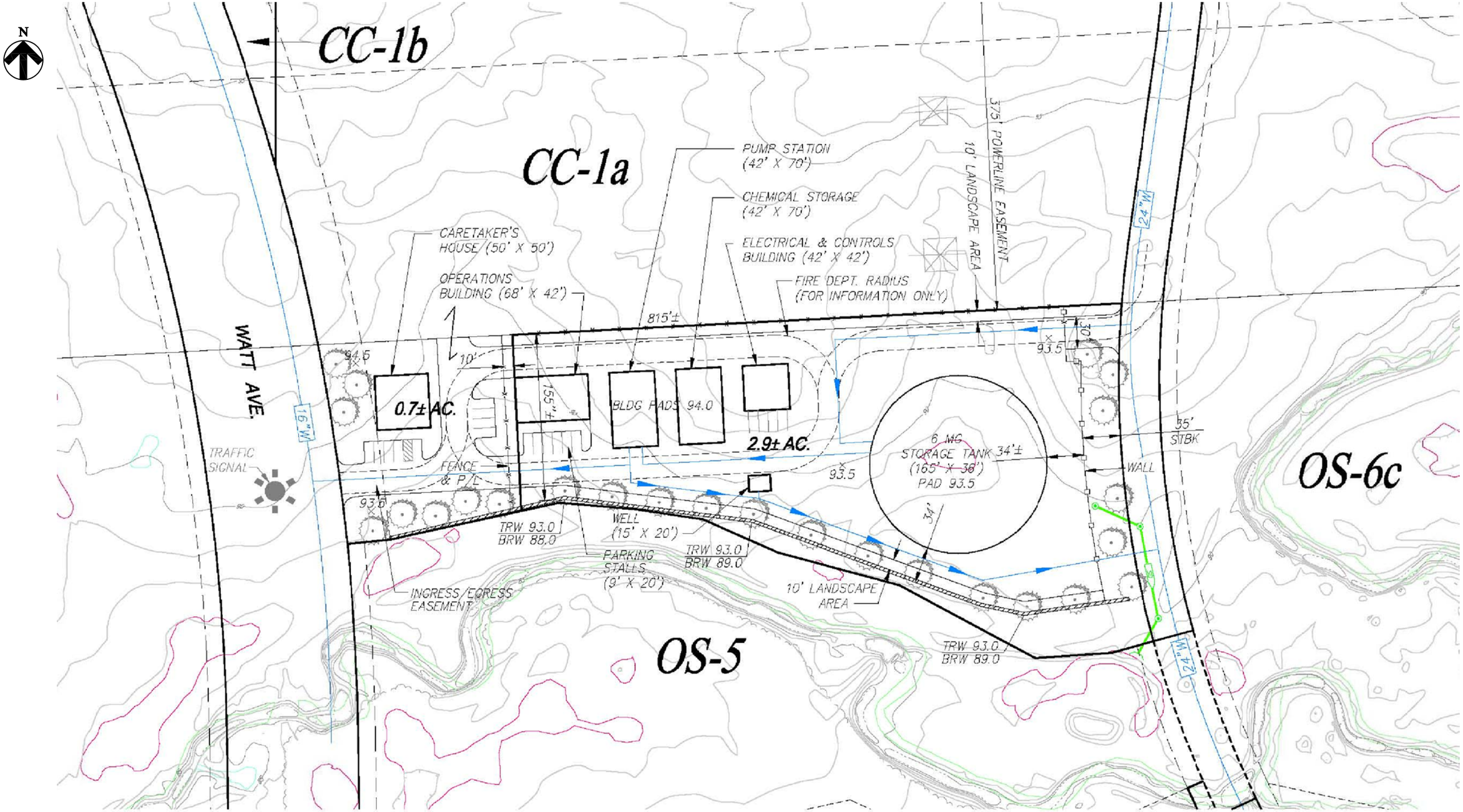

SOURCE: MACKAY & SOMPS

FIGURE 3-2
MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA POTABLE WATER MASTER PLAN
CONCEPTUAL POTABLE WATER FACILITY SITE PLAN

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PROJECT BOUNDARY

UR–1

UR–2

UR–3

SIERRA VISTA SPECIFIC PLAN

WEST ROSEVILLE SPECIFIC PLAN

POTABLE WATER INFRASTRUCTURE SITE SEE NOTE 1

WELL SITE

COLOR CODING LEGEND
NODE: MIN PRESSURE (PSI)

40 - 50	
50 - 60	
60 - 70	
70 - 80	
80 - 90	

COLOR CODING LEGEND
PIPE: DIAMETER (IN)

<=	8
<=	12
<=	16
<=	24
<=	30

RICHLAND AND CHAN PROPERTIES

NOTE:

POTABLE WATER INFRASTRUCTURE FACILITY TO INCLUDE STORAGE TANK, PUMP STATION, AND WELL SITE.

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FIGURE 3-3

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA POTABLE WATER MASTER PLAN

SVSP BASE (A) POTABLE WATER DISTRIBUTION SYSTEM

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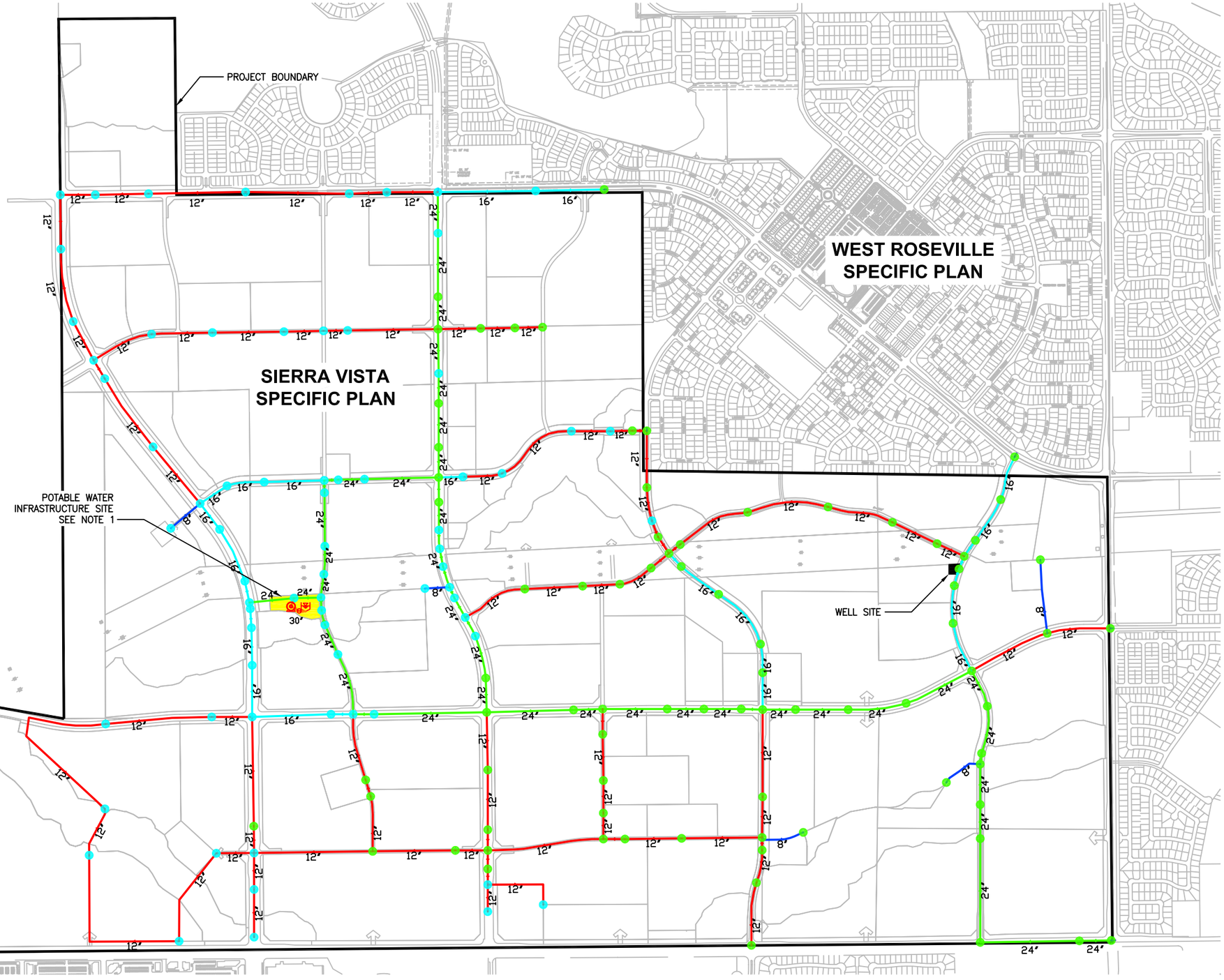

COLOR CODING LEGEND
NODE: MIN PRESSURE (PSI)

	40 - 50
	50 - 60
	60 - 70
	70 - 80
	80 - 90

COLOR CODING LEGEND
PIPE: DIAMETER (IN)

<=	8
<=	12
<=	16
<=	24
<=	30

NOTE:

POTABLE WATER INFRASTRUCTURE FACILITY TO INCLUDE STORAGE TANK, PUMP STATION, AND WELL SITE.

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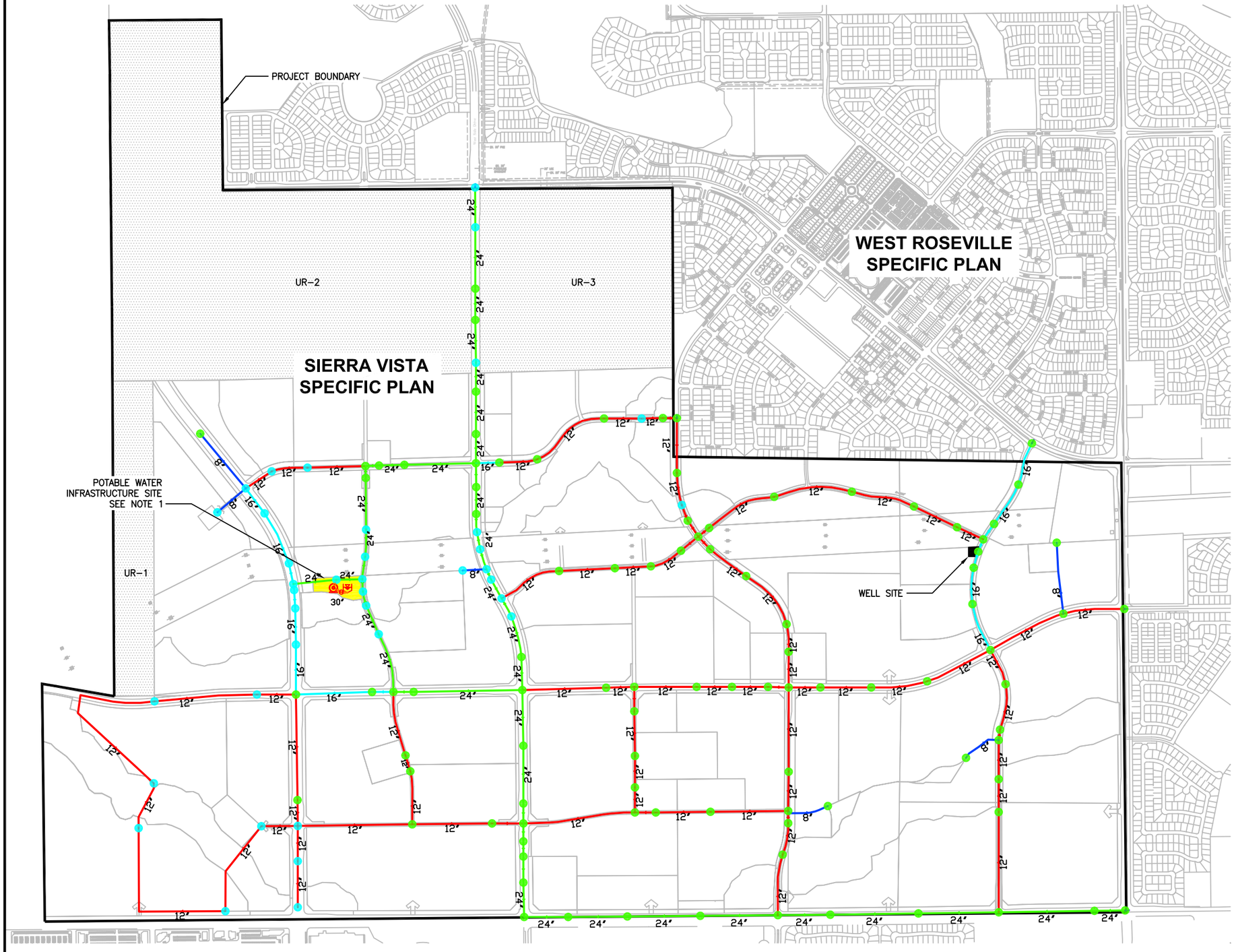
FIGURE 3-4

MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA POTABLE WATER MASTER PLAN
SVSP BASE PLUS UR (A) POTABLE WATER DISTRIBUTION SYSTEM

S:\Common\Projects\219_Sierra Vista\PW Water Study\PW Modeling\Sierra Vista Model\Sierra Vista Potable Water Model.dwg DATE:4/17/09



COLOR CODING LEGEND
NODE: MIN PRESSURE (PSI)

	40 - 50
	50 - 60
	60 - 70
	70 - 80
	80 - 90

COLOR CODING LEGEND
PIPE: DIAMETER (IN)

<=	8
<=	12
<=	16
<=	24
<=	30

RICHLAND AND CHAN PROPERTIES

NOTE:

POTABLE WATER INFRASTRUCTURE FACILITY TO INCLUDE STORAGE TANK, PUMP STATION, AND WELL SITE.

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FIGURE 3-5
MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA POTABLE WATER MASTER PLAN
SVSP BASE (B) POTABLE WATER DISTRIBUTION SYSTEM

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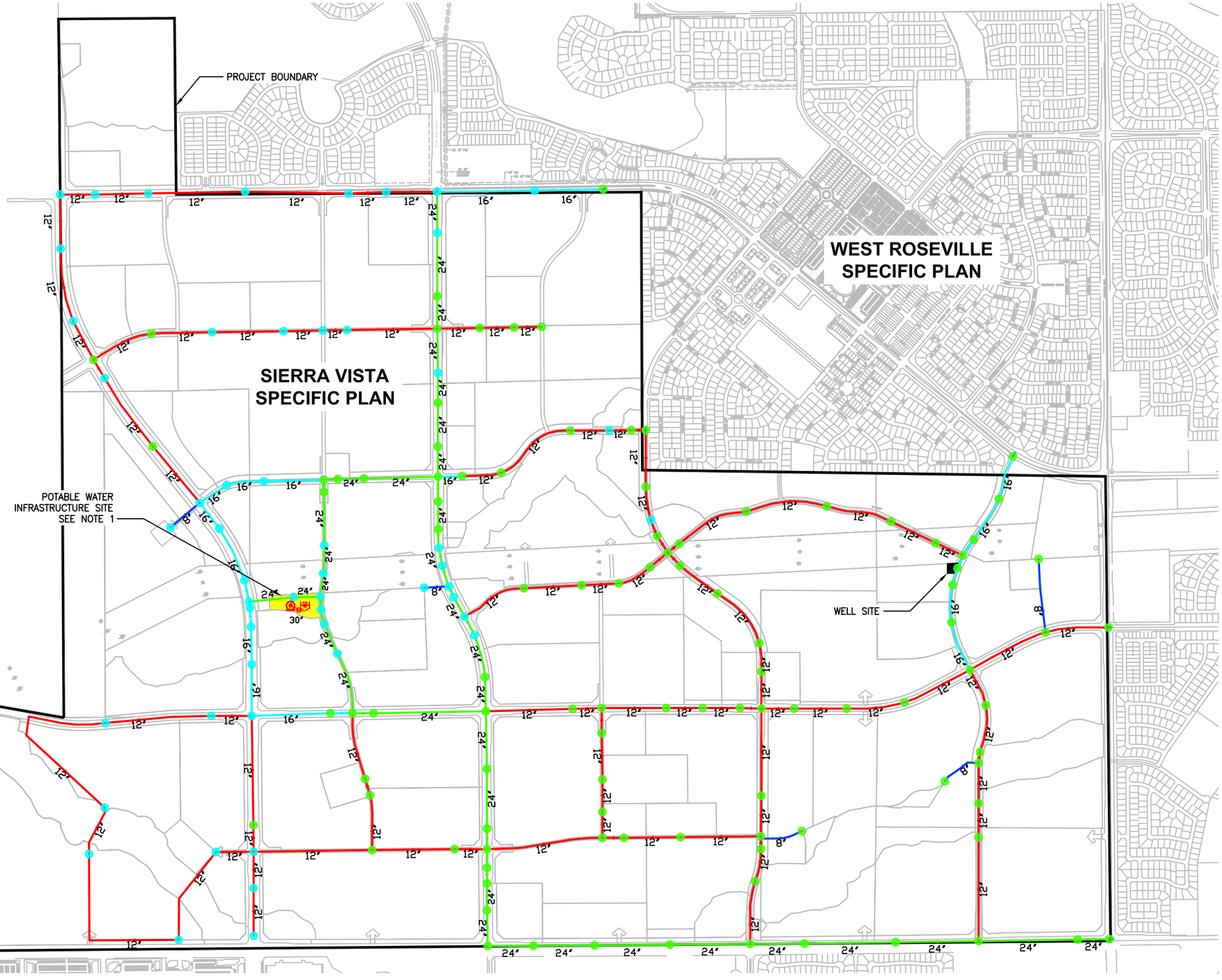

COLOR CODING LEGEND
NODE: MIN PRESSURE (PSI)

	40 - 50
	50 - 60
	60 - 70
	70 - 80
	80 - 90

COLOR CODING LEGEND
PIPE: DIAMETER (IN)

	<=	8
	<=	12
	<=	16
	<=	24
	<=	30

NOTE:

POTABLE WATER INFRASTRUCTURE FACILITY TO INCLUDE STORAGE TANK, PUMP STATION, AND WELL SITE.

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FIGURE 3-6

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA POTABLE WATER MASTER PLAN

SVSP BASE PLUS UR (B) POTABLE WATER DISTRIBUTION SYSTEM

S:\Common\Projects\219_Sierra Vista\PW Water Study\PW Modeling\Sierra Vista Model\Sierra Vista Potable Water Model.dwg DATE:4/17/09

Table 4-1: Fire Flow Modeling Results

Junctions	Parcels	Option Modeled				Fire Flow (gpm)			Can be met with Multiple POC?	Notes
		SVSP Base (A)	SVSP Base (B)	SVSP Base + UR (A)	SVSP Base + UR (B)	Req'd	Actual	Deficit		
14	CC-4a	X		X		4,000	3,442	558	Yes	
28	CC/BP-1	X	X	X	X	4,000	1,466	2,534	Yes	Junctions on Fiddyment and Pleasant Grove will help supply fire flow.
68	CC-2	X		X		4,000	3,332	668	Yes	See text in Section 4.1.
69	CC-2/CC-3	X		X		4,000	3,411	589	Yes	See text in Section 4.1.
70	CC-2/CC-3	X		X		4,000	3,411	589	Yes	See text in Section 4.1.
71	CC/BP-2	X		X		4,000	3,458	542	Yes	See text in Section 4.1.
79	CC-2	X	X	X	X	4,000	3,301	699	Yes	4 other junctions bordering CC-2 meet full fire flow requirements
95	LDR-1	X	X	X	X	1,500	1,375	125	Yes	These park and LDR parcels are expected to be served from multiple locations.
122	CC/ CMU-5 Richland			X	X	4,000	3,140	860	Yes	2 neighboring junctions bordering that commercial property meet full fire flow requirements
130	MDR-1 or 2	X	X			2,500	1,466	1,034	Yes	J-130 is supplied only with an 8-inch for the SVSP Base models from one POC.
140	CC-2 Richland			X	X	4,000	3,863 (B) 3,937 (A)	137 (B) 63 (A)	Yes	Parcel can be served off of West Side Drive as well.

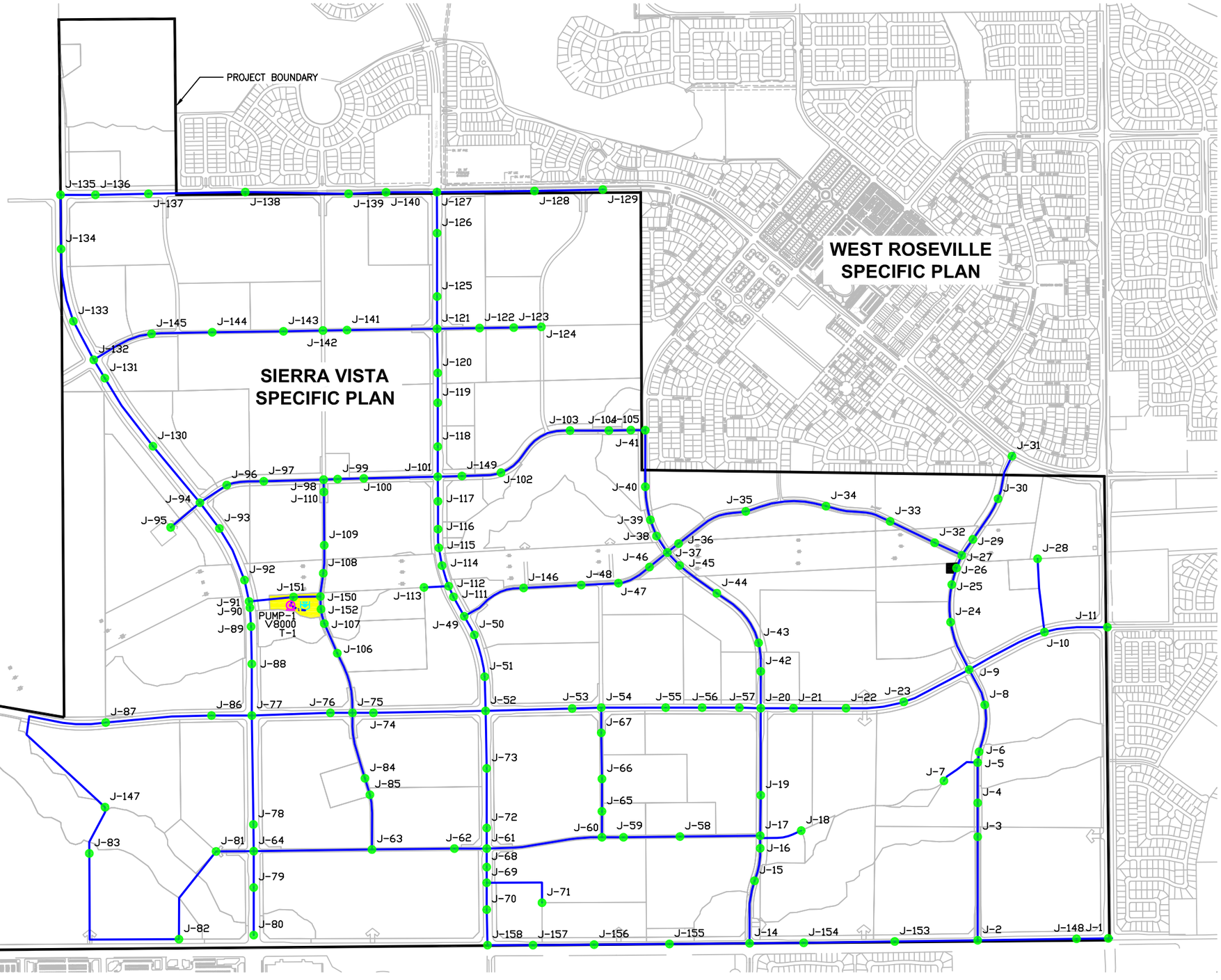
Notes:
1. These numbers reflect 50 psi residual in the system.

SECTION 5 – REFERENCES

1. City of Roseville, *Feasibility Analysis Report for the Sierra Vista Specific Plan,* April 2007.
2. HydroScience Engineers *DRAFT Sierra Vista Recycled Water Master Plan,* March 2009.
3. MacKay & Somps Civil Engineering, Inc., *Sierra Vista Land Use Plan DRAFT,* January 22, 2009.
4. MWH, Technical Memorandum 1; Unit Water Demand Factor Revision, November 6, 2002.
5. MWH, Technical Memorandum 1; Unit Water Demand Factor Verification and Water Demand Evaluation and Update, September 2006.
6. Spink Corporation, General Plan Update Water System Study, 1993
7. Wood Rodgers, Master Water Study for West Roseville Specific Plan Area, May 2003.

APPENDIX A

H2ONET Water Model Junction and Pipe Output Reports



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APPENDIX A

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA POTABLE WATER MASTER PLAN

WATER MODEL OUTPUT REPORTS - JUNCTION ID'S

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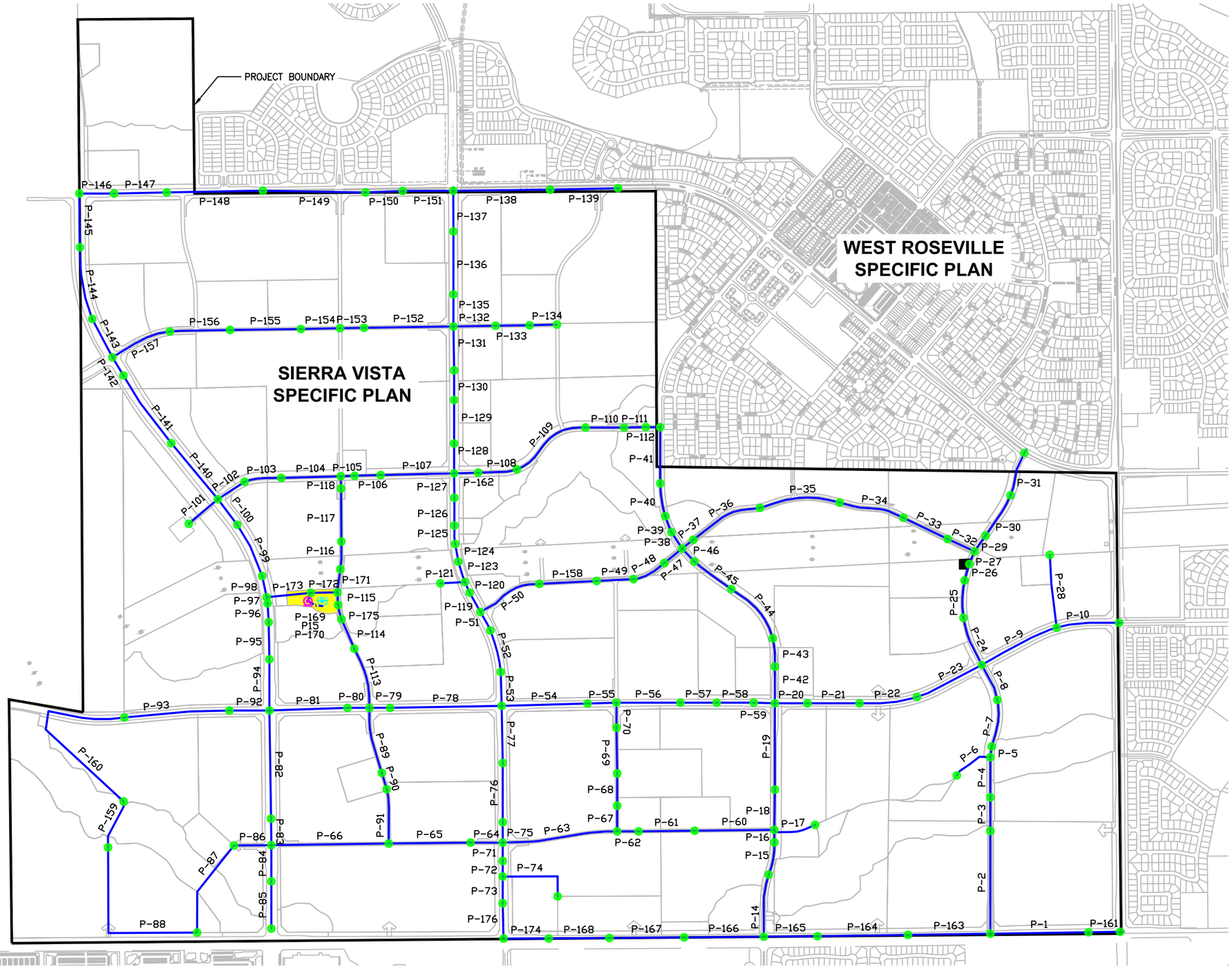

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APPENDIX A

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA POTABLE WATER MASTER PLAN

WATER MODEL OUTPUT REPORTS - PIPE ID'S

S:\Common\Projects\219_Sierra Vista\PW Water Study\PW Modeling\Sierra Vista Model\Sierra Vista Potable Water Model.dwg DATE:4/17/09

Output Report - Junction Pressure - SVSP Base (A)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-1	51.30	04:00	51.30	03:30	51.30	0.00
	J-10	52.98	08:30	52.87	19:00	52.90	0.12
	J-100	62.12	06:00	60.83	19:00	61.09	1.29
	J-101	59.82	06:00	58.80	19:00	59.01	1.02
	J-102	60.98	06:00	60.28	19:00	60.44	0.70
	J-103	60.45	06:00	60.13	19:00	60.21	0.32
	J-104	61.72	06:00	61.57	19:00	61.61	0.15
	J-105	59.98	06:00	59.91	19:00	59.93	0.06
	J-106	67.03	06:00	65.42	19:00	65.74	1.61
	J-107	68.00	06:00	66.27	19:00	66.60	1.73
	J-108	65.00	06:00	63.25	19:00	63.58	1.75
	J-109	64.51	06:00	62.85	19:00	63.17	1.66
	J-11	51.30	04:00	51.30	19:00	51.30	0.00
	J-110	62.02	06:00	60.53	19:00	60.83	1.48
	J-111	63.20	06:00	62.22	19:00	62.44	0.98
	J-112	64.51	06:00	63.52	19:00	63.74	0.98
	J-113	64.94	06:00	63.96	19:00	64.18	0.98
	J-114	65.39	06:00	64.40	19:00	64.62	0.99
	J-115	63.67	06:00	62.67	19:00	62.89	1.00
	J-116	62.38	06:00	61.38	19:00	61.60	1.00
	J-117	60.67	06:00	59.65	19:00	59.87	1.01
	J-118	60.03	06:00	59.09	19:00	59.28	0.95
	J-119	58.95	06:00	58.11	19:00	58.28	0.83
	J-120	62.41	06:00	61.66	19:00	61.80	0.76
	J-121	59.81	06:00	59.17	19:00	59.28	0.64
	J-125	60.46	06:00	59.91	19:00	60.00	0.55
	J-126	60.68	06:00	60.29	19:00	60.33	0.39
	J-127	61.11	06:00	60.84	19:00	60.85	0.28
	J-130	61.78	06:00	60.14	19:00	60.47	1.64
	J-14	59.83	08:30	59.18	19:00	59.37	0.65
	J-146	59.99	06:00	59.23	19:00	59.42	0.77
	J-147	67.61	08:30	66.64	19:00	66.91	0.97
	J-148	52.16	08:30	52.13	19:00	52.14	0.03
	J-149	61.07	06:00	60.17	19:00	60.36	0.90
	J-15	59.40	08:30	58.75	19:00	58.93	0.65
	J-150	66.79	06:00	64.96	19:00	65.30	1.83
	J-151	67.04	06:00	64.94	19:00	65.31	2.10
	J-152	67.39	06:00	65.61	19:00	65.95	1.79
	J-16	58.11	08:30	57.45	19:00	57.64	0.65
	J-17	58.11	08:30	57.45	19:00	57.64	0.66
	J-18	57.67	08:30	57.02	19:00	57.20	0.66
	J-19	58.54	08:30	57.91	19:00	58.09	0.63
	J-2	55.59	08:30	55.46	19:00	55.50	0.13
	J-20	54.23	08:30	53.66	19:00	53.83	0.57
	J-21	52.93	08:30	52.39	19:00	52.54	0.54
	J-22	54.66	08:30	54.16	19:00	54.31	0.50
	J-23	55.53	08:30	55.07	19:00	55.20	0.45
	J-24	51.94	08:30	51.60	19:00	51.70	0.34
	J-25	52.30	08:30	51.98	19:00	52.07	0.31
	J-26	53.13	08:30	52.83	19:00	52.92	0.30

Output Report - Junction Pressure - SVSP Base (A)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-27	53.61	08:30	53.32	19:00	53.41	0.29
	J-28	51.67	08:30	51.52	06:00	51.59	0.15
	J-29	54.09	08:30	53.86	19:00	53.93	0.24
	J-3	57.30	08:30	57.07	19:00	57.13	0.23
	J-30	53.78	08:30	53.66	19:00	53.70	0.11
	J-31	50.00	04:00	50.00	19:00	50.00	0.00
	J-32	53.84	08:30	53.54	19:00	53.63	0.30
	J-33	56.68	08:30	56.35	19:00	56.44	0.33
	J-34	57.14	08:30	56.77	19:00	56.88	0.37
	J-35	58.93	08:30	58.50	19:00	58.62	0.43
	J-36	57.69	08:30	57.20	19:00	57.34	0.49
	J-37	57.92	08:30	57.42	19:00	57.56	0.50
	J-38	59.88	08:30	59.46	19:00	59.58	0.42
	J-39	61.19	08:30	60.84	19:00	60.94	0.36
	J-4	57.29	08:30	57.03	19:00	57.10	0.26
	J-40	59.05	08:30	58.82	19:00	58.89	0.23
	J-41	58.67	06:00	58.67	19:00	58.67	0.00
	J-42	54.67	08:30	54.11	19:00	54.27	0.56
	J-43	53.36	08:30	52.82	19:00	52.97	0.55
	J-44	56.61	08:30	56.09	19:00	56.24	0.53
	J-45	56.40	08:30	55.89	19:00	56.04	0.51
	J-46	59.87	08:30	59.34	19:00	59.49	0.53
	J-47	57.70	08:30	57.14	19:00	57.30	0.57
	J-48	55.56	06:00	54.94	19:00	55.11	0.62
	J-49	63.19	06:00	62.21	19:00	62.43	0.97
	J-5	57.71	08:30	57.41	19:00	57.50	0.30
	J-50	63.18	06:00	62.20	19:00	62.43	0.98
	J-51	60.14	06:00	59.15	19:00	59.38	0.99
	J-52	58.83	06:00	57.84	19:00	58.07	1.00
	J-53	56.73	06:00	55.92	19:00	56.13	0.81
	J-54	56.47	06:00	55.72	19:00	55.92	0.75
	J-55	55.11	06:00	54.46	19:00	54.65	0.65
	J-56	54.67	08:30	54.05	19:00	54.23	0.62
	J-57	55.97	08:30	55.38	19:00	55.55	0.59
	J-58	57.24	08:30	56.56	19:00	56.75	0.68
	J-59	58.12	08:30	57.41	19:00	57.61	0.70
	J-6	57.71	08:30	57.40	19:00	57.49	0.31
	J-60	60.72	08:30	60.01	19:00	60.21	0.71
	J-61	58.77	08:30	57.98	19:00	58.21	0.79
	J-62	58.12	08:30	57.30	19:00	57.53	0.83
	J-63	60.77	06:00	59.83	19:00	60.08	0.94
	J-64	63.54	08:30	62.57	19:00	62.84	0.97
	J-65	60.29	08:30	59.58	19:00	59.79	0.71
	J-66	58.56	08:30	57.86	19:00	58.06	0.70
	J-67	57.29	06:00	56.58	19:00	56.78	0.72
	J-68	59.42	08:30	58.63	19:00	58.86	0.79
	J-69	61.59	08:30	60.80	19:00	61.02	0.79
	J-7	56.85	08:30	56.55	19:00	56.63	0.30
	J-70	61.15	08:30	60.36	19:00	60.59	0.79
	J-71	63.32	08:30	62.53	19:00	62.75	0.79

Output Report - Junction Pressure - SVSP Base (A)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-72	59.86	08:30	59.07	19:00	59.30	0.79
	J-73	57.78	06:00	56.93	19:00	57.16	0.85
	J-74	63.34	06:00	62.02	19:00	62.30	1.31
	J-75	62.94	06:00	61.56	19:00	61.85	1.38
	J-76	62.07	06:00	60.68	19:00	60.97	1.39
	J-77	63.58	06:00	62.13	19:00	62.45	1.45
	J-78	60.98	06:00	59.96	19:00	60.24	1.02
	J-79	65.05	08:30	64.08	19:00	64.35	0.97
	J-8	56.40	08:30	56.05	19:00	56.15	0.36
	J-80	68.51	08:30	67.55	19:00	67.82	0.97
	J-81	64.18	08:30	63.21	19:00	63.48	0.97
	J-82	64.59	08:30	63.62	19:00	63.89	0.96
	J-83	68.04	08:30	67.07	19:00	67.34	0.96
	J-84	58.36	06:00	57.23	19:00	57.50	1.13
	J-85	58.31	06:00	57.23	19:00	57.50	1.08
	J-86	65.81	06:00	64.50	19:00	64.81	1.30
	J-87	67.67	06:00	66.65	19:00	66.94	1.02
	J-88	66.57	06:00	64.93	19:00	65.26	1.65
	J-89	68.89	06:00	67.08	19:00	67.42	1.81
	J-9	54.66	08:30	54.27	19:00	54.38	0.39
	J-90	67.67	06:00	65.77	19:00	66.12	1.89
	J-91	67.04	06:00	65.12	19:00	65.47	1.92
	J-92	65.70	06:00	63.82	19:00	64.17	1.88
	J-93	67.13	06:00	65.35	19:00	65.69	1.78
	J-94	65.13	06:00	63.40	19:00	63.74	1.73
	J-95	66.92	06:00	65.34	19:00	65.66	1.58
	J-96	66.58	06:00	64.95	19:00	65.27	1.63
	J-97	66.11	06:00	64.56	19:00	64.88	1.55
	J-98	62.21	06:00	60.77	19:00	61.05	1.44
	J-99	62.18	06:00	60.79	19:00	61.07	1.39

Output Report - Pipe Velocity - SVSP Base (A)

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
P-1	1.29	19:00	0.60	08:30	1.12	0.69
P-10	1.58	19:00	0.85	08:30	1.39	0.72
P-100	1.07	06:00	0.17	08:30	0.34	0.89
P-101	1.22	06:00	0.24	14:30	0.38	0.99
P-102	1.06	06:00	0.00	04:00	0.65	1.06
P-103	0.82	19:00	0.04	08:00	0.69	0.79
P-104	0.97	19:00	0.02	07:00	0.77	0.94
P-105	1.69	06:00	0.46	08:30	1.33	1.23
P-106	1.68	06:00	0.45	08:30	1.33	1.23
P-107	1.57	06:00	0.41	08:30	1.34	1.16
P-108	1.30	19:00	0.02	08:30	1.07	1.28
P-109	1.38	19:00	0.02	08:00	1.10	1.37
P-110	1.44	19:00	0.07	05:30	1.12	1.36
P-111	1.46	19:00	0.03	05:30	1.13	1.43
P-112	1.46	19:00	0.01	05:30	1.14	1.45
P-113	2.04	06:00	0.79	08:30	0.97	1.24
P-114	2.10	06:00	0.82	08:30	0.97	1.28
P-115	2.10	06:00	0.26	14:30	0.47	1.85
P-116	1.69	06:00	0.57	08:30	1.16	1.12
P-117	1.65	06:00	0.55	08:30	1.16	1.10
P-118	1.65	06:00	0.55	08:30	1.16	1.10
P-119	0.87	06:00	0.47	08:30	0.58	0.41
P-120	0.88	06:00	0.47	08:30	0.58	0.41
P-121	0.20	06:00	0.04	14:30	0.06	0.16
P-123	0.90	06:00	0.48	08:30	0.59	0.43
P-124	0.91	06:00	0.48	08:30	0.59	0.43
P-125	0.91	06:00	0.48	08:30	0.59	0.43
P-126	0.96	06:00	0.50	08:30	0.60	0.46
P-127	0.98	06:00	0.51	08:30	0.61	0.47
P-128	1.84	19:00	0.07	08:00	1.43	1.77
P-129	1.84	19:00	0.05	08:00	1.43	1.79
P-130	1.87	19:00	0.01	08:00	1.44	1.85
P-131	1.88	19:00	0.02	08:00	1.44	1.86
P-135	1.88	19:00	0.02	08:00	1.44	1.86
P-136	1.90	19:00	0.04	07:30	1.45	1.86
P-137	1.92	19:00	0.00	07:00	1.46	1.92
P-14	0.24	06:00	0.05	14:30	0.07	0.19
P-140	0.64	06:00	0.12	14:30	0.20	0.52
P15	4.12	06:00	0.00	21:30	0.56	4.12
P-15	0.46	06:00	0.09	14:30	0.15	0.37
P-158	0.99	06:00	0.40	08:30	0.60	0.59
P-159	0.51	06:00	0.04	14:30	0.11	0.46
P-16	0.53	06:00	0.10	14:30	0.16	0.43
P-160	0.81	06:00	0.10	14:30	0.20	0.71
P-161	1.31	19:00	0.63	08:30	1.14	0.68
P-162	1.30	19:00	0.02	08:30	1.07	1.27
P-169	4.12	06:00	0.00	23:00	0.56	4.12
P-17	0.08	06:00	0.02	14:30	0.02	0.06
P-170	4.12	06:00	0.00	14:30	0.56	4.12
P-171	1.70	06:00	0.57	08:30	1.15	1.13

Output Report - Pipe Velocity - SVSP Base (A)

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
P-172	3.80	06:00	0.91	14:30	1.21	2.90
P-173	2.63	06:00	0.91	14:30	1.15	1.73
P-175	2.10	06:00	0.82	08:30	0.97	1.28
P-18	0.55	19:00	0.11	08:30	0.44	0.44
P-19	0.88	06:00	0.37	08:30	0.65	0.51
P-2	1.28	19:00	0.58	08:30	1.10	0.70
P-20	0.95	19:00	0.18	08:30	0.77	0.78
P-21	0.97	19:00	0.15	08:30	0.77	0.81
P-22	0.99	19:00	0.11	07:30	0.77	0.88
P-23	1.04	19:00	0.01	07:30	0.78	1.02
P-24	1.51	06:00	1.05	19:00	1.13	0.46
P-25	1.35	06:00	1.00	19:00	1.08	0.35
P-26	1.21	08:30	0.94	19:00	1.01	0.27
P-27	1.94	19:00	1.67	08:30	1.87	0.27
P-28	0.64	06:00	0.13	14:30	0.20	0.52
P-29	2.08	19:00	1.42	08:30	1.90	0.66
P-3	1.24	19:00	0.52	08:30	1.06	0.72
P-30	2.08	19:00	1.42	08:30	1.90	0.66
P-31	2.13	19:00	1.50	08:30	1.96	0.64
P-32	0.44	08:30	0.07	14:30	0.20	0.36
P-33	0.44	08:30	0.07	14:30	0.20	0.37
P-34	0.50	08:30	0.04	14:30	0.19	0.46
P-35	0.66	06:00	0.01	14:30	0.18	0.65
P-36	0.79	06:00	0.01	14:00	0.18	0.78
P-37	0.80	06:00	0.01	14:00	0.18	0.79
P-38	1.65	19:00	0.61	08:30	1.39	1.04
P-39	1.65	19:00	0.61	08:30	1.39	1.04
P-4	1.21	19:00	0.49	08:30	1.03	0.73
P-40	1.65	19:00	0.61	08:30	1.39	1.04
P-41	1.71	19:00	0.69	08:30	1.45	1.02
P-42	0.42	19:00	0.10	08:30	0.34	0.32
P-43	0.44	19:00	0.07	08:30	0.35	0.37
P-44	0.50	19:00	0.01	06:30	0.36	0.49
P-45	0.56	19:00	0.10	08:30	0.43	0.46
P-46	0.56	19:00	0.10	08:30	0.43	0.46
P-47	0.76	19:00	0.21	08:30	0.62	0.56
P-48	0.76	19:00	0.21	08:30	0.62	0.56
P-49	0.80	06:00	0.33	08:30	0.61	0.47
P-5	1.21	19:00	0.48	08:30	1.03	0.73
P-50	1.15	06:00	0.47	08:30	0.59	0.68
P-51	0.76	19:00	0.35	08:30	0.65	0.41
P-52	0.73	19:00	0.31	08:30	0.62	0.42
P-53	0.72	19:00	0.28	07:30	0.60	0.44
P-54	1.50	06:00	0.59	08:30	0.74	0.91
P-55	1.37	06:00	0.54	08:30	0.75	0.83
P-56	1.12	06:00	0.44	08:30	0.80	0.69
P-57	0.94	19:00	0.34	08:30	0.81	0.60
P-58	0.95	19:00	0.32	08:30	0.82	0.63
P-59	0.96	19:00	0.31	08:30	0.82	0.65
P-6	0.06	06:00	0.01	14:30	0.02	0.05

Output Report - Pipe Velocity - SVSP Base (A)

	ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
	P-60	0.40	19:00	0.11	08:30	0.34	0.28
	P-61	0.64	06:00	0.24	08:30	0.33	0.40
	P-62	0.86	06:00	0.25	19:00	0.31	0.61
	P-63	0.58	19:00	0.09	08:30	0.48	0.50
	P-64	0.77	19:00	0.07	08:30	0.63	0.70
	P-65	0.75	06:00	0.24	08:30	0.61	0.50
	P-66	0.59	19:00	0.23	08:30	0.51	0.36
	P-67	0.55	06:00	0.24	08:30	0.31	0.31
	P-68	0.65	06:00	0.28	08:30	0.34	0.37
	P-69	0.90	06:00	0.34	14:30	0.42	0.56
	P-7	1.19	19:00	0.46	08:30	1.01	0.73
	P-70	1.00	06:00	0.36	14:30	0.45	0.64
	P-71	0.56	06:00	0.11	14:30	0.17	0.45
	P-72	0.33	06:00	0.06	14:30	0.10	0.27
	P-73	0.14	06:00	0.03	14:30	0.04	0.11
	P-74	0.19	06:00	0.04	14:30	0.06	0.16
	P-75	0.56	06:00	0.24	08:30	0.33	0.32
	P-76	1.09	06:00	0.41	14:30	0.49	0.69
	P-77	1.36	06:00	0.46	14:30	0.58	0.90
	P-78	1.41	06:00	0.44	08:30	1.16	0.97
	P-79	1.52	06:00	0.49	08:30	1.16	1.03
	P-8	1.17	19:00	0.40	06:00	0.98	0.77
	P-80	0.83	19:00	0.34	06:00	0.69	0.49
	P-81	0.75	19:00	0.05	06:00	0.60	0.70
	P-82	1.53	06:00	0.00	22:00	0.22	1.53
	P-83	1.03	06:00	0.11	19:00	0.25	0.93
	P-84	0.64	06:00	0.12	14:30	0.20	0.51
	P-85	0.03	06:00	0.01	14:30	0.01	0.03
	P-86	0.86	06:00	0.22	14:30	0.32	0.63
	P-87	0.78	06:00	0.21	14:30	0.29	0.57
	P-88	0.50	06:00	0.15	14:30	0.21	0.35
	P-89	1.45	06:00	0.00	09:00	0.22	1.45
	P-9	1.32	19:00	0.45	06:00	1.11	0.88
	P-90	1.37	06:00	0.01	19:00	0.22	1.36
	P-91	1.21	06:00	0.06	19:00	0.23	1.15
	P-92	1.52	06:00	0.24	14:30	0.43	1.28
	P-93	1.29	06:00	0.19	14:30	0.35	1.09
	P-94	1.67	06:00	0.41	08:30	0.63	1.26
	P-95	1.84	06:00	0.48	08:30	0.62	1.37
	P-96	1.85	06:00	0.48	08:30	0.62	1.37
	P-97	1.86	06:00	0.48	19:00	0.62	1.39
	P-98	1.18	06:00	0.22	08:30	0.34	0.96
	P-99	1.14	06:00	0.20	08:30	0.34	0.94

Output Report - Junction Pressure - SVSP Base plus UR (A)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-1	51.30	04:00	51.30	19:00	51.30	0.00
	J-10	52.96	08:30	52.78	19:00	52.83	0.18
	J-100	62.06	06:00	60.81	19:00	61.08	1.25
	J-101	59.69	06:00	58.77	19:00	58.99	0.92
	J-102	60.92	06:00	60.22	19:00	60.40	0.70
	J-103	60.42	06:00	60.10	19:00	60.19	0.32
	J-104	61.71	06:00	61.55	19:00	61.60	0.16
	J-105	59.97	06:00	59.91	19:00	59.93	0.06
	J-106	67.11	06:00	65.42	19:00	65.75	1.69
	J-107	68.10	06:00	66.26	19:00	66.61	1.84
	J-108	65.10	06:00	63.25	19:00	63.59	1.85
	J-109	64.57	06:00	62.85	19:00	63.18	1.72
	J-11	51.30	04:00	51.30	19:00	51.30	0.00
	J-110	62.01	06:00	60.52	19:00	60.82	1.49
	J-111	63.12	06:00	62.20	19:00	62.43	0.92
	J-112	64.42	06:00	63.50	19:00	63.73	0.92
	J-113	64.85	06:00	63.94	19:00	64.16	0.92
	J-114	65.29	06:00	64.38	19:00	64.60	0.92
	J-115	63.57	06:00	62.65	19:00	62.87	0.92
	J-116	62.27	06:00	61.35	19:00	61.58	0.92
	J-117	60.54	06:00	59.63	19:00	59.85	0.92
	J-118	59.87	06:00	59.05	19:00	59.26	0.82
	J-119	58.74	06:00	58.07	19:00	58.24	0.68
	J-120	62.18	06:00	61.60	19:00	61.76	0.58
	J-121	59.55	06:00	59.11	19:00	59.23	0.44
	J-122	56.03	08:00	55.63	19:00	55.75	0.40
	J-123	58.19	08:30	57.79	19:00	57.91	0.40
	J-124	57.32	08:30	56.92	19:00	57.04	0.39
	J-125	60.20	06:00	59.85	19:00	59.95	0.34
	J-126	60.40	06:00	60.27	19:00	60.31	0.13
	J-127	60.84	06:00	60.83	19:00	60.84	0.00
	J-128	62.57	14:30	62.57	06:00	62.57	0.00
	J-129	59.54	00:00	59.54	06:00	59.54	0.00
	J-130	61.32	06:00	60.34	19:00	60.60	0.98
	J-131	62.89	08:30	62.19	19:00	62.40	0.70
	J-132	61.58	08:30	60.93	19:00	61.13	0.65
	J-133	63.31	08:30	62.69	19:00	62.88	0.62
	J-134	68.07	08:30	67.51	19:00	67.68	0.56
	J-135	67.86	08:30	67.34	19:00	67.50	0.51
	J-136	66.77	08:30	66.29	19:00	66.44	0.48
	J-137	65.69	08:30	65.26	19:00	65.39	0.43
	J-138	68.52	08:30	68.16	06:00	68.31	0.35
	J-139	63.80	08:30	63.59	06:00	63.70	0.21
	J-14	59.83	08:30	59.17	19:00	59.36	0.66
	J-140	61.23	08:30	61.10	06:00	61.17	0.13
	J-141	63.36	08:30	62.88	19:00	63.03	0.48
	J-142	65.52	08:30	65.02	19:00	65.17	0.50
	J-143	65.94	08:30	65.41	19:00	65.56	0.53
	J-144	63.75	08:30	63.17	19:00	63.35	0.58
	J-145	60.72	08:30	60.10	19:00	60.29	0.62

Output Report - Junction Pressure - SVSP Base plus UR (A)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-146	59.94	06:00	59.21	19:00	59.41	0.73
	J-147	67.60	08:30	66.65	19:00	66.92	0.95
	J-148	52.16	08:30	52.13	19:00	52.14	0.03
	J-149	60.98	06:00	60.09	19:00	60.31	0.89
	J-15	59.40	08:30	58.74	19:00	58.93	0.66
	J-150	66.91	06:00	64.96	19:00	65.31	1.95
	J-151	67.26	06:00	64.95	19:00	65.33	2.32
	J-152	67.51	06:00	65.61	19:00	65.96	1.90
	J-16	58.10	08:30	57.44	19:00	57.63	0.66
	J-17	58.10	08:30	57.44	19:00	57.63	0.66
	J-18	57.67	08:30	57.01	19:00	57.20	0.66
	J-19	58.53	08:30	57.90	19:00	58.08	0.64
	J-2	55.59	08:30	55.46	19:00	55.50	0.13
	J-20	54.23	08:30	53.65	19:00	53.82	0.57
	J-21	52.93	08:30	52.38	19:00	52.54	0.55
	J-22	54.66	08:30	54.15	19:00	54.30	0.50
	J-23	55.52	08:30	55.07	19:00	55.20	0.46
	J-24	51.94	08:30	51.59	19:00	51.69	0.35
	J-25	52.29	08:30	51.98	19:00	52.07	0.32
	J-26	53.13	08:30	52.82	19:00	52.91	0.30
	J-27	53.61	08:30	53.32	19:00	53.40	0.29
	J-28	51.64	08:30	51.47	06:00	51.52	0.17
	J-29	54.09	08:30	53.85	19:00	53.92	0.24
	J-3	57.29	08:30	57.06	19:00	57.13	0.23
	J-30	53.78	08:30	53.66	19:00	53.70	0.12
	J-31	50.00	08:30	50.00	19:00	50.00	0.00
	J-32	53.84	08:30	53.53	19:00	53.62	0.30
	J-33	56.67	08:30	56.34	19:00	56.44	0.33
	J-34	57.14	08:30	56.77	19:00	56.88	0.37
	J-35	58.92	08:30	58.49	19:00	58.62	0.43
	J-36	57.68	08:30	57.19	19:00	57.33	0.49
	J-37	57.91	08:30	57.41	19:00	57.55	0.50
	J-38	59.87	08:30	59.45	19:00	59.57	0.43
	J-39	61.19	08:30	60.83	19:00	60.93	0.36
	J-4	57.28	08:30	57.02	19:00	57.10	0.26
	J-40	59.05	08:30	58.82	19:00	58.89	0.23
	J-41	58.67	06:00	58.67	19:00	58.67	0.00
	J-42	54.66	08:30	54.10	19:00	54.26	0.56
	J-43	53.36	08:30	52.81	19:00	52.97	0.55
	J-44	56.61	08:30	56.08	19:00	56.23	0.53
	J-45	56.39	08:30	55.88	19:00	56.03	0.51
	J-46	59.86	08:30	59.33	19:00	59.48	0.53
	J-47	57.70	08:30	57.12	19:00	57.29	0.57
	J-48	55.54	08:30	54.92	19:00	55.10	0.62
	J-49	63.12	06:00	62.19	19:00	62.42	0.92
	J-5	57.71	08:30	57.41	19:00	57.49	0.30
	J-50	63.11	06:00	62.19	19:00	62.42	0.93
	J-51	60.08	06:00	59.14	19:00	59.37	0.95
	J-52	58.78	06:00	57.82	19:00	58.06	0.96
	J-53	56.69	06:00	55.91	19:00	56.13	0.78

Output Report - Junction Pressure - SVSP Base plus UR (A)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-54	56.44	06:00	55.71	19:00	55.92	0.73
	J-55	55.10	08:30	54.45	19:00	54.64	0.65
	J-56	54.66	08:30	54.04	19:00	54.23	0.62
	J-57	55.96	08:30	55.37	19:00	55.54	0.59
	J-58	57.24	08:30	56.55	19:00	56.75	0.69
	J-59	58.11	08:30	57.40	19:00	57.61	0.71
	J-6	57.71	08:30	57.39	19:00	57.48	0.31
	J-60	60.71	08:30	60.00	19:00	60.21	0.71
	J-61	58.77	08:30	57.97	19:00	58.21	0.79
	J-62	58.12	08:30	57.29	19:00	57.53	0.83
	J-63	60.78	06:00	59.83	19:00	60.09	0.95
	J-64	63.55	06:00	62.57	19:00	62.85	0.98
	J-65	60.28	08:30	59.57	19:00	59.78	0.71
	J-66	58.56	08:30	57.85	19:00	58.06	0.71
	J-67	57.27	08:30	56.57	19:00	56.77	0.70
	J-68	59.41	08:30	58.62	19:00	58.85	0.79
	J-69	61.58	08:30	60.79	19:00	61.02	0.79
	J-7	56.84	08:30	56.54	19:00	56.63	0.30
	J-70	61.15	08:30	60.35	19:00	60.59	0.79
	J-71	63.31	08:30	62.52	19:00	62.75	0.79
	J-72	59.85	08:30	59.06	19:00	59.29	0.79
	J-73	57.75	06:00	56.92	19:00	57.16	0.82
	J-74	63.36	06:00	62.02	19:00	62.31	1.34
	J-75	62.98	06:00	61.56	19:00	61.86	1.42
	J-76	62.11	06:00	60.67	19:00	60.98	1.44
	J-77	63.63	06:00	62.14	19:00	62.46	1.49
	J-78	61.01	06:00	59.97	19:00	60.25	1.04
	J-79	65.04	06:00	64.08	19:00	64.36	0.96
	J-8	56.40	08:30	56.04	19:00	56.14	0.36
	J-80	68.51	08:30	67.55	19:00	67.83	0.96
	J-81	64.17	08:30	63.21	19:00	63.49	0.96
	J-82	64.58	08:30	63.63	19:00	63.90	0.95
	J-83	68.03	08:30	67.08	19:00	67.35	0.95
	J-84	58.39	06:00	57.23	19:00	57.51	1.16
	J-85	58.33	06:00	57.23	19:00	57.50	1.10
	J-86	65.85	06:00	64.51	19:00	64.82	1.34
	J-87	67.71	06:00	66.66	19:00	66.95	1.05
	J-88	66.67	06:00	64.94	19:00	65.28	1.73
	J-89	69.02	06:00	67.10	19:00	67.45	1.92
	J-9	54.66	08:30	54.26	19:00	54.38	0.39
	J-90	67.81	06:00	65.79	19:00	66.15	2.02
	J-91	67.20	06:00	65.14	19:00	65.50	2.05
	J-92	65.80	06:00	63.86	19:00	64.21	1.94
	J-93	67.08	06:00	65.43	19:00	65.75	1.66
	J-94	65.01	06:00	63.51	19:00	63.82	1.50
	J-95	66.80	06:00	65.44	19:00	65.75	1.36
	J-96	66.52	06:00	65.03	19:00	65.34	1.49
	J-97	66.08	06:00	64.62	19:00	64.92	1.47
	J-98	62.19	06:00	60.75	19:00	61.04	1.44
	J-99	62.14	06:00	60.77	19:00	61.06	1.37

Output Report - Pipe Velocity - SVSP Base plus UR (A)

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
P-1	1.30	19:00	0.62	08:30	1.12	0.69
P-10	1.55	19:00	0.81	08:30	1.35	0.74
P-100	1.78	06:00	0.27	08:30	0.84	1.52
P-101	1.22	06:00	0.24	14:30	0.38	0.99
P-102	0.48	19:00	0.03	07:30	0.40	0.46
P-103	0.54	19:00	0.03	05:00	0.43	0.51
P-104	0.62	19:00	0.10	06:00	0.51	0.52
P-105	2.09	06:00	0.45	08:30	1.33	1.64
P-106	2.08	06:00	0.45	08:30	1.33	1.63
P-107	1.96	06:00	0.40	08:30	1.34	1.56
P-108	1.38	19:00	0.06	04:30	1.12	1.32
P-109	1.47	19:00	0.04	08:00	1.16	1.43
P-110	1.52	19:00	0.01	07:30	1.18	1.51
P-111	1.54	19:00	0.04	05:30	1.19	1.50
P-112	1.55	19:00	0.02	05:30	1.19	1.52
P-113	2.27	06:00	0.80	08:30	0.98	1.47
P-114	2.34	06:00	0.83	08:30	0.98	1.51
P-115	2.34	06:00	0.40	14:30	0.61	1.94
P-116	2.17	06:00	0.64	08:30	1.15	1.53
P-117	2.13	06:00	0.62	08:30	1.15	1.51
P-118	2.13	06:00	0.62	08:30	1.15	1.51
P-119	0.56	19:00	0.44	08:30	0.51	0.12
P-120	0.56	19:00	0.44	08:30	0.51	0.12
P-121	0.20	06:00	0.04	14:30	0.06	0.16
P-123	0.57	19:00	0.45	08:30	0.52	0.12
P-124	0.57	19:00	0.45	08:30	0.52	0.12
P-125	0.57	19:00	0.45	08:30	0.52	0.12
P-126	0.59	19:00	0.47	08:30	0.54	0.11
P-127	0.59	19:00	0.48	08:30	0.54	0.11
P-128	1.72	19:00	0.04	04:30	1.40	1.69
P-129	1.73	19:00	0.05	04:30	1.40	1.68
P-130	1.75	19:00	0.08	04:30	1.41	1.67
P-131	1.77	19:00	0.10	04:30	1.41	1.67
P-132	1.14	06:00	0.22	14:30	0.36	0.92
P-133	0.87	06:00	0.17	14:30	0.27	0.70
P-134	0.58	06:00	0.11	14:30	0.18	0.46
P-135	2.06	19:00	0.01	05:00	1.59	2.06
P-136	2.08	19:00	0.04	05:00	1.60	2.04
P-137	2.10	19:00	0.04	07:00	1.62	2.07
P-138	0.09	06:00	0.00	19:30	0.01	0.09
P-139	0.11	06:00	0.04	14:30	0.05	0.07
P-14	0.24	06:00	0.05	14:30	0.07	0.19
P-140	1.91	06:00	0.60	08:30	0.86	1.31
P-141	1.63	06:00	0.48	08:30	0.88	1.14
P-142	1.05	19:00	0.22	08:30	0.91	0.83
P-143	0.88	06:00	0.26	08:30	0.53	0.62
P-144	0.62	19:00	0.13	08:30	0.54	0.49
P-145	0.68	19:00	0.06	08:30	0.56	0.62
P-146	0.68	19:00	0.05	08:30	0.56	0.63
P-147	0.74	19:00	0.02	04:30	0.57	0.72

Output Report - Pipe Velocity - SVSP Base plus UR (A)

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
P-148	0.87	19:00	0.21	04:30	0.69	0.66
P-149	1.06	19:00	0.50	08:30	0.91	0.57
P15	4.85	06:00	0.00	13:30	0.63	4.85
P-15	0.46	06:00	0.09	14:30	0.15	0.37
P-150	1.28	06:00	0.60	08:30	1.00	0.68
P-151	1.39	06:00	0.64	08:30	1.03	0.75
P-152	1.14	06:00	0.53	08:30	0.77	0.61
P-153	1.00	06:00	0.47	08:30	0.72	0.52
P-154	1.00	06:00	0.47	08:30	0.72	0.52
P-155	0.69	19:00	0.30	08:30	0.59	0.39
P-156	0.58	19:00	0.14	08:30	0.47	0.44
P-157	0.51	19:00	0.01	05:30	0.39	0.50
P-158	0.92	06:00	0.39	08:30	0.61	0.53
P-159	0.52	06:00	0.05	14:30	0.11	0.47
P-16	0.53	06:00	0.10	14:30	0.16	0.43
P-160	0.82	06:00	0.10	14:30	0.21	0.72
P-161	1.32	19:00	0.65	08:30	1.15	0.68
P-162	0.78	19:00	0.03	04:30	0.63	0.75
P-169	4.85	06:00	0.00	12:30	0.63	4.85
P-17	0.08	06:00	0.02	14:30	0.02	0.06
P-170	4.85	06:00	0.00	15:30	0.63	4.85
P-171	2.18	06:00	0.64	08:30	1.15	1.54
P-172	4.52	06:00	0.71	14:30	1.12	3.82
P-173	3.05	06:00	0.71	14:30	1.02	2.35
P-175	2.34	06:00	0.83	08:30	0.98	1.51
P-18	0.55	19:00	0.11	08:30	0.44	0.44
P-19	0.87	06:00	0.37	08:30	0.64	0.50
P-2	1.29	19:00	0.59	08:30	1.11	0.69
P-20	0.96	19:00	0.17	08:30	0.77	0.79
P-21	0.98	19:00	0.15	08:30	0.77	0.83
P-22	1.00	19:00	0.11	08:30	0.78	0.89
P-23	1.04	19:00	0.05	08:30	0.79	1.00
P-24	1.48	06:00	1.04	19:00	1.12	0.44
P-25	1.33	06:00	1.00	19:00	1.08	0.33
P-26	1.21	08:30	0.93	19:00	1.00	0.27
P-27	1.95	19:00	1.68	08:30	1.88	0.27
P-28	0.64	06:00	0.13	14:30	0.20	0.52
P-29	2.09	19:00	1.43	08:30	1.91	0.66
P-3	1.25	19:00	0.54	08:30	1.06	0.71
P-30	2.09	19:00	1.43	08:30	1.91	0.66
P-31	2.15	19:00	1.51	08:30	1.97	0.64
P-32	0.43	08:30	0.08	14:30	0.21	0.35
P-33	0.44	08:30	0.08	14:30	0.21	0.36
P-34	0.50	08:30	0.05	14:30	0.20	0.45
P-35	0.64	06:00	0.01	14:30	0.19	0.63
P-36	0.77	06:00	0.01	14:30	0.18	0.76
P-37	0.78	06:00	0.02	14:30	0.18	0.76
P-38	1.66	19:00	0.63	08:30	1.39	1.04
P-39	1.66	19:00	0.63	08:30	1.39	1.04
P-4	1.22	19:00	0.50	08:30	1.04	0.72

Output Report - Pipe Velocity - SVSP Base plus UR (A)

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
P-40	1.67	19:00	0.63	08:30	1.40	1.03
P-41	1.72	19:00	0.71	08:30	1.46	1.01
P-42	0.42	19:00	0.09	08:30	0.34	0.33
P-43	0.44	19:00	0.06	08:30	0.35	0.38
P-44	0.50	19:00	0.00	06:00	0.36	0.50
P-45	0.56	19:00	0.11	08:30	0.43	0.46
P-46	0.56	19:00	0.11	08:30	0.44	0.46
P-47	0.78	19:00	0.19	08:30	0.63	0.59
P-48	0.78	19:00	0.19	08:30	0.63	0.59
P-49	0.73	06:00	0.32	08:30	0.62	0.42
P-5	1.22	19:00	0.50	08:30	1.03	0.72
P-50	1.08	06:00	0.45	08:30	0.60	0.63
P-51	0.71	19:00	0.21	06:00	0.59	0.50
P-52	0.68	19:00	0.11	06:00	0.56	0.57
P-53	0.67	19:00	0.05	06:00	0.54	0.61
P-54	1.45	06:00	0.58	08:30	0.75	0.87
P-55	1.32	06:00	0.53	08:30	0.76	0.79
P-56	1.08	06:00	0.42	08:30	0.80	0.65
P-57	0.95	19:00	0.33	08:30	0.82	0.62
P-58	0.96	19:00	0.31	08:30	0.82	0.65
P-59	0.97	19:00	0.30	08:30	0.82	0.66
P-6	0.06	06:00	0.01	14:30	0.02	0.05
P-60	0.40	19:00	0.11	08:30	0.34	0.29
P-61	0.64	06:00	0.23	08:30	0.33	0.41
P-62	0.86	06:00	0.25	19:00	0.32	0.61
P-63	0.58	19:00	0.08	08:30	0.48	0.50
P-64	0.75	19:00	0.07	08:30	0.62	0.68
P-65	0.85	06:00	0.24	08:30	0.60	0.61
P-66	0.55	19:00	0.23	08:30	0.47	0.33
P-67	0.52	06:00	0.24	08:30	0.31	0.28
P-68	0.61	06:00	0.28	08:30	0.34	0.34
P-69	0.86	06:00	0.34	14:30	0.41	0.53
P-7	1.20	19:00	0.48	08:30	1.01	0.73
P-70	0.96	06:00	0.35	14:30	0.44	0.61
P-71	0.56	06:00	0.11	14:30	0.17	0.45
P-72	0.33	06:00	0.06	14:30	0.10	0.27
P-73	0.14	06:00	0.03	14:30	0.04	0.11
P-74	0.19	06:00	0.04	14:30	0.06	0.16
P-75	0.49	06:00	0.24	08:30	0.31	0.26
P-76	1.03	06:00	0.39	14:30	0.48	0.64
P-77	1.29	06:00	0.45	14:30	0.56	0.85
P-78	1.72	06:00	0.46	08:30	1.16	1.26
P-79	1.83	06:00	0.50	08:30	1.15	1.33
P-8	1.18	19:00	0.45	08:30	0.99	0.74
P-80	0.78	19:00	0.15	06:00	0.63	0.63
P-81	0.70	19:00	0.01	07:00	0.55	0.69
P-82	1.57	06:00	0.00	02:30	0.21	1.57
P-83	1.07	06:00	0.07	19:00	0.23	1.00
P-84	0.64	06:00	0.12	14:30	0.20	0.51
P-85	0.03	06:00	0.01	14:30	0.01	0.03

Output Report - Pipe Velocity - SVSP Base plus UR (A)

	ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
	P-86	0.84	06:00	0.22	14:30	0.31	0.62
	P-87	0.77	06:00	0.20	14:30	0.29	0.56
	P-88	0.49	06:00	0.15	14:30	0.20	0.34
	P-89	1.50	06:00	0.00	19:00	0.23	1.50
	P-9	1.30	19:00	0.34	06:00	1.07	0.95
	P-90	1.42	06:00	0.03	19:00	0.24	1.40
	P-91	1.26	06:00	0.07	19:00	0.25	1.19
	P-92	1.54	06:00	0.24	14:30	0.43	1.29
	P-93	1.30	06:00	0.20	14:30	0.36	1.10
	P-94	1.89	06:00	0.41	08:30	0.59	1.48
	P-95	2.07	06:00	0.41	19:00	0.58	1.66
	P-96	2.07	06:00	0.41	19:00	0.58	1.67
	P-97	2.09	06:00	0.40	19:00	0.58	1.69
	P-98	1.90	06:00	0.31	08:30	0.83	1.59
	P-99	1.86	06:00	0.30	08:30	0.84	1.56

Output Report - Junction Pressure - SVSP Base (B)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-1	51.30	04:00	51.30	19:00	51.30	0.00
	J-10	52.59	08:30	52.28	06:00	52.49	0.31
	J-100	61.48	06:00	58.96	19:00	59.52	2.51
	J-101	59.25	06:00	57.09	19:00	57.57	2.16
	J-102	60.58	06:00	58.90	19:00	59.28	1.68
	J-103	60.25	06:00	59.47	19:00	59.65	0.78
	J-104	61.62	06:00	61.25	19:00	61.33	0.38
	J-105	59.94	06:00	59.78	19:00	59.82	0.15
	J-106	66.13	06:00	63.23	19:00	63.87	2.90
	J-107	67.15	06:00	64.10	19:00	64.76	3.05
	J-108	64.21	06:00	61.14	19:00	61.79	3.08
	J-109	63.75	06:00	60.78	19:00	61.42	2.97
	J-11	51.30	08:30	51.30	06:00	51.30	0.00
	J-110	61.31	06:00	58.56	19:00	59.16	2.76
	J-111	62.34	06:00	60.25	19:00	60.75	2.09
	J-112	63.67	06:00	61.58	19:00	62.08	2.10
	J-113	64.10	06:00	62.01	19:00	62.51	2.09
	J-114	64.61	06:00	62.50	19:00	62.99	2.11
	J-115	62.93	06:00	60.81	19:00	61.30	2.12
	J-116	61.68	06:00	59.56	19:00	60.05	2.13
	J-117	60.04	06:00	57.89	19:00	58.38	2.15
	J-118	59.50	06:00	57.56	19:00	58.00	1.93
	J-119	58.45	06:00	56.85	19:00	57.21	1.60
	J-120	61.95	06:00	60.58	19:00	60.88	1.37
	J-121	59.40	06:00	58.36	19:00	58.59	1.04
	J-125	60.08	06:00	59.28	19:00	59.46	0.79
	J-126	60.36	06:00	60.05	19:00	60.12	0.31
	J-127	60.84	06:00	60.83	19:00	60.83	0.00
	J-130	61.02	06:00	58.00	19:00	58.67	3.02
	J-14	58.64	08:30	57.61	19:00	57.88	1.02
	J-146	59.12	06:30	57.52	19:00	57.94	1.60
	J-147	66.58	08:30	64.39	19:00	64.95	2.19
	J-148	52.03	08:30	51.94	19:00	51.96	0.09
	J-149	60.56	06:00	58.46	19:00	58.93	2.10
	J-15	58.20	08:30	57.12	19:00	57.41	1.08
	J-150	65.97	06:00	62.80	19:00	63.48	3.17
	J-151	66.23	06:00	62.78	19:00	63.48	3.45
	J-152	66.57	06:00	63.45	19:00	64.11	3.12
	J-153	55.88	08:30	55.26	19:00	55.42	0.62
	J-154	57.74	08:30	56.86	19:00	57.09	0.87
	J-155	58.81	08:30	57.61	19:00	57.93	1.20
	J-156	59.00	08:30	57.63	19:00	57.99	1.37
	J-157	58.81	08:30	57.30	19:00	57.70	1.51
	J-158	59.10	08:30	57.49	19:00	57.91	1.61
	J-16	56.90	08:30	55.79	19:00	56.09	1.11
	J-17	56.90	08:30	55.78	19:00	56.08	1.12
	J-18	56.47	08:30	55.35	19:00	55.65	1.12
	J-19	57.36	08:30	56.27	19:00	56.56	1.10
	J-2	55.08	08:30	54.70	19:00	54.80	0.38
	J-20	53.15	08:30	52.09	19:00	52.38	1.05

Output Report - Junction Pressure - SVSP Base (B)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-21	51.87	08:30	50.92	19:00	51.18	0.95
	J-22	53.66	08:30	52.87	19:00	53.08	0.79
	J-23	54.60	08:30	54.01	19:00	54.17	0.60
	J-24	51.28	08:30	50.92	06:00	51.03	0.36
	J-25	51.70	08:30	51.35	06:00	51.45	0.34
	J-26	52.56	08:30	52.22	19:00	52.31	0.34
	J-27	53.09	08:30	52.75	19:00	52.84	0.34
	J-28	51.27	08:30	50.88	06:00	51.17	0.39
	J-29	53.66	08:30	53.38	19:00	53.46	0.28
	J-3	56.62	08:30	56.24	06:00	56.37	0.38
	J-30	53.56	08:30	53.42	06:00	53.47	0.14
	J-31	50.00	08:30	50.00	06:00	50.00	0.00
	J-32	53.30	08:30	52.92	19:00	53.03	0.38
	J-33	56.12	08:30	55.67	19:00	55.79	0.45
	J-34	56.55	08:30	56.02	19:00	56.17	0.54
	J-35	58.29	08:30	57.65	19:00	57.83	0.63
	J-36	56.99	08:30	56.27	19:00	56.48	0.72
	J-37	57.21	08:30	56.47	19:00	56.68	0.73
	J-38	59.28	08:30	58.66	19:00	58.84	0.62
	J-39	60.68	08:30	60.16	19:00	60.31	0.52
	J-4	56.58	08:30	56.18	06:00	56.33	0.40
	J-40	58.72	08:30	58.40	19:00	58.49	0.33
	J-41	58.67	06:00	58.66	19:00	58.67	0.00
	J-42	53.63	08:30	52.63	19:00	52.90	0.99
	J-43	52.37	08:30	51.42	19:00	51.68	0.94
	J-44	55.75	08:30	54.91	19:00	55.14	0.83
	J-45	55.64	08:30	54.88	19:00	55.10	0.76
	J-46	59.14	08:30	58.28	19:00	58.52	0.86
	J-47	56.95	07:30	55.89	19:00	56.18	1.06
	J-48	54.78	07:30	53.50	19:00	53.85	1.28
	J-49	62.27	06:00	60.19	19:00	60.70	2.08
	J-5	56.98	08:30	56.58	06:00	56.73	0.40
	J-50	62.22	06:00	60.11	19:00	60.63	2.11
	J-51	59.10	06:00	56.92	19:00	57.46	2.17
	J-52	57.73	06:00	55.50	19:00	56.05	2.23
	J-53	55.49	08:30	53.69	19:00	54.16	1.80
	J-54	55.25	08:30	53.54	19:00	53.98	1.71
	J-55	53.95	08:30	52.47	19:00	52.86	1.48
	J-56	53.54	08:30	52.22	19:00	52.57	1.32
	J-57	54.86	08:30	53.71	19:00	54.02	1.15
	J-58	55.99	08:30	54.62	19:00	54.99	1.36
	J-59	56.83	08:30	55.31	19:00	55.71	1.53
	J-6	56.98	08:30	56.57	06:00	56.72	0.40
	J-60	59.43	08:30	57.85	19:00	58.26	1.58
	J-61	57.26	04:00	55.43	19:00	55.91	1.83
	J-62	56.70	04:00	54.80	19:00	55.29	1.90
	J-63	59.60	08:00	57.47	19:00	58.02	2.13
	J-64	62.46	04:00	60.29	19:00	60.85	2.17
	J-65	59.02	08:30	57.42	19:00	57.83	1.60
	J-66	57.32	08:30	55.69	19:00	56.11	1.63

Output Report - Junction Pressure - SVSP Base (B)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-67	56.08	08:30	54.40	19:00	54.83	1.68
	J-68	57.80	04:00	56.02	19:00	56.48	1.79
	J-69	59.88	08:30	58.13	19:00	58.59	1.75
	J-7	56.12	08:30	55.71	06:00	55.86	0.40
	J-70	59.30	08:30	57.61	19:00	58.05	1.69
	J-72	58.42	04:00	56.55	19:00	57.04	1.87
	J-73	56.53	06:00	54.51	19:00	55.03	2.01
	J-74	62.34	06:00	59.78	19:00	60.37	2.56
	J-75	61.96	06:00	59.34	19:00	59.94	2.62
	J-76	61.09	06:00	58.45	19:00	59.06	2.64
	J-77	62.61	06:00	59.92	19:00	60.55	2.68
	J-78	59.89	04:00	57.70	19:00	58.26	2.20
	J-79	63.97	04:00	61.80	19:00	62.36	2.17
	J-8	55.65	08:30	55.26	06:00	55.39	0.39
	J-80	67.43	04:00	65.27	19:00	65.82	2.17
	J-81	63.10	08:30	60.93	19:00	61.49	2.17
	J-82	63.53	08:30	61.36	19:00	61.91	2.17
	J-83	67.00	08:30	64.82	19:00	65.38	2.18
	J-84	57.25	06:00	54.93	19:00	55.51	2.32
	J-85	57.16	06:00	54.92	19:00	55.49	2.24
	J-86	64.81	06:00	62.29	19:00	62.90	2.52
	J-87	66.69	08:00	64.42	19:00	65.01	2.26
	J-88	65.66	06:00	62.74	19:00	63.39	2.92
	J-89	68.03	06:00	64.91	19:00	65.57	3.12
	J-9	53.90	08:30	53.53	06:00	53.64	0.38
	J-90	66.83	06:00	63.61	19:00	64.28	3.23
	J-91	66.22	06:00	62.96	19:00	63.64	3.26
	J-92	64.89	06:00	61.66	19:00	62.34	3.23
	J-93	66.34	06:00	63.20	19:00	63.87	3.14
	J-94	64.36	06:00	61.26	19:00	61.93	3.10
	J-95	66.15	06:00	63.20	19:00	63.86	2.95
	J-96	65.85	06:00	62.85	19:00	63.50	3.00
	J-97	65.41	06:00	62.51	19:00	63.15	2.90
	J-98	61.52	06:00	58.81	19:00	59.40	2.71
	J-99	61.50	06:00	58.86	19:00	59.44	2.64

Output Report - Pipe Velocity - SVSP Base (B)

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
P-1	3.25	19:00	2.44	08:30	3.04	0.81
P-10	2.77	06:00	2.08	08:30	2.33	0.68
P-100	0.85	06:00	0.00	04:30	0.47	0.85
P-101	1.22	06:00	0.24	14:30	0.38	0.99
P-102	1.12	19:00	0.01	05:30	0.94	1.10
P-103	1.22	19:00	0.00	06:30	1.01	1.22
P-104	1.37	19:00	0.21	06:00	1.16	1.16
P-105	2.33	19:00	0.02	07:30	1.91	2.31
P-106	2.33	19:00	0.02	07:30	1.91	2.32
P-107	2.37	19:00	0.05	07:30	1.93	2.31
P-108	2.67	19:00	0.51	06:00	2.28	2.16
P-109	2.76	19:00	0.82	06:00	2.38	1.93
P-110	2.81	19:00	1.01	06:00	2.44	1.80
P-111	2.83	19:00	1.08	06:00	2.46	1.75
P-112	2.83	19:00	1.10	06:00	2.46	1.73
P-113	2.49	06:00	0.24	19:00	0.58	2.25
P-114	2.56	06:00	0.22	19:00	0.58	2.33
P-115	2.56	06:00	0.91	14:30	1.12	1.65
P-116	1.98	19:00	0.01	08:00	1.64	1.97
P-117	1.99	19:00	0.03	08:00	1.65	1.96
P-118	1.99	19:00	0.03	08:00	1.65	1.96
P-119	2.02	06:00	1.45	08:30	1.77	0.57
P-120	2.03	06:00	1.45	08:30	1.78	0.58
P-121	0.20	06:00	0.04	14:30	0.06	0.16
P-123	2.05	06:00	1.46	08:30	1.78	0.59
P-124	2.05	06:00	1.46	08:30	1.78	0.59
P-125	2.05	06:00	1.46	08:30	1.78	0.59
P-126	2.11	06:00	1.48	08:30	1.80	0.63
P-127	2.13	06:00	1.49	08:30	1.81	0.64
P-128	3.56	19:00	1.03	06:00	3.07	2.53
P-129	3.57	19:00	1.06	06:00	3.08	2.51
P-130	3.59	19:00	1.14	06:00	3.10	2.45
P-131	3.59	19:00	1.14	06:00	3.10	2.45
P-135	3.59	19:00	1.14	06:00	3.10	2.45
P-136	3.59	19:00	1.14	06:00	3.10	2.45
P-137	3.59	19:00	1.14	06:00	3.10	2.45
P-14	0.82	06:00	0.09	08:30	0.57	0.73
P-140	0.64	06:00	0.12	14:30	0.20	0.52
P15	4.12	06:00	0.00	10:30	0.56	4.12
P-15	0.65	19:00	0.00	08:30	0.50	0.65
P-158	1.82	19:00	0.08	07:30	1.51	1.74
P-159	0.61	06:00	0.16	14:30	0.23	0.45
P-16	0.63	19:00	0.01	04:00	0.48	0.62
P-160	0.91	06:00	0.22	14:30	0.32	0.69
P-161	3.27	19:00	2.47	08:30	3.07	0.80
P-162	1.50	19:00	0.28	06:00	1.28	1.22
P-163	3.02	19:00	2.19	08:30	2.81	0.83
P-164	3.01	19:00	2.17	08:30	2.79	0.84
P-165	3.00	19:00	2.16	08:30	2.79	0.84
P-166	2.80	19:00	2.01	06:00	2.63	0.80

Output Report - Pipe Velocity - SVSP Base (B)

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
P-167	2.80	19:00	2.01	06:00	2.62	0.80
P-168	2.79	19:00	1.96	06:00	2.61	0.83
P-169	4.12	06:00	0.00	14:00	0.56	4.12
P-17	0.08	06:00	0.02	14:30	0.02	0.06
P-170	4.12	06:00	0.00	09:00	0.56	4.12
P-171	1.97	19:00	0.00	08:00	1.64	1.97
P-172	3.76	06:00	1.01	14:30	1.27	2.75
P-173	2.68	06:00	1.01	14:30	1.25	1.67
P-174	2.79	19:00	1.94	06:00	2.60	0.85
P-175	2.56	06:00	0.22	19:00	0.58	2.33
P-176	2.99	06:00	2.14	19:00	2.32	0.85
P-18	0.89	14:30	0.09	06:00	0.76	0.80
P-19	1.02	14:30	0.56	06:00	0.96	0.46
P-2	1.57	06:00	0.81	14:30	0.93	0.76
P-20	1.50	19:00	0.27	06:00	1.27	1.23
P-21	1.56	19:00	0.48	06:00	1.34	1.08
P-22	1.66	19:00	0.84	06:00	1.45	0.82
P-23	1.84	19:00	1.12	08:30	1.65	0.72
P-24	0.57	08:30	0.26	06:00	0.48	0.32
P-25	0.51	08:30	0.10	06:00	0.43	0.41
P-26	0.43	14:30	0.03	06:30	0.36	0.41
P-27	3.01	06:00	2.45	14:30	2.52	0.56
P-28	0.64	06:00	0.13	14:30	0.20	0.52
P-29	3.03	19:00	2.50	08:30	2.89	0.53
P-3	1.01	06:00	0.70	14:30	0.75	0.31
P-30	3.03	19:00	2.50	08:30	2.89	0.53
P-31	3.10	06:00	2.58	08:30	2.95	0.53
P-32	0.89	19:00	0.01	08:00	0.68	0.88
P-33	0.88	19:00	0.01	08:00	0.68	0.87
P-34	0.84	19:00	0.00	04:00	0.67	0.83
P-35	0.79	19:00	0.07	08:30	0.66	0.72
P-36	0.75	19:00	0.12	08:30	0.65	0.63
P-37	0.75	19:00	0.12	08:30	0.65	0.63
P-38	2.76	19:00	1.93	08:30	2.54	0.83
P-39	2.76	19:00	1.93	08:30	2.54	0.83
P-4	0.65	06:00	0.63	14:30	0.64	0.03
P-40	2.77	19:00	1.94	08:30	2.54	0.83
P-41	2.82	19:00	2.02	08:30	2.60	0.80
P-42	1.30	19:00	0.83	08:00	1.19	0.47
P-43	1.34	19:00	0.89	08:30	1.24	0.45
P-44	1.44	19:00	1.03	08:30	1.35	0.41
P-45	1.76	06:00	1.19	08:30	1.47	0.57
P-46	1.77	06:00	1.19	08:30	1.47	0.58
P-47	1.96	19:00	0.04	05:00	1.59	1.92
P-48	1.96	19:00	0.04	05:00	1.59	1.92
P-49	1.88	19:00	0.03	07:30	1.54	1.85
P-5	0.65	19:00	0.62	14:30	0.63	0.02
P-50	1.78	19:00	0.05	08:00	1.49	1.73
P-51	2.28	19:00	1.54	08:30	2.11	0.74
P-52	2.25	19:00	1.50	08:30	2.08	0.75

Output Report - Pipe Velocity - SVSP Base (B)

	ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
	P-53	2.24	19:00	1.47	08:30	2.06	0.76
	P-54	2.00	06:00	0.94	19:00	1.05	1.05
	P-55	1.47	06:00	0.73	08:30	1.08	0.73
	P-56	1.46	14:30	0.06	08:00	1.21	1.40
	P-57	1.72	19:00	0.32	06:00	1.43	1.40
	P-58	1.77	19:00	0.51	06:00	1.49	1.26
	P-59	1.79	19:00	0.57	06:30	1.51	1.22
	P-6	0.06	06:00	0.01	14:30	0.02	0.05
	P-60	1.45	19:00	0.41	06:00	1.23	1.04
	P-61	1.36	19:00	0.10	06:00	1.13	1.27
	P-62	1.30	19:00	0.09	06:30	1.07	1.22
	P-63	1.56	14:30	0.24	06:00	1.39	1.32
	P-64	1.27	08:30	0.55	19:00	0.74	0.72
	P-65	1.55	06:00	0.68	19:00	0.88	0.88
	P-66	0.42	08:30	0.01	19:00	0.12	0.41
	P-67	0.69	08:30	0.23	19:00	0.32	0.46
	P-68	0.73	08:30	0.26	19:00	0.35	0.47
	P-69	0.83	08:30	0.33	19:00	0.43	0.50
	P-7	0.58	09:00	0.38	06:00	0.56	0.20
	P-70	0.87	04:30	0.36	19:00	0.46	0.51
	P-71	3.06	06:00	2.16	19:00	2.34	0.90
	P-72	3.00	06:00	2.15	19:00	2.33	0.86
	P-73	3.00	06:00	2.15	19:00	2.33	0.86
	P-75	2.72	06:00	1.64	19:00	1.81	1.08
	P-76	2.86	06:00	1.68	19:00	1.85	1.18
	P-77	2.92	06:00	1.69	14:30	1.87	1.23
	P-78	1.81	06:00	0.73	14:30	0.88	1.08
	P-79	1.92	06:00	0.71	14:30	0.87	1.21
	P-8	0.51	14:30	0.07	06:00	0.46	0.45
	P-80	0.72	19:00	0.17	08:30	0.59	0.56
	P-81	0.64	19:00	0.01	06:30	0.50	0.63
	P-82	1.85	06:00	0.46	14:30	0.67	1.38
	P-83	1.35	06:00	0.36	14:30	0.52	0.98
	P-84	0.64	06:00	0.12	14:30	0.20	0.51
	P-85	0.03	06:00	0.01	14:30	0.01	0.03
	P-86	0.75	06:00	0.10	14:30	0.20	0.65
	P-87	0.67	06:00	0.09	14:30	0.17	0.58
	P-88	0.39	06:00	0.03	08:30	0.09	0.37
	P-89	1.84	06:00	0.67	14:30	0.84	1.17
	P-9	2.16	19:00	1.73	08:30	2.04	0.43
	P-90	1.76	06:00	0.65	14:30	0.81	1.11
	P-91	1.59	06:00	0.62	14:30	0.76	0.97
	P-92	1.63	06:00	0.36	14:30	0.55	1.27
	P-93	1.39	06:00	0.31	14:30	0.47	1.08
	P-94	1.99	06:00	0.08	19:00	0.37	1.90
	P-95	2.16	06:00	0.04	19:00	0.36	2.13
	P-96	2.17	06:00	0.03	19:00	0.36	2.13
	P-97	2.19	06:00	0.03	19:00	0.36	2.16
	P-98	0.97	06:00	0.03	08:30	0.47	0.93
	P-99	0.93	06:00	0.02	08:30	0.47	0.91

Output Report - Junction Pressure - SVSP Base plus UR (B)

ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
J-1	51.30	08:30	51.30	19:00	51.30	0.00
J-10	52.59	08:30	52.30	06:00	52.50	0.29
J-100	61.63	06:00	59.04	19:00	59.60	2.59
J-101	59.34	06:00	57.13	19:00	57.63	2.21
J-102	60.65	06:00	58.93	19:00	59.32	1.72
J-103	60.29	06:00	59.48	19:00	59.67	0.81
J-104	61.64	06:00	61.25	19:00	61.34	0.39
J-105	59.94	06:00	59.79	19:00	59.82	0.16
J-106	66.43	06:00	63.36	19:00	64.00	3.07
J-107	67.47	06:00	64.22	19:00	64.89	3.24
J-108	64.52	06:00	61.26	19:00	61.92	3.26
J-109	64.02	06:00	60.90	19:00	61.54	3.13
J-11	51.30	08:30	51.30	06:00	51.30	0.00
J-110	61.52	06:00	58.65	19:00	59.26	2.87
J-111	62.47	06:00	60.32	19:00	60.83	2.15
J-112	63.80	06:00	61.65	19:00	62.15	2.16
J-113	64.23	06:00	62.08	19:00	62.58	2.15
J-114	64.73	06:00	62.56	19:00	63.06	2.17
J-115	63.04	06:00	60.87	19:00	61.37	2.17
J-116	61.79	06:00	59.61	19:00	60.11	2.18
J-117	60.14	06:00	57.94	19:00	58.44	2.19
J-118	59.56	06:00	57.57	19:00	58.02	1.99
J-119	58.49	06:00	56.82	19:00	57.20	1.67
J-120	61.96	06:00	60.51	19:00	60.84	1.45
J-121	59.37	06:00	58.25	19:00	58.51	1.12
J-122	55.81	06:00	54.77	19:00	55.03	1.03
J-123	57.93	06:00	56.94	19:00	57.19	0.99
J-124	57.04	06:00	56.07	19:00	56.32	0.97
J-125	60.06	06:00	59.20	19:00	59.40	0.86
J-126	60.35	06:00	60.01	19:00	60.09	0.34
J-127	60.84	06:00	60.83	19:00	60.83	0.00
J-128	62.57	08:30	62.57	06:00	62.57	0.00
J-129	59.54	00:00	59.54	06:00	59.54	0.00
J-130	60.95	06:00	58.75	19:00	59.28	2.20
J-131	62.45	05:00	60.91	19:00	61.34	1.54
J-132	61.15	05:00	59.75	19:00	60.15	1.40
J-133	62.88	05:30	61.58	19:00	61.95	1.30
J-134	67.65	05:30	66.53	19:00	66.87	1.11
J-135	67.43	05:30	66.46	19:00	66.77	0.97
J-136	66.35	07:30	65.48	19:00	65.76	0.87
J-137	65.28	07:30	64.56	19:00	64.80	0.73
J-138	68.20	08:30	67.72	19:00	67.89	0.48
J-139	63.65	08:30	63.42	19:00	63.50	0.22
J-14	58.66	08:30	57.67	19:00	57.94	0.98
J-140	61.14	08:30	61.01	19:00	61.05	0.13
J-141	63.03	06:00	61.93	19:00	62.23	1.10
J-142	65.16	06:30	64.04	19:00	64.35	1.12
J-143	65.53	05:00	64.39	19:00	64.71	1.15
J-144	63.33	05:00	62.09	19:00	62.44	1.24
J-145	60.29	05:00	58.96	19:00	59.34	1.32

Output Report - Junction Pressure - SVSP Base plus UR (B)

ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
J-146	59.23	06:00	57.58	19:00	58.01	1.65
J-147	66.61	04:00	64.53	19:00	65.09	2.08
J-148	52.03	08:30	51.94	19:00	51.97	0.09
J-149	60.64	06:00	58.50	19:00	58.98	2.14
J-15	58.22	08:30	57.18	19:00	57.47	1.04
J-150	66.31	06:00	62.93	19:00	63.61	3.38
J-151	66.66	06:00	62.92	19:00	63.63	3.74
J-152	66.89	06:00	63.57	19:00	64.25	3.32
J-153	55.89	08:30	55.30	19:00	55.46	0.59
J-154	57.75	08:30	56.92	19:00	57.14	0.84
J-155	58.83	08:30	57.68	19:00	57.99	1.15
J-156	59.02	08:30	57.71	19:00	58.07	1.31
J-157	58.83	08:30	57.39	19:00	57.78	1.44
J-158	59.12	04:00	57.58	19:00	58.00	1.54
J-16	56.92	08:30	55.86	19:00	56.15	1.07
J-17	56.92	08:30	55.85	19:00	56.15	1.07
J-18	56.49	08:30	55.41	19:00	55.71	1.07
J-19	57.38	08:30	56.33	19:00	56.62	1.05
J-2	55.09	08:30	54.72	19:00	54.82	0.37
J-20	53.16	08:30	52.15	19:00	52.43	1.01
J-21	51.89	08:30	50.97	19:00	51.23	0.92
J-22	53.67	08:30	52.91	19:00	53.13	0.76
J-23	54.62	08:30	54.04	19:00	54.20	0.58
J-24	51.28	08:30	50.95	19:00	51.04	0.34
J-25	51.70	08:30	51.37	19:00	51.47	0.33
J-26	52.57	08:30	52.24	19:00	52.33	0.33
J-27	53.09	08:30	52.77	19:00	52.86	0.33
J-28	51.27	08:30	50.91	06:00	51.18	0.37
J-29	53.66	08:30	53.39	19:00	53.47	0.27
J-3	56.63	08:30	56.29	06:00	56.39	0.34
J-30	53.57	08:30	53.44	19:00	53.47	0.13
J-31	50.00	08:30	50.00	19:00	50.00	0.00
J-32	53.31	08:30	52.94	19:00	53.05	0.37
J-33	56.13	08:30	55.69	19:00	55.82	0.43
J-34	56.56	08:30	56.04	19:00	56.19	0.52
J-35	58.29	08:30	57.68	19:00	57.86	0.61
J-36	57.00	08:30	56.31	19:00	56.51	0.69
J-37	57.21	08:30	56.51	19:00	56.72	0.71
J-38	59.28	08:30	58.69	19:00	58.87	0.60
J-39	60.69	08:30	60.19	19:00	60.34	0.50
J-4	56.59	08:30	56.23	06:00	56.35	0.36
J-40	58.73	08:30	58.41	19:00	58.51	0.31
J-41	58.67	06:00	58.66	19:00	58.67	0.00
J-42	53.64	08:30	52.69	19:00	52.96	0.95
J-43	52.38	08:30	51.47	19:00	51.73	0.91
J-44	55.76	08:30	54.95	19:00	55.19	0.80
J-45	55.65	08:30	54.92	19:00	55.14	0.73
J-46	59.15	07:30	58.32	19:00	58.56	0.83
J-47	56.98	07:30	55.93	19:00	56.23	1.05
J-48	54.82	05:00	53.56	19:00	53.91	1.27

Output Report - Junction Pressure - SVSP Base plus UR (B)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-49	62.41	06:00	60.27	19:00	60.78	2.14
	J-5	56.99	08:30	56.63	06:00	56.75	0.36
	J-50	62.37	06:00	60.20	19:00	60.71	2.18
	J-51	59.27	06:00	57.02	19:00	57.55	2.25
	J-52	57.91	06:00	55.61	19:00	56.16	2.30
	J-53	55.51	08:30	53.79	19:00	54.25	1.73
	J-54	55.27	08:30	53.63	19:00	54.06	1.64
	J-55	53.97	08:30	52.55	19:00	52.94	1.42
	J-56	53.55	08:30	52.29	19:00	52.64	1.27
	J-57	54.88	08:30	53.77	19:00	54.08	1.11
	J-58	56.01	08:30	54.70	19:00	55.06	1.31
	J-59	56.85	08:30	55.39	19:00	55.79	1.46
	J-6	56.98	08:30	56.62	06:00	56.74	0.36
	J-60	59.45	08:30	57.93	19:00	58.35	1.52
	J-61	57.32	06:00	55.53	19:00	56.01	1.79
	J-62	56.76	06:00	54.91	19:00	55.40	1.85
	J-63	59.75	06:00	57.60	19:00	58.15	2.15
	J-64	62.57	06:00	60.42	19:00	60.98	2.15
	J-65	59.04	08:30	57.50	19:00	57.92	1.54
	J-66	57.34	08:30	55.77	19:00	56.20	1.56
	J-67	56.10	08:30	54.49	19:00	54.92	1.61
	J-68	57.85	06:00	56.12	19:00	56.58	1.73
	J-69	59.92	06:00	58.23	19:00	58.69	1.69
	J-7	56.12	08:30	55.76	06:00	55.88	0.36
	J-70	59.32	04:00	57.70	19:00	58.14	1.62
	J-72	58.51	06:00	56.65	19:00	57.14	1.86
	J-73	56.69	06:00	54.62	19:00	55.13	2.08
	J-74	62.58	06:00	59.90	19:00	60.50	2.68
	J-75	62.22	06:00	59.46	19:00	60.07	2.76
	J-76	61.35	06:00	58.58	19:00	59.19	2.77
	J-77	62.88	06:00	60.08	19:00	60.69	2.80
	J-78	60.06	06:00	57.83	19:00	58.40	2.23
	J-79	64.05	06:00	61.93	19:00	62.49	2.12
	J-8	55.66	08:30	55.31	06:00	55.41	0.35
	J-80	67.52	06:00	65.40	19:00	65.96	2.12
	J-81	63.18	06:00	61.07	19:00	61.62	2.11
	J-82	63.57	04:00	61.49	19:00	62.05	2.07
	J-83	67.03	04:00	64.96	19:00	65.51	2.07
	J-84	57.49	06:00	55.06	19:00	55.64	2.43
	J-85	57.40	06:00	55.04	19:00	55.61	2.36
	J-86	65.07	06:00	62.44	19:00	63.05	2.63
	J-87	66.87	06:00	64.57	19:00	65.15	2.31
	J-88	65.98	06:00	62.89	19:00	63.54	3.08
	J-89	68.38	06:00	65.06	19:00	65.73	3.32
	J-9	53.91	08:30	53.57	19:00	53.66	0.34
	J-90	67.20	06:00	63.77	19:00	64.45	3.44
	J-91	66.59	06:00	63.12	19:00	63.80	3.48
	J-92	65.23	06:00	61.87	19:00	62.54	3.36
	J-93	66.57	06:00	63.52	19:00	64.15	3.05
	J-94	64.53	06:00	61.65	19:00	62.26	2.88

Output Report - Junction Pressure - SVSP Base plus UR (B)

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	J-95	66.32	06:00	63.58	19:00	64.19	2.73
	J-96	66.04	06:00	63.18	19:00	63.79	2.86
	J-97	65.61	06:00	62.76	19:00	63.37	2.84
	J-98	61.71	06:00	58.90	19:00	59.50	2.81
	J-99	61.69	06:00	58.95	19:00	59.54	2.73

Output Report - Pipe Velocity - SVSP Base plus UR (B)

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
P-1	3.21	19:00	2.43	08:30	3.00	0.78
P-10	2.72	06:00	2.08	08:30	2.31	0.65
P-100	1.50	06:00	0.07	08:00	1.24	1.44
P-101	1.22	06:00	0.24	14:30	0.38	0.99
P-102	0.54	19:00	0.05	05:00	0.45	0.50
P-103	0.60	19:00	0.07	06:00	0.50	0.54
P-104	0.68	19:00	0.22	06:00	0.59	0.46
P-105	2.18	19:00	0.08	08:00	1.82	2.10
P-106	2.18	19:00	0.08	08:00	1.82	2.10
P-107	2.21	19:00	0.02	08:00	1.84	2.19
P-108	2.64	19:00	0.36	06:00	2.24	2.29
P-109	2.73	19:00	0.66	06:00	2.34	2.07
P-110	2.78	19:00	0.85	06:00	2.39	1.93
P-111	2.80	19:00	0.92	06:00	2.42	1.88
P-112	2.81	19:00	0.94	06:00	2.42	1.87
P-113	2.67	06:00	0.20	19:00	0.56	2.48
P-114	2.74	06:00	0.18	19:00	0.55	2.56
P-115	2.74	06:00	1.09	14:30	1.28	1.65
P-116	1.86	19:00	0.07	04:00	1.61	1.79
P-117	1.87	19:00	0.09	04:00	1.61	1.79
P-118	1.87	19:00	0.09	04:00	1.61	1.79
P-119	1.88	06:00	1.42	08:30	1.69	0.46
P-120	1.89	06:00	1.42	08:30	1.70	0.47
P-121	0.20	06:00	0.04	14:30	0.06	0.16
P-123	1.91	06:00	1.43	08:30	1.70	0.48
P-124	1.91	06:00	1.43	08:30	1.70	0.48
P-125	1.91	06:00	1.43	08:30	1.71	0.48
P-126	1.97	06:00	1.45	08:30	1.72	0.51
P-127	1.98	06:00	1.46	08:30	1.73	0.53
P-128	3.32	19:00	0.40	06:00	2.81	2.92
P-129	3.33	19:00	0.43	06:00	2.82	2.90
P-130	3.35	19:00	0.50	06:00	2.85	2.85
P-131	3.37	19:00	0.57	06:00	2.87	2.80
P-132	1.14	06:00	0.22	14:30	0.36	0.92
P-133	0.87	06:00	0.17	14:30	0.27	0.70
P-134	0.58	06:00	0.11	14:30	0.18	0.46
P-135	3.74	19:00	1.16	06:00	3.22	2.58
P-136	3.76	19:00	1.22	06:00	3.24	2.54
P-137	3.78	19:00	1.31	06:00	3.27	2.48
P-138	0.09	06:00	0.02	08:30	0.03	0.07
P-139	0.12	06:00	0.06	08:30	0.08	0.06
P-14	0.75	06:00	0.09	08:30	0.55	0.66
P-140	1.70	14:30	0.23	08:00	1.49	1.48
P-141	1.76	19:00	0.08	08:00	1.52	1.69
P-142	1.95	19:00	0.07	07:30	1.60	1.88
P-143	1.12	19:00	0.07	07:30	0.95	1.05
P-144	1.20	19:00	0.00	05:00	0.99	1.20
P-145	1.26	19:00	0.01	07:00	1.03	1.25
P-146	1.26	19:00	0.01	06:30	1.03	1.25
P-147	1.32	19:00	0.03	06:00	1.09	1.28

Output Report - Pipe Velocity - SVSP Base plus UR (B)

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
P-148	1.45	19:00	0.50	06:00	1.23	0.95
P-149	1.64	19:00	1.07	08:30	1.46	0.58
P15	4.85	06:00	0.00	11:00	0.63	4.85
P-15	0.64	19:00	0.00	08:30	0.48	0.64
P-150	1.72	19:00	1.17	08:30	1.54	0.55
P-151	1.75	19:00	1.21	08:30	1.57	0.53
P-152	1.23	06:00	0.83	08:30	1.05	0.40
P-153	1.13	19:00	0.77	08:00	1.01	0.36
P-154	1.13	19:00	0.77	08:00	1.01	0.36
P-155	1.01	19:00	0.53	07:30	0.88	0.49
P-156	0.90	19:00	0.25	06:30	0.75	0.65
P-157	0.83	19:00	0.00	06:00	0.67	0.83
P-158	1.79	19:00	0.07	08:00	1.49	1.73
P-159	0.63	06:00	0.19	14:30	0.25	0.44
P-16	0.62	19:00	0.01	04:30	0.46	0.61
P-160	0.93	06:00	0.25	14:30	0.35	0.68
P-161	3.23	19:00	2.46	08:30	3.02	0.77
P-162	1.49	19:00	0.19	06:00	1.26	1.29
P-163	2.98	19:00	2.17	08:30	2.77	0.80
P-164	2.96	19:00	2.15	08:30	2.75	0.81
P-165	2.96	19:00	2.14	08:30	2.74	0.81
P-166	2.77	19:00	1.96	06:00	2.59	0.81
P-167	2.77	19:00	1.96	06:00	2.59	0.81
P-168	2.76	19:00	1.91	06:00	2.58	0.85
P-169	4.85	06:00	0.00	19:30	0.63	4.85
P-17	0.08	06:00	0.02	14:30	0.02	0.06
P-170	4.85	06:00	0.00	09:00	0.63	4.85
P-171	1.86	19:00	0.07	04:00	1.60	1.79
P-172	4.51	06:00	0.73	14:30	1.13	3.78
P-173	3.06	06:00	0.73	14:30	1.04	2.33
P-174	2.75	19:00	1.89	06:00	2.57	0.86
P-175	2.74	06:00	0.18	19:00	0.55	2.56
P-176	3.03	06:00	2.17	19:00	2.35	0.86
P-18	0.87	14:30	0.13	06:30	0.75	0.74
P-19	1.00	14:30	0.49	06:00	0.94	0.51
P-2	1.56	06:00	0.81	14:30	0.93	0.75
P-20	1.47	19:00	0.17	06:00	1.24	1.30
P-21	1.53	19:00	0.38	06:00	1.30	1.15
P-22	1.62	19:00	0.73	06:00	1.41	0.89
P-23	1.80	19:00	1.11	08:30	1.61	0.70
P-24	0.57	08:30	0.28	06:00	0.49	0.29
P-25	0.51	08:30	0.13	06:00	0.44	0.38
P-26	0.45	14:30	0.04	06:30	0.37	0.40
P-27	2.98	06:00	2.43	14:30	2.51	0.55
P-28	0.64	06:00	0.13	14:30	0.20	0.52
P-29	3.01	19:00	2.49	08:30	2.86	0.52
P-3	1.00	06:00	0.70	14:30	0.75	0.30
P-30	3.01	19:00	2.49	08:30	2.86	0.51
P-31	3.06	19:00	2.57	08:30	2.92	0.49
P-32	0.86	19:00	0.05	04:00	0.67	0.82

Output Report - Pipe Velocity - SVSP Base plus UR (B)

	ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
	P-33	0.86	19:00	0.04	04:00	0.67	0.82
	P-34	0.82	19:00	0.01	08:30	0.66	0.81
	P-35	0.77	19:00	0.08	08:30	0.65	0.68
	P-36	0.73	19:00	0.14	08:30	0.64	0.59
	P-37	0.73	19:00	0.14	08:30	0.64	0.59
	P-38	2.73	19:00	1.91	05:30	2.49	0.82
	P-39	2.73	19:00	1.91	05:30	2.50	0.81
	P-4	0.66	19:00	0.63	14:30	0.64	0.02
	P-40	2.73	19:00	1.92	05:30	2.50	0.81
	P-41	2.79	19:00	2.01	08:30	2.56	0.78
	P-42	1.28	19:00	0.82	04:00	1.17	0.46
	P-43	1.31	19:00	0.88	04:00	1.21	0.44
	P-44	1.41	19:00	1.02	08:30	1.32	0.39
	P-45	1.72	06:00	1.18	08:30	1.45	0.54
	P-46	1.72	06:00	1.18	08:30	1.45	0.54
	P-47	1.93	19:00	0.03	05:30	1.56	1.90
	P-48	1.93	19:00	0.03	05:30	1.56	1.90
	P-49	1.84	19:00	0.06	07:30	1.51	1.78
	P-5	0.65	19:00	0.62	06:00	0.64	0.03
	P-50	1.75	19:00	0.02	08:00	1.47	1.73
	P-51	2.18	19:00	1.50	08:30	2.02	0.67
	P-52	2.15	19:00	1.46	08:30	1.99	0.69
	P-53	2.13	19:00	1.44	08:30	1.97	0.69
	P-54	2.06	06:00	0.90	19:00	1.02	1.17
	P-55	1.53	06:00	0.75	08:30	1.05	0.78
	P-56	1.42	14:30	0.08	08:00	1.18	1.33
	P-57	1.68	19:00	0.24	06:00	1.39	1.44
	P-58	1.74	19:00	0.43	06:00	1.44	1.31
	P-59	1.75	19:00	0.49	06:00	1.46	1.26
	P-6	0.06	06:00	0.01	14:30	0.02	0.05
	P-60	1.42	19:00	0.28	06:00	1.19	1.14
	P-61	1.33	19:00	0.03	06:00	1.10	1.30
	P-62	1.27	19:00	0.03	06:30	1.04	1.25
	P-63	1.53	14:30	0.09	06:00	1.36	1.44
	P-64	1.29	08:30	0.65	19:00	0.83	0.64
	P-65	1.68	06:00	0.77	19:00	0.96	0.91
	P-66	0.43	08:30	0.04	06:00	0.20	0.39
	P-67	0.69	08:30	0.24	19:00	0.33	0.45
	P-68	0.73	08:30	0.27	19:00	0.36	0.46
	P-69	0.83	08:30	0.34	19:00	0.44	0.49
	P-7	0.58	19:00	0.38	06:00	0.56	0.21
	P-70	0.87	04:00	0.37	19:00	0.47	0.50
	P-71	3.10	06:00	2.19	19:00	2.38	0.91
	P-72	3.05	06:00	2.18	19:00	2.36	0.87
	P-73	3.05	06:00	2.18	19:00	2.36	0.87
	P-75	2.77	06:00	1.65	19:00	1.83	1.12
	P-76	2.91	06:00	1.69	19:00	1.87	1.22
	P-77	2.97	06:00	1.71	19:00	1.89	1.26
	P-78	2.04	06:00	0.60	14:30	0.79	1.45
	P-79	2.16	06:00	0.58	14:30	0.79	1.58

Output Report - Pipe Velocity - SVSP Base plus UR (B)

	ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
	P-8	0.52	14:30	0.06	06:00	0.46	0.46
	P-80	0.54	19:00	0.09	08:30	0.42	0.45
	P-81	0.46	19:00	0.03	08:00	0.36	0.43
	P-82	1.90	06:00	0.53	14:30	0.73	1.38
	P-83	1.40	06:00	0.43	14:30	0.57	0.98
	P-84	0.64	06:00	0.12	14:30	0.20	0.51
	P-85	0.03	06:00	0.01	14:30	0.01	0.03
	P-86	0.73	06:00	0.07	14:30	0.17	0.66
	P-87	0.65	06:00	0.06	14:30	0.15	0.59
	P-88	0.37	06:00	0.00	14:30	0.06	0.37
	P-89	1.89	06:00	0.66	14:30	0.84	1.22
	P-9	2.14	19:00	1.72	08:30	2.02	0.42
	P-90	1.81	06:00	0.65	14:30	0.81	1.16
	P-91	1.64	06:00	0.62	14:30	0.76	1.03
	P-92	1.65	06:00	0.39	14:30	0.57	1.26
	P-93	1.42	06:00	0.34	14:30	0.50	1.07
	P-94	2.19	06:00	0.10	14:30	0.40	2.09
	P-95	2.37	06:00	0.13	14:30	0.45	2.23
	P-96	2.37	06:00	0.13	14:30	0.45	2.24
	P-97	2.39	06:00	0.14	14:30	0.46	2.25
	P-98	1.62	06:00	0.13	08:00	1.22	1.49
	P-99	1.58	06:00	0.11	08:00	1.23	1.47

APPENDIX B

Sierra Vista Detailed Potable Water Demand Summary

Sierra Vista Potable Water Demand Detail

SVSP Base Land Uses								Model Input data		
No.	Parcel ID	Area Description	Total Acreage	Dwelling Units	Average Day Demand	Max Day Demand	Annual Demand	Junction IDs		Average Demand
					(GPD)	(GPD)	(AFY)	(A) Alts	(B) Alts	(GPM)
1	LDR-1	Low Density Residential	28.8	144	86,400	172,800	96.8	J-95	J-95	60.00
2	LDR-2	Low Density Residential	17.3	86	51,600	103,200	57.8	J-96	J-96	35.83
3	LDR-3	Low Density Residential	18.5	92	55,200	110,400	61.8	J-97	J-97	38.33
4	LDR-4	Low Density Residential	9.3	46	27,600	55,200	30.9	J-103	J-103	19.17
5	LDR-5	Low Density Residential	16.4	82	49,200	98,400	55.1	J-97/ J-109	J-97/ J-109	34.17
6	LDR-6	Low Density Residential	17.4	87	52,200	104,400	58.5	J-146/ J-47	J-146/ J-47	36.25
7	LDR-7	Low Density Residential	6.4	32	19,200	38,400	21.5	J-104/ J-40	J-104/ J-40	13.33
8	LDR-8	Low Density Residential	13.7	68	40,800	81,600	45.7	J-40/ J-35	J-40/ J-35	28.33
9	LDR-9	Low Density Residential	8.4	42	25,200	50,400	28.2	J-34	J-34	17.50
10	LDR-10	Low Density Residential	16.9	84	50,400	100,800	56.5	J-33/ J-30	J-33/ J-30	35.00
11	LDR-11	Low Density Residential	15.7	78	46,800	93,600	52.4	J-87/ J-88	J-87/ J-88	32.50
12	LDR-12	Low Density Residential	21.6	108	64,800	129,600	72.6	J-74/ J-50	J-74/ J-50	45.00
13	LDR-13	Low Density Residential	18.8	94	56,400	112,800	63.2	J-50/ J-48	J-50/ J-48	39.17
14	LDR-14	Low Density Residential	18.9	94	56,400	112,800	63.2	J-51/ J-53	J-51/ J-53	39.17
15	LDR-15	Low Density Residential	29.6	148	88,800	177,600	99.5	J-25/ J-10	J-25/ J-10	61.67
16	LDR-16	Low Density Residential	32.8	164	98,400	196,800	110.2	J-87/ J-147	J-87/ J-147	68.33
17	LDR-17	Low Density Residential	24.2	121	72,600	145,200	81.3	J-74/ J-73	J-74/ J-73	50.42
18	LDR-18	Low Density Residential	39.3	196	117,600	235,200	131.7	J-72/ J-53	J-72/ J-53	81.67
19	LDR-19	Low Density Residential	4.9	24	14,400	28,800	16.1	J-67	J-67	10.00
20	LDR-20a	Low Density Residential	18.8	94	56,400	112,800	63.2	J-22	J-22	39.17
21	LDR-20b	Low Density Residential	3.1	15	9,000	18,000	10.1	J-16	J-16	6.25
22	LDR-21	Low Density Residential	26.3	131	78,600	157,200	88.0	J-23/ J-6	J-23/ J-6	54.58
23	LDR-22	Low Density Residential	30.2	151	90,600	181,200	101.5	J-8/ J-10	J-8/ J-10	62.92
24	LDR-23	Low Density Residential	23.9	119	71,400	142,800	80.0	J-68/ J-59	J-68/ J-59	49.58
25	LDR-24	Low Density Residential	23.4	117	70,200	140,400	78.6	J-58/ J-15	J-58/ J-15	48.75
26	MDR-1	Medium Density Residential	9.4	84	27,132	54,264	30.4	J-130/ J-93	J-130/ J-93	18.84
27	MDR-2	Medium Density Residential	7.8	70	22,610	45,220	25.3	J-130	J-130	15.70
28	MDR-3	Medium Density Residential	25.5	229	73,967	147,934	82.9	J-100/ J-119	J-100/ J-119	51.37
29	MDR-4	Medium Density Residential	14.5	130	41,990	83,980	47.0	J-102	J-102	29.16
30	MDR-5	Medium Density Residential	4.8	43	13,889	27,778	15.6	J-93/ J-96	J-93/ J-96	9.65
31	MDR-6	Medium Density Residential	22.9	206	66,538	133,076	74.5	J-100/ J-116	J-100/ J-116	46.21
32	MDR-7	Medium Density Residential	16.1	144	46,512	93,024	52.1	J-88/ J-76	J-88/ J-76	32.30
33	MDR-8	Medium Density Residential	10.7	96	31,008	62,016	34.7	J-44	J-44	21.53
34	MDR-9	Medium Density Residential	39.9	359	115,957	231,914	129.9	J-43/ J-23	J-43/ J-23	80.53
35	MDR-10	Medium Density Residential	22.6	203	65,569	131,138	73.4	J-86/ J-78	J-86/ J-78	45.53
36	MDR-11	Medium Density Residential	33.9	305	98,515	197,030	110.4	J-78/ J-76	J-78/ J-76	68.41
37	MDR-12	Medium Density Residential	18.8	169	54,587	109,174	61.1	J-85/ J-72	J-85/ J-72	37.91
38	MDR-13	Medium Density Residential	16	144	46,512	93,024	52.1	J-19/ J-21	J-19/ J-21	32.30
39	MDR-14	Medium Density Residential	18.7	168	54,264	108,528	60.8	J-4	J-4	37.68
40	HDR-1	High Density Residential	4.1	84	14,868	29,736	16.7	J-119	J-119	10.33
41	HDR-2	High Density Residential	4.1	84	14,868	29,736	16.7	J-118	J-118	10.33
42	HDR-3	High Density Residential	5.6	138	24,426	48,852	27.4	J-30	J-30	16.96
43	HDR-4	High Density Residential	8	160	28,320	56,640	31.7	J-44	J-44	19.67
44	HDR-5	High Density Residential	8.6	172	30,444	60,888	34.1	J-56	J-56	21.14
45	HDR-6	High Density Residential	28.1	843	149,211	298,422	167.1	J-55/ J-19	J-55/ J-19	103.62
46	HDR-7	High Density Residential	7.6	152	26,904	53,808	30.1	J-79	J-79	18.68
47	CMU-1	Commercial Mixed Use	5.4	40	21,109	42,218	23.6	J-57/ J-42	J-57/ J-42	14.66
48	CMU-2	Commercial Mixed Use	5.4	40	21,109	42,218	23.6	J-42/ J-21	J-42/ J-21	14.66
49	CMU-3	Commercial Mixed Use	23.5	175	92,028	184,056	103.1	J-82/ J-83	J-82/ J-83	63.91
50	PR-1	Park	1	N/A	2,988	5,976	3.3	J-95	J-95	2.08
51	PR-2	Park	1.7	N/A	5,080	10,159	5.7	J-99	J-99	3.53
52	PR-3	Park	1.1	N/A	3,287	6,574	3.7	J-105	J-105	2.28
53	PR-4	Park	5	N/A	14,940	29,880	16.7	J-113	J-113	10.38
54	PR-5	Park	8.1	N/A	24,203	48,406	27.1	J-47	J-47	16.81
55	PR-6	Park	8	N/A	23,904	47,808	26.8	J-25	J-25	16.60
56	PR-7	Park	2.6	N/A	7,769	15,538	8.7	J-28	J-28	5.40
57	PR-8	Park	4.2	N/A	12,550	25,099	14.1	J-84	J-84	8.72
58	PR-9	Park	10.7	N/A	31,972	63,943	35.8	J-65/ J-58	J-65/ J-58	22.20
59	PR-10	Park	1.9	N/A	5,677	11,354	6.4	J-18	J-18	3.94
60	PR-11	Park	1.5	N/A	4,482	8,964	5.0	J-7	J-7	3.11
61	PR-12	Park	39.9	N/A	119,221	238,442	133.5	J-83	J-83	82.79
62	PR-13	Park	4.2	N/A	12,550	25,099	14.1	J-81	J-81	8.72
63	PQP-1	Public/Quasi Public (church)	4.2	N/A	7,476	14,952	8.4	J-117	J-117	5.19
64	PQP-2	Public/Quasi Public (RW site)	1.8	N/A	3,204	6,408	3.6	J-102	J-102	2.23
65	PQP-3	Public/Quasi Public (Electric)	0.8	N/A	2,050	4,099	2.3	J-116	J-116	1.42
66	PQP-4	Public/Quasi Public (Recycle)	0.4	N/A	712	1,424	0.8	J-115	J-115	0.49
67	PQP-5	Public/Quasi Public (PWTF)	2.8	N/A	4,984	9,968	5.6	J-90	J-90	1809.02
68	PQP-6	Public/Quasi Public (El Sch)	12	N/A	41,448	82,896	46.4	J-106	J-106	28.78
69	PQP-7	Public/Quasi Public (Fire)	2.8	N/A	4,984	9,968	5.6	J-111	J-111	3.46
70	PQP-8	Public/Quasi Public (Mid Sch)	21.6	N/A	87,869	175,738	98.4	J-55	J-55	61.02
71	PQP-9	Public/Quasi Public (well)	0.3	N/A	534	1,068	0.6	J-26	J-26	1805.56
72	PQP-10	Public/Quasi Public (El Sch)	12	N/A	41,448	82,896	46.4	J-24	J-24	28.78
73	PQP-11	Public/Quasi Public (El Sch)	12	N/A	41,448	82,896	46.4	J-66	J-66	28.78
74	CC-1a	Communiy Commercial	7.5	N/A	19,485	38,970	21.8	J-92/ J-108	J-92/ J-108	13.53
75	CC-1b	Communiy Commercial	0.1	N/A	260	520	0.3	J-92	J-92	0.18
76	CC-2	Communiy Commercial	56	N/A	145,488	290,976	163.0	J-79/ J-62	J-79/ J-62	101.03
77	CC-3	Communiy Commercial	8.8	N/A	22,862	45,725	25.6	J-70	J-70/ J-157	15.88
78	CC-4a	Communiy Commercial	12.6	N/A	32,735	65,470	36.7	J-14	J-14/ J-154	22.73
79	CC-4b	Communiy Commercial	28.8	N/A	74,822	149,645	83.8	J-2/ J-3	J-153/ J-3	51.96
80	CC-5	Communiy Commercial	39.8	N/A	103,400	206,801	115.8	J-3/ J-148	J-3/ J-148	71.81
81	CC/BP-1	Commercial Business Park	15.1	N/A	39,230	78,460	43.9	J-28	J-28	27.24
82	CC/BP-2	Commercial Business Park	12.2	N/A	31,696	63,391	35.5	J-71	J-156	22.01
83	LC-1	Landscape Corridor (LDR-3)	0.085	N/A	254	508	0.3	J-98	J-98	0.18
84	LC-2	Landscape Corridor (LDR-4)	0.025	N/A	75	149	0.1	J-41	J-41	0.05
85	LC-3	Landscape Corridor (LDR-5)	0.123	N/A	368	735	0.4	J-110	J-110	0.26
86	LC-4	Landscape Corridor (LDR-8)	0.501	N/A	1,497	2,994	1.7	J-35	J-35	1.04
87	LC-5	Landscape Corridor (LDR-9)	0.615	N/A	1,838	3,675	2.1	J-34	J-34	1.28
88	LC-6	Landscape Corridor (LDR-10)	0.27	N/A	807	1,614	0.9	J-33	J-33	0.56
89	LC-7	Landscape Corridor (LDR-11)	1.703	N/A	5,089	10,177	5.7	J-88	J-88	3.53
90	LC-8	Landscape Corridor (LDR-12)	2.304	N/A	6,884	13,769	7.7	J-51	J-51	4.78
91	LC-9	Landscape Corridor (LDR-13)	0.436	N/A	1,303	2,606	1.5	J-50	J-50	0.90

Sierra Vista Potable Water Demand Detail

No.	Parcel ID	Area Description	Total Acreage	Dwelling Units	Average Day Demand	Max Day Demand	Annual Demand	Junction IDs		Average Demand
					(GPD)	(GPD)	(AFY)	(A) Alts	(B) Alts	(GPM)
92	LC-10	Landscape Corridor (LDR-14)	1.567	N/A	4,682	9,364	5.2	J-51	J-51	3.25
93	LC-11	Landscape Corridor (LDR-15)	1.842	N/A	5,504	11,008	6.2	J-10	J-10	3.82
94	LC-12	Landscape Corridor (LDR-16)	2.234	N/A	6,675	13,350	7.5	J-87	J-87	4.64
95	LC-13	Landscape Corridor (LDR-17)	1.876	N/A	5,605	11,211	6.3	J-74	J-74	3.89
96	LC-14	Landscape Corridor (LDR-18)	2.37	N/A	7,082	14,163	7.9	J-73	J-73	4.92
97	LC-15	Landscape Corridor (LDR-19)	0.554	N/A	1,655	3,311	1.9	J-67	J-67	1.15
98	LC-16	Landscape Corridor (LDR-20a)	0.587	N/A	1,754	3,508	2.0	J-22	J-22	1.22
99	LC-17	Landscape Corridor (LDR-21)	0.877	N/A	2,620	5,241	2.9	J-23	J-23	1.82
100	LC-18	Landscape Corridor (LDR-22)	2.086	N/A	6,233	12,466	7.0	J-10	J-10	4.33
101	LC-19	Landscape Corridor (LDR-23)	0.375	N/A	1,121	2,241	1.3	J-68	J-68	0.78
102	LC-20	Landscape Corridor (MDR-1)	2.197	N/A	6,565	13,129	7.4	J-130	J-130	4.56
103	LC-21	Landscape Corridor (MDR-2)	1.418	N/A	4,237	8,474	4.7	J-130	J-130	2.94
104	LC-22	Landscape Corridor (MDR-3)	0.785	N/A	2,346	4,691	2.6	J-118	J-118	1.63
105	LC-23	Landscape Corridor (MDR-5)	0.738	N/A	2,205	4,410	2.5	J-93	J-93	1.53
106	LC-24	Landscape Corridor (MDR-6)	0.809	N/A	2,417	4,835	2.7	J-117	J-117	1.68
107	LC-25	Landscape Corridor (MDR-7)	1.608	N/A	4,805	9,609	5.4	J-76	J-76	3.34
108	LC-26	Landscape Corridor (MDR-9)	1.598	N/A	4,775	9,550	5.3	J-23	J-23	3.32
109	LC-27	Landscape Corridor (MDR-10)	1.94	N/A	5,797	11,593	6.5	J-86	J-86	4.03
110	LC-28	Landscape Corridor (MDR-11)	2.466	N/A	7,368	14,737	8.3	J-76	J-76	5.12
111	LC-29	Landscape Corridor (MDR-12)	0.649	N/A	1,939	3,878	2.2	J-72	J-72	1.35
112	LC-30	Landscape Corridor (MDR-13)	0.427	N/A	1,276	2,552	1.4	J-21	J-21	0.89
113	LC-31	Landscape Corridor (MDR-14)	0.591	N/A	1,766	3,532	2.0	J-4	J-4	1.23
114	LC-32	Landscape Corridor (OS-1)	0.121	N/A	362	723	0.4	J-41	J-41	0.25
115	LC-33	Landscape Corridor (OS-2)	0.023	N/A	69	137	0.1	J-115	J-115	0.05
116	LC-34	Landscape Corridor (OS-3)	0.174	N/A	520	1,040	0.6	J-36	J-36	0.36
117	LC-35	Landscape Corridor (OS-4a)	0.142	N/A	424	849	0.5	J-92	J-92	0.29
118	LC-36	Landscape Corridor (OS-4b)	0.255	N/A	762	1,524	0.9	J-89	J-89	0.53
119	LC-37	Landscape Corridor (OS-5)	0.205	N/A	613	1,225	0.7	J-89	J-89	0.43
120	LC-38	Landscape Corridor (OS-6b)	0.276	N/A	825	1,649	0.9	J-108/ J-114	J-108/ J-114	0.57
121	LC-39	Landscape Corridor (OS-6c)	0.191	N/A	571	1,141	0.6	J-107	J-107	0.40
122	LC-40	Landscape Corridor (OS-7a)	0.765	N/A	2,286	4,572	2.6	J-48	J-48	1.59
123	LC-41	Landscape Corridor (OS-7b)	0.141	N/A	421	843	0.5	J-46	J-46	0.29
124	LC-42	Landscape Corridor (OS-8a)	0.783	N/A	2,340	4,679	2.6	J-34	J-34	1.62
125	LC-43	Landscape Corridor (OS-8b)	0.065	N/A	194	388	0.2	J-36	J-36	0.13
126	LC-44	Landscape Corridor (OS-8c)	0.116	N/A	347	693	0.4	J-33	J-33	0.24
127	LC-45	Landscape Corridor (OS-8d)	0.238	N/A	711	1,422	0.8	J-32	J-32	0.49
128	LC-46	Landscape Corridor (OS-9)	0.205	N/A	613	1,225	0.7	J-32	J-32	0.43
129	LC-47	Landscape Corridor (OS-11)	0.835	N/A	2,495	4,990	2.8	J-80	J-80	1.73
130	LC-48	Landscape Corridor (OS-12)	0.874	N/A	2,612	5,223	2.9	J-80	J-80	1.81
131	LC-49	Landscape Corridor (OS-13)	0.623	N/A	1,862	3,723	2.1	J-14	J-155	1.29
132	LC-50	Landscape Corridor (OS-14)	0.686	N/A	2,050	4,100	2.3	J-14	J-14	1.42
133	LC-51	Landscape Corridor (OS-16)	0.129	N/A	385	771	0.4	J-6	J-6	0.27
134	LC-52	Landscape Corridor (PQP-1)	0.531	N/A	1,587	3,173	1.8	J-117	J-117	1.10
135	LC-53	Landscape Corridor (PQP-3)	0.208	N/A	622	1,243	0.7	J-116	J-116	0.43
136	LC-54	Landscape Corridor (PQP-4)	0.131	N/A	391	783	0.4	J-115	J-115	0.27
137	LC-55	Landscape Corridor (PQP-7)	0.329	N/A	983	1,966	1.1	J-111	J-111	0.68
138	P-1	Paseo (MDR-2)	0.25	N/A	747	1,494	0.8	J-96	J-96	0.52
139	P-2	Paseo (LDR-2)	0.52	N/A	1,554	3,108	1.7	J-96	J-96	1.08
140	P-3	Paseo (MDR-5)	0.35	N/A	1,046	2,092	1.2	J-96	J-96	0.73
141	P-4	Paseo (LDR-3)	1.13	N/A	3,376	6,753	3.8	J-97	J-97	2.34
142	P-5	Paseo (LDR-5)	0.56	N/A	1,673	3,347	1.9	J-97	J-97	1.16
143	P-6	Paseo (MDR-3)	1.28	N/A	3,825	7,649	4.3	J-100	J-100	2.66
144	P-7	Paseo (MDR-6)	0.84	N/A	2,510	5,020	2.8	J-100	J-100	1.74
145	P-8	Paseo (HDR-1)	0.45	N/A	1,345	2,689	1.5	J-149	J-149	0.93
146	P-9a	Paseo (PQP-1)	0.31	N/A	926	1,853	1.0	J-149	J-149	0.64
147	P-9b	Paseo (PQP-2)	0.33	N/A	986	1,972	1.1	J-102	J-102	0.68
148	P-10	Paseo (MDR-4)	1.33	N/A	3,974	7,948	4.5	J-102	J-102	2.76
149	P-11	Paseo (OS-2)	0.54	N/A	1,614	3,227	1.8	J-103	J-103	1.12
150	P-12a	Paseo (LDR-4)	0.7	N/A	2,092	4,183	2.3	J-103	J-103	1.45
151	P-12b	Paseo (OS-1)	0.18	N/A	538	1,076	0.6	J-104	J-104	0.37
152	P-13	Paseo (LDR-7)	0.31	N/A	926	1,853	1.0	J-104	J-104	0.64
153	P-14a	Paseo (LDR-7)	1.16	N/A	3,466	6,932	3.9	J-40	J-40	2.41
154	P-14b	Paseo (OS-2)	0.14	N/A	418	837	0.5	J-39	J-39	0.29
155	P-14c	Paseo (LDR-6)	0.15	N/A	448	896	0.5	J-38	J-38	0.31
156	P-15	Paseo (LDR-8)	0.31	N/A	926	1,853	1.0	J-40	J-40	0.64
157	P-16	Paseo (OS-3)	0.25	N/A	747	1,494	0.8	J-39	J-39	0.52
158	P-17	Paseo (OS-7a)	0.07	N/A	209	418	0.2	J-38	J-38	0.15
159	P-18	Paseo (OS-8b)	0.2	N/A	598	1,195	0.7	J-45	J-45	0.42
160	P-19	Paseo (OS-7b	0.19	N/A	568	1,135	0.6	J-45	J-45	0.39
161	P-20	Paseo (HDR-4)	0.83	N/A	2,480	4,960	2.8	J-44	J-44	1.72
162	P-21	Paseo (MDR-8)	1.4	N/A	4,183	8,366	4.7	J-44	J-44	2.91
163	P-22	Paseo (MDR-9)	0.26	N/A	777	1,554	0.9	J-43	J-43	0.54
164	P-23	Paseo (CC (CMU-2)	0.24	N/A	717	1,434	0.8	J-42	J-42	0.50
165	P-24	Paseo (CC (CMU-1)	0.3	N/A	896	1,793	1.0	J-42	J-42	0.62
166	P-25	Paseo (MDR-13)	1.85	N/A	5,528	11,056	6.2	J-19	J-19	3.84
167	P-26	Paseo (HDR-6)	0.91	N/A	2,719	5,438	3.0	J-19	J-19	1.89
168	P-27	Paseo (LDR-20b)	0.43	N/A	1,285	2,570	1.4	J-16	J-16	0.89
169	P-28	Paseo (LDR-24)	0.45	N/A	1,345	2,689	1.5	J-15	J-15	0.93
170	P-29	Paseo (OS-15b)	0.03	N/A	90	179	0.1	J-16	J-16	0.06
171	P-30	Paseo (OS-15a)	0.29	N/A	867	1,733	1.0	J-15	J-15	0.60
172	P-31	Paseo (OS-14)	0.27	N/A	807	1,614	0.9	J-14	J-14	0.56
173	P-32	Paseo (CC-4a)	0.53	N/A	1,584	3,167	1.8	J-14	J-14	1.10
174	P-33	Paseo (LDR-10)	0.89	N/A	2,659	5,319	3.0	J-30	J-30	1.85
175	P-34	Paseo (HDR-3)	0.44	N/A	1,315	2,629	1.5	J-30	J-30	0.91
176	P-35	Paseo (OS-9)	0.18	N/A	538	1,076	0.6	J-29	J-29	0.37
177	P-36	Paseo (OS-10)	0.19	N/A	568	1,135	0.6	J-29	J-29	0.39
178	P-37	Paseo (OS-8d)	0.04	N/A	120	239	0.1	J-27	J-27	0.08
179	P-38	Paseo (LDR-15)	0.89	N/A	2,659	5,319	3.0	J-24	J-24	1.85
180	P-39	Paseo (MDR-9)	0.32	N/A	956	1,912	1.1	J-9	J-9	0.66
181	P-40	Paseo (LDR-21)	1.43	N/A	4,273	8,546	4.8	J-8	J-8	2.97
182	P-41	Paseo (LDR-22)	0.57	N/A	1,703	3,406	1.9	J-8	J-8	1.18
183	P-42	Paseo (OS-16)	0.24	N/A	717	1,434	0.8	J-6	J-6	0.50

Sierra Vista Potable Water Demand Detail

No.	Parcel ID	Area Description	Total Acreage	Dwelling Units	Average Day Demand	Max Day Demand	Annual Demand	Junction IDs		Average Demand
					(GPD)	(GPD)	(AFY)	(A) Alts	(B) Alts	(GPM)
184	P-43	Paseo (OS-15c)	0.37	N/A	1,106	2,211	1.2	J-4	J-4	0.77
185	P-44	Paseo (MDR-14)	0.32	N/A	956	1,912	1.1	J-4	J-4	0.66
186	P-45	Paseo (OS-15d)	0.03	N/A	90	179	0.1	J-3	J-3	0.06
187	P-46	Paseo (CC-5)	0.42	N/A	1,255	2,510	1.4	J-3	J-3	0.87
188	P-47	Paseo (CC-4b)	0.41	N/A	1,225	2,450	1.4	J-3	J-3	0.85
	Total Base SVSP		**2064.1**	**6,655**	**3,815,802**	**7,631,604**	**4,274.2**			**6,260.6**

SVSP Base plus UR Land Uses

No.	Parcel ID	Area Description	Total Acreage	Dwelling Units	Average Day Demand	Max Day Demand	Annual Demand	Junction IDs		Average Demand
					(GPD)	(GPD)	(AFY)	(A) Alts	(B) Alts	(GPM)
189	LDR-Chan	Low Density Residential	28.6	143	85,800	171,600	96.1	J-131	J-131	59.58
190	LDR-1	Low Density Residential	37.5	187	112,200	224,400	125.7	J-138	J-138	77.92
191	LDR-2	Low Density Residential	31.4	157	94,200	188,400	105.5	J-129/ J-124	J-129/ J-124	65.42
192	LDR-3	Low Density Residential	23.7	118	70,800	141,600	79.3	J-144/ J-143	J-144/ J-143	49.17
193	LDR-4	Low Density Residential	15.9	79	47,400	94,800	53.1	J-124	J-124	32.92
194	MDR-1	Medium Density Residential	9.5	85	27,455	54,910	30.8	J-145	J-145	19.07
195	MDR-2	Medium Density Residential	28.2	253	81,719	163,438	91.5	J-139/ J-125	J-139/ J-125	56.75
196	MDR-3	Medium Density Residential	20	179	57,817	115,634	64.8	J-128	J-128	40.15
197	MDR-5	Medium Density Residential	9.7	87	28,101	56,202	31.5	J-131/ J-145	J-131/ J-145	19.51
198	MDR-6	Medium Density Residential	16.7	150	48,450	96,900	54.3	J-141/ J-120	J-141/ J-120	33.65
199	MDR-7	Medium Density Residential	8.4	75	24,225	48,450	27.1	J-123	J-123	16.82
200	HDR-1	High Density Residential	14.5	290	51,330	102,660	57.5	J-137	J-137	35.65
201	HDR-2	High Density Residential	12.3	246	43,542	87,084	48.8	J-133	J-133	30.24
202	HDR-3	High Density Residential	17.5	350	61,950	123,900	69.4	J-126/ J-122	J-126/ J-122	43.02
203	CMU-1	Commercial Mixed Use	6.4	42	24,061	48,122	27.0	J-136	J-136	16.71
204	CMU-5	Commercial Mixed Use	6.9	50	26,776	53,552	30.0	J-120/ J-122	J-120/ J-122	18.59
205	PR-1	Park	10	N/A	29,880	59,760	33.5	J-144	J-144	20.75
206	PR-2	Park	8	N/A	23,904	47,808	26.8	J-123	J-123	16.60
207	PQP-2	Public/Quasi Public (El Sch)	10	N/A	34,540	69,080	38.7	J-143	J-143	23.99
208	CC-1	Communiy Commercial	19.7	N/A	51,181	102,361	57.3	J-137/ J-134	J-137/ J-134	35.54
209	CC-2	Communiy Commercial	13.6	N/A	35,333	70,666	39.6	J-126/ J-140	J-126/ J-140	24.54
210	CC-3	Communiy Commercial	2.4	N/A	6,235	12,470	7.0	J-133	J-133	4.33
211	CC-4	Communiy Commercial	2	N/A	5,196	10,392	5.8	J-131	J-131	3.61
212	LC-1	Landscape Corridor (LDR-1)	1.6	N/A	4,888	9,777	5.5	J-138	J-138	3.39
213	LC-2	Landscape Corridor (LDR-2)	0.7	N/A	1,960	3,920	2.2	J-129	J-129	1.36
214	LC-3	Landscape Corridor (MDR-1)	0.3	N/A	849	1,697	1.0	J-145	J-145	0.59
215	LC-4	Landscape Corridor (MDR-2)	1.2	N/A	3,711	7,422	4.2	J-139/ J-125	J-139/ J-125	2.58
216	LC-5	Landscape Corridor (MDR-3)	1.0	N/A	2,931	5,862	3.3	J-128	J-128	2.04
217	LC-6	Landscape Corridor (MDR-4)	2.0	N/A	6,096	12,191	6.8	J-134	J-134	4.23
218	LC-7	Landscape Corridor (MDR-5)	0.9	N/A	2,689	5,378	3.0	J-131	J-131	1.87
219	LC-8	Landscape Corridor (MDR-6)	0.6	N/A	1,891	3,783	2.1	J-120	J-120	1.31
220	LC-9	Landscape Corridor (OS-1)	0.3	N/A	887	1,775	1.0	J-135	J-135	0.62
221	LC-10	Landscape Corridor (PQP-1)	0.2	N/A	684	1,369	0.8	J-135	J-135	0.48
222	LC-11	Landscape Corridor (CMU-1)	1.1	N/A	3,143	6,287	3.5	J-136	J-136	2.18
223	LC-12	Landscape Corridor (CMU-5)	0.6	N/A	1,847	3,693	2.1	J-120	J-120	1.28
224	LC-13	Landscape Corridor (CC-1)	1.8	N/A	5,331	10,661	6.0	J-136	J-136	3.70
225	LC-14	Landscape Corridor (CC-2)	1.7	N/A	5,056	10,111	5.7	J-126	J-126	3.51
226	LC-15	Landscape Corridor (CC-3)	0.7	N/A	2,235	4,470	2.5	J-133	J-133	1.55
227	LC-16	Landscape Corridor (CC-4)	0.5	N/A	1,437	2,874	1.6	J-131	J-131	1.00
	Total SVSP Base plus UR		**427.7**	**2,491**	**1,117,731**	**2,235,461**	**1,252.0**			**776.2**
	Total SVSP Base + SVSP Base plus UR		**2064.1**	**9,146**	**4,933,533**	**9,867,065**	**5,526.3**			**7,036.8**

Notes:

1. PQP-5 and PQP-9 are modeled with an additional 1805.56 gpm demand with no diurnal flow pattern to simulate filling of the 2.6 MG ASR wells.
2. Parcels with multiple model junctions listed were assumed to be served from two points of connection, located on adjacent major right of ways.
3. The total acreage for SVSP Base plus UR is equal to the SVSP Base acreage due to the development of the UR parcels located within the SVSP Base.
4. Average demand includes flows from the wells, but excludes flow available to PCWA. This is because the PCWA demands are on separate junctions in the A and B alts.
5. Average demands are placed on the junction ID specified, except when there are multiple junctions. In that situation, the average demand is assigned to each junction equally.

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HYDROSCIENCE ENGINEERS, INC. (HSe) is a civil and environmental engineering firm that plans, designs, and manages the construction of water, wastewater, and recycled water projects. With offices in Sacramento, Napa, Stockton, and San Jose, we understand and address the complex water needs of California.

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HydroScience Engineers

APPENDIX H-2

ATTACHMENT 3
SIERRA VISTA SPECIFIC PLAN
WATER CONSERVATION PLAN

Technical Memorandum

HydroScience Engineers, Inc.

To: Jeff Jones

From: Michael Hyatt

Reviewed by: Curtis Lam

Subject: TM #1 - Sierra Vista Specific Plan Water Conservation Plan

Date: July 6, 2009

Introduction

HydroScience Engineers (HSe) was retained by the Sierra Vista Owners Group to prepare a Water Conservation Plan (WCP) for the Sierra Vista Specific Plan (SVSP). The City of Roseville (City) has requested that the SVSP incorporate water conservation measures into the design of the SVSP that reduce the overall water demands for the combination of potable and/or recycled water.

There are no specific water conservation requirements or guidance beyond those in the building or plumbing codes in California. There are a wide number of methods for increasing water use efficiency that could be feasible for this project. This technical memorandum presents potentially feasible efforts and planning approaches to reduce SVSP water usage to meet the City's request. The potential reduction in demand for several of these methods is presented in this memorandum. This is done in the followings steps:

- Develop a baseline water use inventory for the project;
- Identify and describe methods for reducing water consumption; and
- Estimate the reduction in water demand using the recommended measures.

The scenario evaluated in this Technical Memorandum was the SVSP Base scenario, which excludes the Chan and Richland parcels.

Baseline Water Use

The baseline water use for the project was established using the City's standard water use factors. These water use factors are based on historic data and water use trends developed by MWH in TM #1 (MWH, 2002). These factors are presented in **Table 1.** The water use factors used in the SVSP Potable Water Master Plan were set to match these values.

Table 1: Water Use Factors and Demands

Land Use Designation	Abbreviation	Total Area (acres)	Dwelling Units	Water Use Factor[1]	Annual Demand[(2)] (AFY)
Residential					
Low Density Residential	LDR	502.4	2,524	varies	1,684
Medium Density Residential	MDR	250	2,221	323 gpd/DU	818
High Density Residential	HDR	67.9	1,650	177 gpd/DU	327
Non-Residential					
Commercial Mixed Use	CC (CMU)	32	255	177 gpd/DU + 2,598 gpd/acre	144
Park	PR	90.6	-	2,988 gpd/acre	303
Open Space	OS	256.6	-	0 gpd/acre	0
Public/Quasi-Public (all)	P/QP	57.5	-	varies	213
Community Commercial	CC	141.7	-	2,598 gpd/acre	412
Commercial/ Business Park	CC/BP	24.5	-	2,598 gpd/acre	71
Landscape Corridor	LC	70.1	-	2,988 gpd/acre	235
Paseo	P	13.9	-	2,988 gpd/acre	47
Urban Reserve	UR	432.2	-	-	0
Major Roads	ROW	124.7	-	-	0
Subtotals		**+/- 2064**	**6,650**		**4,254**

Notes:
1. Demand use factors are based on the MWH TM1 "Conservative Scenario" (MWH, 2002)
2. Annual demand based on the SVSP Base land use plan, updated July 1, 2009.

Water usage in residential areas is considerably different from that in non-residential areas. For residential areas that have water use factors based on dwelling units, the base usage rate described above in **Table 1** was divided into a number of categories based on typical patterns of water use in a residential area as presented in **Table 2**. This typical water usage information was taken from the City of Roseville FAQ's regarding water conservation (http://www.roseville.ca.us/faqs/categoryqna.asp?id=7#790). This estimate was used to quantify the impact of various conservation measures would have on the Project's water demand.

Table 2: Typical Residential Water Usage

Use	Percent of Total Use[1]
Landscaping	51%
Toilets	13%
Faucets, cooking, cleaning	10%
Shower	9%
Clothes washer	8%
Bath	6%
Toilet leaks	2%
Dishwasher	1%

Notes:
1. Typical water usage based on information in the City of Roseville FAQs regarding water conservation - http://www.roseville.ca.us/faqs/categoryqna.asp?id=7#790

For single-family residences, the water demand for landscaping was split between the front and back of the residence. It was assumed that 60% of the demand would be in the back and 40% would be in the front. This division of landscaping between the front and back yards was estimated with greater demand in the back yard than the front yard due to driveways limiting the irrigation in a typical front yard.

This assumption established the base front yard demand of 20.4% of total residential water usage and the base backyard demand of 30.6% of total residential water usage. This baseline water use data can be seen in **Table 3.**

Table 3: Residential Base Water Use

Land Use Designation	Annual Demand (AFY)	Annual Front Yard Demand (AFY)	Annual Back Yard Demand (AFY)
Low Density Residential	1,684	344	515
Medium Density Residential	818	167	250
High Density Residential	327	63	100
Sub-Total	**2,829**	**574**	**865**

Water demands were separated for the front and back yards to allow for different conservation measures in each. Steps like limiting turf in the front yards may not necessarily be feasible in the back yard.

Methods for Reducing Water Consumption

Methods that could be used in combination to reduce the SVSP Base water consumption by an estimated 20% are presented below.

Limiting the amount of turf in front yards and replacing turf with low water use plantings: One of the simplest and most effective ways to conserve water is to limit the area of turf being irrigated or exchanging higher water use plant materials such as turf for lower water using plant materials. There are a number of plantings that can be used that dramatically reduce water demand when they replace turf. The actual demand for these plantings will depend on the individual species planted. Data provided by the City of Roseville water conservation staff indicates replacing turf with low water use plantings could yield a 70% savings as compared to irrigation of turf.

Residential: It was assumed that replacing turf with low water use plantings could be accomplished on all types of residential property, including low, medium, and high-density residential parcels. In order to assess the potential impact of this change on residential parcels, the following assumptions were made:

- When accounting for driveways and hardscape areas, the landscaped area in the front yard represents 70% of the front yard area. This area would be reduced 42% of the front yard.
- The remaining 28% of the front yard landscaped area will be planted with low water using materials. This results in the following front yard areas: 30% hardscape (driveway, paths), 42% turf, 28% low water use plantings.
- For the Roseville area, low water usage materials on average use 30% of water used on turf (a 70% water savings). This is based on estimates by the Fair Oaks Horticultural Center (Garden Notes, June 2008), that low water use plantings use between 65-75% less water than an average lawn (i.e. turf).
- Low water usage areas will utilize low volume irrigation systems like a drip or micro spray system design to achieve uniformity of 90% rather than an overhead spray irrigation system.

Table 4 presents the results of the residential water savings for replacing landscape turf.

Table 4: Reduced Landscape Turf Water Savings

Land Use Designation	Annual Front Yard Demand[2] (AFY)	Base Turf Area[1]	New Turf Area[1]	Low Water Use Area[1]	Reduced Annual Front Yard Demand (AFY)	Water Savings for Reduced Turf (AFY)
Low Density Residential	344	70%	42%	28%	248	**96**
Medium Density Residential	167	70%	42%	28%	120	**47**
High Density Residential	63	70%	42%	28%	45	**18**
Sub-Total	**573**				**412**	**161**

Notes:
1. As a percentage of the front yard.
2. From Table 3.

It was noted that high-density residential land uses would be irrigated with recycled water, and would conserve recycled water.

As an example of how these values were calculated, the calculation for the reduced annual front yard demand is presented below. For the low-density residential land uses, reducing the initial turf area from 70% to 42% and replacing that area (28%) with low water use plantings resulted in the following annual demands.

$$344 AFY * \left(\frac{42\%}{70\%} + \frac{28\% * 30\%}{70\%} \right) = 248 AFY$$

Non-Residential: Turf reduction on non-residential parcels within the SVSP was assumed to be employed in the parks, paseos, and landscape corridors. The assumptions utilized to estimate water conservation in these areas are as follows:

- Parks were assumed to use 98% of all water for landscape irrigation.
- Parks were estimated to irrigated approximately 80% of their parcel area. It was assumed the 80% turf would be reduced to 60%, with the remaining 20% turf being converted to low water use plantings.
- Both landscape corridors and paseos are assumed to use 100% of their water for landscape irrigation.
- Both landscape corridors and paseos were assumed to irrigate approximately 80% of their parcel area with turf. This was reduced to 30% turf and 50% low water use plantings.
- For the Roseville area, low water usage plantings were assumed to average use 30% of water used on turf (a 70% water savings).
- Low water usage areas will utilize low volume irrigation systems like a drip or micro spray system design to achieve uniformity of 90% rather than an overhead spray irrigation system.

Table 5 presents the results of the non-residential water savings for replacing landscape turf.

Table 5: Reduced Landscape Turf Water Savings

Land Use Designation	Annual Irrigation Demand[2] (AFY)	Base Turf Area[1]	New Turf Area[1]	Low Water Use Area[1]	Reduced Irrigation Demand (AFY)	Water Savings for Reduced Turf (AFY)
Parks	297	80%	60%	20%	245	**52**
Paseos	47	80%	30%	50%	26	**21**
Landscape Corridors	235	80%	30%	50%	132	**103**
Sub-Total	**579**				**403**	**176**

Notes:
1. As a percentage of the front yard.
2. This incorporates the reduction in water demand to account for only the fraction used for irrigation of parks described above.

Smart Irrigation Controller: A smart irrigation controller restricts irrigation to only the times and water application rates that are really needed. Demand for water varies greatly with weather patterns and time of year. Standard irrigation schedules do not account for actual weather conditions during the day, week, or month that could vary significantly from normal weather patterns. This deviation can result in significant water waste. A smart irrigation controller can account for these variations by using information for both weather and soil moisture conditions.

Fourteen studies estimating the percentage of water conservation associated with the use of smart irrigation controllers were summarized in a paper published by the US Bureau of Reclamation (USBR, April 2008). These studies estimated the range of water savings associated with their use to be between 7-41%. This document instead uses a value of 20% for the estimate of water savings from the use of smart irrigation controllers.

It was noted that the references estimated water savings when going from one type of controller to the smart irrigation controller. However, not all houses have controllers for both the front and back yards. Some existing houses use impact heads connected to a hose to irrigate their front or back yards. This irrigation method is less efficient and results in higher water waste. Considering these issues, the percent of water savings for this measure was increased to 20%.

The additional savings expected with the use of a smart irrigation controller are presented in **Table 6.** All of the land using turf reduction measures would also employ smart irrigation controllers. These calculations assume that the area of turf is reduced as described above.

Table 6: Smart Irrigation Controller Water Savings

Land Use Designation	Original Demand (AFY)	Reduced Demand (AFY)	Water Savings (AFY)
Low Density Residential			
Front Yard	249	199	50
Back Yard	519	415	104
Medium Density Residential			
Front Yard	118	94	24
Back Yard	246	197	49
High Density Residential			
Front Yard	45	36	9
Back Yard	100	80	20
Parks	245	196	49
Paseo	26	21	5
Landscape Corridors	132	106	26
Sub-Total	**1,680**	**1,344**	**336**

Notes:
1. Original demand includes the turf reduction water conservation measures that were previously described.

As an example, for the low density residential front yards, the annual demand is 249 AFY. Assuming that this demand is reduced by 20% when using smart irrigation controllers, the reduced demand is estimated to be:

$$249 AFY * (80\%) = 199 AFY$$

Recirculating hot water: Recirculating hot water systems use a pump to keep the water in the hot water lines circulating back to the water heater to keep the water in the hot water lines hot. This provides hot water at the tap immediately and prevents having to let cold water flow until the water heats up. These systems can be operated in a number of different ways but all conserve water in the same manner. For this study, it was estimated that each draw for hot water would waste approximately 1.25 gallons per day. This is equivalent drawing water through 50 ft of ¾" pipe with each draw, and drawing hot water in this manner six times per day per dwelling unit. The expected savings are presented in **Table 7.**

Table 7: Re-circulating Hot Water Savings

Land Use Designation	Dwelling Units (DU)	Water Savings for Recirculating Hot Water (AFY)
Low Density Residential	2,524	**21**
Medium Density Residential	2,221	**19**
High Density Residential	1,650	**14**
Commercial Mixed Use	255	**2**
Sub-Total	**6,650**	**56**

As an example, for the low density residential, the total number of dwelling units is 2,524. The reduced water demand would be estimated to be:

$$2{,}524 DU * 7.5 \frac{gal}{day} * \frac{AF}{325{,}851 gal} * 365 day / yr = 21 AFY$$

Summary

The total volume of water conservation estimated when implementing these water conservation measures for the SVSP Base land use plan is summarized in **Table 8**. This volume of water conservation includes both conservation of potable and recycled water.

Table 8: Water Conservation Estimate

Method	Water Savings (AFY)	Percentage Reduction[1]
Reduced landscape turf – residential front yards	161	3.8%
Reduced landscape turf – parks, paseos, landscape corridors	176	4.1%
Smart irrigation controllers – all types of land uses	336	7.9%
Re-circulating hot water – residential	56	1.3%
Total	**729**	**17.1%**

Notes:
1. Percentages rounded to two significant figures.

If the described water conservation were taken for the SVSP Base and resulted in the water conservation measures described in this memorandum, it is estimated that the SVSP Base overall water demand would be reduced by 729 AFY to 3,523 AFY. This would represent a 17.1% reduction from the original water demand for the SVSP Base of 4,252 AFY. This water savings does not include the use of recycled water in the SVSP Base.

Though the actual water conservation realized will depend in part on the participation of the homeowners or tenants of the affected parcels, it is expected that these measures could be implemented and maintained in the long run by employing the following measures:

- Constructing the parcels with these water conservation measures in place. By simply having an available smart irrigation controller, using this controller is a financially sound decision for the land owner versus replacing the controller with a different one.
- Landscape areas for non-single family land uses will be maintained by the City, the applicable school district, commercial owners or a homeowners association. It is expected that these professionals will be able to maintain these water savings through the professional management of these landscapes.
- For single family residences, it is expected that a two-fold measure will be required to realize long-term water savings.
    1. Restrictions in the codes, covenants and restrictions for each parcel that would limit the types and/or locations of landscape in the front yards of each residence.
    2. 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 SVSP landowners by City staff, the promotion of the City's water conservation website, and the availability of City water conservation staff to respond to specific questions.

3. Educating homeowners on how to use and set up their smart irrigation controllers, and how to add onto it for their backyard irrigation.

References

1. HydroScience Engineers Sierra Vista Potable Water Master Plan, April 2009.
2. HydroScience Engineers Sierra Vista Recycled Water Master Plan, April 2009.
3. Mackay & Somps Civil Engineering, Inc. *Sierra Vista Land Use Plan DRAFT,* January 22, 2009.
4. MWH, Technical Memorandum 1; Unit Water Demand Factor Revision, November 6, 2002.
5. University of California Cooperative Extension, Sacramento County Agriculture and Natural Resources, Garden Notes, June 2008.
6. US Bureau of Reclamation, Summary of Smart Controller Water Savings Studies, April 2008.

APPENDIX H-2

ATTACHMENT 4
SIERRA VISTA RECYCLED WATER MASTER PLAN WITH ADDENDUM

Technical Memorandum

HydroScience Engineers, Inc.

To: Kelye McKinney

From: Kyle Horn

Reviewed by: Curtis Lam

CC: Jeff Jones, Mark Sauer, Mike Smith

Subject: Sierra Vista Specific Plan (SVSP), Recycled Water Master Plan Addendum #1

Date: July 10, 2009

This document updates the June 2009 Sierra Vista Specific Plan (SVSP) Recycled Water Master Plan to reflect the changes to the SVSP Land Use Plan update dated July 1, 2009. The following table summarizes the changes to the document. Text formatted in **bold** reflects the updated portion of text. Updated text in the attached tables is also bolded, along with other numbers that were formatted in bold in the original table.

Page	Document Change
Figure 1-2	Figure 1-2 (attached) reflects the July 1, 2009 SVSP land use plan
Figures 2-1, 2-2, and 2-3	Recycled water distribution pipes shown in Figures 2-1, 2-2,and 2-3 do not reflect the changes due to the revised land use plan. The new SVSP recycled water distribution system is shown in the new Figures 4-2 and 4-3.
P. 13, ¶ 5-7	Revise text to read: "**Table 3-1** and **Table 3-2** contain a summary of the recycled water market assessment grouped by land use designation, and each includes the percentage of each area irrigated with recycled water. These percentages were used to develop recycled water demands for both options. The tables show the relative magnitude of the various customers within the SVSP likely to use recycled water **both with and without the water conservation measures**. A detailed breakdown of each individual site and demand is attached as **Appendix B**. The total area within the SVSP to be irrigated with recycled water is approximately **239.1** acres for the SVSP Base option and **289.1** for the SVSP Base plus UR option. The SVSP base option identifies **135** unique land use areas as potential recycled water users, with an overall average annual recycled water demand of approximately **865 AFY, or 563 AFY with water conservation measures employed.**"
P. 14, ¶ 1	Revise text to read: "The SVSP Base plus UR option identifies 29 additional land use areas as potential recycled water users, resulting in a total of **164** land use areas with the SVSP. Combined, these areas have an overall average annual recycled water demand of approximately **1,046 AFY, or 680 AFY with water conservation measures employed.** The City has directed the SVSP to employ the water conservation measures to reduce recycled water usage in the SVSP. Thus, this report assumes from this point forward that the SVSP recycled water demands are those that assume water conservation is employed as specified in the SVSP Water Conservation Plan (HSe, July 2009).
P. 14, Table 3-1	Replace Table 3-1 with the attached Table 3-1
P. 15, Table 3-2	Replace Table 3-2 with the attached Table 3-2

Page	Document Change
P. 15, ¶ 2	Revise Section 3.2 to read as follows: **"The ADWF from the SVSP Base is estimated to be approximately 1.37 MGD (MacKay and Somps, 2009). The SVSP Base peak month recycled water demand is estimated to be 1.29 MGD. Thus, no supplemental water supply source is required for the SVSP Base.** **The ADWF from the SVSP Base plus UR is estimated to be approximately 2.39 MGD (Mackay and Somps, 2009). The SVSP Base peak month recycled water demand is estimated to be 1.56 MGD. Thus, no supplemental water supply source is required for the SVSP Base plus UR."** Also, Tables 3-3 and 3-4 are deleted.
P. 17, Section 3.3 (all)	Replace Section 3.3 to read as follows: **"Since the recycled water demand for the SVSP Base and SVSP Base plus UR with water conservation is less than what was evaluated in TM 5b, Alternatives Development and Evaluation for Recycled Water Distribution System, of the South Placer Regional Wastewater and Recycled Water Systems Evaluation Project, the recommended diurnal recycled supply scenarios from that technical memorandum would continue to apply with the following modifications:** • **The amount of recycled water supplied by the PGWWTP for the purposes of meeting SVSP recycled water demands would be reduced to the SVSP recycled water demands presented in this report.** • **Recycled water deliveries for the SVSP would be delivered instead to the West Roseville Recycled Water Storage Tank and Pump Station for conveyance to the SVSP."** Also, Table 3-5 is deleted.
Figure 4-1	Figure 4-1 (attached) reflects the changes to the SVSP Base distribution system due to the July 1, 2009 SVSP land use plan
Figure 4-2	Figure 4-2 (attached) reflects the changes to the SVSP Base plus UR distribution system due to the July 1,2009 SVSP land use plan
P. 22, Table 4-1	Replace Table 4-1 with the attached Table 4-1
P. 23, ¶ 2	Revise text to read: "The minimum capacity of the new WRSP storage tank to store recycled water required for the SVSP would be approximately **1.50** MG for the SVSP Base scenario and **1.82** MG for the SVSP Base plus UR scenario. This is equivalent to one peak day of the recycled water demand specified in Section 3.1, plus a 20% safety factor. This tank size would provide the City with the flexibility to provide recycled water at any time of the day without having to maintain flow at a constant rate for any specified amount of time."
P. 23, Table 4-2	Replace Table 4-2 with the attached Table 4-2
P. 23, 2nd Bullet	SVSP Base plus UR (~**4,400** gpm peak hour) or SVSP Base (~**3,600** gpm peak hour) [2];

Page	Document Change
P. 25, ¶ 1 and 2	Replace paragraphs 1 and 2 with the following text: **"This would result in a peak hour capacity of approximately 14,000 gpm. This capacity is sufficient to meet the peak hour demand of both the SVSP and the WRSP, plus the additional demands from the WRSP described in TM 5b. It is expected that upgrading the existing pump station would have a significantly lower construction cost than constructing an entirely new pump station.** **The preferred course of action is to expand the capacity of the existing pump station to meet the additional needs of the SVSP. If it is determined that the pumps cannot be cost-effectively replaced within the existing WRSP, a new pump station will need to be constructed. It is also expected that a new control strategy that accommodates the SVSP will be part of the design."**
Figure 4-3	New recycled water tank shown in Figure 4-3 will be **1.82 MG**
P. 27, 2nd bullet	Replace last sentence to read: **"…The resulting peak day demand for the SVSP Base is 1.29 MGD and 1.56 MGD for the SVSP Base plus UR."**
P, 27, 3rd bullet	Replace bullet to read: **"Recycled Water Availability. Based on the ADWF and peak month recycled water demand, there is adequate recycled water available to supply the SVSP Base and SVSP Base plus UR. No supplemental water supply is required."**
P. 27, 4th bullet	Delete this bullet
P. 27, Section 5.2, 1st bullet	Replace text as follows: …"**A 1.82 or 1.50 MG tank**…"
P. 28, first bullet	Replace text as follows: **"Upgrade the existing WRSP recycled water pump station. The upgraded WRSP pump station will need to have the ability to pump WRSP flows, other flows as documented in TM 5b, as well as an additional 4,400 gpm (~11,900 gpm total) for the SVSP Base plus UR or 3,600 gpm (11,100 gpm) for the SVSP Base, both with a TDH of 215 ft."**
P. 28, Section 5.3, first bullet	Replace text as follows: **"Distribution System. Recycled water will be distributed through either a 64,100 ft (SVSP Base plus UR) or 51,600 ft (SVSP Base) SVSP distribution system…"**

Table 3-1: Recycled Water Market Assessment (Grouped by Land Use) – SVSP Base Option

Land Use Designation	Abbreviation	% Area Irrigated with Recycled Water	Total Area (Acres)	Annual Demand (AFY)	Annual Demand w/ Water Conservation (AFY)	Peak Day Demand (MGD)
Residential						
Low Density Residential	LDR	Not Irrigated with Recycled Water	**502.4**	0	0	0
Medium Density Residential	MDR	Not Irrigated with Recycled Water	**250**	0	0	0
High Density Residential	HDR	20%	**67.9**	**49.2**	**32.0**	**0.07**
Urban Reserve	UR	Not Irrigated with Recycled Water	**432.2**	0	0	0
Non-Residential Facilities						
Community Commercial	CC	15%	**141.7**	**76.9**	**50.0**	**0.11**
Commercial Mixed Use	CMU	15%	**32**	**17.4**	**11.3**	**0.03**
Commercial/Business Park	CC/BP	15%	**24.5**	**13.3**	**8.7**	**0.02**
Landscape Corridor	LC	85%	**70.1**	**215.6**	**140.2**	**0.32**
Paseo	PASEO	15%	**13.9**	**43.0**	**27.9**	**0.06**
Public/Quasi-Public-A[1]	P/QP-A	Not Irrigated with Recycled Water	**4.6**	0	0	0
Public/Quasi-Public-B[2]	P/QP-B	40%	**44.3**	**64.2**	**41.7**	**0.10**
Public/Quasi-Public-C[3]	P/QP-B	15%	**8.6**	**4.7**	**3.1**	**0.01**
Park	PR	75%	**90.6**	**246**	**159.9**	**0.56**
Open Space	OS	Not Irrigated with Recycled Water	**256.6**	0	0	0
Roads	ROW	30%	**124.7**	**135.3**	**88**	**0.37**
Total			**2,064.1±**	**865.6**	**562.8**	**1.29**

Notes:
1. P/QP-A includes parcels such as recycled water facilities, solid waste facilities, water treatment and supply facilities, wells, fire station, and electrical substation.
2. P/QP-B includes schools
3. P/QP-C includes the fire station and church site
4. Annual Recycled Water Demands were rounded off to the nearest AFY.

Table 3-2: Recycled Water Market Assessment (Grouped by Land Use) – SVSP Base plus UR Scenario

Land Use Designation	Abbreviation	% Area Irrigated with Recycled Water	Total Area (Acres)	Annual Demand (AFY)	Annual Demand w/ Water Conservation (AFY)	Peak Day Demand (MGD)
Residential						
Low Density Residential	LDR	Not Irrigated with Recycled Water	**639.5**	0	0	0
Medium Density Residential	MDR	Not Irrigated with Recycled Water	**342.5**	0	0	0
High Density Residential	HDR	20%	**112.2**	**81.2**	**52.8**	**0.12**
Urban Reserve	UR	Not Irrigated with Recycled Water	**18.2**	0	0	0
Non-Residential Facilities						
Community Commercial	CC	15%	**179.4**	**97.4**	**63.3**	**0.14**
Commercial Mixed Use	CMU	15%	**45.3**	**24.6**	**16.0**	**0.04**
Commercial/Business Park	CC/BP	15%	**24.5**	**13.3**	**8.7**	**0.02**
Landscape Corridor	LC	85%	**85.4**	**262.6**	**170.7**	**0.39**
Paseo	PASEO	15%	**13.9**	**43.0**	**27.9**	**0.06**
Public/Quasi-Public-A[1]	P/QP-A	Not Irrigated with Recycled Water	**6.2**	**0**	**0**	**0**
Public/Quasi-Public-B[2]	P/QP-B	40%	**54.3**	**78.6**	**51.1**	**0.12**
Public/Quasi-Public-C[3]	P/QP-B	15%	**8.6**	**4.7**	**3.1**	**0.01**
Park	PR	75%	**108.6**	**294.8**	**191.7**	**0.44**
Open Space	OS	Not Irrigated with Recycled Water	**291.0**	0	0	0
Roads	ROW	30%	**134.5**	**146.1**	**95**	**0.22**
Total			**2,064.1±**	**1,046**	**680.3**	**1.56**

Notes:
1. P/QP-A includes parcels such as recycled water facilities, solid waste facilities, water treatment and supply facilities, wells, fire station, and electrical substation.
2. P/QP-B includes schools
3. P/QP-C includes the fire station and church site
4. Annual recycled water demands were rounded off to the nearest AFY.

Table 4-1: Summary of Pipeline Infrastructure – SVSP Base and SVSP Base plus UR

Pipe Size (Diameter)	SVSP Base Total Length (ft)	SVSP Base plus UR Total Length (ft)	Difference (ft)
6-inch	**10,500**	**23,000**	12,500
8-inch	**3,800**	**3,800**	0
12-inch	**26,700**	**26,700**	0
16-inch	7,300	7,300	0
24-inch	3,300	3,300	0
30-inch	0	0	0
Total	**51,600**	**64,100**	**12,500**

Notes:
1. Pipeline total lengths were rounded to the nearest 100.

Table 4-2: Minimum Tank Specifications

Parameter	SVSP Base plus UR	SVSP Base
Tank Diameter	**98 feet**	**89 feet**
Tank Height (Maximum Level)	32 feet	32 feet
Minimum Tank Level	5.0 feet	5.0 feet
Nominal Tank Volume	**1.82 MG**	**1.50 MG**

Notes:
1. These dimensions provide the minimum storage requirement of one peak day of flow and flow assumptions for this scenario with a 20% factor of safety.

N

RICHLAND PLANNED COMMUNITIES

WEST ROSEVILLE SPECIFIC PLAN

WEST SIDE DR

PLEASANT GROVE BLVD

MARKET AVE

CHAN PROPERTY

FIDDYMENT RD

BASELINE RD

LEGEND

LDR	LOW DENSITY RESIDENTIAL
MDR	MEDIUM DENSITY RESIDENTIAL
HDR	HIGH DENSITY RESIDENTIAL
CC/CMU	COMMERCIAL MIXED USE
CC/BP	COMMERCIAL/BUSINESS PARK
CC	COMMUNITY COMMERCIAL
PQP	PUBLIC/QUASI–PUBLIC
PR	PARKS & RECREATION
OS	OPEN SPACE
UR	URBAN RESERVE
P	PASEOS

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FIGURE 1-2

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA RECYCLED WATER MASTER PLAN

LAND USE PLAN - SVSP BASE SCENARIO

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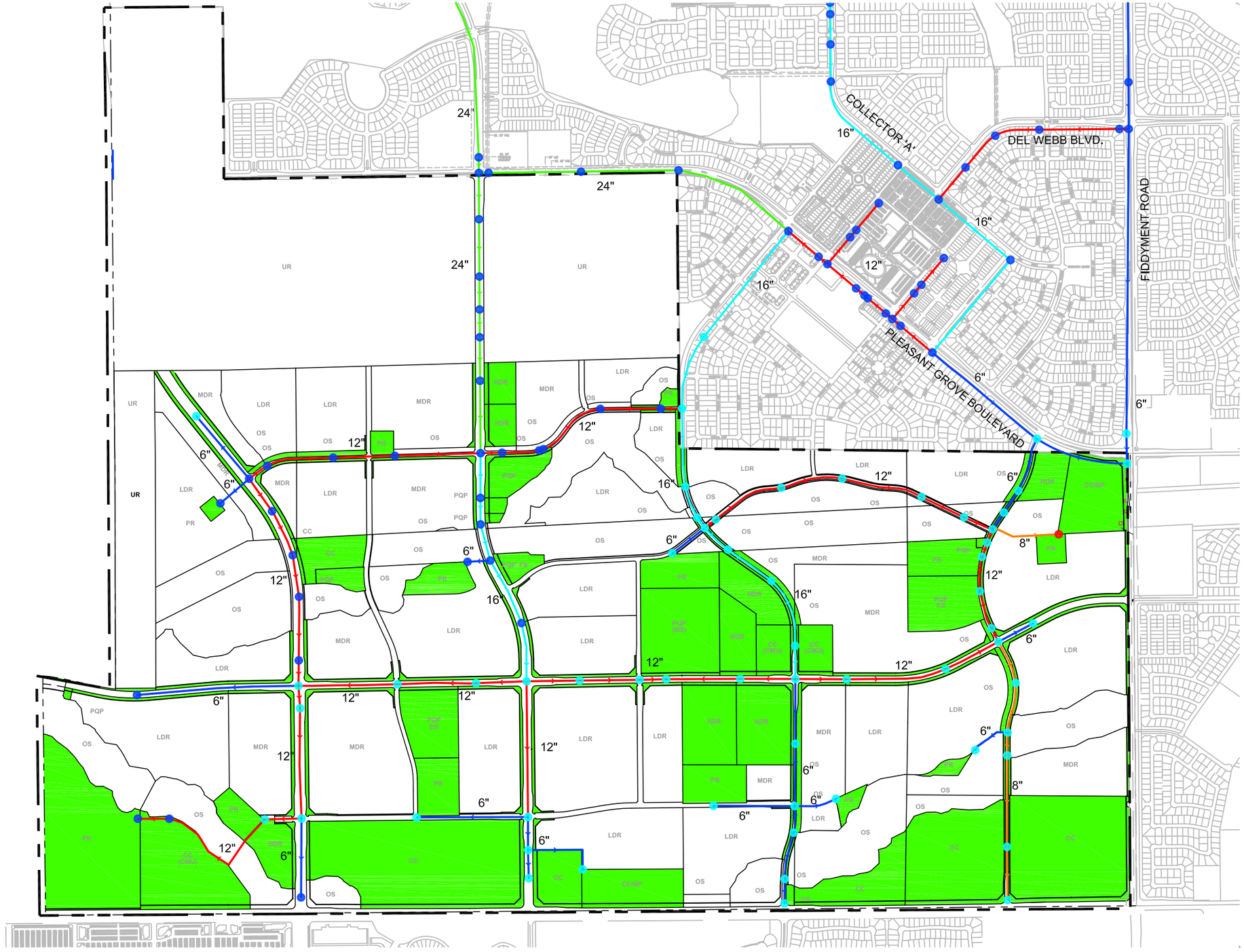

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FIGURE 4-1
MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA RECYCLED WATER MASTER PLAN
SVSP BASE RECYCLED WATER DISTRIBUTION SYSTEM

S:\Common\Projects\219_Sierra Vista\Recycled Water Study\RW Model\h2omap\2-2009\Complete West Roseville Recycled Water Model 072009.dwg DATE:7/10/09

COLLECTOR 'A'

DEL WEBB BLVD.

FIDDYMENT ROAD

PLEASANT GROVE BOULEVARD

COLOR CODING LEGEND
NODE: MIN PRESSURE (PSI)

50 - 60	
60 - 70	
70 - 80	
80 - 90	

COLOR CODING LEGEND
PIPE: DIAMETER (IN)

<=	6
<=	8
<=	12
<=	16
<=	24

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FIGURE 4-2

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA RECYCLED WATER MASTER PLAN

SVSP BASE PLUS UR RECYCLED WATER DISTRIBUTION SYSTEM

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SIERRA VISTA COMMUNITIES

Sierra Vista Recycled Water Master Plan

Prepared For: MacKay & Somps Civil Engineers, Inc.

June 2009

HydroScience Engineers

Sierra Vista
Recycled Water Master Plan

June 2009

Prepared for

MacKay & Somps Civil Engineers, Inc.

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SECTION 1 – INTRODUCTION

This Sierra Vista Recycled Water Master Plan (Master Plan) was prepared by HydroScience Engineers (HSe) for MacKay & Somps Civil Engineering, Inc. (MacKay & Somps) in support of the Sierra Vista Specific Plan (SVSP) Area. This section summarizes the purpose, background, and the organization for this Master Plan.

1.1 Purpose

This document will provide an evaluation of methods to supply and distribute recycled water to the SVSP to meet its proposed recycled water demand. The purpose of the Master Plan is to:

- Develop a market assessment of potential recycled water customers within SVSP;
- Evaluate recycled water supply and storage options for the SVSP;
- Develop a functional and reliable recycled water infrastructure for each supply scenario; and
- Identify any upgrades to existing off-site facilities required for each supply scenario.

1.2 Background

The SVSP is a 2,064± acre development located in Placer County, California, south and west of the City of Roseville (City). The SVSP area is encompassed by the West Roseville Specific Plan (WRSP) to the north, Fiddyment Road to the east, Baseline Road to the south, and open space to the west. A map showing the SVSP and the vicinity is provided as **Figure 1-1**. It is expected that the SVSP will be annexed into the City.

The total SVSP area includes two properties that are referred to in this Master Plan as the Richland (UR-2 and UR-3) and Chan (UR-1) properties. Though these properties are not a part of the SVSP, recycled water infrastructure within the SVSP is being sized assuming that these areas will be developed in the future. The Master Plan includes a model of the recycled water infrastructure both with (SVSP Base plus UR) and without (SVSP Base) these developments so that the extent of improvements required for these two properties are detailed.

The SVSP is currently undeveloped rolling grassland and agricultural lands. The area has topographical elevations ranging from 75 to 125 ft, and generally slopes from east to west.

The SVSP is proposed to include a variety of mixed-use developments including low, medium, and high-density housing; shopping centers; commercial mixed use and business parks; schools; parks; paseos; and open spaces. Proposed land uses within the SVSP are shown in **Figure 1-2**. **Figure 1-2** is based on the Conceptual Land Use plan as of January 22, 2009, and shows the location of the Chan and Richland properties in relation to the SVSP Base. **Figure 1-3** shows the potential development of the Richland property based on

the June 2008 land use plan. Buildout of the Chan property, based on the June 2008 land use plan, will be strictly low density residential housing and thus will not utilize recycled water.

The SVSP was modeled to allow the backbone infrastructure to be phased. Phases may be developed in any sequence provided public safety, health, and welfare issues are addressed, and subject to the approval of the City. Parcel specific improvements will be determined with small lot tentative maps or subsequent entitlements.

1.3 Existing Documents

Several documents about the City's previous recycled water distribution system and the SVSP are summarized below:

West Roseville Recycled Water Storage Tank and Pump Station Project Preliminary Design Report (2005): This document identified the typical recycled water storage and pumping needs for this Urban Growth Area (UGA). Similar infrastructure sizing principles that were applied to the WRSP will be applied to SVSP. This document is referred to in **Section 6 – References** as HSe, 2005.

Recycled Water Study for the West Roseville Specific Plan Area (2003 and updated in 2004): This document identified proposed recycled water users, demands, supplies, facility requirements, and operational requirements for the WRSP in Roseville, CA. This distribution system receives recycled water from the Pleasant Grove Wastewater Treatment Plant (PGWWTP). Included in this plan are the storage, pumping, piping, and supply requirements to deliver recycled water to the WRSP from the PGWWTP. This study also proposed an interconnection from the WRSP to the City's existing recycled water distribution system through a converted 18-inch sewer force main. This connection would supply 700 gpm to the Dry Creek Wastewater Treatment Plant (DCWWTP) distribution system from the PGWWTP through the WRSP distribution system. This intertie was included to balance supply and demand for the customer demands anticipated at the time. This document is referred to in **Section 6 – References** as HSe, 2003.

Recycled Water Distribution System Feasibility Study for the City of Roseville (2000): This document was developed to provide methodologies to estimate recycled water demands throughout the City based on irrigated acreage and evapotranspiration data, and evaluate the existing and planned recycled water distribution system supplied by the DCWWTP. This document was prepared before information about the WRSP was available. This document is referred to in the **Section 6 – References** as HSe, 2000.

SPWA Systems Evaluation South Placer Regional Wastewater and Recycled Water Systems Evaluation (June 2007 and various 2008 updates): This document, a regional planning update of the City's wastewater and recycled water system and identified the current and buildout wastewater and recycled water flow projections. Within this document are technical memoranda (TMs) that provide more detailed information about their subject matter. This document is referred to in **Section 6 – References** as RMC, 2007.

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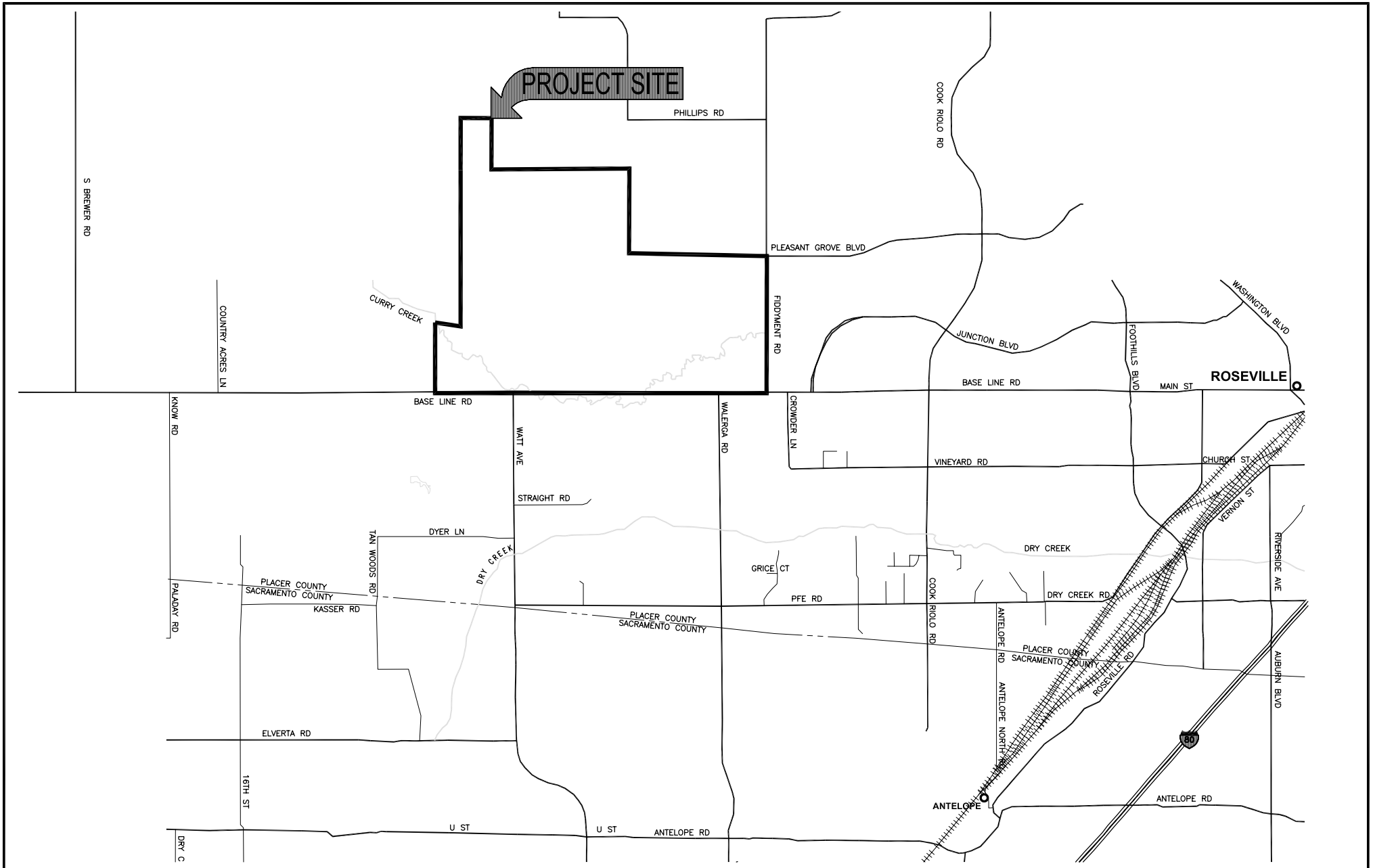

FIGURE 1-1

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA RECYCLED WATER MASTER PLAN

PROJECT LOCATION MAP

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N

WEST SIDE DR

PLEASANT GROVE BLVD

RICHLAND PLANNED COMMUNITIES

UR-2

UR-3

MARKET AVE

WEST ROSEVILLE SPECIFIC PLAN

CHAN PROPERTY

UR-1

LDR-1

MDR-1

MDR-2

LDR-2

LDR-3

MDR-3

HDR-1

MDR-4

LDR-4

PASEO-12b

OS-1

PR-3

PASEO-12a

PASEO-1

PASEO-2

PASEO-4

PR-2

PASEO-6

HDR-2

PASEO-10

PASEO-8

PASEO-11

PASEO-13

OS-2

LDR-7

PASEO-3

PASEO-5

MDR-5

LDR-5

PASEO-7

PASEO-9a

PQP-1

PQP-2

PASEO-9b

PASEO-14b

PASEO-15

PASEO-16

LDR-8

LDR-9

LDR-10

PASEO-33

PASEO-34

HDR-3

CC/BP-1

PASEO-35

OS-9

OS-10

PR-1

CC-1b

MDR-6

PQP-3

PQP-4

OS-6a

LDR-6

PASEO-14a

PASEO-14c

OS-3

OS-8a

OS-8c

OS-8d

PASEO-36

PASEO-37

CC-1a

OS-6b

OS-7a

PASEO-17

PASEO-18

OS-8b

PQP-9

PR-7

LDR-15

OS-4a

PQP-5

OS-6c

PR-4

PQP-7 FS

OS-7b

PASEO-19

PASEO-21

MDR-8

PR-6

PASEO-38

OS-4b

OS-5

PQP-6 ES

LDR-13

PR-5

PASEO-20

HDR-4

PQP-10 ES

LDR-12

LDR-14

PQP-8 (MS)

HDR-5

PASEO-22

MDR-9

PASEO-39

LDR-22

LDR-11

MDR-7

PASEO-24

CC (CMU-1)

PASEO-23

CC (CMU-2)

PASEO-41

PASEO-40

LDR-16

MDR-10

LDR-17

LDR-18

LDR-19

PASEO-26

PASEO-25

LDR-21

OS-16

PASEO-42

OS-11

MDR-11

PR-8

MDR-12

PQP-11 ES

HDR-6

MDR-13

LDR-20a

PASEO-44

MDR-14

PR-11

PASEO-43

PR-9

OS-15c

PR-13

HDR-7

PR-10

OS-15d

PASEO-45

PASEO-27

LDR-20b

OS-15b

PR-12

CC (CMU-3)

LDR-23

LDR-24

PASEO-28

PASEO-29

PASEO-30

CC-4b

CC-5

PASEO-46

CC-2

CC-3

CC/BP-2

OS-13

OS-14

OS-15a

PASEO-31

PASEO-32

CC-4a

PASEO-47

OS-12

FIDDYMENT RD

BASELINE RD

LEGEND

LDR	LOW DENSITY RESIDENTIAL
MDR	MEDIUM DENSITY RESIDENTIAL
HDR	HIGH DENSITY RESIDENTIAL
CMU	COMMERCIAL MIXED USE
CC/BP	COMMERCIAL/BUSINESS PARK
CC	COMMUNITY COMMERCIAL
PQP	PUBLIC/QUASI-PUBLIC
PR	PARKS & RECREATION
OS	OPEN SPACE
UR	URBAN RESERVE
P	PASEOS

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FIGURE 1-2

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA RECYCLED WATER MASTER PLAN

LAND USE PLAN - SVSP BASE SCENARIO

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N

PQP-1

OS-1

HDR-1

CC
(CMU-1)

PLEASANT GROVE BLVD

WEST SIDE DR

CC-1

LDR-1

CC-2

MDR-3

HDR-3

HDR-2

MDR-1

PR-1

PQP-2
ES

MDR-2

PR-2

LDR-2

CC-3

MDR-5

LDR-3

MDR-6

CC
(CMU-5)

MDR-7

LDR-4

CC-3

LEGEND

LDR	LOW DENSITY RESIDENTIAL
MDR	MEDIUM DENSITY RESIDENTIAL
HDR	HIGH DENSITY RESIDENTIAL
CMU	COMMERCIAL MIXED USE
CC/BP	COMMERCIAL/BUSINESS PARK
CC	COMMUNITY COMMERCIAL
PQP	PUBLIC/QUASI–PUBLIC
PR	PARKS & RECREATION
OS	OPEN SPACE
UR	URBAN RESERVE
P	PASEOS

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FIGURE 1-3
MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA RECYCLED WATER MASTER PLAN
LAND USE PLAN - RICHLAND PLANNED COMMUNITIES

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The following TMs were utilized in the development of this document.

- **TM 2b, Average Dry Weather Flow Projection for the Ultimate SPWA Service Area (including UGAs):** This document includes all of the estimated ADWF for each UGA and the estimated buildout wastewater flows for the PGWWTP. This document was updated on January 24, 2008.
- **TM 5a, Market Assessment for Recycled Water Distribution System:** This document includes a high-level market assessment for recycled water throughout the City, and the City's recycled water supply policy for supplying recycled water to UGAs. This document was updated on February 11, 2008.
- **TM 5b, Alternatives Development and Evaluation for Recycled Water Distribution System:** This memorandum identifies alternatives for the expansion and distribution of recycled water, and also presents diurnal recycled water supply strategies. This document was updated on February 11, 2008.

1.4 Report Organization

This Master Plan provides a description of the recycled water supply options and facilities required for the SVSP. The sections contained in this report are:

- Section 1 – Introduction;
- Section 2 – Planning and Modeling Criteria;
- Section 3 – Recycled Water Customers and Demands;
- Section 4 – Recycled Water Supply;
- Section 5 – Results and Recommendations;
- Section 6 – References; and
- Appendices.

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SECTION 2 – PLANNING AND MODELING CRITERIA

This section presents planning and modeling criteria and assumptions used to develop the recycled water demands.

2.1 Planning Criteria

The primary planning criteria to determine recycled water demands per acre of irrigated area are evapotranspiration (ET) rates and precipitation. Previous studies [(HSe, 2003) and (HSe, 2000)] have estimated standard evapotranspiration rates and rainfall for the City. A summary of how these criteria are utilized is included below.

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

$$ET = ET_o * k_c$$

where:

ET_0 = *Normal year reference crop evapotranspiration rate for a given geographic location [California Department of Water Resources (DWR), California Irrigation Management Information System (CIMIS) database]*

k_c = *Crop coefficient for a given crop (University of California – Cooperative Extension, California Turfgrass Culture Leaflet)*

For this study, reference crop normal year evapotranspiration rates (ET_0) for the City were obtained from the DWR CIMIS database. Crop coefficients for cool weather turf grasses were obtained from the, California Turfgrass Culture leaflet (University of California, 1997). Calculated ET rates and irrigation demands are shown in **Table 2-1**.

Precipitation: Annual precipitation data for the Sacramento area was obtained from the California DWR. Annual rainfall values from 1850 through 1998 were averaged to obtain typical annual rainfall data. A breakdown of rainfall by month was calculated using typical monthly rainfall percentages.

Estimated Unit Irrigation Demands: Typical monthly unit irrigation demands for turf grasses are summarized in **Table 2-1** and were calculated using the following formula:

$$ID = \frac{(ET - Pe_p)l_r}{e_i}$$

where:

ID = *Irrigation demand in inches*

ET = *Evapotranspiration for turf grasses in the City*

P = *Average precipitation, DWR*

e_p = *Precipitation irrigation efficiency, 0.8. Assumes 20% of rainfall during growing season is lost to evaporation, runoff, etc.*

l_r = *Loss Rate, equal to 1.1. This assumes that approximately 10% of the applied water passes through the grass root zone and is lost.*

e_i = *Irrigation efficiency, equal to 0.8 - 0.9 depending on season. This assumes that 10 – 20% of the applied irrigation water is lost to the environment.*

Table 2-1: Typical Irrigation Demands for SVSP Turf Grasses

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

Notes:
1. This data was the basis for determining demands for the City of Roseville and West Roseville in the *Recycled Water Study for West Roseville Specific Plan Area (May 2003)*.

As shown in **Table 2-1,** the total annual unit irrigation demand for grasses is estimated at 43.4 inches. A peak monthly irrigation demand of 9.2 inches is projected for July. The irrigation demand for a winter month is assumed to never fall below zero. For months during which the irrigation demand is positive, additional water is applied from the irrigation system. The typical season for irrigation demands stretches between April and October, with a small amount of irrigation necessary in March. No irrigation demands are projected between November and February.

2.2 Modeling Options

There are two wastewater treatment facilities within Roseville, the PGWWTP and DCWWTP. The SVSP lies within the collection service area of the PGWWTP.

Four potentially feasible options were identified for delivering recycled water to the SVSP from the PGWWTP. These are as follows:

1. **Expand the WRSP recycled water distribution system to include the SVSP.** This option would expand the existing WRSP distribution system to include the SVSP. Connections between the systems would be made to the 24-inch mainline planned in West Side Drive, the 16-inch mainline in Market Street, and to the 6-inch mainline in Pleasant Grove Blvd. **Figure 2-1** identifies the size and locations of those connections. Recycled water would be pumped from the PGWWTP to the WRSP tanks and pump station, as it currently does, which in turn would serve the combined WRSP/SVSP system. This scenario requires recycled water to be pumped twice to reach SVSP customers: by the PGWWTP and WRSP pump stations.

   In order for this option to be feasible, storage and pumping capacity at the WRSP tank and pump station site would need to be increased. Additional recycled water storage would be necessary to provide the required one day of peak day storage to the SVSP. Pumping capacity would need to be increased to meet the combined demands of the WRSP and SVSP distribution systems.

2. **Construct a parallel pipeline from the PGWWTP to a SVSP recycled water storage tank.** A 16-inch parallel pipeline would travel west from the PGWWTP along Phillip Road and then south along West Side Drive to the PQP-2 site within the SVSP. Though a 16-inch parallel pipeline is the pipe size required for the SVSP Base or SVSP Base plus UR, it is expected that this pipeline would be oversized to allow this pipeline to be extended by others to serve Curry Creek and Regional University, and oversized on Phillip Road to serve Brookfield and Creekview. This option requires recycled water to be pumped twice to reach SVSP customers: by the PGWWTP and SVSP pump stations.

   Option 2 would fill the new SVSP recycled water storage tank in accordance with the "recommended fill option" in TM 5b, which is either the Equal Tank or Two Tank Fill options. These options would mean that recycled water would be supplied to the SVSP tank anywhere from several hours a day up to 24 hours a day. For the purposes of developing and running the modeled options, it was assumed that recycled water was supplied from the PGWWTP at a continuous rate over the 15-hour period from 6:00 AM to 9:00 PM. This pattern was intended to conservatively estimate the availability of recycled water. The City will control delivery of recycled water to the on-site storage tank through telemetry and the SCADA system. Actual recycled water deliveries may vary over the course of the day from what was assumed in this document, but these variations will be attenuated by providing at least one day of on-site storage. This recycled water supply option is shown in **Figure 2-2**.

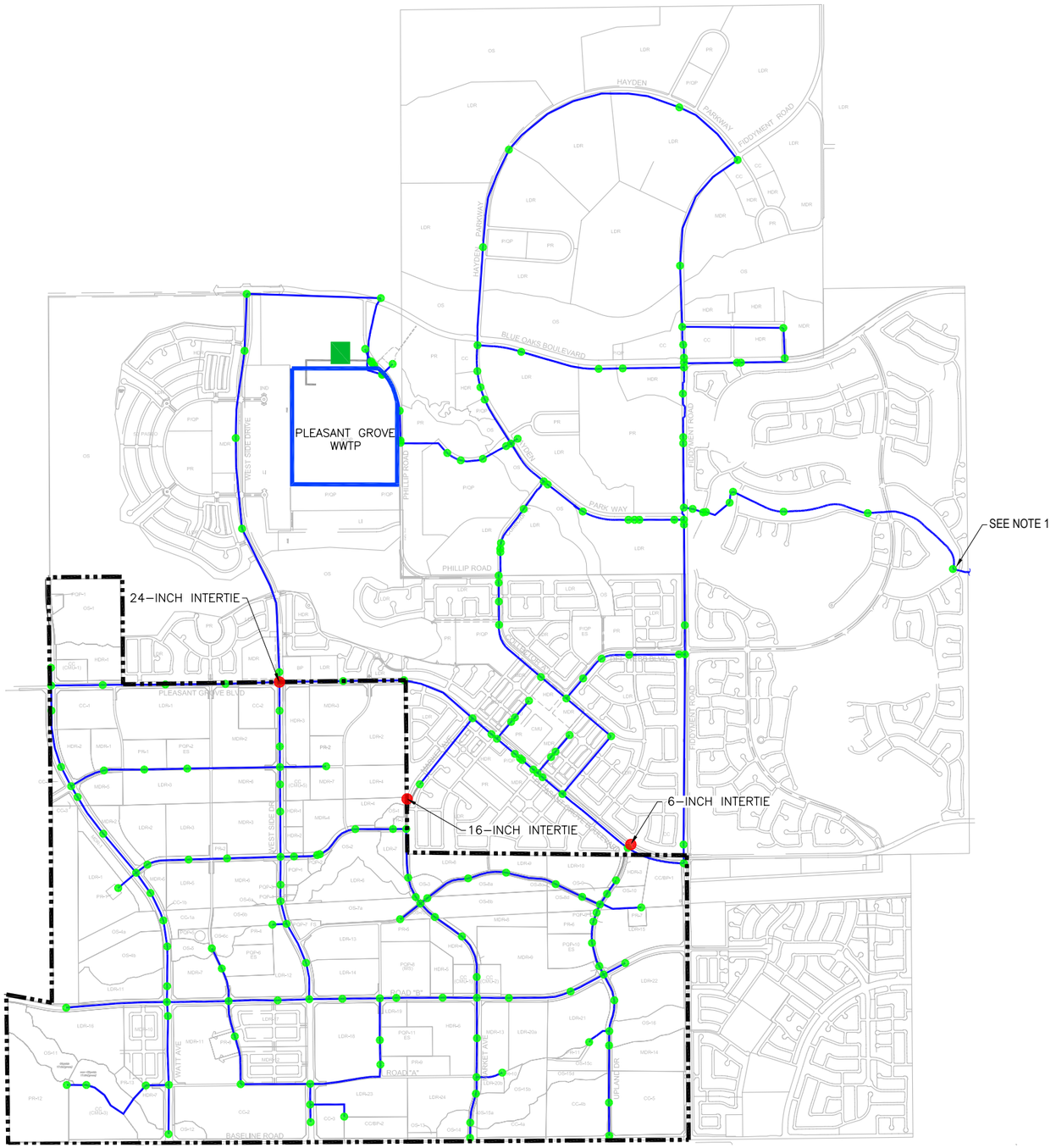
3. **Supply the SVSP recycled water distribution system during off-peak hours using the West Roseville Recycled Water Distribution System using the West Roseville Pump Station.** This option would connect the SVSP distribution system to the proposed 24-inch distribution mainline in West Side Drive. Essentially, the WRSP distribution system would be used to convey recycled water from the PGWWTP to fill a SVSP storage tank during off peak periods. To do this, recycled water would be pumped by the PGWWTP to the WRSP storage tank and pump station, then pumped through the existing and proposed WRSP distribution system to where West Side Drive will meet the SVSP. From there, a 16-inch line would convey recycled water through the SVSP distribution system to the SVSP storage tank. The SVSP storage tank would store recycled water for the SVSP, and the SVSP pump station would pump recycled water to SVSP customers. This scenario requires recycled water to be pumped three times to reach SVSP customers: by the PGWWTP, WRSP, and SVSP pump stations.

   If the SVSP and WRSP distribution systems were to be connected, recycled water deliveries to the SVSP would be limited to off-peak periods, specifically 6:00 AM to 9:00 PM. This is because during peak hours at buildout, the WRSP pump station will not have any available capacity. However, during off-peak hours, the WRSP pump station will be pumping only to Sun City, the North Zone, and Wood Creek Oaks Golf Course. These combined demands are approximately 3,000 gpm. This leaves approximately 4,200 gpm of available capacity at the WRSP pump station. This recycled water supply option is shown in **Figure 2-3**.

4. **Supply the SVSP recycled water distribution system during off-peak hours using the West Roseville Recycled Water Distribution System, but bypassing the West Roseville Pump Station.** This option would also connect the SVSP distribution system to the proposed 24-inch distribution mainline in West Side Drive. However, this alternative would not use the WRSP pump station to pump recycled water to the SVSP storage tank. Rather, it would bypass the WRSP pump station by upgrading the existing bypass line connecting the 24-inch supply and discharge lines at the WRSP pump station. This bypass line would be upgraded to make the entire bypass alignment 24-inches in diameter, and to tie the isolation valve on the bypass line into SCADA so it could be remotely controlled.

   The PGWWTP pump station would pump recycled water through this bypass, through the WRSP distribution system, through a 16-inch recycled water transmission line and into the SVSP storage tank. The PGWWTP would pump in this manner during off-peak hours. This is because this option requires the WRSP distribution system to operate at a lower pressure when the PGWWTP pump station is on-line. This scenario requires recycled water to be pumped twice to reach SVSP customers: by the PGWWTP and SVSP pump stations.

   If the SVSP and WRSP distribution systems were to be connected, recycled water deliveries to the SVSP would be limited to off-peak periods, specifically 6:00 AM to 9:00 PM. However, due to the bypass of the WRSP pump station the line within the SVSP upsizes to 24-inches because of pressure decreases in the system due to the lower head pumps at the PGWWTP. Additionally, the PGWWTP pump station will then be pumping to Sun City, the North Zone, and Wood Creek Oaks Golf Course. During periods when the PGWWTP is pressurizing the WRSP and SVSP, and the WRSP pump station is



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LEGEND

- SIERRA VISTA SPECIFIC PLAN PROJECT BOUNDARY
- WRSP PUMP STATION AND STORAGE TANK SITE
- RW INTERTIE

NOTE

1. CONNECTION TO THE DRY CREEK RECYCLED WATER DISTRIBUTION SYSTEM

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FIGURE 2-1
MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA RECYCLED WATER MASTER PLAN
OPTION 1 - EXPAND WRSP PUMP STATION TO SERVE SVSP

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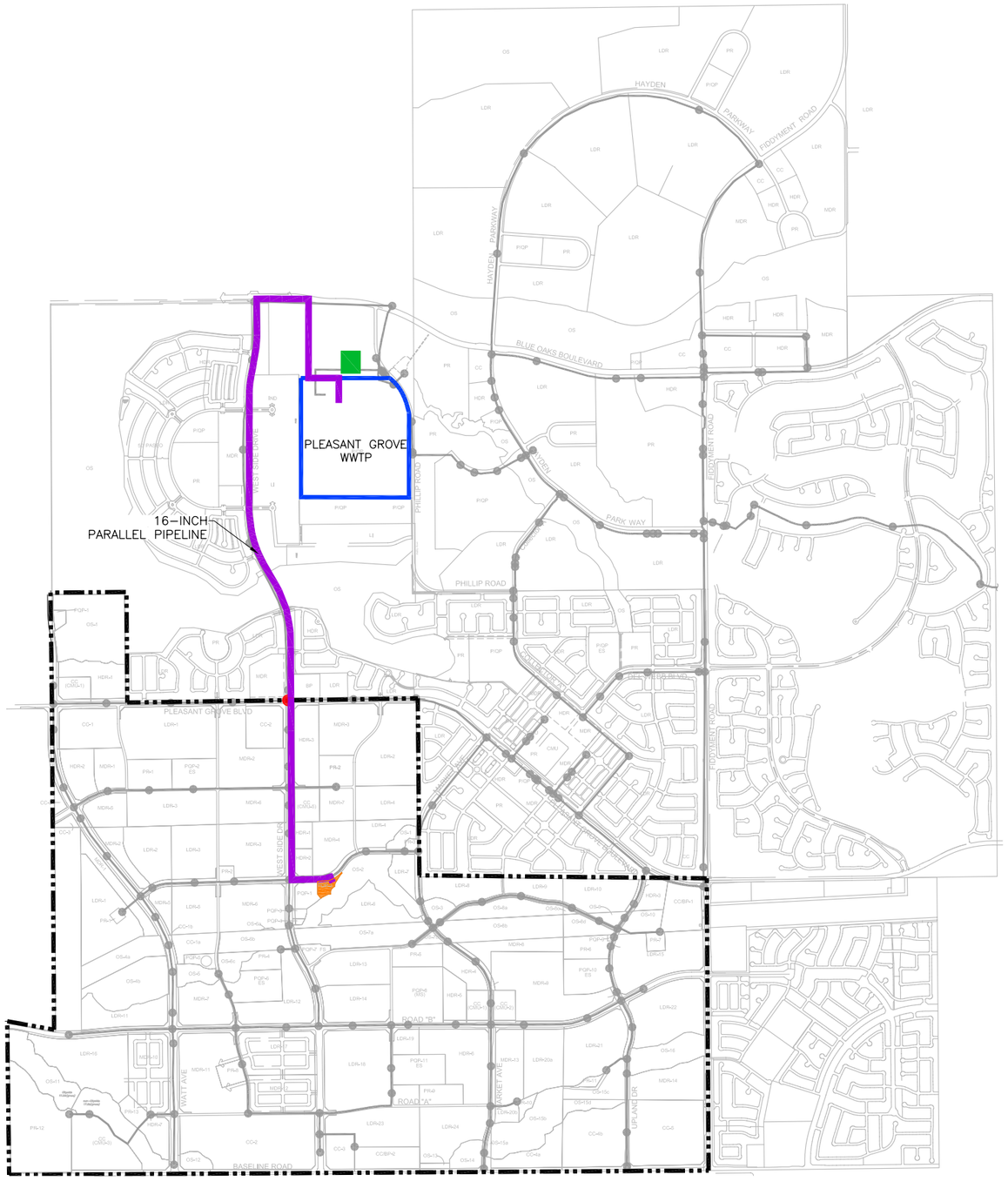

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LEGEND

- SIERRA VISTA SPECIFIC PLAN PROJECT BOUNDARY
- RW PARALLEL PIPELINE SCENARIO
- WRSP PUMP STATION AND STORAGE TANK SITE
- SVSP PUMP STATION AND STORAGE TANK SITE

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FIGURE 2-2
MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA RECYCLED WATER MASTER PLAN
OPTION 2 - PARALLEL PIPELINE

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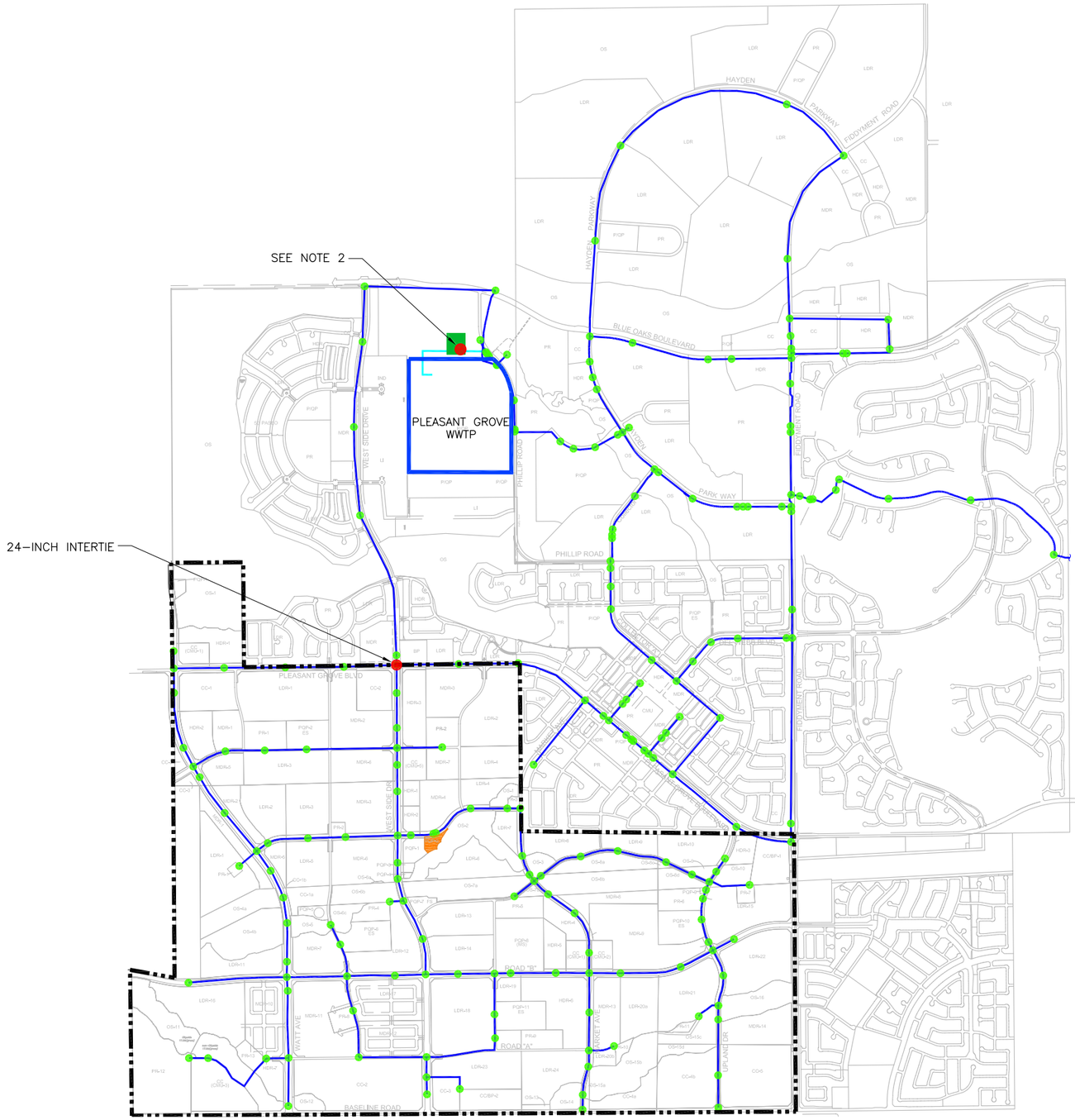

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LEGEND

- SIERRA VISTA SPECIFIC PLAN PROJECT BOUNDARY
- WRSP PUMP STATION AND STORAGE TANK SITE
- SVSP PUMP STATION AND STORAGE TANK SITE
- EXISTING PGWWTP–WRSP PUMP STATION CONNECTION

NOTES:

1. OPTION 3 – RECYCLED WATER WILL BE PUMPED FROM THE PGWWTP TO THE WRSP PUMP STATION AND THEN PUMPED DURING OFF HOURS THROUGH THE DISTRIBUTION SYSTEM TO THE SVSP.
2. OPTION 4 – THE BYPASS OF THE WRSP PUMP STATION WOULD NEED TO BE UPGRADED TO ALLOW THE PGWWTP PUMP STATION TO FILL THE SVSP RW STORAGE TANK.

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FIGURE 2-3

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA RECYCLED WATER MASTER PLAN

OPTIONS 3 & 4 - USING WRSP DISTRIBUTION SYSTEM TO SUPPLY SVSP

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bypassed, the pressure in these service areas would decrease. This recycled water supply option is shown in **Figure 2-3**.

Options Modeled: This Master Plan was prepared assuming that recycled water would be supplied to the SVSP by expanding the WRSP distribution system to include the SVSP (Option 1). Option 1 was selected as the preferred option and the option to proceed with for detailed modeling for a number of reasons, as listed below:

- This option reduces long term pumping costs by reducing the number of times recycled water is to be pumped (three to two) to supply the end user;
- The overall quantity of pipelines needed to be constructed and maintained is decreased;
- No recycled water storage tank and pump station would need to be constructed or maintained within the SVSP;
- The land on which the SVSP recycled water storage tank and pump station is proposed could be made available for other uses; and
- The WRSP recycled water distribution system does not need to be oversized to supply the SVSP with recycled water. During the original planning of this distribution system, it was sized specifically for this purpose.

This option was modeled for the SVSP Base and SVSP Base plus UR land use plans. Each scenario is described below.

SVSP Base: The SVSP Base scenario is a model of the recycled water infrastructure based on the needs of the SVSP without the Richland/Chan buildout. Recycled water demands were assumed to be zero in these areas, and these properties will have no recycled water pipelines other than the supply pipeline between West Side Drive and Road "A." This scenario was modeled to identify the baseline infrastructure that would be required for the SVSP without the Richland and Chan properties.

SVSP Base plus UR: This land use plan builds upon the SVSP by adding the recycled water demands within both the Richland and Chan properties. All recycled water infrastructure throughout the SVSP and Richland/Chan buildout would be resized based on the results of the modeling. Comparing the infrastructure required for the SVSP Base and SVSP Base plus UR allows for the cost to upsize infrastructure within the SVSP Base to be identified. It should be noted that all recycled water infrastructure within the Richland and Chan properties with the exception of the mainline in Westside Dr. will not be required to be built until development of those properties begins. See **Section 4** for the modeling results and infrastructure comparison.

2.3 Modeling Criteria

The desktop software used to model the SVSP's proposed recycled water system, SVSP supply options, and SVSP infrastructure was H_2ONET 8.0 by MWH Soft, Inc. H_2ONET calculations, for this model, were based on the Hazen-Williams formula for pressure friction.

The City's draft recycled water working model was used as the base for developing this model. The draft model was used as a starting point and then revised to add infrastructure and demands for the SVSP and buildout of the WRSP. The City's existing recycled water model was used as the base model to add infrastructure and demands for the SVSP. Additionally, this model provides a full analysis of the hydraulic performance of the proposed water distribution infrastructure. It also allows for a general analysis of the impact the SVSP will have on the City's existing recycled water distribution system.

In order to conduct a general analysis of the impact the SVSP will have on the City's existing and planned recycled water distribution system, the proposed SVSP recycled water distribution system as well as the full buildout WRSP recycled water system were added to the PGWWTP portion of the City's existing recycled water model. This complete WRSP recycled water model best analyzes the full system at buildout conditions. From these buildout conditions, analysis of the impact the SVSP will have on the existing and planned WRSP distribution system as well as identifying any required improvements to existing infrastructure can be determined.

To combine these three models, a number of assumptions were required. These included:

- The existing City model represented the currently connected recycled water demands in WRSP. HSe replaced these demands with the buildout WRSP recycled water demands from the original 2003 study except where new demands were added (e.g. Blue Oaks Blvd east of Fiddyment, 18-inch line to Sun City, North Zone Tank). This was done to accurately reflect the buildout requirements of the WRSP pump station;
- Existing pipelines in the City model were modified based on the WRSP Recycled Water Feasibility Study and what was actually constructed;
- The logic for operation of the WRSP pump station was modified to allow four of the 1,800-gpm pumps to operate at buildout flows;
- The pressure-reducing valve was modified to adjust pump station discharge pressures to those expected during buildout (84-psi);
- The pipelines for Phases 3 and 4 of the WRSP were added;
- The pipelines for the Dry Creek recycled water distribution system were deleted from the model. This was done in order to simplify the model for analysis of the WRSP distribution system. The Dry Creek recycled water distribution system receives flow from the WRSP pump station for service to Sun City golf course and to fill the North Zone tank. A node containing demands identical to those required to service the golf course and tank was used to accurately simulate flows to the Dry Creek system over the analysis period. See Note 1 on **Figure 2-1**;
- Flow into the WRSP storage tanks will be controlled by a SCADA operated control valve. However, the existing WRSP storage tanks are modeled as a fixed head reservoir and thus flow is assumed to be infinite from the PGWWTP. This was not changed for the purposes of SVSP modeling; and
- For an evaluation of supplemental and diurnal water supply requirements for one City-wide development option, **Sections 3.2 and 3.3** present a summary of the supplemental

water supply and diurnal water supply requirements for the SVSP/WRSP recycled water storage tank.

Infrastructure Criteria: The sizing of recycled water infrastructure requires modeling of recycled water use based on actual projected recycled water demands for the two land use options. Preliminary discussions with the City have indicated that this infrastructure will include the following requirements:

- Adherence to standard City pipeline diameters, namely 6-inch, 8-inch, 12-inch, 16-inch, 24-inch, and 30-inches;
- All pipe velocities must remain below 5 ft/s;
- Construction of a minimum of one July day of on-site recycled water storage;
- Construction of or upgrading existing recycled water pumping facilities to maintain the minimum recycled water distribution system pressure for the July day demands; and
- Multiple points of connection to the existing City recycled water distribution system.

Peak Day Demands: Peak day flows are estimated by applying peaking factors to calculated average day demands. Peak day flow rates account for seasonal variations in evapotranspiration rates. Based on the data shown in **Table 2-1**, the average monthly irrigation demand over the year is 3.6 inches. However, the peak monthly irrigation demand occurs in July and is 9.2 inches. Thus, the monthly peak demand factor is:

$$Factor = \frac{9.2\ in}{3.6\ in}$$

Peak Demand Factor = *2.56*

It is assumed that peak day demand is essentially the same as peak monthly irrigation demand for facility planning purposes. This is reasonable because not all customers will be irrigating during the same period. It is further assumed that "true" peak day irrigation demand conditions (all customers irrigating on the same day) would rarely occur, and the cost of providing facilities to meet these demands is not justified. Therefore, a peak day demand factor of 2.56 times the average day demand is assumed.

Peak Hour Demands: Peak hour delivery demands for irrigation systems are a function of the length of daily irrigation periods. Historically, the City's recycled water demands were based on the assumption (for planning purposes) that all irrigation demands occur between 9:00 PM and 6:00 AM at a consistent hourly rate. Thus, the peak hour flow is the peak day flow concentrated into a 9-hour time period. This factor equates to:

$$Factor = \frac{24\ hr}{9\ hr}$$

Peak Hour Factor = *2.67*

Adjusted Peak Hour Factor	*= 150 % × 2.67*
	= 4.00

The adjusted peak hour factor includes an additional 50% safety factor to accommodate variability in peak irrigation demand flow rates that are actually designed into the SVSP. This factor is multiplied by the peak day demand, and assumes that the irrigation demands are uniform over the 9-hour daily irrigation period. Actual peaking requirements can be reduced by scheduling water deliveries to larger customers during off-peak hours. A summary of peaking factors assumed for landscape irrigation in this study is provided below:

Peak Day Demand	*= 2.56 × Average Day Demand*
Peak Hour Delivery Demand	*= 4.00 × Peak Day Demand*
	or
	= 10.24 × Average Day Demand

Minimum Pressure: For the West Roseville Recycled Water Feasibility Study, it was assumed that a minimum dynamic pressure during the peak hour of 40 psi would be maintained. During the design of the WRSP recycled water storage tank and pump station, the City determined that local recycled water service users required a minimum pressure of 60 psi. This increase in pressure was intended to apply to all City recycled water customers, and eliminated the need to install booster pumps for individual services. The SVSP recycled water distribution system was modeled using 60 psi as the target minimum pressure at the recycled water meter.

2.4 Summary of Assumptions

There are a number of assumptions built into each model. These assumptions include:

- The total annual unit irrigation demand for grasses is estimated at 43.4 inches;
- Peak hour delivery demand is based on 10.24 times the average day demand;
- The minimum pressure in the SVSP recycled water distribution system is 60-psi;
- Pipeline diameters for new pipelines were limited to the sizes typically installed by the City;
- A storage tank and pump station upgrade would be constructed at the existing WRSP storage tank and pump station site. This new tank and upgraded pump station would provide all of the storage and pumping required to reliably deliver recycled water to the SVSP and WRSP; and
- An analysis of the diurnal recycled water supply for the PGWWTP showed that sufficient recycled water was available to serve the combined demands of the WRSP and SVSP (see **Section 3.3**). For the purposes of modeling, an infinite recycled water supply from the PGWWTP was assumed.

SECTION 3 – RECYCLED WATER CUSTOMERS AND DEMANDS

This section provides the market assessment for the recycled water customers and demands for the proposed development's two land use plans. The demands are based on land use and associated acreage for each land use.

3.1 Market Assessment

The SVSP will use recycled water to irrigate all non-residential landscaping to maximize recycled water use. Users of recycled water in the SVSP will include parks, landscaped corridors, paseos, commercial, commercial mixed/use, public/quasi-public, and high density residential parcels. Recycled water is not planned for irrigation use for single family parcels (LDR and MDR) due to the increased potential for cross-connection with the potable water system.

To estimate recycled water demands, HSe obtained the proposed acreages and types of development for each zoning area within the SVSP. HSe also determined the approximate percentage of irrigated area within each zoning area based on previous experience with other projects in the Roseville area and City standards. Non-irrigated areas were assumed to include hardscaped surfaces such as sidewalks, buildings, walkways, parking lots, and other non-irrigated areas. These usage percentages vary somewhat from those developed previously for the WRSP. However, these percentages were updated to reflect the actual percentage of hardscape and irrigated area projected for each type of land use within the SVSP. These percentages were applied to each zoning area to estimate the irrigated areas and recycled water demand for each user.

A Title 22 Engineering Report will be prepared and supplied to the City for the use of recycled water within the SVSP (including the Richland/Chan buildout). It should be noted that no usage of recycled water for indoor or industrial uses, such as toilet or urinal flushing or cooling towers, were included in this Master Plan. Facilities that use recycled water for these types of uses are required to prepare a dual-plumbed engineering report in accordance with Title 22 requirements.

Table 3-1 and **Table 3-2** contain a summary of the recycled water market assessment grouped by land use designation, and each includes the percentage of each area irrigated with recycled water. These percentages were used to develop recycled water demands for both options. The tables show the relative magnitude of the various customers within the SVSP likely to use recycled water. A detailed breakdown of each individual site and demand is attached as **Appendix B**.

The total area within the SVSP to be irrigated with recycled water is approximately 232.8 acres for SVSP base option and 282.7 for the SVSP Base plus UR option.

The SVSP base option identifies 145 unique land use areas as potential recycled water users, with an overall average annual recycled water demand of approximately **843 AFY.**

The SVSP Base plus UR option identifies 29 additional land use areas as potential recycled water users, resulting in a total of 174 land use areas with the SVSP. Combined, these areas have an overall average annual recycled water demand of approximately **1,023 AFY.**

It is noted that the actual number of recycled water meter service connections may vary from the number of sites identified in the market assessment. This is due to the variations of irrigation system design, the size of some parcels, the phasing of construction, or the number of meters required.

Table 3-1: Recycled Water Market Assessment (Grouped by Land Use) – SVSP Base Option

Land Use Designation	Abbreviation	% Area Irrigated with Recycled Water	Total Area (Acres)	Annual Demand (AFY)	Peak Day Demand (MGD)
Residential					
Low Density Residential	LDR	Not Irrigated with Recycled Water	484.6	0	0
Medium Density Residential	MDR	Not Irrigated with Recycled Water	261.6	0	0
High Density Residential	HDR	20%	66.1	48	0.11
Urban Reserve	UR	Not Irrigated with Recycled Water	427.7	0	0
Non-Residential Facilities					
Community Commercial	CC	15%	153.6	83	0.19
Commercial Mixed Use	CMU	15%	34.3	19	0.04
Commercial/Business Park	CC/BP	15%	27.3	15	0.03
Landscape Corridor	LC	85%	43.7	135	0.31
Paseo	PASEO	15%	26.1	80	0.18
Public/Quasi-Public-A[1]	P/QP-A	Not Irrigated with Recycled Water	6.1	0	0
Public/Quasi-Public-B[2]	P/QP-B	40%	64.6	87	0.20
Park	PR	75%	89.9	244	0.56
Open Space	OS	Not Irrigated with Recycled Water	256.9	0	0
Roads	ROW	30%	121.6	132	0.30
Total			**824.1±**	**843**	**1.92**

Notes:
1. P/QP-A includes parcels such as recycled water facilities, solid waste facilities, water treatment and supply facilities, wells, fire station, and electrical substation.
2. P/QP-B includes schools
3. Annual Recycled Water Demands were rounded off to the nearest AFY.

Table 3-2: Recycled Water Market Assessment (Grouped by Land Use) – SVSP Base plus UR Scenario

Land Use Designation	Abbreviation	% Area Irrigated with Recycled Water	Total Area (Acres)	Annual Demand (AFY)	Peak Day Demand (MGD)
Residential					
Low Density Residential	LDR	Not Irrigated with Recycled Water	621.7	0	0
Medium Density Residential	MDR	Not Irrigated with Recycled Water	354.1	0	0
High Density Residential	HDR	20%	110.4	80	0.18
Urban Reserve	UR	Not Irrigated with Recycled Water	13.5	0	0
Non-Residential Facilities					
Community Commercial	CC	15%	191.3	104	0.24
Commercial Mixed Use	CMU	15%	47.6	26	0.06
Commercial/Business Park	CC/BP	15%	27.3	15	0.03
Landscape Corridor	LC	85%	59.0	182	0.41
Paseo	PASEO	15%	26.1	80	0.18
Public/Quasi-Public-A[1]	P/QP-A	Not Irrigated with Recycled Water	7.7	0	0
Public/Quasi-Public-B[2]	P/QP-B	40%	74.6	102	0.23
Park	PR	75%	107.9	292	0.67
Open Space	OS	Not Irrigated with Recycled Water	291.3	0	0
Roads	ROW	30%	131.4	143	0.33
Total			**2,064.1±**	**1,023**	**2.33**

Notes:
1. P/QP-A includes parcels such as recycled water facilities, solid waste facilities, water treatment and supply facilities, wells, fire station, and electrical substation.
2. P/QP-B includes schools
3. Annual Recycled Water Demands were rounded off to the nearest AFY.

3.2 Supplemental Water Supply

The City has indicated that any new UGA, on its peak day, may only receive a quantity of recycled water equivalent to the average day of sanitary sewage provided for treatment by the City. TM 5a states that "the City will only commit to providing a UGA with a supply of recycled water equal to the amount of wastewater that is generated by the UGA during July ADWF conditions. This supply is henceforth referred to as the "committed [recycled water] supply."

The ADWF from the SVSP Base is currently estimated to be approximately 1.37 MGD (MacKay and Somps, 2009). The SVSP Base peak month recycled water demand is estimated to be 1.92 MGD. During July, the recycled water demand is in excess of the

ADWF for the SVSP Base by 0.55 MGD. Thus, a supplemental water supply is required. This supplemental water supply will either originate from the use of excess recycled water from the PGWWTP, if it is available, or from a new nonpotable irrigation well constructed specifically for the purposes of supplying supplemental water to the SVSP.

The SVSP Base plus UR peak day recycled water demand of 2.33 MGD is higher than the SVSP Base plus UR ADWF of 1.84 MGD. The SVSP Base plus UR requires 0.49 MGD of supplemental water during the peak month. Similar to the SVSP Base, the SVSP Base plus UR will utilize a supplemental recycled water supply consisting of either excess recycled water from the PGWWTP or a new nonpotable irrigation well to supply supplemental water to the SVSP.

Table 3-3 and **Table 3-4** identify the anticipated recycled water demand for each month based on the planning criteria presented in **Section 2.1**, and compares it to the amount of recycled water available (the ADWF) each month to develop the supplemental water supply requirements.

Table 3-3: Supplemental Water Supply Requirements for SVSP Base Option

Month	Irrigation Demand (AF)	Available Recycled Water (AF)	Supplemental Water Supply (AF)
January	0	0	0
February	0	0	0
March	9	9	0
April	63	63	0
May	112	112	0
June	156	128	28
July	179	128	51
August	156	128	28
September	112	112	0
October	56	56	0
November	0	0	0
December	0	0	0
Total	**843**	**735**	**108**

Notes:
1. Demand is based on 232.8 acres of potential recycled water irrigation area.
2. All AFY values rounded to the nearest AFY.

Table 3-4: Supplemental Recycled Water Requirements for SVSP Base plus UR Option

Month	Irrigation Demand (AF)	Available Recycled Water (AF)	Supplemental Water Supply (AF)
January	0	0	0
February	0	0	0
March	11	11	0
April	76	76	0
May	136	136	0
June	189	172	18
July	218	172	46
August	189	172	18
September	136	136	0
October	68	68	0
November	0.00	0.00	0
December	0.00	0.00	0
Total	**1,024**	**942**	**81**

Notes:
1. Demand is based on 282.7 acres of potential recycled water irrigation area.
2. All AFY values rounded to the nearest AFY.

Supplemental water supplies would be required for the SVSP during the months of June, July, and August. Based on the projected recycled water demands and supply, the total annual volume of supplemental water is approximately 108 AFY for the SVSP Base and 81 AFY for the SVSP Base plus UR.

3.3 Diurnal Recycled Water Supply

Given the uncertainties in estimating what the recycled water availability will be when the SVSP is constructed, the amount of available recycled water was not included in the H2ONET model. However, in order to simulate how recycled water would be supplied to the combined buildout of the SVSP and WRSP, a diurnal analysis of the amount of recycled water available given these assumptions was calculated in this section.

The effluent flow available from the PGWWTP was calculated based on the flows provided in TM 2b, adjusted to reflect the buildout of only the WRSP, SVSP Base plus UR, and the 2005 Regional Service Area. The buildout ADWF for this scenario is calculated in **Table 3-5**. It should be noted that this assumption does not make any representations about when or if any of the excluded land uses would be constructed. Rather, it only is a representation of a conservative availability of effluent from the PGWWTP for the purposes of modeling the filling and drawdown of the storage tanks proposed at the WRSP.

Table 3-5: Assumed Effluent Flow Available from the PGWWTP

Land Use [(1)]	**Buildout ADWF (MGD)**
Buildout ADWF [(2)]	**25.30**
Brookfield UGA	0.73
Creekview UGA	1.06
Curry Creek UGA	2.72
Inviro Tech UGA	0.08
Orchard Creek UGA	0.02
Placer Ranch UGA (inside)	0.90
Placer Ranch UGA (outside)	1.27
Regional University UGA	1.17
Rezones	0.50
SVSP Flow Difference [(3)]	0.26
Net remaining ADWF	**16.59**
Net remaining ADWF/Buildout ADWF	**65.6%**

Notes:
1. Land uses shown are the UGAs or areas that were assumed to not be constructed in order to calculate the ADWF effluent flow available at buildout of the SVSP Base plus UR.
2. Based on flows identified at buildout of the ultimate service area from TM 2b.
3. This flow represents the difference between the assumed ADWF in TM 2b (2.10 MGD) and the ADWF in the SVSP 2009 Sewer Master Plan (1.86 MGD).

As shown in **Table 3-5**, the percentage of remaining ADWF versus buildout ADWF is 65.6% assuming only buildout of the combined SVSP and WRSP systems plus the 2005 regional service area. This 65.6% factor was then applied to the diurnal effluent flow into the chlorine contact basin of 24.8 MGD presented in TM 5b. The 'Pleasant Grove Wastewater Treatment Plant Supply Analysis' Table from TM 5b is attached as **Appendix D** for reference. This resulted in a total available effluent flow of approximately 16.2 MGD. This reduced diurnal effluent flow was then used to prepare a diurnal summary of what the level in the WRSP recycled water storage tanks would be over a 24-hour period. Flows over a 24-hour period were assumed to include:

- Roseville Energy Park: 66,000 gallons/hour, 24-hours per day, or 1.58 MGD [1];
- Flow to the North Zone tank for the Woodcreek Oaks Golf Course and the Sun City Golf Course: 146,717 gal/hr, 15 hours per day during "off peak", totaling 2.20 MGD [1];
- WRSP: up to 3.88 MGD, 432,000 gal/hr, 9 hours per day, during peak flow [1]; and
- SVSP Base plus UR: up to 2.33 MGD, 259,000 gal/hr, 9 hours per day, during peak flow.

Notes:
1. Flow, and hours of operation are based on the 'Pleasant Grove Wastewater Treatment Plant Supply Analysis for Alternative C – Two Tank Fill' Table from TM 5b, updated February 11, 2008.

In total, the West Roseville pump station would be pumping approximately 8.41 MGD to the WRSP, SVSP, and the North Zone tank under this simulation. The PGWWTP would also pump this flow plus the 1.58 MGD for the Roseville Energy Park, or approximately 9.99 MGD.

The SVSP Base and SVSP Base plus UR land use plans both require the construction of a supplemental water supply source to comply with the City policy of recycled water supply specified in TM 5a. For this project, that supplemental water supply will be in the form of a nonpotable irrigation well with an air-gapped connection to the new recycled water storage tank.

The results of this simulation are shown in **Appendix C**. This simulation is presented for the SVSP Base plus UR land use plan, which assumes more recycled water usage than the SVSP Base land use plan.

Though an accurate simulation of the hourly rate of supply required for a supplemental water supply could not be calculated, it is assumed that any nonpotable irrigation well supplying supplemental water would need to add at least 0.55 MGD of water during a 24-hour period. A nonpotable irrigation well meeting these requirements would need to have a sustained yield of at least 382 gpm. There are many wells with capacities in excess of 1,000 gpm just south of the City in the Antelope area of Sacramento County.

It is expected that a nonpotable irrigation well meeting or exceeding the required supplemental water supply requirements will be constructed.

Recycled Water Supply from PGWWTP to the WRSP: The PGWWTP will supply the WRSP storage tank through the existing 24-inch transmission pipeline. This section summarizes the hydraulic issues associated with that supply.

Based on the diurnal water supply scenario in the previous section, the peak hour flow to the WRSP storage tank from the PGWWTP is essentially the peak demand flow for the expanded WRSP pump station plus the flow to the Roseville Energy Park (REP) at 9:00 pm. At this time, the WRSP tank is full and the volume of effluent available is maximized. At that time, the net flow through that 24-inch supply pipeline is 905,758 gal/hr, or 15,096 gpm.

If the existing 24-inch pipeline were to continue to be utilized, the velocity in that 24-inch pipeline would be approximately 10.7 ft/s upstream of the REP turnout, and 9.9 ft/s downstream of the REP turnout. The City has indicated that this velocity is acceptable for this length of pipeline (Buchanan, 2009).

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SECTION 4 – RECYCLED WATER SUPPLY

This section provides information on the method that recycled water will be supplied to the SVSP and how it will be distributed to the customers.

4.1 Recycled Water Distribution System

Distribution system pipelines were located primarily in proposed roadways and paseos with nodes extending to any land uses with recycled water demands. The intent of the distribution system layout was to meet all recycled water demands while minimizing pipe lengths and diameters and maintaining pipe velocities below 5 ft/s. Once the layout was configured to meet all recycled water demands, the SVSP distribution system was combined with the existing and proposed WRSP distribution system. The combined distribution system was evaluated to determine whether infrastructure improvements to the existing and/or planned WRSP distribution system would be necessary. Transmission mainlines within the WRSP distribution system remained within design parameters while supplying the peak flow to the SVSP. Pipeline sizes within the SVSP were then optimized through iterations of up- and downsizing until all pipelines and nodes met the modeling design criteria described in **Section 2.2**.

For both the SVSP Base and Base plus UR land use plans, the recycled water distribution system infrastructure downstream of where the SVSP meets the WRSP distribution systems are identical with the only difference being the infrastructure for the Richland/Chan buildout being removed for the SVSP Base scenario. Additionally, no transmission mainline improvements or oversizing is required within the WRSP distribution system to accommodate the SVSP demands.

The distribution system pipeline alignment is a looped system. The two main pipeline alignments travel north to south from the main intertie locations to the WRSP system at West Side Drive (24-inch) and Market Street (16-inch). The two main alignments are connected by two main east west connections along Road “A,” and Road “B.” The pipelines along Road “A” and “B” extend to the east beyond Market Street where another loop is created by the Upland Drive extension and intertie. These east-west lines also extend west to Watt Avenue where another loop is formed. Multiple laterals from the main loop alignments extend along roadways to serve customers outside of the primary loops.

Figure 4-1 shows the proposed alignment for the SVSP Base distribution system, while **Figure 4-2** shows the proposed alignment for the SVSP Base plus UR distribution system. Based on these figures, the nodes serving the customers to the east are the limiting nodes as they result in the lowest distribution system pressures. These nodes are also located furthest from the storage tank and pump station and are at higher elevations.

All pressures and pipeline velocities remain within City standards except for one node. Modeling showed that the only node to not meet the minimum pressure requirement of 60 psi was Junction 112, which is located on the east end of the SVSP near Fiddyment Road and north of Road “B.” This location is away from the main source tie-ins for the SVSP, and located at the highest elevation. The minimum pressure at this junction is 57.6 psi. Because this pressure was close to 60 psi and no other nodes had pressures below 60 psi, it was

decided to not increase pressures system wide to provide 60 psi at this one node. Pipeline sizes and pumping requirements were optimized to maintain a minimum pressure of 60 psi at remaining nodes and a maximum velocity of 5 ft/s within pipe sections.

A summary of the pipeline infrastructure associated with the SVSP Base and SVSP Base plus UR modeled by HSe is provided as **Table 4-1**. The table includes the pipe sizes and the total lengths of each pipe size required for the system. It should be noted that all of the additional pipeline required to serve the SVSP Base plus UR would be constructed within the UR, and does not require upsizing of pipelines within the SVSP Base.

Table 4-1: Summary of Pipeline Infrastructure – SVSP Base and SVSP Base plus UR

Pipe Size (Diameter)	SVSP Base Total Length (ft)	SVSP Base plus UR Total Length (ft)	Difference (ft)
6-inch	12,800	25,300	12,500
8-inch	9,500	9,500	0
12-inch	25,100	25,100	0
16-inch	7,300	7,300	0
24-inch	3,300	3,300	0
30-inch	0	0	0
Total	**58,000**	**70,500**	**12,500**

Notes:
1. Pipeline total lengths were rounded to the nearest 100.

Output data for both the SVSP Base and SVSP Base plus UR model runs can be found in **Appendix A**. Data for areas upstream of the WRSP storage tank and pump station are specifically excluded due to how the existing storage tanks are modeled and the lack of available PGWWTP flow data.

4.2 Storage Tank and Pump Station

The use of the WRSP storage tank and pump station will require both an expanded storage and pumping capacity to also supply the SVSP. By increasing the storage and pumping capacity of the WRSP facilities, demands from the SVSP would not limit the ability of the WRSP pump station to pump and store the buildout demands of the WRSP. Connections to expand the WRSP recycled water system to serve the SVSP would be made to the 24-inch mainline planned in West Side Drive, the 16-inch mainline in Market Street, and to the 6-inch mainline in Pleasant Grove Blvd.

This section describes the storage and pumping requirements for the SVSP Base and the SVSP Base plus UR land use plans.

Storage Tank: Recycled water storage for the SVSP would be co-located with the WRSP storage tanks and pump station site. This is in accordance with the operation of the preferred recycled water supply option as specified in **Section 2.2**.

COLLECTOR 'A'

DEL WEBB BLVD.

FIDDYMENT ROAD

PLEASANT GROVE BOULEVARD

COLOR CODING LEGEND
NODE: MIN PRESSURE (PSI)

- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90

COLOR CODING LEGEND
PIPE: DIAMETER (IN)

- <= 6
- <= 8
- <= 12
- <= 16
- <= 24

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FIGURE 4-1
MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA RECYCLED WATER MASTER PLAN
SVSP BASE RECYCLED WATER DISTRIBUTION SYSTEM

S:\Common\Projects\219_Sierra Vista\Recycled Water Study\RW Model\h2omap\2-2009\Complete West Roseville Recycled Water Model.dwg DATE:6/11/09

COLLECTOR 'A'

DEL WEBB BLVD.

FIDDYMENT ROAD

PLEASANT GROVE BOULEVARD

COLOR CODING LEGEND
NODE: MIN PRESSURE (PSI)

50 - 60	
60 - 70	
70 - 80	
80 - 90	

COLOR CODING LEGEND
PIPE: DIAMETER (IN)

<=	6
<=	8
<=	12
<=	16
<=	24

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FIGURE 4-2
MACKAY & SOMPS CIVIL ENGINEERS, INC.
SIERRA VISTA RECYCLED WATER MASTER PLAN
SVSP BASE PLUS UR RECYCLED WATER DISTRIBUTION SYSTEM

S:\Common\Projects\219_Sierra Vista\Recycled Water Study\RW Model\h2omap\2-2009\Complete West Roseville Recycled Water Model.dwg DATE:6/11/09

The WRSP already has two 1 MG welded steel recycled water storage tanks in operation (HSe, 2005). Those tanks will continue to be utilized to provide recycled water storage. A third recycled water tank will be added to provide storage for demands associated with the SVSP. Adding a third tank with a smaller volume is more cost effective than building one large tank to provide all of the recycled water storage at the WRSP. It also does not require demolition of the existing tanks.

The minimum capacity of the new WRSP storage tank to store recycled water required for the SVSP would be approximately 2.3 MG for the SVSP Base scenario and 2.8 MG for the SVSP Base plus UR scenario. This is equivalent to one peak day of the recycled water demand specified in **Section 3.1**, plus a 20% safety factor. This tank size would provide the City with the flexibility to provide recycled water at any time of the day without having to maintain flow at a constant rate for any specified amount of time.

Conceptual tank specifications for the SVSP Base and SVSP Base plus UR are included in **Table 4-2**. It was intended for the new tank to have the same HGL as the two existing tanks. Thus, the tank foundation would be at the same grade as the other two tanks, and the tank height would also be 32 feet. This would allow all three tanks to work in concert with each other, similar to how the two tanks work together currently.

Table 4-2: Minimum Tank Specifications

Parameter	SVSP Base plus UR	SVSP Base
Tank Diameter	122 feet	111 feet
Tank Height (Maximum Level)	32 feet	32 feet
Minimum Tank Level	5.0 feet	5.0 feet
Nominal Tank Volume	2.8 MG	2.3 MG

Notes:
1. These dimensions provide the minimum storage requirement of one peak day of flow and flow assumptions for this scenario with a 20% factor of safety.

It is expected that the tank to be added at the WRSP for the benefit of the SVSP will be sized to accommodate the SVSP Base plus UR demands. This storage tank was conceptually located to the north of the two existing recycled water storage tanks. **Figure 4-3** shows a conceptual site plan for the expansion of the WRSP storage tank and pump station.

Pump Station: The expanded WRSP pump station would be expected to meet the following peak flow demands:

- WRSP Buildout (~7,200 gpm peak hour) [1];
- SVSP Base plus UR (~6,500 gpm peak hour) or SVSP Base (~5,400 gpm peak hour) [2]; and
- North Zone (1,300 gpm during peak hour) [3].

Notes:
1. WRSP demands are based on planning documents, the design of the pump station, and the flows presented in TM 5b.
2. SVSP demands are based on Section 3.1 of this document.
3. North Zone demands are based on conversation with Bryan Buchanan of the city of Roseville. It should be noted that the flow to the North Zone presented here differs from the flow presented in TM 5b in that TM 5b shows all flow to the North Zone and golf courses during the off peak period. The 1,300 gpm is assumed in excess to the flows presented in TM 5b.

At buildout of the WRSP and SVSP, the WRSP pump station will need to have the ability to pump approximately 14,800 gpm at 215 ft TDH to meet all of these demands. For the buildout of the WRSP and the SVSP Base, the WRSP pump station will need to have the ability to pump approximately 13,900 gpm at 215 TDH. At these requirements, the pump station will provide a minimum of 60 psi of pressure to each point of connection throughout the combined distribution system. The 215 ft TDH was calculated based on the hydraulic model. To adequately supply flow (13,900 – 14,800 gpm) to the combined WRSP and SVSP distribution system and meet the City's pressure and velocity design criteria, 215 ft TDH pumps are required.

The WRSP pump station was sized, designed, and constructed to supply 7,200 gpm of demand with four duty pumps and one additional pump in standby mode (HSe, 2005). Additionally, there is a low-flow jockey pump to handle low flows.

There are two options available to expand the WRSP pump station to handle the demands of the SVSP. Each are briefly summarized below.

1. **Expand capacity of WRSP pump station within existing pump station site.** This alternative would essentially replace the existing pumps and motors with larger capacity models that would meet the hydraulic requirements for the expanded SVSP Base + UR or SVSP Base demands. For the SVSP Base plus UR, these new duty pumps would be 200 hp. In addition to new pumps and motors, the bowls, starters, panels, and electrical capacity of the system are expected to require upgrading. The suction piping from the manifold to each pump may also need to be upsized from 18-inches to 20-inches. The discharge piping may also need to be upsized. Depending on the pump selected, the depth of the can may need to be increased. During detailed design of this project, the Engineer will determine all of the required improvements.

   This alternative would require modifications to the pump station while the pump station continues to operate. Alternately, construction of the improvements can be implemented during periods when the station is not operating or operating at reduced demands. This would typically occur during the winter months.

2. **Construct new pump station and abandon existing pump station.** This alternative would essentially abandon the existing pump station and control building and replace them with an entirely new pump station and control building. This alternative would be implemented if it was determined that the existing pump station could not be reasonably upgraded to meet the increased demands. One potential location for a new pump station would be in the parking lot to the east of the existing pump station.

   This alternative could be constructed with minimal interruptions to the existing pump station operations. Shutdowns to the pump station would be required to facilitate tie-ins and potentially startup testing.

The vendor for the existing pumps at the WRSP pump station was contacted to determine if the demands for the full buildout of the combined WRSP and SVSP Base plus UR could be met by replacing the pumps and motors within the existing cans. Preliminary indications are that the pumps can be upgraded to approximately 3,500 gpm each within the existing cans.

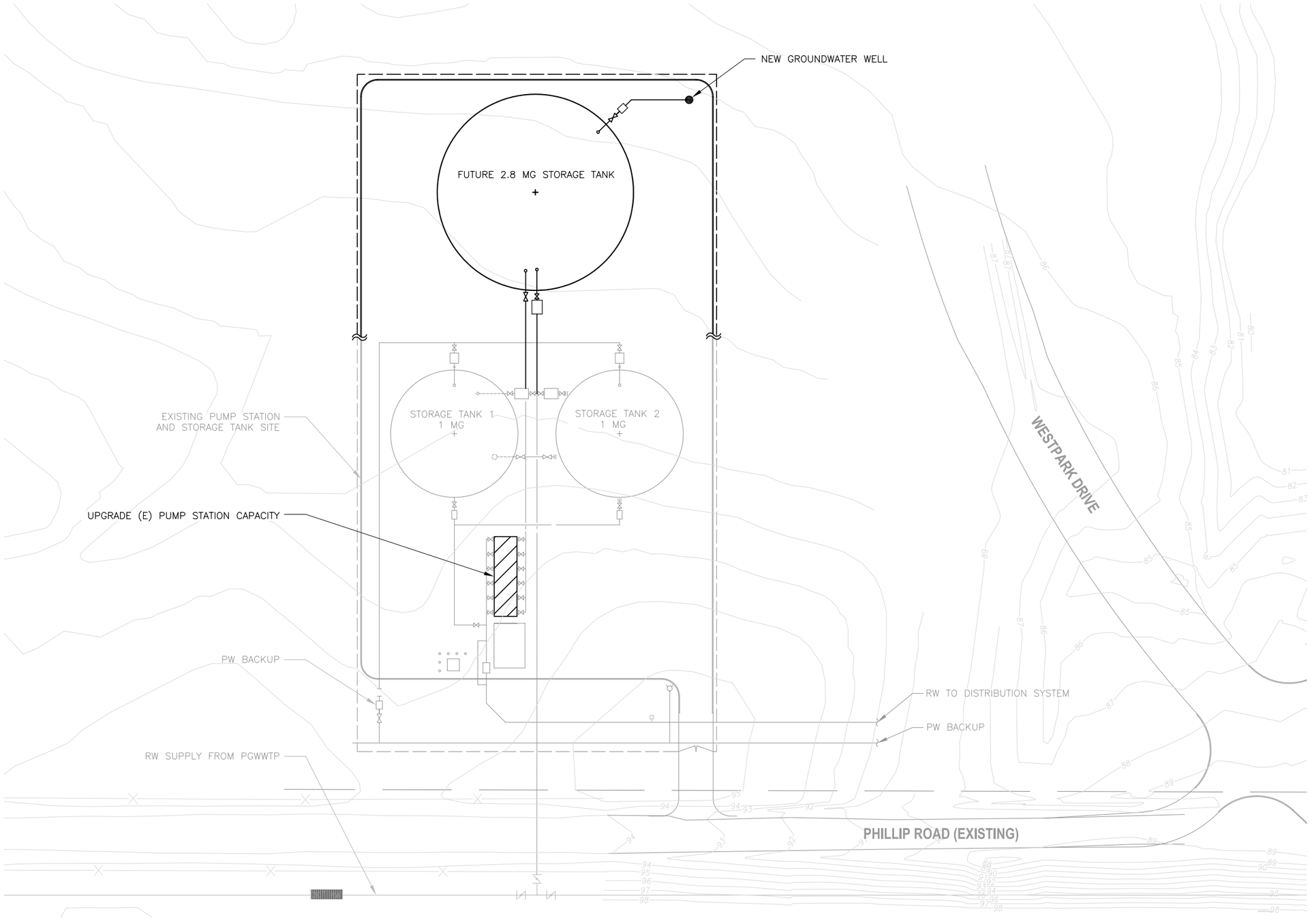

FIGURE 4-3

MACKAY & SOMPS CIVIL ENGINEERS, INC.

SIERRA VISTA POTABLE WATER MASTER PLAN

CONCEPTUAL SITE PLAN FOR THE EXPANSION OF THE WRSP STORAGE TANK AND PUMP STATION

HydroScience Engineers

S:\Common\Projects\219_Sierra Vista\Recycled Water Study\RW Model\Figures\Figure 4-4 032009 MJH.dwg DATE:6/11/09

This would result in a peak day capacity of approximately 14,000 gpm, or 800 gpm less than the combined system peak hour demand. The SVSP Base, and Base plus UR have a safety factor of 50%; due to this upgrading the existing pump station is feasible. These improvements would require upgrading of the suction piping diameter and possible the discharge piping. This alternative would also have a significantly lower construction cost than constructing an entirely new pump station.

The preferred course of action is to expand the capacity of the existing pump station. If it is determined that the pumps cannot be cost-effectively replaced within the existing WRSP, a new pump station will need to be constructed. It is also expected that a new control strategy that accommodates the SVSP will be part of this design.

4.3 Implementation

The phasing of the SVSP has yet to be determined. Based on how the SVSP is phased, it may be necessary to use alternate water supplies (e.g. potable water, groundwater) on an interim basis to supply the recycled water distribution system. It is expected that the SVSP Phasing Plan will detail will detail how the recycled water distribution system is phased and constructed, and what water supplies will be utilized during each phase.

The necessary upgrades to the WRSP storage tank and pump station site will be constructed by the City. The existing facilities are located on City property and are City owned and maintained. The funding mechanisms for these upgrades will be detailed in the agreement between the developers and the City.

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SECTION 5 – RESULTS AND RECOMMENDATIONS

This master plan identifies the requirements for and includes the following results and recommendations with respect to recycled water supply, operational storage and pumping, and recycled water infrastructure.

5.1 Recycled Water Supply and Demand

The following results and recommendations pertain to the recycled water supply and the SVSP recycled water demand.

- **Recycled Water Supply.** Recycled water will be supplied by the PGWWTP via an expansion of the WRSP distribution system and an upgrade to the existing WRSP storage tank and pump station site. Three interties will be made to the WRSP distribution system at West Side Drive, Market Street, and Upland Drive.
- **Recycled Water Demand.** The intent of the recycled water system analysis was to maximize recycled water use through a semi-aggressive water use strategy. All potential customers consistent with a semi-aggressive use will receive recycled water. Semi-aggressive use customers include golf courses, parks, schools, and publicly landscaped, commercial, industrial, and multi-family areas. The resulting peak day demand for the SVSP Base is 1.92 MGD and 2.33 MGD for SVSP Base plus UR.
- **Recycled Water Availability.** Based on a preliminary sanitary sewer flow rate of 1.37 and 1.84 MGD, and an anticipated peak day recycled water demand of 1.92 and 2.33 MGD for SVSP Base and SVSP Base plus UR respectively, additional recycled water or supplemental water is required during the months of June, July, and August. A supplemental water supply of up to 0.55 MGD for SVSP Base option and 0.49 MGD for the SVSP Base plus UR option will be required to meet the peak demands on the days that the recycled water demand exceeds the ADWF.
- **Supplemental water.** The required supplemental water supply will either originate from the use of excess recycled water from the PGWWTP, if it is available, or from a new nonpotable irrigation well constructed for the purpose of supplying supplemental water to the SVSP. A new nonpotable irrigation well will be provided with a capacity of 0.55 MGD on the WRSP storage tank and pump station site for the purposes of providing this supplemental water supply.

5.2 Operational Storage and Pumping

The following results and recommendations pertain to the operational storage and pumping requirements for the SVSP.

- **Construct a new recycled water storage tank.** A 2.8 or 2.3 MG tank is required to provide recycled water storage for the SVSP Base plus UR or SVSP Base land use plans. The new tank will be located adjacent to the existing WRSP storage tank and pump station site.

- **Upgrade the existing WRSP recycled water pump station.** The upgraded WRSP pump station will need to have the ability to pump approximately 14,000 gpm at 215 ft TDH to meet the SVSP/WRSP Buildout Demands. The upgraded WRSP pump station would need to be upgraded to 12,900 gpm at 215 ft TDH is the SVSP Base was used instead.

5.3 Recycled Water Distribution

The following results and recommendations pertain to the distribution system designed to meet the recycled water demands and modeling criteria for the SVSP.

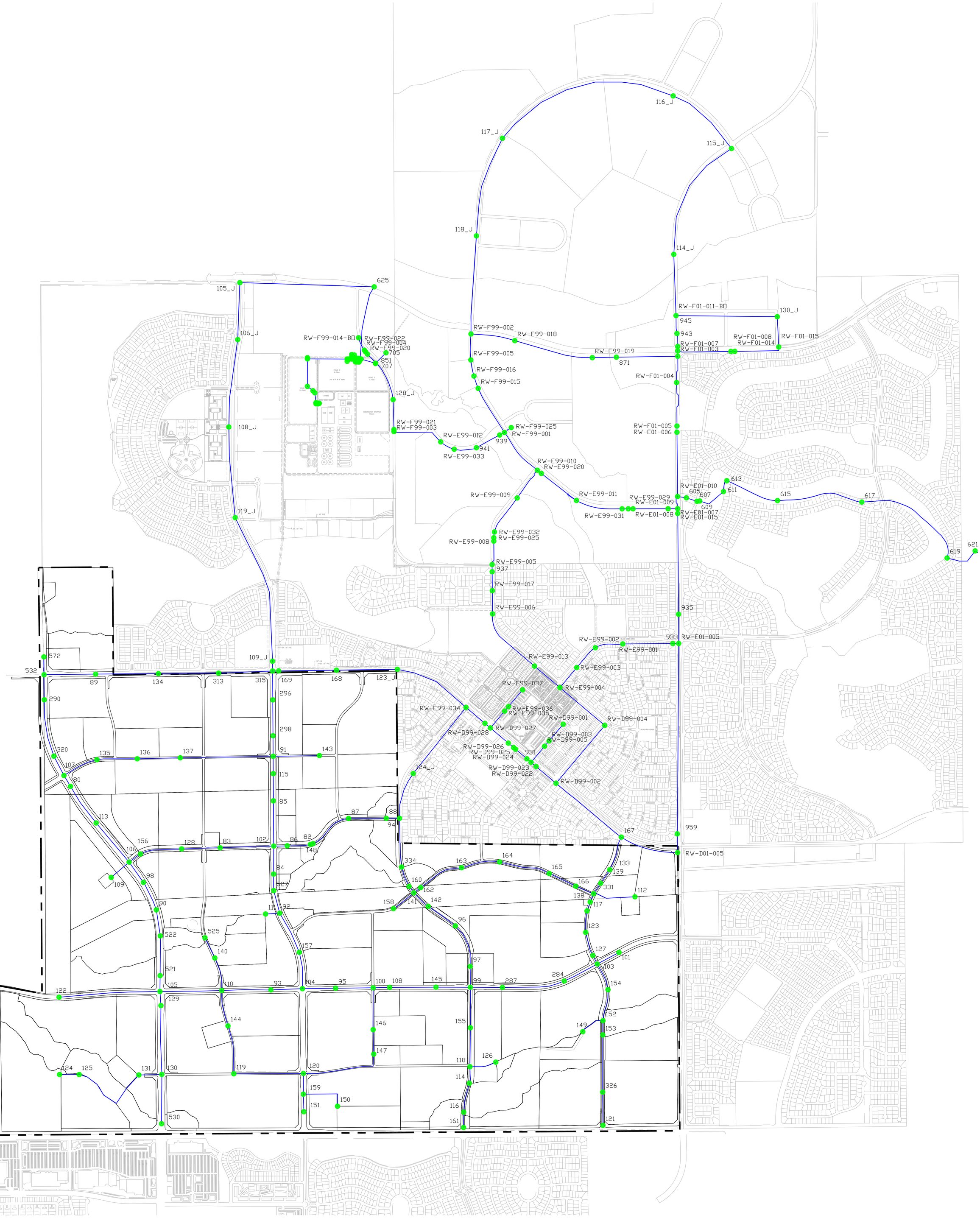
- **Distribution System.** Recycled water will be distributed through either a 70,500 foot (SVSP Base plus UR) or 58,000 foot (SVSP Base) SVSP distribution system consisting of 6-inch, 8-inch, 12-inch, 16-inch, and 24-inch pipelines. The system pipelines generally follow street alignments and extend to all potential SVSP recycled water customers.
- **Modeling Criteria.** All recycled water infrastructure meets the minimum 60 psi pressure requirement at every node except junction 112, and does not exceed 5 ft/s within any pipe section with no main transmission infrastructure improvements to the WRSP distribution system.

SECTION 6 – REFERENCES

1. Buchanan, Bryan, City of Roseville, personal communication, April 2009.
2. EDAW, Sierra Vista Specific Plan – Conceptual Land Use Plan, May 15, 2007.
3. HydroScience Engineers, Recycled Water Distribution System Feasibility Study for the City of Roseville, 2000.
4. HydroScience Engineers, Recycled Water Study for the West Roseville Specific Plan Area, May 2003 and updated 2004.
5. HydroScience Engineers, West Roseville Recycled Water Storage Tank and Pump Station Preliminary Design Report, 2005.
6. MacKay & Somps Civil Engineers, Inc., Sierra Vista Specific Plan – Master Sanitary Sewer Plan, March 2009.
7. RMC, South Placer Regional Wastewater & Recycled Water Systems Evaluation Project –, June 2007 and updated in 2008.
8. University of California – Cooperative Extension, California Turfgrass Culture: Using ET_0 (Reference Evapotranspiration) for Turfgrass Irrigation Efficiency, 1997.

APPENDIX A

H2ONET Modeling Output Data



APPENDIX A

MACKAY & SOMPS CIVIL ENGINEERS, INC.

DRAFT SIERRA VISTA RECYCLED WATER MASTER PLAN

RECYCLED WATER MODEL OUTPUT REPORTS - JUNCTION ID'S

HydroScience Engineers

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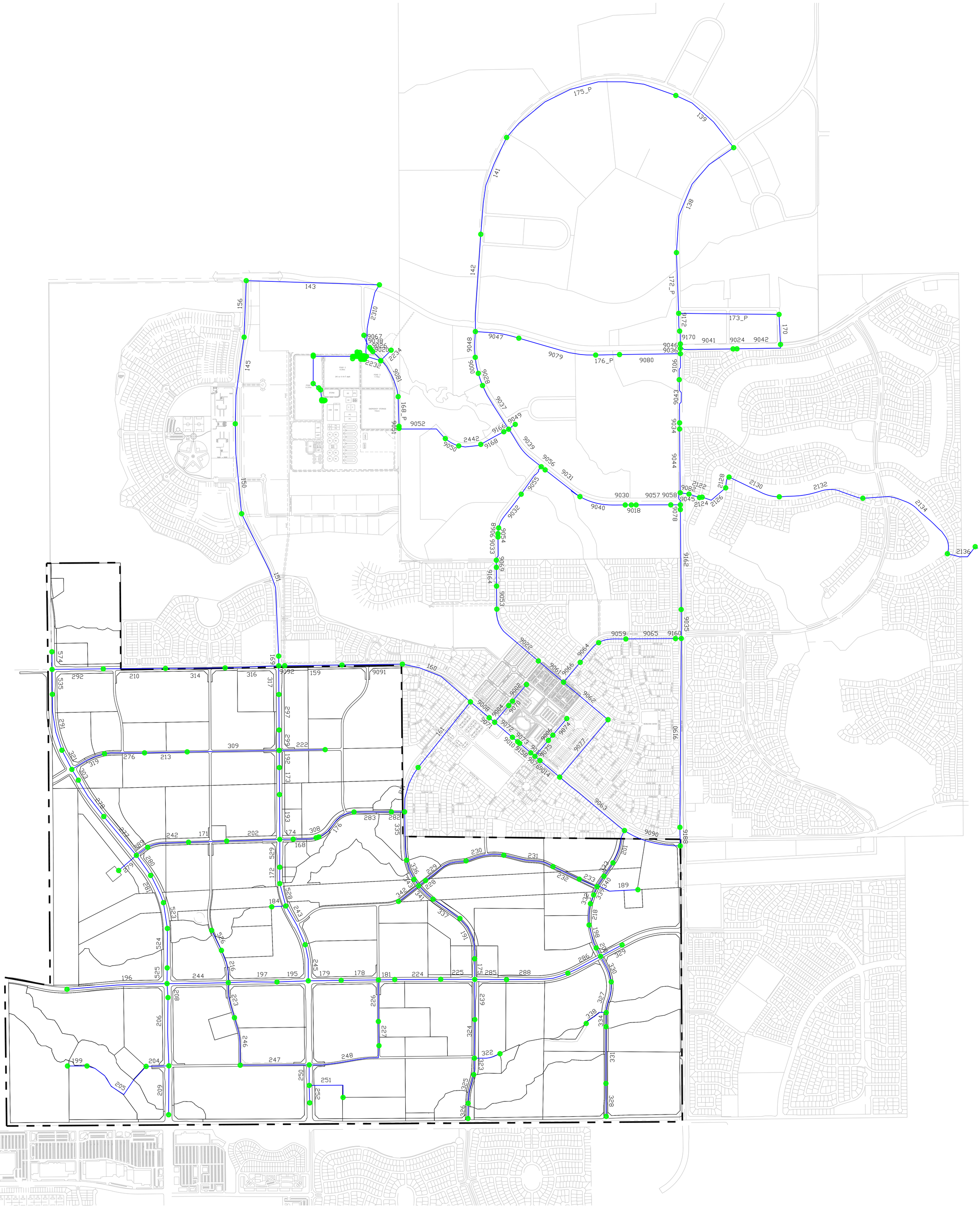

APPENDIX A

MACKAY & SOMPS CIVIL ENGINEERS, INC.

DRAFT SIERRA VISTA RECYCLED WATER MASTER PLAN

RECYCLED WATER MODEL OUTPUT REPORTS - PIPE ID'S

S:\Common\Projects\219_Sierra Vista\Recycled Water Study\RW Model\h2omap\2-2009\Complete West Roseville Recycled Water Model.dwg DATE: 3/13/09

H2ONET Hydraulic Modeling Output Report - SVSP Base - Junction Report

ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
169	85.19	06:00	74.03	00:00	80.73	11.17
168	84.76	06:00	73.54	00:00	80.27	11.22
167	76.48	06:00	64.73	00:00	71.78	11.75
315	85.19	06:00	74.03	00:00	80.73	11.16
326	80.86	09:00	63.29	00:00	73.83	17.57
121	79.13	09:00	61.56	00:00	72.10	17.57
95	81.30	06:00	66.65	00:00	75.44	14.65
RW-E99-037	82.14	06:00	71.33	00:00	77.81	10.81
RW-E99-036	81.27	06:00	70.46	00:00	76.95	10.81
RW-E99-035	81.27	06:00	70.46	00:00	76.95	10.81
RW-E99-034	83.02	06:00	71.68	00:00	78.48	11.34
RW-E99-013	82.05	06:00	74.00	00:00	78.83	8.05
RW-E99-006	83.77	06:00	76.53	02:00	80.87	7.25
RW-E99-004	82.92	06:00	74.62	00:00	79.60	8.30
RW-E99-003	82.92	06:00	74.62	00:00	79.60	8.30
RW-E99-002	82.06	06:00	73.75	00:00	78.73	8.30
RW-E99-001	82.05	06:00	73.75	00:00	78.73	8.30
RW-E01-005	79.46	06:00	71.16	00:00	76.14	8.30
RW-D99-028	82.14	06:00	71.21	00:00	77.77	10.93
RW-D99-027	82.14	06:00	71.33	00:00	77.81	10.81
RW-D99-026	81.26	06:00	70.84	00:00	77.09	10.42
RW-D99-025	81.25	06:00	70.95	00:00	77.13	10.30
RW-D99-024	81.25	06:00	70.99	00:00	77.15	10.26
RW-D99-023	80.37	06:00	70.45	00:00	76.40	9.92
RW-D99-022	80.37	06:00	70.56	00:00	76.44	9.81
RW-D99-005	81.24	06:00	71.32	00:00	77.27	9.92
RW-D99-004	81.20	06:00	72.43	00:00	77.69	8.77
RW-D99-003	81.24	06:00	71.32	00:00	77.27	9.92
RW-D99-002	80.35	06:00	70.98	00:00	76.60	9.38
RW-D99-001	82.10	06:00	72.18	00:00	78.13	9.92
RW-D01-005	75.17	06:00	63.92	00:00	70.67	11.25
959	75.17	06:00	64.19	00:00	70.78	10.98
935	82.02	06:00	74.35	00:00	78.95	7.67
933	80.32	06:00	72.03	00:00	77.00	8.30
931	80.38	06:00	70.36	00:00	76.37	10.01
124_J	81.72	06:00	69.32	00:00	76.76	12.40
123_J	84.32	06:00	73.05	00:00	79.81	11.27
109_J	86.06	06:00	75.10	00:00	81.68	10.96
99	78.48	06:00	63.71	00:00	72.57	14.77
98	89.08	06:00	73.80	00:00	82.97	15.28
97	76.97	06:00	62.30	00:00	71.10	14.67
96	79.56	06:00	65.12	00:00	73.79	14.44
94	83.45	06:00	70.53	00:00	78.28	12.92
93	84.33	06:00	69.27	00:00	78.31	15.05
92	88.43	06:00	75.02	00:00	83.07	13.41
91	83.46	06:00	71.68	00:00	78.75	11.79
90	89.52	06:00	73.91	00:00	83.27	15.61
88	83.89	06:00	71.00	00:00	78.73	12.89
87	85.19	06:00	72.42	00:00	80.08	12.76
86	84.33	06:00	71.86	00:00	79.34	12.47
85	83.46	06:00	71.37	00:00	78.63	12.09
84	86.06	06:00	73.23	00:00	80.93	12.82
83	85.19	06:00	71.72	00:00	79.80	13.47
82	85.62	06:00	73.05	00:00	80.59	12.58
530	91.46	06:00	73.44	00:00	84.25	18.02
527	87.35	06:00	74.28	00:00	82.13	13.07
525	91.89	06:00	75.43	00:00	85.31	16.47
522	91.89	06:00	76.03	00:00	85.55	15.86
521	89.52	06:00	73.29	00:00	83.02	16.23
334	81.29	06:00	67.61	00:00	75.82	13.68
331	77.83	06:00	62.86	04:00	71.84	14.97
298	83.90	06:00	72.25	00:00	79.24	11.64
296	84.76	06:00	73.38	00:00	80.21	11.38
287	80.43	06:00	65.54	00:00	74.47	14.88
284	79.56	09:00	64.48	00:00	73.53	15.08
166	78.26	06:00	63.36	00:00	72.30	14.90
165	78.69	06:00	63.90	00:00	72.78	14.79
164	79.13	06:00	64.55	00:00	73.29	14.58
163	79.56	06:00	65.16	00:00	73.80	14.40
162	81.29	06:00	67.13	00:00	75.63	14.16
161	83.89	06:00	65.76	00:00	76.64	18.13
160	81.94	06:00	67.95	00:00	76.34	13.99
159	85.41	07:00	68.36	00:00	78.59	17.04
158	82.16	06:00	67.49	00:00	76.29	14.66
157	86.92	06:00	72.94	00:00	81.33	13.98
156	88.87	06:00	74.07	00:00	82.95	14.79
155	82.80	06:00	66.28	00:00	76.19	16.53
154	81.51	09:00	65.59	00:00	75.14	15.92
153	81.29	09:00	64.47	00:00	74.56	16.82
152	81.29	09:00	64.70	00:00	74.65	16.59
151	85.19	07:00	68.12	00:00	78.36	17.07
150	86.70	07:00	69.55	00:00	79.84	17.15
149	81.29	09:00	64.67	00:00	74.64	16.62
148	85.62	06:00	73.03	00:00	80.59	12.59
147	85.19	09:00	68.58	00:00	78.54	16.61
146	82.59	06:00	66.41	00:00	76.12	16.19
145	78.70	06:00	63.85	00:00	72.76	14.85
144	83.89	06:00	67.41	00:00	77.30	16.48
142	81.29	06:00	67.06	00:00	75.60	14.23

H2ONET Hydraulic Modeling Output Report - SVSP Base - Junction Report

ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
141	82.16	06:00	68.04	00:00	76.51	14.11
140	90.38	06:00	73.92	00:00	83.80	16.46
139	77.82	06:00	63.29	00:00	72.01	14.53
138	77.40	06:00	62.38	00:00	71.39	15.02
133	77.59	06:00	63.72	00:00	72.04	13.87
131	89.08	06:00	70.76	00:00	81.75	18.33
130	87.35	06:00	69.41	00:00	80.18	17.94
129	87.35	06:00	70.69	00:00	80.69	16.66
128	85.62	06:00	71.49	00:00	79.97	14.13
127	78.05	06:00	62.89	00:00	71.98	15.15
126	83.02	06:00	65.47	00:00	76.00	17.55
125	91.68	06:00	72.24	02:00	83.90	19.43
124	91.68	06:00	72.04	04:00	83.82	19.64
123	76.32	06:00	61.19	00:00	70.26	15.13
122	92.97	06:00	76.38	00:00	86.34	16.60
120	82.59	07:00	65.74	00:00	75.85	16.86
119	84.76	06:00	67.90	00:00	78.01	16.86
118	83.02	06:00	65.51	00:00	76.02	17.51
117	76.75	06:00	61.68	00:00	70.72	15.07
116	83.45	06:00	65.43	00:00	76.24	18.03
115	83.46	06:00	71.56	00:00	78.70	11.91
114	83.02	06:00	65.27	00:00	75.92	17.75
113	87.35	06:00	72.08	00:00	81.24	15.28
112	73.51	06:00	58.44	00:00	67.48	15.07
111	90.81	06:00	77.29	00:00	85.40	13.52
110	86.06	06:00	70.09	00:00	79.67	15.97
109	88.43	06:00	73.42	00:00	82.43	15.02
108	80.00	06:00	65.12	00:00	74.05	14.88
106	88.43	06:00	73.43	00:00	82.43	15.00
105	87.35	06:00	71.01	00:00	80.81	16.35
104	82.38	06:00	67.97	00:00	76.62	14.41
103	78.70	09:00	63.53	00:00	72.63	15.16
102	83.46	06:00	71.08	00:00	78.51	12.39
101	76.97	09:00	61.65	00:00	70.84	15.32
100	80.43	06:00	65.55	00:00	74.48	14.88
RW-F99-025	87.24	06:00	82.50	21:00	85.34	4.74
RW-F99-022	91.72	06:00	91.31	21:00	91.56	0.41
RW-F99-021	88.19	06:00	85.62	21:00	87.16	2.57
RW-F99-020	91.72	06:00	91.31	21:00	91.56	0.41
RW-F99-019	91.56	06:00	80.52	21:00	87.14	11.04
RW-F99-018	90.69	06:00	79.98	21:00	86.41	10.71
RW-F99-016	88.97	06:00	80.74	21:00	85.68	8.23
RW-F99-015	88.10	06:00	80.58	21:00	85.09	7.53
RW-F99-014-BO	92.58	06:00	92.18	21:00	92.42	0.41
RW-F99-005	89.83	06:00	80.71	21:00	86.18	9.12
RW-F99-004	91.72	06:00	91.31	21:00	91.56	0.41
RW-F99-003	88.19	06:00	85.58	21:00	87.15	2.61
RW-F99-002	91.56	06:00	81.03	21:00	87.35	10.53
RW-F99-001	88.11	06:00	83.37	21:00	86.21	4.74
RW-F01-015	84.64	06:00	73.02	21:00	79.99	11.61
RW-F01-014	86.36	06:00	74.83	21:00	81.75	11.53
RW-F01-011-BO	87.23	06:00	75.36	21:00	82.48	11.87
RW-F01-008	86.36	06:00	74.84	21:00	81.75	11.53
RW-F01-007	86.36	06:00	74.93	21:00	81.79	11.43
RW-F01-005	83.67	06:00	75.34	21:00	80.34	8.33
RW-F01-004	86.33	06:00	76.12	21:00	82.24	10.21
RW-F01-003	86.36	06:00	75.04	21:00	81.83	11.33
RW-E99-033	87.28	06:00	83.49	21:00	85.76	3.78
RW-E99-032	84.62	06:00	78.42	00:00	82.14	6.20
RW-E99-031	87.11	06:00	81.72	21:00	84.96	5.39
RW-E99-029	86.24	06:00	80.84	21:00	84.08	5.40
RW-E99-025	84.63	06:00	78.34	00:00	82.11	6.28
RW-E99-020	85.47	06:00	80.32	21:00	83.41	5.16
RW-E99-017	83.77	06:00	76.79	00:00	80.98	6.98
RW-E99-012	89.88	06:00	86.37	21:00	88.48	3.51
RW-E99-011	86.29	06:00	81.00	21:00	84.17	5.29
RW-E99-010	85.48	06:00	80.33	21:00	83.42	5.15
RW-E99-009	85.48	06:00	79.85	21:00	83.23	5.63
RW-E99-008	84.63	06:00	78.30	00:00	82.10	6.33
RW-E99-005	83.76	06:00	77.10	00:00	81.10	6.66
RW-E01-015	87.94	06:00	82.43	21:00	85.74	5.50
RW-E01-010	88.77	06:00	83.38	21:00	86.61	5.38
RW-E01-009	86.24	06:00	80.82	21:00	84.07	5.42
RW-E01-008	87.94	06:00	82.54	21:00	85.78	5.40
RW-E01-007	87.93	06:00	82.53	21:00	85.77	5.40
RW-E01-006	83.67	06:00	75.60	21:00	80.44	8.07
945	88.09	06:00	76.44	21:00	83.43	11.65
943	87.23	06:00	75.74	21:00	82.63	11.49
941	86.40	06:00	82.22	21:00	84.73	4.18
939	88.11	06:00	83.46	21:00	86.25	4.64
937	83.77	06:00	77.00	00:00	81.06	6.76
871	88.96	06:00	77.84	21:00	84.51	11.12
851	89.12	06:00	88.67	21:00	88.94	0.46
727	73.75	06:00	70.10	21:00	72.29	3.64
707	89.12	06:00	88.72	21:00	88.96	0.41
705	90.85	06:00	90.45	21:00	90.69	0.41
693	90.00	06:00	89.95	00:00	89.98	0.05
625	94.32	06:00	92.74	00:00	93.69	1.57
623	72.38	06:00	68.43	21:00	70.80	3.96

H2ONET Hydraulic Modeling Output Report - SVSP Base - Junction Report

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	621	74.42	06:00	70.20	21:00	72.73	4.21
	619	73.68	06:00	69.36	21:00	71.95	4.32
	617	79.31	06:00	74.61	21:00	77.43	4.70
	615	81.37	06:00	76.39	21:00	79.38	4.98
	613	84.18	06:00	79.02	21:00	82.12	5.16
	611	85.95	06:00	80.76	21:00	83.88	5.20
	609	86.93	06:00	81.64	21:00	84.81	5.29
	607	86.94	06:00	81.64	21:00	84.82	5.30
	605	87.85	06:00	82.51	21:00	85.71	5.34
	603	73.85	06:00	70.12	21:00	72.36	3.73
	599	73.76	06:00	70.11	21:00	72.30	3.65
	597	73.75	06:00	70.10	21:00	72.29	3.65
	130_J	87.23	06:00	75.56	21:00	82.56	11.67
	128_J	88.21	06:00	86.16	21:00	87.39	2.05
	119_J	90.40	06:00	81.67	00:00	86.91	8.73
	118_J	85.94	06:00	74.17	21:00	81.23	11.77
	117_J	85.94	06:00	73.66	21:00	81.03	12.27
	116_J	81.61	06:00	68.83	21:00	76.50	12.79
	115_J	81.61	06:00	68.67	21:00	76.44	12.94
	114_J	85.93	06:00	73.22	21:00	80.85	12.71
	108_J	90.40	06:00	83.32	00:00	87.57	7.09
	106_J	90.41	06:00	84.95	00:00	88.22	5.46
	105_J	90.41	06:00	86.10	00:00	88.69	4.32

H2ONET Hydraulic Modeling Output Report - SVSP Base - Pipe Report

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
9092	0.84	00:00	0.16	06:00	0.43	0.68
9091	0.84	00:00	0.16	06:00	0.43	0.68
169	3.43	04:00	0.22	09:00	1.51	3.21
201	3.28	21:00	0.32	20:00	1.50	2.96
9090	1.12	00:00	0.14	20:00	0.54	0.98
P11	2.41	21:00	0.09	20:00	1.02	2.31
317	2.59	04:00	0.06	09:00	1.07	2.52
9232_U	9.23	03:00	0.92	10:00	4.25	8.31
9232_D	9.23	02:00	0.92	09:00	4.25	8.31
9232U	9.23	03:00	0.92	10:00	4.25	8.31
9232D	9.23	02:00	0.92	09:00	4.25	8.31
9190	1.49	00:00	0.14	20:00	0.68	1.34
9188	1.49	00:00	0.14	20:00	0.68	1.34
9172	1.68	00:00	0.05	07:00	0.70	1.63
9170	1.68	00:00	0.05	07:00	0.70	1.63
9168	4.12	21:00	0.70	19:00	2.07	3.41
9166	4.12	21:00	0.70	19:00	2.07	3.41
9164	2.47	04:00	0.23	20:00	1.13	2.24
9162	1.82	21:00	0.41	20:00	0.98	1.41
9160	0.08	21:00	0.07	09:00	0.07	0.02
9158	2.49	21:00	0.44	20:00	1.26	2.05
9082	1.48	06:00	0.53	00:00	1.10	0.95
9081	4.84	21:00	0.70	19:00	2.36	4.13
9080	1.08	21:00	0.08	07:00	0.48	1.00
9079	1.19	21:00	0.08	07:00	0.52	1.10
9078	1.82	21:00	0.41	20:00	0.98	1.41
9077	2.02	21:00	0.27	20:00	0.97	1.75
9076	2.49	21:00	0.44	20:00	1.26	2.05
9075	0.000000	10:00	0.000000	24:00	0.000000	0.00
9074	0.000000	17:00	0.00	04:00	0.00	0.000000
9073	2.49	21:00	0.44	20:00	1.26	2.05
9072	2.49	21:00	0.44	20:00	1.26	2.05
9071	2.49	21:00	0.44	20:00	1.26	2.05
9070	0.000000	19:00	0.00	22:00	0.000000	0.000000
9069	2.74	04:00	0.23	20:00	1.23	2.50
9068	2.74	04:00	0.23	20:00	1.23	2.50
9067	0.000000	24:00	0.00	12:00	0.00	0.000000
9066	0.08	21:00	0.07	09:00	0.07	0.02
9065	0.08	21:00	0.07	09:00	0.07	0.02
9064	0.08	21:00	0.07	09:00	0.07	0.02
9063	2.16	21:00	0.17	20:00	0.97	1.99
9062	2.02	21:00	0.27	20:00	0.97	1.75
9061	1.97	00:00	0.23	20:00	0.93	1.74
9059	0.08	21:00	0.07	09:00	0.07	0.02
9058	0.78	06:00	0.61	00:00	0.71	0.17
9057	0.78	06:00	0.61	00:00	0.71	0.17
9056	1.55	21:00	0.78	07:00	1.09	0.77
9055	2.74	04:00	0.23	20:00	1.23	2.50
9054	2.74	04:00	0.23	20:00	1.23	2.50
9053	2.47	04:00	0.23	20:00	1.13	2.24
9052	4.12	21:00	0.70	19:00	2.07	3.41
9051	4.12	21:00	0.70	19:00	2.07	3.41
9050	4.12	21:00	0.70	19:00	2.07	3.41
9049	0.000000	22:00	0.00	03:00	0.000000	0.000000
9048	4.80	21:00	0.11	07:00	1.98	4.70
9047	1.19	21:00	0.08	07:00	0.52	1.10
9046	1.68	00:00	0.05	07:00	0.70	1.63
9045	1.16	06:00	0.67	21:00	0.96	0.49
9044	2.65	22:00	0.42	07:00	1.31	2.23
9043	2.65	22:00	0.42	07:00	1.31	2.23
9042	0.37	00:00	0.01	07:00	0.15	0.36
9041	0.37	00:00	0.01	07:00	0.15	0.36
9040	1.55	21:00	0.78	07:00	1.09	0.77
9039	2.77	21:00	0.68	09:00	1.51	2.09
9038	0.000000	05:00	0.00	12:00	0.000000	0.000000
9037	4.80	21:00	0.11	07:00	1.98	4.70
9036	2.51	22:00	0.03	07:00	1.02	2.48
9035	1.82	21:00	0.41	20:00	0.98	1.41
9034	2.65	22:00	0.42	07:00	1.31	2.23
9033	2.74	04:00	0.23	20:00	1.23	2.50
9032	2.74	04:00	0.23	20:00	1.23	2.50
9031	1.55	21:00	0.78	07:00	1.09	0.77
9030	1.55	21:00	0.78	07:00	1.09	0.77
9028	4.80	21:00	0.11	07:00	1.98	4.70
9026	0.000000	05:00	0.00	12:00	0.000000	0.000000
9024	0.37	00:00	0.01	07:00	0.15	0.36
9022	2.47	04:00	0.23	20:00	1.13	2.24
9020	0.000000	01:00	0.00	06:00	0.000000	0.000000
9018	1.55	21:00	0.78	07:00	1.09	0.77
9016	2.65	22:00	0.42	07:00	1.31	2.23
9014	2.49	21:00	0.44	20:00	1.26	2.05
9012	2.49	21:00	0.44	20:00	1.26	2.05
9010	2.49	21:00	0.44	20:00	1.26	2.05
9008	2.49	21:00	0.44	20:00	1.26	2.05
9006	0.000000	20:00	0.00	02:00	0.000000	0.000000
9004	0.000000	13:00	0.000000	00:00	0.000000	0.00
9002	0.000000	14:00	0.00	00:00	0.00	0.000000
9000	4.80	21:00	0.11	07:00	1.98	4.70
2458	10.88	21:00	1.58	19:00	5.30	9.30

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
2442	4.12	21:00	0.70	19:00	2.07	3.41
2310	4.39	00:00	0.22	09:00	1.89	4.17
2234	0.000000	19:00	0.00	24:00	0.00	0.000000
2232	4.84	21:00	0.70	12:00	2.36	4.13
2142	1.48	06:00	0.53	00:00	1.10	0.95
2140	1.48	06:00	0.53	00:00	1.10	0.95
2138	1.48	06:00	0.53	00:00	1.10	0.95
2136	1.48	06:00	0.53	00:00	1.10	0.95
2134	1.48	06:00	0.53	00:00	1.10	0.95
2132	1.48	06:00	0.53	00:00	1.10	0.95
2130	1.48	06:00	0.53	00:00	1.10	0.95
2128	1.48	06:00	0.53	00:00	1.10	0.95
2126	1.48	06:00	0.53	00:00	1.10	0.95
2124	1.48	06:00	0.53	00:00	1.10	0.95
2122	1.48	06:00	0.53	00:00	1.10	0.95
2106	1.48	06:00	0.53	00:00	1.10	0.95
2104	1.48	06:00	0.53	00:00	1.10	0.95
176_P	1.08	21:00	0.08	07:00	0.48	1.00
175_P	0.95	21:00	0.02	07:00	0.39	0.93
173_P	0.37	00:00	0.01	07:00	0.15	0.36
172_P	1.77	00:00	0.05	07:00	0.74	1.72
170	0.37	00:00	0.01	07:00	0.15	0.36
168_P	4.12	21:00	0.70	19:00	2.07	3.41
161	2.61	21:00	0.11	06:00	1.11	2.50
160	0.83	00:00	0.16	06:00	0.43	0.67
159	0.84	00:00	0.16	06:00	0.43	0.68
156	4.36	04:00	0.22	09:00	1.88	4.14
151	3.69	00:00	0.22	09:00	1.61	3.47
150	4.11	00:00	0.22	09:00	1.78	3.89
145	4.16	00:00	0.22	09:00	1.80	3.94
143	4.39	00:00	0.22	09:00	1.89	4.17
142	2.18	21:00	0.02	07:00	0.88	2.16
141	1.32	21:00	0.02	07:00	0.54	1.30
139	0.62	21:00	0.05	07:00	0.28	0.57
138	0.58	00:00	0.05	07:00	0.26	0.53
529	2.93	00:00	0.05	09:00	1.20	2.88
528	2.85	00:00	0.05	09:00	1.17	2.80
526	0.19	00:00	0.00	11:00	0.07	0.19
525	1.64	00:00	0.03	07:00	0.67	1.62
524	1.85	01:00	0.03	07:00	0.76	1.83
523	1.89	00:00	0.03	07:00	0.77	1.87
343	2.84	00:00	0.02	20:00	1.15	2.82
342	1.88	00:00	0.00	07:00	0.75	1.88
341	1.79	21:00	0.04	15:00	0.74	1.75
340	2.43	21:00	0.32	20:00	1.16	2.12
339	1.39	21:00	0.04	20:00	0.58	1.34
338	0.38	00:00	0.00	13:00	0.15	0.38
337	1.77	21:00	0.04	15:00	0.73	1.73
336	2.87	00:00	0.02	20:00	1.16	2.85
335	2.93	24:00	0.02	20:00	1.18	2.91
334	1.96	00:00	0.00	15:00	0.78	1.96
333	2.60	21:00	0.32	20:00	1.23	2.29
332	1.36	21:00	0.04	20:00	0.57	1.32
331	1.72	00:00	0.00	13:00	0.69	1.72
330	2.54	00:00	0.00	07:00	1.02	2.54
329	0.96	00:00	0.00	20:00	0.38	0.96
328	0.15	00:00	0.00	17:00	0.06	0.15
327	2.24	00:00	0.00	07:00	0.90	2.24
326	0.99	00:00	0.00	10:00	0.40	0.99
325	1.21	00:00	0.00	09:00	0.48	1.21
324	2.05	00:00	0.00	14:00	0.82	2.05
323	1.50	00:00	0.00	07:00	0.60	1.50
322	0.46	00:00	0.00	14:00	0.19	0.46
308	1.28	22:00	0.13	06:00	0.59	1.14
299	2.45	00:00	0.06	09:00	1.02	2.39
297	2.52	04:00	0.06	09:00	1.05	2.46
289	2.38	00:00	0.03	09:00	0.97	2.35
288	1.03	00:00	0.04	17:00	0.44	0.99
286	0.87	00:00	0.04	17:00	0.37	0.83
285	1.11	00:00	0.04	17:00	0.47	1.06
283	1.07	05:00	0.13	06:00	0.51	0.94
282	0.97	22:00	0.13	06:00	0.47	0.83
281	2.00	01:00	0.03	07:00	0.81	1.97
280	2.06	00:00	0.03	07:00	0.84	2.04
279	0.29	00:00	0.00	12:00	0.11	0.29
277	0.89	00:00	0.00	10:00	0.36	0.89
252	0.43	00:00	0.00	07:00	0.17	0.43
251	0.57	00:00	0.00	13:00	0.23	0.57
250	1.18	00:00	0.00	15:00	0.47	1.18
248	0.78	21:00	0.03	12:00	0.33	0.74
247	0.03	06:00	0.02	21:00	0.03	0.02
246	1.30	00:00	0.03	19:00	0.54	1.26
245	2.51	00:00	0.05	09:00	1.03	2.46
244	1.48	21:00	0.03	16:00	0.61	1.46
243	2.66	00:00	0.05	09:00	1.09	2.61
242	2.46	00:00	0.03	09:00	1.00	2.44
239	2.76	00:00	0.00	14:00	1.10	2.76
233	1.10	00:00	0.04	17:00	0.46	1.06
232	1.15	00:00	0.04	17:00	0.48	1.11

H2ONET Hydraulic Modeling Output Report - SVSP Base - Pipe Report

	ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
	231	1.19	00:00	0.04	17:00	0.50	1.15
	230	1.29	00:00	0.04	17:00	0.54	1.25
	229	1.34	00:00	0.04	17:00	0.56	1.31
	228	1.38	00:00	0.04	17:00	0.57	1.34
	227	2.01	21:00	0.03	12:00	0.82	1.97
	226	2.76	21:00	0.03	12:00	1.13	2.73
	225	0.90	21:00	0.11	12:00	0.43	0.79
	224	0.40	21:00	0.11	12:00	0.23	0.28
	223	1.81	00:00	0.03	19:00	0.75	1.78
	218	0.95	21:00	0.04	20:00	0.41	0.91
	216	1.53	00:00	0.00	09:00	0.61	1.53
	209	0.47	00:00	0.00	07:00	0.19	0.47
	208	2.96	00:00	0.00	09:00	1.18	2.96
	206	2.69	00:00	0.00	09:00	1.08	2.69
	205	2.23	00:00	0.00	07:00	0.89	2.23
	204	2.55	00:00	0.00	12:00	1.02	2.55
	202	2.81	00:00	0.03	09:00	1.14	2.79
	200	0.52	21:00	0.04	20:00	0.24	0.48
	199	1.97	00:00	0.00	10:00	0.79	1.97
	198	0.56	21:00	0.04	20:00	0.25	0.52
	197	2.69	21:00	0.01	06:00	1.08	2.68
	196	0.59	00:00	0.00	15:00	0.23	0.59
	195	2.82	21:00	0.01	06:00	1.13	2.81
	193	2.38	04:00	0.06	09:00	0.99	2.32
	192	2.45	04:00	0.06	09:00	1.02	2.38
	191	1.62	21:00	0.04	15:00	0.67	1.58
	189	0.67	00:00	0.00	16:00	0.27	0.67
	184	1.07	00:00	0.00	10:00	0.43	1.07
	181	0.22	00:00	0.11	12:00	0.16	0.11
	179	1.62	00:00	0.10	06:00	0.71	1.53
	178	1.47	00:00	0.10	06:00	0.65	1.37
	176	1.16	05:00	0.13	06:00	0.54	1.03
	175	1.53	21:00	0.04	15:00	0.63	1.49
	174	1.46	22:00	0.13	06:00	0.66	1.32
	173	2.41	00:00	0.06	09:00	1.00	2.35
	172	2.87	00:00	0.05	09:00	1.18	2.82
	171	2.59	00:00	0.03	09:00	1.05	2.57
	168	1.30	22:00	0.13	06:00	0.60	1.16

H2ONET Hydraulic Modeling Output Report - SVSP Base plus UR - Junction Report

ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
169	87.19	06:00	73.40	00:00	81.68	13.80
168	86.76	06:00	72.92	00:00	81.22	13.84
167	78.48	06:00	64.73	00:00	72.98	13.76
313	90.22	06:00	73.31	00:00	83.46	16.91
315	87.19	07:00	73.40	00:00	81.68	13.79
326	82.86	06:00	62.54	00:00	74.73	20.32
121	81.13	06:00	60.81	00:00	73.00	20.32
95	83.30	06:00	65.77	00:00	76.29	17.52
RW-E99-037	84.14	06:00	70.99	00:00	78.88	13.14
RW-E99-036	83.27	06:00	70.13	00:00	78.01	13.14
RW-E99-035	83.27	06:00	70.13	00:00	78.01	13.14
RW-E99-034	85.02	06:00	71.08	23:00	79.45	13.94
RW-E99-013	84.05	06:00	74.85	00:00	80.37	9.20
RW-E99-006	85.77	06:00	77.60	00:00	82.50	8.17
RW-E99-004	84.92	06:00	75.38	00:00	81.10	9.55
RW-E99-003	84.92	06:00	75.38	00:00	81.10	9.54
RW-E99-002	84.06	06:00	74.51	00:00	80.24	9.54
RW-E99-001	84.06	06:00	74.52	00:00	80.24	9.54
RW-E01-005	81.46	06:00	71.92	00:00	77.65	9.54
RW-D99-028	84.14	06:00	70.82	00:00	78.81	13.32
RW-D99-027	84.14	06:00	70.99	00:00	78.88	13.14
RW-D99-026	83.26	06:00	70.70	00:00	78.23	12.56
RW-D99-025	83.25	06:00	70.86	00:00	78.30	12.39
RW-D99-024	83.25	06:00	70.93	00:00	78.32	12.32
RW-D99-023	82.37	06:00	70.56	00:00	77.65	11.82
RW-D99-022	82.37	06:00	70.71	00:00	77.71	11.65
RW-D99-005	83.24	06:00	71.42	00:00	78.51	11.82
RW-D99-004	83.20	06:00	73.02	00:00	79.13	10.18
RW-D99-003	83.24	06:00	71.42	00:00	78.51	11.82
RW-D99-002	82.35	06:00	71.35	00:00	77.95	11.01
RW-D99-001	84.10	06:00	72.29	00:00	79.38	11.82
RW-D01-005	77.17	06:00	64.06	00:00	71.93	13.12
959	77.17	06:00	64.38	00:00	72.05	12.79
935	84.02	06:00	75.29	00:00	80.53	8.72
933	82.32	06:00	72.79	00:00	78.51	9.54
931	82.38	06:00	70.42	00:00	77.60	11.95
124_J	83.72	06:00	68.63	00:00	77.69	15.09
123_J	86.32	06:00	72.44	00:00	80.77	13.89
109_J	88.06	06:00	74.43	00:00	82.61	13.63
99	80.48	06:00	62.92	00:00	73.46	17.56
98	91.08	06:00	72.38	00:00	83.60	18.70
97	78.97	06:00	61.51	00:00	71.98	17.46
96	81.56	06:00	64.35	00:00	74.68	17.21
94	85.45	06:00	69.80	00:00	79.19	15.65
93	86.33	06:00	68.30	00:00	79.11	18.03
92	90.44	06:00	74.15	00:00	83.92	16.29
91	85.46	06:00	70.86	00:00	79.62	14.61
90	91.52	06:00	72.55	00:00	83.93	18.97
89	93.25	06:00	70.98	00:00	84.34	22.26
88	85.89	06:00	70.26	00:00	79.64	15.63
87	87.19	06:00	71.65	00:00	80.97	15.53
86	86.33	06:00	71.03	00:00	80.21	15.30
85	85.46	06:00	70.54	00:00	79.49	14.92
84	88.06	06:00	72.38	00:00	81.78	15.68
83	87.19	06:00	70.64	00:00	80.57	16.56
82	87.62	06:00	72.23	00:00	81.47	15.39
80	90.22	06:00	67.83	00:00	81.27	22.39
572	96.71	06:00	73.48	00:00	87.42	23.22
532	94.54	06:00	71.38	00:00	85.28	23.16
530	93.46	06:00	72.24	00:00	84.97	21.22
527	89.35	06:00	73.42	00:00	82.98	15.93
525	93.89	06:00	74.33	00:00	86.07	19.56
522	93.89	06:00	74.73	00:00	86.23	19.17
521	91.52	06:00	72.06	00:00	83.73	19.46
334	83.29	06:00	66.86	00:00	76.72	16.43
331	79.83	06:00	62.13	00:00	72.75	17.70
320	90.22	06:00	67.18	00:00	81.00	23.04
298	85.90	06:00	71.48	00:00	80.13	14.42
296	86.76	06:00	72.68	00:00	81.13	14.08
290	92.38	06:00	69.08	00:00	83.06	23.30
287	82.43	06:00	64.76	00:00	75.36	17.66
284	81.56	06:00	63.72	00:00	74.43	17.84
166	80.26	06:00	62.63	00:00	73.21	17.63
165	80.70	06:00	63.17	00:00	73.69	17.52
164	81.13	06:00	63.81	00:00	74.20	17.32
163	81.56	06:00	64.42	00:00	74.70	17.14
162	83.29	06:00	66.38	00:00	76.53	16.91
161	85.89	06:00	64.97	00:00	77.52	20.92
160	83.94	06:00	67.19	00:00	77.24	16.75
159	87.41	06:00	67.36	00:00	79.39	20.05
158	84.16	06:00	66.74	00:00	77.19	17.42
157	88.92	06:00	72.05	00:00	82.17	16.87
156	90.87	06:00	72.66	00:00	83.58	18.21
155	84.81	06:00	65.48	00:00	77.08	19.32
154	83.51	06:00	64.84	00:00	76.04	18.67
153	83.29	06:00	63.72	03:00	75.46	19.57
152	83.29	06:00	63.95	00:00	75.56	19.34
151	87.19	06:00	67.12	00:00	79.16	20.07
150	88.70	06:00	68.55	00:00	80.64	20.16

H2ONET Hydraulic Modeling Output Report - SVSP Base plus UR - Junction Report

ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
149	83.29	06:00	63.93	00:00	75.54	19.36
148	87.62	06:00	72.22	00:00	81.46	15.40
147	87.19	06:00	67.63	00:00	79.36	19.56
146	84.59	06:00	65.49	00:00	76.95	19.10
145	80.70	06:00	63.03	00:00	73.63	17.67
144	85.89	06:00	66.36	23:00	78.08	19.53
143	85.90	06:00	70.50	00:00	79.74	15.39
142	83.29	06:00	66.29	00:00	76.49	17.00
141	84.16	06:00	67.29	00:00	77.41	16.87
140	92.38	06:00	72.83	00:00	84.56	19.55
139	79.82	06:00	62.69	00:00	72.97	17.13
138	79.40	06:00	61.65	00:00	72.30	17.75
137	91.09	06:00	70.01	00:00	82.65	21.08
136	90.22	06:00	67.67	00:00	81.20	22.55
135	88.92	06:00	66.33	00:00	79.89	22.59
134	91.52	06:00	71.58	00:00	83.54	19.94
133	79.59	06:00	63.28	00:00	73.07	16.31
131	91.08	06:00	69.55	00:00	82.47	21.53
130	89.35	06:00	68.21	00:00	80.90	21.14
129	89.35	06:00	69.49	00:00	81.41	19.86
128	87.62	06:00	70.24	23:00	80.67	17.38
127	80.05	06:00	62.15	00:00	72.89	17.90
126	85.02	06:00	64.67	00:00	76.88	20.35
125	93.68	06:00	71.04	03:00	84.62	22.64
124	93.68	06:00	70.84	03:00	84.54	22.84
123	78.32	06:00	60.45	00:00	71.17	17.87
122	94.98	06:00	75.17	00:00	87.05	19.80
120	84.60	06:00	64.73	00:00	76.65	19.86
119	86.76	06:00	66.89	00:00	78.81	19.86
118	85.02	06:00	64.72	00:00	76.90	20.30
117	78.75	06:00	60.94	00:00	71.63	17.81
116	85.45	06:00	64.64	00:00	77.13	20.82
115	85.46	06:00	70.73	00:00	79.57	14.73
114	85.02	06:00	64.48	00:00	76.81	20.54
113	89.35	06:00	68.20	00:00	80.89	21.15
112	75.51	06:00	57.71	00:00	68.39	17.79
111	92.81	06:00	76.42	00:00	86.26	16.40
110	88.06	06:00	69.00	00:00	80.43	19.06
109	90.44	06:00	71.95	00:00	83.04	18.49
108	82.00	06:00	64.28	00:00	74.91	17.72
107	88.06	06:00	65.45	05:00	79.02	22.61
106	90.44	06:00	71.96	00:00	83.05	18.47
105	89.35	06:00	69.80	00:00	81.53	19.55
104	84.38	06:00	67.07	00:00	77.46	17.31
103	80.70	06:00	62.78	00:00	73.53	17.91
102	85.46	06:00	70.23	00:00	79.37	15.24
101	78.97	06:00	60.90	00:00	71.74	18.06
100	82.43	06:00	64.71	00:00	75.34	17.72
RW-F99-025	89.24	06:00	84.17	21:00	87.21	5.07
RW-F99-022	93.72	06:00	93.28	00:00	93.54	0.44
RW-F99-021	90.19	06:00	87.47	21:00	89.11	2.72
RW-F99-020	93.72	06:00	93.28	00:00	93.54	0.44
RW-F99-019	93.56	06:00	82.18	21:00	89.01	11.37
RW-F99-018	92.70	06:00	81.64	21:00	88.27	11.05
RW-F99-016	90.97	06:00	82.40	21:00	87.54	8.56
RW-F99-015	90.10	06:00	82.25	21:00	86.96	7.86
RW-F99-014-BO	94.58	06:00	94.14	00:00	94.41	0.44
RW-F99-005	91.83	06:00	82.38	21:00	88.05	9.46
RW-F99-004	93.72	06:00	93.28	00:00	93.54	0.44
RW-F99-003	90.19	06:00	87.43	21:00	89.09	2.76
RW-F99-002	93.56	06:00	82.69	21:00	89.21	10.87
RW-F99-001	90.11	06:00	85.04	21:00	88.08	5.07
RW-F01-015	86.64	06:00	74.68	21:00	81.86	11.95
RW-F01-014	88.37	06:00	76.49	21:00	83.62	11.87
RW-F01-011-BO	89.23	06:00	77.02	21:00	84.35	12.21
RW-F01-008	88.37	06:00	76.50	21:00	83.62	11.86
RW-F01-007	88.37	06:00	76.59	21:00	83.66	11.77
RW-F01-005	85.67	06:00	76.98	21:00	82.20	8.70
RW-F01-004	88.33	06:00	77.77	21:00	84.11	10.56
RW-F01-003	88.37	06:00	76.70	21:00	83.70	11.67
RW-E99-033	89.28	06:00	85.25	21:00	87.67	4.03
RW-E99-032	86.63	06:00	79.78	00:00	83.89	6.85
RW-E99-031	89.11	06:00	83.33	21:00	86.80	5.78
RW-E99-029	88.24	06:00	82.45	21:00	85.93	5.79
RW-E99-025	86.63	06:00	79.68	00:00	83.85	6.95
RW-E99-020	87.48	06:00	81.93	21:00	85.26	5.54
RW-E99-017	85.77	06:00	77.94	00:00	82.64	7.83
RW-E99-012	91.88	06:00	88.15	21:00	90.39	3.74
RW-E99-011	88.29	06:00	82.61	21:00	86.02	5.68
RW-E99-010	87.48	06:00	81.95	21:00	85.27	5.53
RW-E99-009	87.48	06:00	81.35	00:00	85.03	6.13
RW-E99-008	86.63	06:00	79.62	00:00	83.82	7.01
RW-E99-005	85.77	06:00	78.34	00:00	82.79	7.43
RW-E01-015	89.94	06:00	84.01	21:00	87.57	5.93
RW-E01-010	90.77	06:00	84.99	21:00	88.46	5.77
RW-E01-009	88.24	06:00	82.44	21:00	85.92	5.80
RW-E01-008	89.94	06:00	84.15	21:00	87.62	5.80
RW-E01-007	89.93	06:00	84.14	21:00	87.62	5.79
RW-E01-006	85.67	06:00	77.23	21:00	82.29	8.44

H2ONET Hydraulic Modeling Output Report - SVSP Base plus UR - Junction Report

	ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)	Difference (psi)
	945	90.10	06:00	78.11	21:00	85.30	11.99
	943	89.23	06:00	77.40	21:00	84.50	11.83
	941	88.40	06:00	83.94	21:00	86.61	4.46
	939	90.11	06:00	85.15	21:00	88.12	4.97
	937	85.77	06:00	78.22	00:00	82.75	7.55
	871	90.96	06:00	79.51	21:00	86.38	11.46
	851	91.12	06:00	90.68	00:00	90.94	0.45
	727	75.75	06:00	71.71	21:00	74.13	4.03
	707	91.12	06:00	90.68	00:00	90.95	0.44
	705	92.85	06:00	92.41	00:00	92.68	0.44
	693	92.00	06:00	91.94	00:00	91.97	0.06
	625	96.32	06:00	94.39	00:00	95.55	1.93
	623	74.39	06:00	70.04	21:00	72.65	4.35
	621	76.42	06:00	71.81	21:00	74.58	4.60
	619	75.68	06:00	70.97	21:00	73.80	4.71
	617	81.31	06:00	76.23	21:00	79.28	5.09
	615	83.37	06:00	78.00	21:00	81.23	5.37
	613	86.18	06:00	80.63	21:00	83.96	5.55
	611	87.96	06:00	82.37	21:00	85.72	5.59
	609	88.93	06:00	83.25	21:00	86.66	5.68
	607	88.94	06:00	83.25	21:00	86.66	5.69
	605	89.85	06:00	84.12	21:00	87.56	5.73
	603	75.85	06:00	71.73	21:00	74.20	4.12
	599	75.76	06:00	71.72	21:00	74.14	4.04
	597	75.75	06:00	71.72	21:00	74.14	4.04
	130_J	89.23	06:00	77.22	21:00	84.43	12.01
	128_J	90.21	06:00	88.06	21:00	89.35	2.15
	119_J	92.40	06:00	81.62	00:00	88.08	10.78
	118_J	87.94	06:00	75.84	21:00	83.10	12.10
	117_J	87.94	06:00	75.33	21:00	82.90	12.61
	116_J	83.61	06:00	70.49	21:00	78.37	13.12
	115_J	83.61	06:00	70.34	21:00	78.30	13.28
	114_J	87.94	06:00	74.88	21:00	82.71	13.05
	108_J	92.40	06:00	83.67	00:00	88.91	8.73
	106_J	92.41	06:00	85.69	00:00	89.72	6.72
	105_J	92.41	06:00	87.11	00:00	90.29	5.31

H2ONET Hydraulic Modeling Output Report - SVSP Base plus UR - Pipe Report

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
9092	0.77	01:00	0.16	06:00	0.40	0.61
9091	0.76	00:00	0.16	06:00	0.40	0.60
169	3.95	03:00	0.22	13:00	1.71	3.73
201	3.63	21:00	0.32	12:00	1.64	3.31
9090	1.29	03:00	0.14	12:00	0.60	1.14
P11	2.52	21:00	0.09	12:00	1.07	2.43
316	3.21	00:00	0.01	13:00	1.29	3.19
317	2.97	03:00	0.06	06:00	1.23	2.91
9232_U	9.93	00:00	0.92	14:00	4.53	9.00
9232_D	9.93	00:00	0.92	13:00	4.53	9.00
9232U	9.93	00:00	0.92	14:00	4.53	9.00
9232D	9.93	00:00	0.92	13:00	4.53	9.00
9190	1.65	00:00	0.14	12:00	0.75	1.51
9188	1.65	00:00	0.14	12:00	0.75	1.51
9172	1.67	00:00	0.05	06:00	0.70	1.63
9170	1.67	00:00	0.05	06:00	0.70	1.63
9168	4.30	21:00	0.70	06:00	2.14	3.59
9166	4.30	21:00	0.70	06:00	2.14	3.59
9164	2.83	00:00	0.23	12:00	1.27	2.60
9162	2.11	21:00	0.41	12:00	1.09	1.69
9160	0.11	21:00	0.07	06:00	0.09	0.05
9158	3.11	21:00	0.44	12:00	1.51	2.68
9082	1.48	06:00	0.53	00:00	1.10	0.95
9081	5.01	21:00	0.70	06:00	2.43	4.31
9080	1.08	21:00	0.08	06:00	0.48	1.00
9079	1.19	21:00	0.08	06:00	0.53	1.11
9078	2.11	21:00	0.41	12:00	1.09	1.69
9077	2.39	21:00	0.27	12:00	1.12	2.12
9076	3.11	21:00	0.44	12:00	1.51	2.68
9075	0.000000	08:00	0.000000	02:00	0.000000	0.00
9074	0.000000	14:00	0.00	11:00	0.00	0.000000
9073	3.11	21:00	0.44	12:00	1.51	2.68
9072	3.11	21:00	0.44	12:00	1.51	2.68
9071	3.11	21:00	0.44	12:00	1.51	2.68
9070	0.000000	22:00	0.00	03:00	0.000000	0.000000
9069	3.09	00:00	0.23	12:00	1.38	2.86
9068	3.09	00:00	0.23	12:00	1.38	2.86
9067	0.000000	09:00	0.00	10:00	0.00	0.000000
9066	0.11	21:00	0.07	06:00	0.09	0.05
9065	0.11	21:00	0.07	06:00	0.09	0.05
9064	0.11	21:00	0.07	06:00	0.09	0.05
9063	2.34	21:00	0.17	12:00	1.04	2.17
9062	2.39	21:00	0.27	12:00	1.12	2.12
9061	2.33	01:00	0.23	12:00	1.07	2.10
9059	0.11	21:00	0.07	06:00	0.09	0.05
9058	0.78	07:00	0.63	00:00	0.72	0.15
9057	0.78	07:00	0.63	00:00	0.72	0.15
9056	1.57	21:00	0.78	06:00	1.10	0.79
9055	3.09	00:00	0.23	12:00	1.38	2.86
9054	3.09	00:00	0.23	12:00	1.38	2.86
9053	2.83	00:00	0.23	12:00	1.27	2.60
9052	4.30	21:00	0.70	06:00	2.14	3.59
9051	4.30	21:00	0.70	06:00	2.14	3.59
9050	4.30	21:00	0.70	06:00	2.14	3.59
9049	0.000000	01:00	0.00	04:00	0.000000	0.000000
9048	4.81	21:00	0.11	06:00	1.99	4.70
9047	1.19	21:00	0.08	06:00	0.53	1.11
9046	1.67	00:00	0.05	06:00	0.70	1.63
9045	1.16	06:00	0.67	21:00	0.96	0.49
9044	2.64	00:00	0.42	06:00	1.31	2.21
9043	2.64	00:00	0.42	06:00	1.31	2.21
9042	0.37	00:00	0.01	06:00	0.15	0.36
9041	0.37	00:00	0.01	06:00	0.15	0.36
9040	1.57	21:00	0.78	06:00	1.10	0.79
9039	2.94	21:00	0.68	06:00	1.58	2.27
9038	0.000000	20:00	0.00	03:00	0.000000	0.000000
9037	4.81	21:00	0.11	06:00	1.99	4.70
9036	2.51	22:00	0.03	06:00	1.02	2.48
9035	2.11	21:00	0.41	12:00	1.09	1.69
9034	2.64	00:00	0.42	06:00	1.31	2.21
9033	3.09	00:00	0.23	12:00	1.38	2.86
9032	3.09	00:00	0.23	12:00	1.38	2.86
9031	1.57	21:00	0.78	06:00	1.10	0.79
9030	1.57	21:00	0.78	06:00	1.10	0.79
9028	4.81	21:00	0.11	06:00	1.99	4.70
9026	0.000000	20:00	0.00	00:00	0.000000	0.000000
9024	0.37	00:00	0.01	06:00	0.15	0.36
9022	2.83	00:00	0.23	12:00	1.27	2.60
9020	0.000000	21:00	0.00	07:00	0.000000	0.000000
9018	1.57	21:00	0.78	06:00	1.10	0.79
9016	2.64	00:00	0.42	06:00	1.31	2.21
9014	3.11	21:00	0.44	12:00	1.51	2.68
9012	3.11	21:00	0.44	12:00	1.51	2.68
9010	3.11	21:00	0.44	12:00	1.51	2.68
9008	3.11	21:00	0.44	12:00	1.51	2.68
9006	0.000000	05:00	0.00	23:00	0.000000	0.000000
9004	0.000000	18:00	0.000000	05:00	0.000000	0.00
9002	0.000000	22:00	0.00	24:00	0.00	0.000000
9000	4.81	21:00	0.11	06:00	1.99	4.70

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
2458	5.01	21:00	0.70	06:00	2.43	4.31
2442	4.30	21:00	0.70	06:00	2.14	3.59
2310	4.91	00:00	0.22	13:00	2.10	4.69
2234	0.000000	00:00	0.00	12:00	0.00	0.000000
2232	5.01	21:00	0.70	06:00	2.43	4.31
2142	1.48	06:00	0.53	00:00	1.10	0.95
2140	1.48	06:00	0.53	00:00	1.10	0.95
2138	1.48	06:00	0.53	00:00	1.10	0.95
2136	1.48	06:00	0.53	00:00	1.10	0.95
2134	1.48	06:00	0.53	00:00	1.10	0.95
2132	1.48	06:00	0.53	00:00	1.10	0.95
2130	1.48	06:00	0.53	00:00	1.10	0.95
2128	1.48	06:00	0.53	00:00	1.10	0.95
2126	1.48	06:00	0.53	00:00	1.10	0.95
2124	1.48	06:00	0.53	00:00	1.10	0.95
2122	1.48	06:00	0.53	00:00	1.10	0.95
2106	1.48	06:00	0.53	00:00	1.10	0.95
2104	1.48	06:00	0.53	00:00	1.10	0.95
176_P	1.08	21:00	0.08	06:00	0.48	1.00
175_P	0.95	21:00	0.02	06:00	0.39	0.93
173_P	0.37	00:00	0.01	06:00	0.15	0.36
172_P	1.77	00:00	0.05	06:00	0.74	1.72
170	0.37	00:00	0.01	06:00	0.15	0.36
168_P	4.30	21:00	0.70	06:00	2.14	3.59
161	2.73	21:00	0.11	06:00	1.16	2.62
160	0.72	00:00	0.16	06:00	0.38	0.56
159	0.77	01:00	0.16	06:00	0.40	0.61
156	4.88	03:00	0.22	13:00	2.08	4.66
151	4.21	00:00	0.22	13:00	1.81	3.99
150	4.63	00:00	0.22	13:00	1.98	4.41
145	4.68	00:00	0.22	13:00	2.00	4.46
143	4.91	00:00	0.22	13:00	2.10	4.69
142	2.18	21:00	0.02	06:00	0.88	2.16
141	1.32	21:00	0.02	06:00	0.54	1.30
139	0.62	21:00	0.05	06:00	0.28	0.57
138	0.58	00:00	0.05	06:00	0.26	0.53
574	0.69	00:00	0.00	11:00	0.28	0.69
535	0.90	22:00	0.01	10:00	0.37	0.88
529	2.97	00:00	0.05	06:00	1.22	2.92
528	2.89	01:00	0.05	06:00	1.19	2.84
526	0.19	00:00	0.00	19:00	0.07	0.19
525	1.43	00:00	0.03	13:00	0.59	1.40
524	1.63	00:00	0.03	13:00	0.67	1.61
523	1.68	01:00	0.03	13:00	0.69	1.65
343	2.88	00:00	0.02	12:00	1.16	2.86
342	1.88	00:00	0.00	07:00	0.75	1.88
341	1.84	01:00	0.04	12:00	0.76	1.80
340	2.78	21:00	0.32	12:00	1.30	2.46
339	1.45	21:00	0.04	20:00	0.60	1.40
338	0.38	00:00	0.00	13:00	0.15	0.38
337	1.81	01:00	0.04	12:00	0.75	1.78
336	2.90	00:00	0.02	12:00	1.17	2.89
335	2.97	00:00	0.02	12:00	1.20	2.95
334	1.96	00:00	0.00	11:00	0.78	1.96
333	2.95	21:00	0.32	12:00	1.37	2.63
332	1.42	21:00	0.04	20:00	0.60	1.38
331	1.72	00:00	0.00	17:00	0.69	1.72
330	2.54	00:00	0.00	09:00	1.02	2.54
329	0.96	00:00	0.00	11:00	0.38	0.96
328	0.15	00:00	0.00	14:00	0.06	0.15
327	2.24	00:00	0.00	19:00	0.90	2.24
326	0.99	00:00	0.00	17:00	0.40	0.99
325	1.21	00:00	0.00	14:00	0.48	1.21
324	2.05	00:00	0.00	19:00	0.82	2.05
323	1.50	00:00	0.00	08:00	0.60	1.50
322	0.46	00:00	0.00	13:00	0.19	0.46
321	1.80	21:00	0.01	10:00	0.73	1.79
319	0.22	23:00	0.01	06:00	0.09	0.21
314	2.98	22:00	0.01	13:00	1.20	2.96
309	3.55	22:00	0.01	06:00	1.43	3.54
308	1.13	22:00	0.13	19:00	0.53	1.00
303	1.68	21:00	0.02	10:00	0.69	1.65
299	2.84	03:00	0.06	06:00	1.17	2.78
297	2.91	00:00	0.06	06:00	1.20	2.85
292	1.68	22:00	0.01	13:00	0.68	1.66
291	0.81	21:00	0.01	10:00	0.33	0.80
289	2.70	00:00	0.02	06:00	1.09	2.68
288	0.97	22:00	0.04	13:00	0.41	0.92
286	0.81	22:00	0.04	13:00	0.35	0.76
285	1.05	22:00	0.04	13:00	0.44	1.00
283	0.92	01:00	0.13	19:00	0.45	0.79
282	0.82	22:00	0.13	19:00	0.41	0.69
281	1.78	00:00	0.03	13:00	0.73	1.75
280	1.84	00:00	0.03	13:00	0.75	1.82
279	0.29	00:00	0.00	15:00	0.11	0.29
278	2.15	21:00	0.02	10:00	0.88	2.13
277	3.04	21:00	0.02	10:00	1.23	3.02
276	0.37	23:00	0.01	06:00	0.15	0.36
252	0.43	00:00	0.00	15:00	0.17	0.43

H2ONET Hydraulic Modeling Output Report - SVSP Base plus UR - Pipe Report

ID	Max.Value (ft/s)	Max.Time (hrs)	Min.Value (ft/s)	Min.Time (hrs)	Average (ft/s)	Difference (ft/s)
251	0.57	00:00	0.00	07:00	0.23	0.57
250	1.18	00:00	0.00	07:00	0.47	1.18
248	0.86	21:00	0.03	14:00	0.37	0.83
247	0.07	21:00	0.03	19:00	0.05	0.03
246	1.21	00:00	0.03	19:00	0.51	1.18
245	2.55	01:00	0.05	06:00	1.05	2.50
244	1.70	21:00	0.03	19:00	0.70	1.67
243	2.70	01:00	0.05	06:00	1.11	2.65
242	2.78	22:00	0.02	06:00	1.13	2.76
239	2.76	00:00	0.00	19:00	1.10	2.76
233	1.07	00:00	0.04	06:00	0.45	1.04
232	1.12	00:00	0.04	06:00	0.47	1.09
231	1.17	00:00	0.04	06:00	0.49	1.13
230	1.27	00:00	0.04	06:00	0.53	1.23
229	1.32	00:00	0.04	06:00	0.55	1.28
228	1.35	00:00	0.04	06:00	0.56	1.32
227	2.09	21:00	0.03	14:00	0.86	2.06
226	2.85	21:00	0.03	14:00	1.16	2.81
225	1.04	21:00	0.11	19:00	0.49	0.93
224	0.54	21:00	0.11	19:00	0.28	0.43
223	1.73	00:00	0.03	19:00	0.71	1.69
222	1.65	00:00	0.00	13:00	0.66	1.65
218	1.01	21:00	0.04	20:00	0.43	0.97
216	1.53	00:00	0.00	07:00	0.61	1.53
213	2.42	22:00	0.01	06:00	0.97	2.41
210	2.53	00:00	0.01	13:00	1.02	2.51
209	0.47	00:00	0.00	08:00	0.19	0.47
208	2.96	00:00	0.00	16:00	1.18	2.96
206	2.69	00:00	0.00	18:00	1.08	2.69
205	2.23	00:00	0.00	11:00	0.89	2.23
204	2.55	00:00	0.00	14:00	1.02	2.55
202	3.14	22:00	0.02	06:00	1.27	3.12
200	0.59	21:00	0.04	20:00	0.26	0.54
199	1.97	00:00	0.00	20:00	0.79	1.97
198	0.63	21:00	0.04	20:00	0.28	0.58
197	2.87	21:00	0.01	14:00	1.16	2.86
196	0.59	00:00	0.00	11:00	0.23	0.59
195	3.00	21:00	0.01	14:00	1.21	2.99
193	2.44	01:00	0.06	06:00	1.01	2.38
192	2.51	00:00	0.06	06:00	1.04	2.45
191	1.67	01:00	0.04	12:00	0.69	1.63
189	0.67	00:00	0.00	18:00	0.27	0.67
184	1.07	00:00	0.00	07:00	0.43	1.07
181	0.11	06:00	0.07	21:00	0.10	0.04
179	1.51	02:00	0.10	19:00	0.66	1.42
178	1.36	22:00	0.10	19:00	0.60	1.26
176	1.01	01:00	0.13	19:00	0.49	0.88
175	1.58	00:00	0.04	12:00	0.65	1.54
174	1.31	22:00	0.13	19:00	0.60	1.18
173	2.47	01:00	0.06	06:00	1.02	2.41
172	2.91	00:00	0.05	06:00	1.19	2.86
171	2.91	01:00	0.02	06:00	1.18	2.89
168	1.15	00:00	0.13	19:00	0.54	1.02

APPENDIX B

Sierra Vista Recycled Water Market Assessment Table by Individual Zoning Area

Sierra Vista Recycled Water Market Assessment

No.	ID	Zoning	Area Description	Total Area	Non-Irrigated Surface	Non-Irrigated Surface	Irrigated Percentage	RW Irrigated	Annual Demand	Peak Day Demand (24 Hours)
				(Acres)	(%)	(Acres)	(%)	(Acres)	(AFY)	(GPD)
1	HDR-1	HDR	High Density Residential	4.1	80%	3.3	20.0%	0.8	3.0	6,784
2	HDR-2	HDR	High Density Residential	4.1	80%	3.3	20.0%	0.8	3.0	6,784
3	HDR-3	HDR	High Density Residential	5.6	80%	4.5	20.0%	1.1	4.1	9,265
4	HDR-4	HDR	High Density Residential	8	80%	6.4	20.0%	1.6	5.8	13,236
5	HDR-5	HDR	High Density Residential	8.6	80%	6.9	20.0%	1.7	6.2	14,229
6	HDR-6	HDR	High Density Residential	28.1	80%	22.5	20.0%	5.6	20.3	46,492
7	HDR-7	HDR	High Density Residential	7.6	80%	6.1	20.0%	1.5	5.5	12,574
8	CMU-1	CMU	Commercial Mixed Use	5.4	85%	4.6	15.0%	0.8	2.9	6,701
9	CMU-2	CMU	Commercial Mixed Use	5.4	85%	4.6	15.0%	0.8	2.9	6,701
10	CMU-3	CMU	Commercial Mixed Use	23.5	85%	20.0	15.0%	3.5	12.8	29,161
11	PR-1	PR	Park	1	25%	0.3	75.0%	0.8	2.7	6,204
12	PR-2	PR	Park	1.7	25%	0.4	75.0%	1.3	4.6	10,548
13	PR-3	PR	Park	1.1	25%	0.3	75.0%	0.8	3.0	6,825
14	PR-4	PR	Park	5	25%	1.3	75.0%	3.8	13.6	31,022
15	PR-5	PR	Park	8.1	25%	2.0	75.0%	6.1	22.0	50,256
16	PR-6	PR	Park	8	25%	2.0	75.0%	6.0	21.7	49,636
17	PR-7	PR	Park	2.6	25%	0.7	75.0%	2.0	7.1	16,132
18	PR-8	PR	Park	4.2	25%	1.1	75.0%	3.2	11.4	26,059
19	PR-9	PR	Park	10.7	25%	2.7	75.0%	8.0	29.1	66,388
20	PR-10	PR	Park	1.9	25%	0.5	75.0%	1.4	5.2	11,789
21	PR-11	PR	Park	1.5	25%	0.4	75.0%	1.1	4.1	9,307
22	PR-12	PR	Park	39.9	25%	10.0	75.0%	29.9	108.3	247,559
23	PR-13	PR	Park	4.2	25%	1.1	75.0%	3.2	11.4	26,059
24	PQP-1	P/QP	Public/Quasi Public (church)	4.2	85%	3.6	15.0%	0.6	2.3	5,212
25	PQP-6	P/QP	Public/Quasi Public (El Sch)	12	60%	7.2	40.0%	4.8	17.4	39,709
26	PQP-7	P/QP	Public/Quasi Public (Fire)	2.8	85%	2.4	15.0%	0.4	1.5	3,475
27	PQP-8	P/QP	Public/Quasi Public (Mid Sch)	21.6	60%	13.0	40.0%	8.6	31.3	71,476
28	PQP-10	P/QP	Public/Quasi Public (El Sch)	12	60%	7.2	40.0%	4.8	17.4	39,709
29	PQP-11	P/QP	Public/Quasi Public (El Sch)	12	60%	7.2	40.0%	4.8	17.4	39,709
30	CC-1a	CC	Communiy Commercial	7.5	85%	6.4	15.0%	1.1	4.1	9,307
31	CC-1b	CC	Communiy Commercial	0.1	85%	0.1	15.0%	0.0	0.1	124
32	CC-2	CC	Communiy Commercial	56	85%	47.6	15.0%	8.4	30.4	69,490
33	CC-3	CC	Communiy Commercial	8.8	85%	7.5	15.0%	1.3	4.8	10,920
34	CC-4a	CC	Communiy Commercial	12.6	85%	10.7	15.0%	1.9	6.8	15,635
35	CC-4b	CC	Communiy Commercial	28.8	85%	24.5	15.0%	4.3	15.6	35,738
36	CC-5	CC	Communiy Commercial	39.8	85%	33.8	15.0%	6.0	21.6	49,388
37	CC/BP-1	CC/BP	Commercial Business Park	15.1	85%	12.8	15.0%	2.3	8.2	18,738
38	CC/BP-2	CC/BP	Commercial Business Park	12.2	85%	10.4	15.0%	1.8	6.6	15,139
39	LC-1	LC	Landscape Corridor (LDR-3)	0.085	15%	0.0	85.0%	0.1	0.3	598
40	LC-2	LC	Landscape Corridor (LDR-4)	0.025	15%	0.0	85.0%	0.0	0.1	176
41	LC-3	LC	Landscape Corridor (LDR-5)	0.123	15%	0.0	85.0%	0.1	0.4	865
42	LC-4	LC	Landscape Corridor (LDR-8)	0.501	15%	0.1	85.0%	0.4	1.5	3,523
43	LC-5	LC	Landscape Corridor (LDR-9)	0.615	15%	0.1	85.0%	0.5	1.9	4,325
44	LC-6	LC	Landscape Corridor (LDR-10)	0.27	15%	0.0	85.0%	0.2	0.8	1,899
45	LC-7	LC	Landscape Corridor (LDR-11)	1.703	15%	0.3	85.0%	1.4	5.2	11,975
46	LC-8	LC	Landscape Corridor (LDR-12)	2.304	15%	0.3	85.0%	2.0	7.1	16,201
47	LC-9	LC	Landscape Corridor (LDR-13)	0.436	15%	0.1	85.0%	0.4	1.3	3,066
48	LC-10	LC	Landscape Corridor (LDR-14)	1.567	15%	0.2	85.0%	1.3	4.8	11,019
49	LC-11	LC	Landscape Corridor (LDR-15)	1.842	15%	0.3	85.0%	1.6	5.7	12,953
50	LC-12	LC	Landscape Corridor (LDR-16)	2.234	15%	0.3	85.0%	1.9	6.9	15,709
51	LC-13	LC	Landscape Corridor (LDR-17)	1.876	15%	0.3	85.0%	1.6	5.8	13,192
52	LC-14	LC	Landscape Corridor (LDR-18)	2.37	15%	0.4	85.0%	2.0	7.3	16,665
53	LC-15	LC	Landscape Corridor (LDR-19)	0.554	15%	0.1	85.0%	0.5	1.7	3,896
54	LC-16	LC	Landscape Corridor (LDR-20a)	0.587	15%	0.1	85.0%	0.5	1.8	4,128
55	LC-17	LC	Landscape Corridor (LDR-21)	0.877	15%	0.1	85.0%	0.7	2.7	6,167
56	LC-18	LC	Landscape Corridor (LDR-22)	2.086	15%	0.3	85.0%	1.8	6.4	14,668
57	LC-19	LC	Landscape Corridor (LDR-23)	0.375	15%	0.1	85.0%	0.3	1.2	2,637
58	LC-20	LC	Landscape Corridor (MDR-1)	2.197	15%	0.3	85.0%	1.9	6.8	15,449
59	LC-21	LC	Landscape Corridor (MDR-2)	1.418	15%	0.2	85.0%	1.2	4.4	9,971
60	LC-22	LC	Landscape Corridor (MDR-3)	0.785	15%	0.1	85.0%	0.7	2.4	5,520
61	LC-23	LC	Landscape Corridor (MDR-5)	0.738	15%	0.1	85.0%	0.6	2.3	5,189
62	LC-24	LC	Landscape Corridor (MDR-6)	0.809	15%	0.1	85.0%	0.7	2.5	5,689
63	LC-25	LC	Landscape Corridor (MDR-7)	1.608	15%	0.2	85.0%	1.4	4.9	11,307
64	LC-26	LC	Landscape Corridor (MDR-9)	1.598	15%	0.2	85.0%	1.4	4.9	11,237
65	LC-27	LC	Landscape Corridor (MDR-10)	1.94	15%	0.3	85.0%	1.6	6.0	13,642
66	LC-28	LC	Landscape Corridor (MDR-11)	2.466	15%	0.4	85.0%	2.1	7.6	17,340
67	LC-29	LC	Landscape Corridor (MDR-12)	0.649	15%	0.1	85.0%	0.6	2.0	4,564
68	LC-30	LC	Landscape Corridor (MDR-13)	0.427	15%	0.1	85.0%	0.4	1.3	3,003
69	LC-31	LC	Landscape Corridor (MDR-14)	0.591	15%	0.1	85.0%	0.5	1.8	4,156
70	LC-32	LC	Landscape Corridor (OS-1)	0.121	15%	0.0	85.0%	0.1	0.4	851
71	LC-33	LC	Landscape Corridor (OS-2)	0.023	15%	0.0	85.0%	0.0	0.1	162
72	LC-34	LC	Landscape Corridor (OS-3)	0.174	15%	0.0	85.0%	0.1	0.5	1,224
73	LC-35	LC	Landscape Corridor (OS-4a)	0.142	15%	0.0	85.0%	0.1	0.4	999
74	LC-36	LC	Landscape Corridor (OS-4b)	0.255	15%	0.0	85.0%	0.2	0.8	1,793

Sierra Vista Recycled Water Market Assessment

No.	ID	Zoning	Area Description	Total Area	Non-Irrigated Surface	Non-Irrigated Surface	Irrigated Percentage	RW Irrigated	Annual Demand	Peak Day Demand (24 Hours)
				(Acres)	(%)	(Acres)	(%)	(Acres)	(AFY)	(GPD)
75	LC-37	LC	Landscape Corridor (OS-5)	0.205	15%	0.0	85.0%	0.2	0.6	1,442
76	LC-38	LC	Landscape Corridor (OS-6b)	0.276	15%	0.0	85.0%	0.2	0.8	1,941
77	LC-39	LC	Landscape Corridor (OS-6c)	0.191	15%	0.0	85.0%	0.2	0.6	1,343
78	LC-40	LC	Landscape Corridor (OS-7a)	0.765	15%	0.1	85.0%	0.7	2.4	5,379
79	LC-41	LC	Landscape Corridor (OS-7b)	0.141	15%	0.0	85.0%	0.1	0.4	991
80	LC-42	LC	Landscape Corridor (OS-8a)	0.783	15%	0.1	85.0%	0.7	2.4	5,506
81	LC-43	LC	Landscape Corridor (OS-8b)	0.065	15%	0.0	85.0%	0.1	0.2	457
82	LC-44	LC	Landscape Corridor (OS-8c)	0.116	15%	0.0	85.0%	0.1	0.4	816
83	LC-45	LC	Landscape Corridor (OS-8d)	0.238	15%	0.0	85.0%	0.2	0.7	1,674
84	LC-46	LC	Landscape Corridor (OS-9)	0.205	15%	0.0	85.0%	0.2	0.6	1,442
85	LC-47	LC	Landscape Corridor (OS-11)	0.835	15%	0.1	85.0%	0.7	2.6	5,872
86	LC-48	LC	Landscape Corridor (OS-12)	0.874	15%	0.1	85.0%	0.7	2.7	6,146
87	LC-49	LC	Landscape Corridor (OS-13)	0.623	15%	0.1	85.0%	0.5	1.9	4,381
88	LC-50	LC	Landscape Corridor (OS-14)	0.686	15%	0.1	85.0%	0.6	2.1	4,824
89	LC-51	LC	Landscape Corridor (OS-16)	0.129	15%	0.0	85.0%	0.1	0.4	907
90	LC-52	LC	Landscape Corridor (PQP-1)	0.531	15%	0.1	85.0%	0.5	1.6	3,734
91	LC-53	LC	Landscape Corridor (PQP-3)	0.208	15%	0.0	85.0%	0.2	0.6	1,463
92	LC-54	LC	Landscape Corridor (PQP-4)	0.131	15%	0.0	85.0%	0.1	0.4	921
93	LC-55	LC	Landscape Corridor (PQP-7)	0.329	15%	0.0	85.0%	0.3	1.0	2,313
94	P-1	P	Paseo (MDR-2)	0.25	15%	0.0	85.0%	0.2	0.8	1,758
95	P-2	P	Paseo (LDR-2)	0.52	15%	0.1	85.0%	0.4	1.6	3,657
96	P-3	P	Paseo (MDR-5)	0.35	15%	0.1	85.0%	0.3	1.1	2,461
97	P-4	P	Paseo (LDR-3)	1.13	15%	0.2	85.0%	1.0	3.5	7,946
98	P-5	P	Paseo (LDR-5)	0.56	15%	0.1	85.0%	0.5	1.7	3,938
99	P-6	P	Paseo (MDR-3)	1.28	15%	0.2	85.0%	1.1	3.9	9,001
100	P-7	P	Paseo (MDR-6)	0.84	15%	0.1	85.0%	0.7	2.6	5,907
101	P-8	P	Paseo (HDR-1)	0.45	15%	0.1	85.0%	0.4	1.4	3,164
102	P-9a	P	Paseo (PQP-1)	0.31	15%	0.0	85.0%	0.3	1.0	2,180
103	P-9b	P	Paseo (PQP-2)	0.33	15%	0.0	85.0%	0.3	1.0	2,320
104	P-10	P	Paseo (MDR-4)	1.33	15%	0.2	85.0%	1.1	4.1	9,352
105	P-11	P	Paseo (OS-2)	0.54	15%	0.1	85.0%	0.5	1.7	3,797
106	P-12a	P	Paseo (LDR-4)	0.7	15%	0.1	85.0%	0.6	2.2	4,922
107	P-12b	P	Paseo (OS-1)	0.18	15%	0.0	85.0%	0.2	0.6	1,266
108	P-13	P	Paseo (LDR-7)	0.31	15%	0.0	85.0%	0.3	1.0	2,180
109	P-14a	P	Paseo (LDR-7)	1.16	15%	0.2	85.0%	1.0	3.6	8,157
110	P-14b	P	Paseo (OS-2)	0.14	15%	0.0	85.0%	0.1	0.4	984
111	P-14c	P	Paseo (LDR-6)	0.15	15%	0.0	85.0%	0.1	0.5	1,055
112	P-15	P	Paseo (LDR-8)	0.31	15%	0.0	85.0%	0.3	1.0	2,180
113	P-16	P	Paseo (OS-3)	0.25	15%	0.0	85.0%	0.2	0.8	1,758
114	P-17	P	Paseo (OS-7a)	0.07	15%	0.0	85.0%	0.1	0.2	492
115	P-18	P	Paseo (OS-8b)	0.2	15%	0.0	85.0%	0.2	0.6	1,406
116	P-19	P	Paseo (OS-7b	0.19	15%	0.0	85.0%	0.2	0.6	1,336
117	P-20	P	Paseo (HDR-4)	0.83	15%	0.1	85.0%	0.7	2.6	5,836
118	P-21	P	Paseo (MDR-8)	1.4	15%	0.2	85.0%	1.2	4.3	9,844
119	P-22	P	Paseo (MDR-9)	0.26	15%	0.0	85.0%	0.2	0.8	1,828
120	P-23	P	Paseo (CC (CMU-2)	0.24	15%	0.0	85.0%	0.2	0.7	1,688
121	P-24	P	Paseo (CC (CMU-1)	0.3	15%	0.0	85.0%	0.3	0.9	2,110
122	P-25	P	Paseo (MDR-13)	1.85	15%	0.3	85.0%	1.6	5.7	13,009
123	P-26	P	Paseo (HDR-6)	0.91	15%	0.1	85.0%	0.8	2.8	6,399
124	P-27	P	Paseo (LDR-20b)	0.43	15%	0.1	85.0%	0.4	1.3	3,024
125	P-28	P	Paseo (LDR-24)	0.45	15%	0.1	85.0%	0.4	1.4	3,164
126	P-29	P	Paseo (OS-15b)	0.03	15%	0.0	85.0%	0.0	0.1	211
127	P-30	P	Paseo (OS-15a)	0.29	15%	0.0	85.0%	0.2	0.9	2,039
128	P-31	P	Paseo (OS-14)	0.27	15%	0.0	85.0%	0.2	0.8	1,899
129	P-32	P	Paseo (CC-4a)	0.53	15%	0.1	85.0%	0.5	1.6	3,727
130	P-33	P	Paseo (LDR-10)	0.89	15%	0.1	85.0%	0.8	2.7	6,258
131	P-34	P	Paseo (HDR-3)	0.44	15%	0.1	85.0%	0.4	1.4	3,094
132	P-35	P	Paseo (OS-9)	0.18	15%	0.0	85.0%	0.2	0.6	1,266
133	P-36	P	Paseo (OS-10)	0.19	15%	0.0	85.0%	0.2	0.6	1,336
134	P-37	P	Paseo (OS-8d)	0.04	15%	0.0	85.0%	0.0	0.1	281
135	P-38	P	Paseo (LDR-15)	0.89	15%	0.1	85.0%	0.8	2.7	6,258
136	P-39	P	Paseo (MDR-9)	0.32	15%	0.0	85.0%	0.3	1.0	2,250
137	P-40	P	Paseo (LDR-21)	1.43	15%	0.2	85.0%	1.2	4.4	10,055
138	P-41	P	Paseo (LDR-22)	0.57	15%	0.1	85.0%	0.5	1.8	4,008
139	P-42	P	Paseo (OS-16)	0.24	15%	0.0	85.0%	0.2	0.7	1,688
140	P-43	P	Paseo (OS-15c)	0.37	15%	0.1	85.0%	0.3	1.1	2,602
141	P-44	P	Paseo (MDR-14)	0.32	15%	0.0	85.0%	0.3	1.0	2,250
142	P-45	P	Paseo (OS-15d)	0.03	15%	0.0	85.0%	0.0	0.1	211
143	P-46	P	Paseo (CC-5)	0.42	15%	0.1	85.0%	0.4	1.3	2,953
144	P-47	P	Paseo (CC-4b)	0.41	15%	0.1	85.0%	0.3	1.3	2,883
145	ROW	ROW	Major Roads	121.6	70%	85.1	30.0%	36.5	132.1	301,787
	Subtotal			**2,064.08**		**1,532.8**		**232.8**	**842.8**	**1,925,955**

Sierra Vista Recycled Water Market Assessment

No.	ID	Zoning	Area Description	Total Area	Non-Irrigated Surface	Non-Irrigated Surface	Irrigated Percentage	RW Irrigated	Annual Demand	Peak Day Demand (24 Hours)
				(Acres)	(%)	(Acres)	(%)	(Acres)	(AFY)	(GPD)
Parcels from previous land use for the Richland/Chan properties										
146	HDR-1	HDR	High Density Residential	14.5	80%	11.6	20.0%	2.9	10.5	23,991
147	HDR-2	HDR	High Density Residential	12.3	80%	9.8	20.0%	2.5	8.9	20,351
148	HDR-3	HDR	High Density Residential	17.5	80%	14.0	20.0%	3.5	12.7	28,954
149	CMU-1	CMU	Commercial Mixed Use	6.4	85%	5.4	15.0%	1.0	3.5	7,942
150	CMU-5	CMU	Commercial Mixed Use	6.9	85%	5.9	15.0%	1.0	3.7	8,562
151	PR-1	PR	Park	10	25%	2.5	75.0%	7.5	27.2	62,045
152	PR-2	PR	Park	8	25%	2.0	75.0%	6.0	21.7	49,636
153	PQP-2	P/QP	Public/Quasi Public (El Sch)	10	60%	6.0	40.0%	4.0	14.5	33,091
154	CC-1	CC	Communiy Commercial	19.7	85%	16.7	15.0%	3.0	10.7	24,446
155	CC-2	CC	Communiy Commercial	13.6	85%	11.6	15.0%	2.0	7.4	16,876
156	CC-3	CC	Communiy Commercial	2.4	85%	2.0	15.0%	0.4	1.3	2,978
157	CC-4	CC	Communiy Commercial	2	85%	1.7	15.0%	0.3	1.1	2,482
158	LC-1	LC	Landscape Corridor (LDR-1)	1.636	15%	0.2	85.0%	1.4	5.0	11,504
159	LC-2	LC	Landscape Corridor (LDR-2)	0.656	15%	0.1	85.0%	0.6	2.0	4,613
160	LC-3	LC	Landscape Corridor (MDR-1)	0.284	15%	0.0	85.0%	0.2	0.9	1,997
161	LC-4	LC	Landscape Corridor (MDR-2)	1.242	15%	0.2	85.0%	1.1	3.8	8,733
162	LC-5	LC	Landscape Corridor (MDR-3)	0.981	15%	0.1	85.0%	0.8	3.0	6,898
163	LC-6	LC	Landscape Corridor (MDR-4)	2.04	15%	0.3	85.0%	1.7	6.3	14,345
164	LC-7	LC	Landscape Corridor (MDR-5)	0.9	15%	0.1	85.0%	0.8	2.8	6,329
165	LC-8	LC	Landscape Corridor (MDR-6)	0.633	15%	0.1	85.0%	0.5	1.9	4,451
166	LC-9	LC	Landscape Corridor (OS-1)	0.297	15%	0.0	85.0%	0.3	0.9	2,088
167	LC-10	LC	Landscape Corridor (PQP-1)	0.229	15%	0.0	85.0%	0.2	0.7	1,610
168	LC-11	LC	Landscape Corridor (CMU-1)	1.052	15%	0.2	85.0%	0.9	3.2	7,397
169	LC-12	LC	Landscape Corridor (CMU-5)	0.618	15%	0.1	85.0%	0.5	1.9	4,346
170	LC-13	LC	Landscape Corridor (CC-1)	1.784	15%	0.3	85.0%	1.5	5.5	12,545
171	LC-14	LC	Landscape Corridor (CC-2)	1.692	15%	0.3	85.0%	1.4	5.2	11,898
172	LC-15	LC	Landscape Corridor (CC-3)	0.748	15%	0.1	85.0%	0.6	2.3	5,260
173	LC-16	LC	Landscape Corridor (CC-4)	0.481	15%	0.1	85.0%	0.4	1.5	3,382
174	ROW	ROW	Major Roads	9.8	70%	6.9	30.0%	2.9	10.6	24,322
	Subtotal			**436.97**		**290.6**		**49.9**	**180.8**	**413,071**
	Total								**1,023.5**	**2,339,026**

APPENDIX C

Diurnal Flow Simulation for Recycled Water Supply to the WRSP Storage Tanks

Expanded WRSP Recycled Water Storage Diurnal Flow and Demand Information

Day	Hour	Effluent Flow into Chlorine Contact basin (gal/hr)		Modeled Recycled Water Demand: (SVSP Base+UR)+(WRSP)+(Flow to 18")	REP Recycled Water Demand (gal/hr)	Expanded WRSP Storage Tank Volume (SVSP Base + UR)
		TM 5b unadjusted	Scaled to SVSP Base + UR	(gal/hr)	(gal/hr)	(gal)
1	6:00	524,393	343,861	78,211	66,000	0
1	7:00	495,114	324,662	78,210	66,000	199,650
1	8:00	535,354	351,048	78,210	66,000	380,102
1	9:00	666,840	437,268	78,210	66,000	586,940
1	10:00	852,098	558,747	78,210	66,000	879,998
1	11:00	971,019	636,727	78,210	66,000	1,294,535
1	12:00	1,213,621	795,809	78,210	66,000	1,787,053
1	13:00	1,257,452	824,551	78,210	66,000	2,438,652
1	14:00	1,189,343	779,889	78,210	66,000	3,118,993
1	15:00	1,299,146	851,891	78,210	66,000	3,754,672
1	16:00	1,257,229	824,404	78,210	66,000	4,462,353
1	17:00	1,202,861	788,754	78,210	66,000	4,800,000
1	18:00	1,128,692	740,119	78,210	66,000	4,800,000
1	19:00	1,390,748	911,957	78,210	66,000	4,800,000
1	20:00	1,563,137	1,024,998	78,211	66,000	4,800,000
1	21:00	1,569,379	1,029,091	839,758	66,000	4,800,000
1	22:00	1,492,147	978,447	839,758	66,000	4,800,000
1	23:00	1,165,859	764,490	839,757	66,000	4,800,000
1	0:00	1,178,080	772,504	839,758	66,000	4,658,733
1	1:00	1,020,537	669,198	839,757	66,000	4,525,479
1	2:00	839,464	550,463	839,758	66,000	4,288,920
1	3:00	747,830	490,375	839,758	66,000	3,933,626
1	4:00	635,130	416,475	839,758	66,000	3,518,243
1	5:00	561,868	368,434	839,758	66,000	3,028,960
2	6:00	524,393	343,861	78,211	66,000	2,491,637
2	7:00	495,114	324,662	78,210	66,000	2,691,287
2	8:00	535,354	351,048	78,210	66,000	2,871,739
2	9:00	666,840	437,268	78,210	66,000	3,078,577
2	10:00	852,098	558,747	78,210	66,000	3,371,635
2	11:00	971,019	636,727	78,210	66,000	3,786,173
2	12:00	1,213,621	795,809	78,210	66,000	4,278,690
2	13:00	1,257,452	824,551	78,210	66,000	4,800,000
2	14:00	1,189,343	779,889	78,210	66,000	4,800,000
2	15:00	1,299,146	851,891	78,210	66,000	4,800,000
2	16:00	1,257,229	824,404	78,210	66,000	4,800,000
2	17:00	1,202,861	788,754	78,210	66,000	4,800,000
2	18:00	1,128,692	740,119	78,210	66,000	4,800,000
2	19:00	1,390,748	911,957	78,210	66,000	4,800,000
2	20:00	1,563,137	1,024,998	78,211	66,000	4,800,000
2	21:00	1,569,379	1,029,091	839,758	66,000	4,800,000
2	22:00	1,492,147	978,447	839,758	66,000	4,800,000
2	23:00	1,165,859	764,490	839,757	66,000	4,800,000
2	0:00	1,178,080	772,504	839,758	66,000	4,658,733
2	1:00	1,020,537	669,198	839,757	66,000	4,525,479
2	2:00	839,464	550,463	839,758	66,000	4,288,920
2	3:00	747,830	490,375	839,758	66,000	3,933,626
2	4:00	635,130	416,475	839,758	66,000	3,518,243
2	5:00	561,868	368,434	839,758	66,000	3,028,960

Notes:

1. Source for Effluent flow into CCB: *Alternatives Development and Evaluation for Recycled Water Distribution System (TM 5b)* , Attachment A
2. For purposes of this calculation, it was assumed that the storage tank volume would be zero at day 1 at 6:00 am. The model would represent the volume of the storage tank at 6:00 am at the day 2 levels, once it reaches steady state.
3. WRSP Storage tank volume for SVSP Base + UR alternative = 2.0 MG + 2.8 MG = 4.8 MG. It was assumed the expanded WRSP Tanks would never fill above 4.8 MG.
4. Flow to 18-inch includes flows to North Zone tank and Sun City GC
5. For rationale for scaled to SVSP Base + UR, refer to the ADWF calculation tab

Calculation of ADWF

Basis: Ultimate buildout ADWF minus all areas that are not constructed, PLUS WRSP and SVSP buildout.

Land Use	Buildout ADWF (MGD)	Notes
Buildout ADWF	**25.30**	from TM 5b
Brookfield UGA	0.73	assumed not to be constructed
Creekview UGA	1.06	assumed not to be constructed
Curry Creek UGA	2.72	assumed not to be constructed
Inviro Tech UGA	0.08	assumed not to be constructed
Orchard Creek UGA	0.02	assumed not to be constructed
Placer Ranch UGA (inside)	0.90	assumed not to be constructed
Placer Ranch UGA (outside)	1.27	assumed not to be constructed
Regional University UGA	1.17	assumed not to be constructed
Rezones	0.50	assumed not to be constructed
Delta between (SVSP UGA in TM 2b) and (SVSP Base + UR in 2009 SVSP Sewer Master Plan)	0.26	2.10 - 1.84 MGD = 0.26 MGD
Net remaining ADWF	**16.59**	
Net remaining ADWF/Buildout ADWF	**65.6%**	

Notes:
1. It should be noted that the ADWF does not equal the actual recycled water supply cited in TM 5b. For the purposes of developing a scaling factor for diurnal flows, all flows from TM 5b were utilized exclusively.
2. ADWF Source: Average Dry Weather Flow Projection for the Ultimate SPWA Service Area (Including Urban Growth Areas) -- TM No. 2b, Tables 5 and 6

APPENDIX D

Pleasant Grove Wastewater Treatment Plant Supply Analysis
TM 5b Table – Two Tank Fill

Pleasant Grove Wastewater Treatment Plant Supply Analysis for Alternative C

Two Tank Fill

Hour	Effluent Flow into Chlorine Contact Basin (gal)	Flow to NZ Tank for WOGC & SCGC (gal)	Roseville Energy Park (gal)	Brookfield (gal)	Curry Creek North (gal)	Curry Creek South (gal)	Regional University (gal)	Placer Ranch (gal)	Creekview & Panhandle (gal)	Sierra Vista (gal)	WRSP (gal)	Recycled Water sent to Creek (gal)	Flow Leaving Plant to be pumped in distribution system (gpm)	Supply and Demand Check
		gpd 2,200,756	gpd 1,584,000	gpd 940,000	gpd 776,816	gpd 3,333,321	gpd 1,720,000	gpd 3,340,000	gpd 1,250,000	gpd 2,460,000	gpd 3,862,911			
6:00	524,393	146,717	66,000	155,838	155,838							0	8,740	0
7:00	495,114	146,717	66,000	141,199	141,199							0	8,252	0
8:00	535,354	146,717	66,000	161,318	161,318							0	8,923	0
9:00	666,840	146,717	66,000	227,061	227,061							0	11,114	0
10:00	852,098	146,717	66,000	319,690			319,690					0	14,202	0
11:00	971,019	146,717	66,000				379,151	379,151				0	16,184	0
12:00	1,213,621	146,717	66,000				500,452	500,452				0	20,227	0
13:00	1,257,452	146,717	66,000				522,367	522,367				0	20,958	0
14:00	1,189,343	146,717	66,000					488,313	488,313			0	19,822	0
15:00	1,299,146	146,717	66,000					543,215	543,215			0	21,652	0
16:00	1,257,229	146,717	66,000					522,256	522,256			0	20,954	0
17:00	1,202,861	146,717	66,000			495,072		495,072				0	20,048	0
18:00	1,128,692	146,717	66,000			457,988				457,988		0	18,812	0
19:00	1,390,748	146,717	66,000			589,015				589,015		0	23,179	0
20:00	1,563,137	146,717	66,000			675,210				675,210		0	26,052	0
21:00	1,569,379	0	66,000			751,689				751,689		0	26,156	0
22:00	1,492,147	0	66,000			713,074					713,074	0	24,869	0
23:00	1,165,859	0	66,000								1,099,859	0	19,431	0
0:00	1,178,080	0	66,000								1,112,080	0	19,635	0
1:00	1,020,537	0	66,000								954,537	0	17,009	0
2:00	839,464	0	66,000									773,464	1,100	0
3:00	747,830	0	66,000									681,830	1,100	0
4:00	635,130	0	66,000									569,130	1,100	0
5:00	561,868	0	66,000									495,868	1,100	0
Totals	**24,757,340**	**2,200,756**	**1,584,000**	**1,005,107**	**685,416**	**3,682,048**	**1,721,661**	**3,450,826**	**1,553,783**	**2,473,903**	**3,879,549**	**2,520,292**		

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HYDROSCIENCE ENGINEERS, INC. (HSe) is a civil and environmental engineering firm that plans, designs, and manages the construction of water, wastewater, and recycled water projects. With offices in Sacramento, Napa, Stockton, and San Jose, we understand and address the complex water needs of California.

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APPENDIX H-2

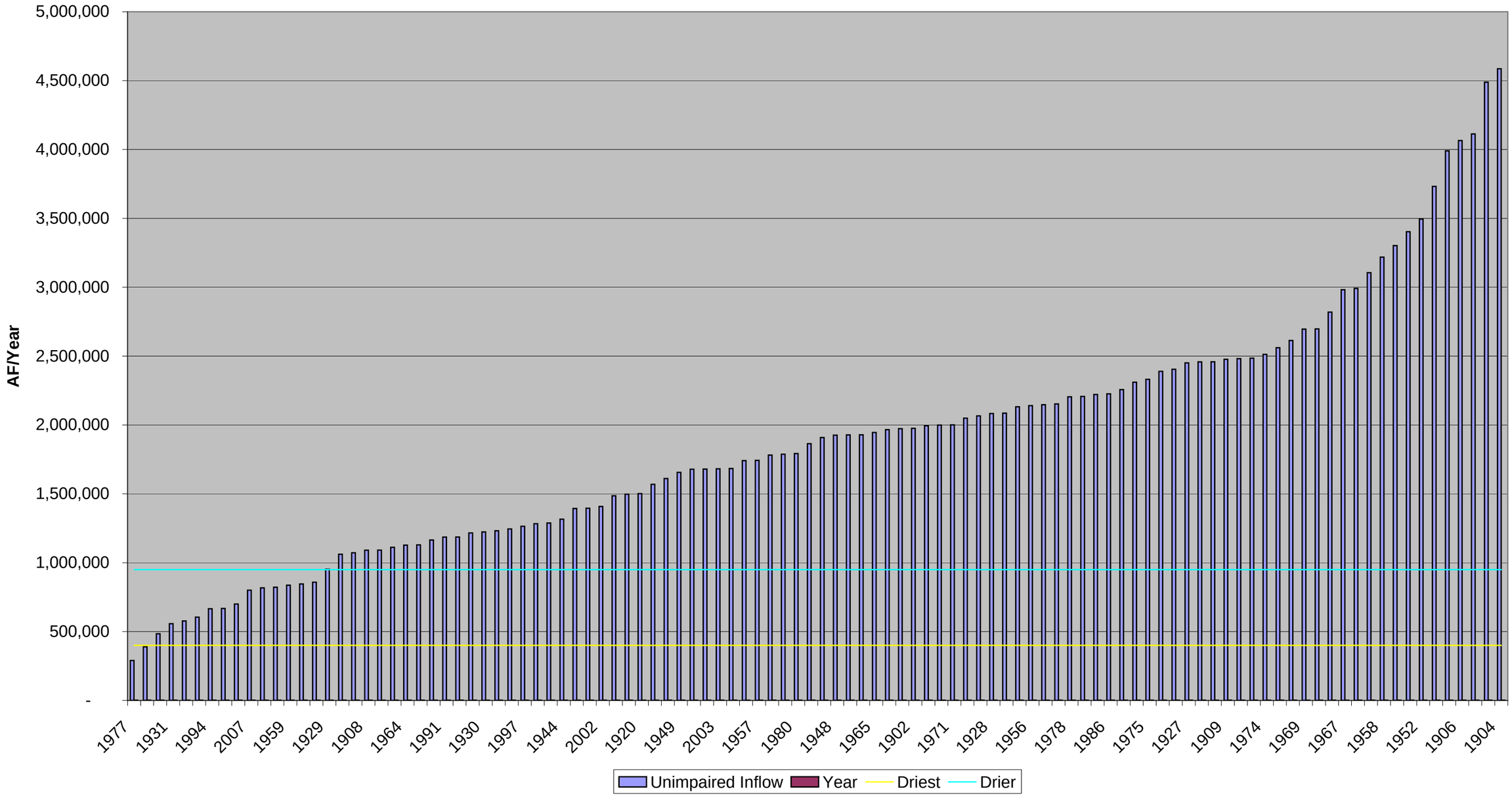
ATTACHMENT 5
AMERICAN RIVER HYDROLOGIC RECORD

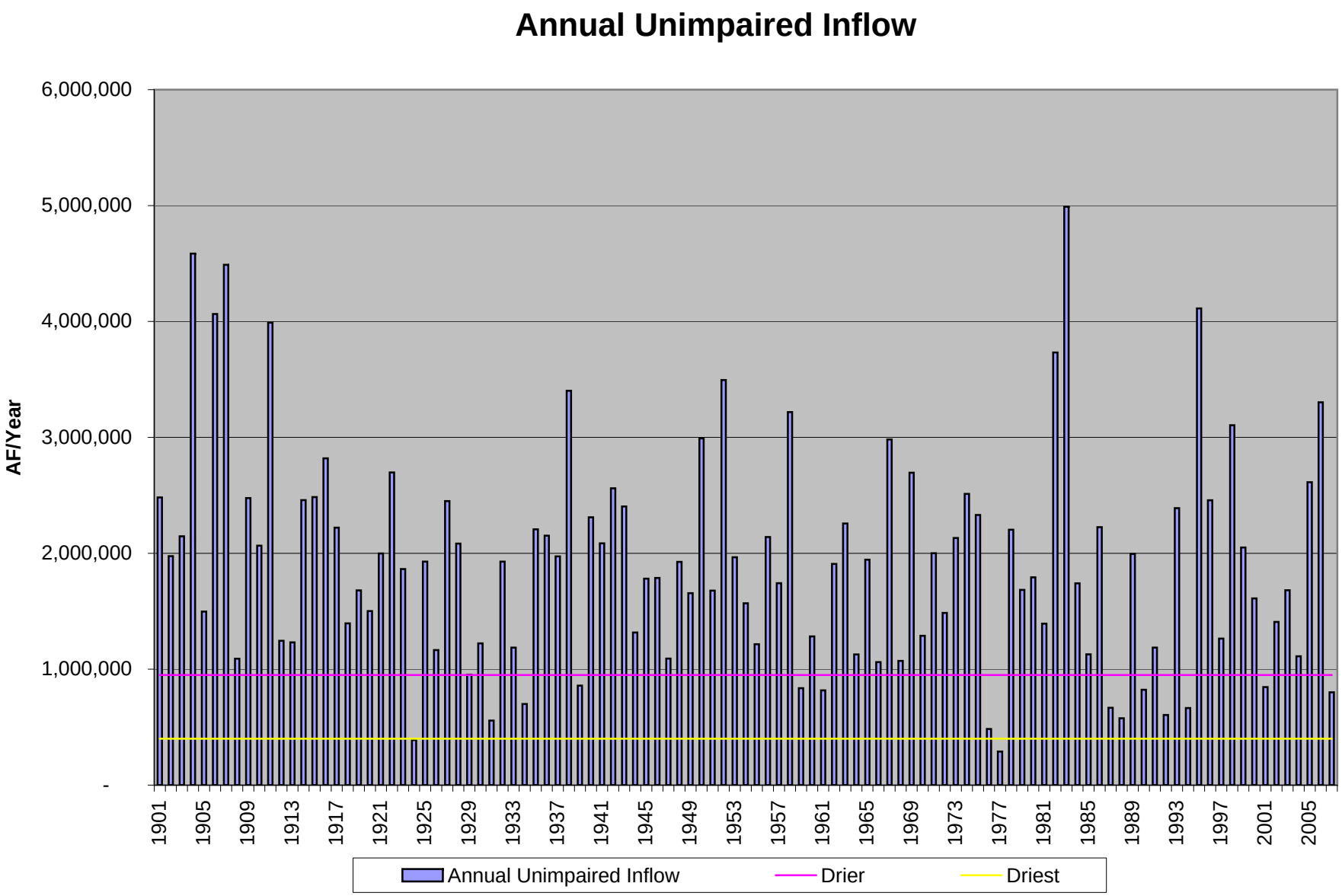
'Monthly FLOW, FULL NATURAL (AF) from CDEC. Data subject to revision
'Note: All data is PST and is displayed in 4-digit year format to comply with Y2K requirements
Station AMERICAN R AT FOLSOM (AMF), sensor 65, from 01/01/1901 (00:00 to 10/10/2007 10:37)

	Stat	Sensor	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Unimpaired	Driest	Drier
86	AMF	65	1901	208,000	535,000	406,000	706,000	690,000	411,000	104,500	21,600	29,600	46,000	66,800	93,000	3,317,500	2,481,500	400,000	950,000
61	AMF	65	1902	64,000	418,500	379,000	565,500	580,000	280,000	69,000	18,900	11,200	27,200	44,500	85,000	2,542,800	1,975,300	400,000	950,000
71	AMF	65	1903	223,000	186,000	555,000	543,000	547,000	218,000	55,000	21,300	10,400	15,400	182,000	63,500	2,619,600	2,147,100	400,000	950,000
106	AMF	65	1904	71,000	672,000	1,330,000	938,000	971,000	751,000	262,500	62,000	71,300	140,500	59,700	65,300	5,394,300	4,586,000	400,000	950,000
39	AMF	65	1905	204,800	238,700	383,100	417,100	389,400	192,200	49,500	21,800	12,200	13,800	18,100	20,300	1,961,000	1,497,200	400,000	950,000
103	AMF	65	1906	450,700	333,300	877,900	724,700	939,300	965,700	396,900	67,700	29,500	23,100	40,100	248,700	5,097,600	4,064,900	400,000	950,000
105	AMF	65	1907	259,700	826,300	1,524,800	932,700	761,300	673,700	345,900	97,200	53,000	45,800	54,500	114,400	5,689,300	4,488,900	400,000	950,000
19	AMF	65	1908	164,400	117,000	207,000	274,100	294,700	166,700	59,300	17,400	11,200	26,600	33,400	39,800	1,411,600	1,090,400	400,000	950,000
85	AMF	65	1909	1,495,100	867,200	404,100	480,600	596,100	468,600	149,100	42,600	21,200	35,600	278,800	475,900	5,314,900	2,476,700	400,000	950,000
66	AMF	65	1910	527,900	294,500	650,000	634,300	500,600	145,000	37,500	17,200	16,800	25,800	38,600	103,100	2,991,300	2,065,800	400,000	950,000
102	AMF	65	1911	859,700	593,300	803,800	902,700	903,300	1,063,700	203,900	33,200	22,700	25,900	31,100	28,300	5,471,600	3,990,300	400,000	950,000
30	AMF	65	1912	73,200	49,300	122,400	177,800	434,700	297,900	58,100	16,800	22,500	19,900	94,700	42,000	1,409,300	1,244,800	400,000	950,000
29	AMF	65	1913	100,200	75,200	113,000	365,100	456,900	164,900	44,400	22,700	13,700	13,800	37,400	137,600	1,544,900	1,231,900	400,000	950,000
84	AMF	65	1914	1,056,400	396,300	507,300	567,800	731,500	407,000	138,500	34,400	16,800	25,400	29,900	47,000	3,958,300	2,458,600	400,000	950,000
87	AMF	65	1915	100,300	516,800	292,300	515,300	967,700	492,600	117,300	30,600	18,700	20,400	30,300	86,600	3,188,900	2,485,200	400,000	950,000
93	AMF	65	1916	482,000	592,400	812,100	708,100	619,600	413,400	128,800	27,500	18,900	45,000	45,800	129,400	4,023,000	2,819,200	400,000	950,000
75	AMF	65	1917	103,100	411,800	280,400	556,300	648,100	545,500	111,400	28,800	17,200	15,800	17,600	37,600	2,773,600	2,221,100	400,000	950,000
36	AMF	65	1918	23,100	129,100	319,200	448,300	323,300	129,400	24,800	7,500	27,000	61,500	54,400	49,300	1,596,900	1,395,400	400,000	950,000
45	AMF	65	1919	46,400	365,300	319,400	572,000	608,100	109,600	21,500	10,400	10,700	12,900	15,400	47,100	2,138,800	1,680,000	400,000	950,000
40	AMF	65	1920	43,800	41,800	243,700	368,200	455,300	178,100	39,100	12,100	9,800	37,900	157,400	275,100	1,862,300	1,501,600	400,000	950,000
63	AMF	65	1921	467,800	319,700	535,300	420,900	525,400	374,800	71,000	12,300	6,300	14,200	38,800	131,000	2,917,500	1,999,000	400,000	950,000
92	AMF	65	1922	112,700	360,100	324,600	480,200	1,027,000	677,300	93,600	13,600	5,900	19,300	55,800	398,000	3,568,100	2,697,300	400,000	950,000
53	AMF	65	1923	275,000	182,800	224,500	564,200	615,900	283,400	96,700	17,500	17,500	23,200	21,100	26,800	2,348,600	1,864,000	400,000	950,000
2	AMF	65	1924	41,900	112,100	57,900	123,000	104,500	26,300	3,500	800	2,300	13,300	57,300	85,900	628,800	388,900	400,000	950,000
56	AMF	65	1925	87,200	598,300	311,700	599,900	612,900	272,900	60,100	11,100	6,500	20,100	32,800	53,700	2,667,200	1,928,000	400,000	950,000
24	AMF	65	1926	48,100	260,500	199,700	479,300	212,200	66,300	12,600	-	1,200	13,200	180,500	141,500	1,615,100	1,165,000	400,000	950,000
82	AMF	65	1927	222,400	774,500	446,800	727,900	616,500	431,800	74,600	13,400	9,100	17,400	113,400	99,100	3,546,900	2,450,900	400,000	950,000
67	AMF	65	1928	108,500	138,300	988,500	536,000	395,600	97,500	19,700	4,400	2,400	11,600	27,500	38,300	2,368,300	2,083,200	400,000	950,000
16	AMF	65	1929	41,700	98,800	148,200	211,000	357,600	179,700	30,400	1,600	1,000	11,300	11,800	162,000	1,255,100	952,600	400,000	950,000
28	AMF	65	1930	144,000	151,000	328,000	357,000	285,000	160,000	27,200	6,840	8,050	16,800	34,100	21,000	1,538,990	1,222,990	400,000	950,000
4	AMF	65	1931	57,000	75,400	139,800	172,900	135,600	47,300	8,100	3,000	4,200	16,000	30,300	165,000	854,600	557,200	400,000	950,000
57	AMF	65	1932	161,100	319,600	298,000	402,500	659,000	425,800	92,500	16,800	8,600	10,900	14,100	23,300	2,432,200	1,928,200	400,000	950,000
26	AMF	65	1933	42,900	46,700	135,000	239,000	354,000	342,000	42,200	9,600	9,200	21,500	33,800	108,300	1,384,200	1,186,300	400,000	950,000
9	AMF	65	1934	159,100	171,400	255,400	195,900	105,700	48,700	11,400	6,500	6,300	10,700	59,100	53,800	1,084,000	699,700	400,000	950,000
74	AMF	65	1935	156,100	147,800	213,000	818,000	667,900	359,600	69,500	16,500	11,100	21,300	30,200	34,300	2,545,300	2,207,100	400,000	950,000
72	AMF	65	1936	408,100	775,400	431,900	635,800	587,000	357,700	83,300	17,700	13,900	10,500	14,500	23,000	3,358,800	2,152,300	400,000	950,000
60	AMF	65	1937	44,200	336,300	395,600	502,500	688,000	234,300	52,000	14,800	12,000	20,300	53,500	436,400	2,789,900	1,973,000	400,000	950,000
99	AMF	65	1938	129,700	538,800	806,000	732,000	1,010,700	598,800	133,600	30,800	20,300	29,800	40,600	44,400	4,115,500	3,402,600	400,000	950,000
15	AMF	65	1939	49,900	69,800	221,500	326,000	175,300	56,900	14,500	5,500	11,500	27,710	19,310	28,220	1,006,140	858,220	400,000	950,000
78	AMF	65	1940	468,150	611,420	846,810	628,430	511,420	198,690	39,960	12,510	13,700	15,200	43,800	249,000	3,639,090	2,310,520	400,000	950,000
68	AMF	65	1941	345,400	472,500	449,000	444,500	719,600	282,400	84,500	22,600	16,700	17,800	48,800	324,500	3,228,300	2,085,900	400,000	950,000
89	AMF	65	1942	582,700	553,700	285,500	626,100	716,800	556,600	155,300	32,100	17,400	16,900	154,100	278,100	3,975,300	2,560,800	400,000	950,000
81	AMF	65	1943	691,300	373,900	929,600	590,400	446,000	264,000	87,400	25,400	17,600	19,430	24,290	30,500	3,499,820	2,404,120	400,000	950,000
34	AMF	65	1944	58,200	144,200	233,810	215,730	471,620	194,150	46,020	14,310	9,460	10,740	120,380	124,060	1,642,680	1,316,220	400,000	950,000
50	AMF	65	1945	97,240	559,930	259,050	417,030	550,430	282,440	70,060	14,610	9,990	35,390	142,610	544,170	2,982,950	1,781,610	400,000	950,000
51	AMF	65	1946	308,490	154,530	341,550	512,980	548,740	203,390	48,510	13,250	12,840	18,370	88,000	86,690	2,337,340	1,787,630	400,000	950,000
20	AMF	65	1947	50,430	172,260	305,360	301,700	262,600	96,070	18,670	9,350	7,430	46,680	43,410	27,980	1,341,940	1,091,270	400,000	950,000
55	AMF	65	1948	170,100	74,360	147,290	531,610	633,960	446,120	87,410	18,510	11,980	13,910	35,410	53,710	2,224,370	1,926,200	400,000	950,000
43	AMF	65	1949	48,000	87,120	351,250	515,920	530,820	167,290	29,050	14,300	10,090	11,510	25,630	24,510	1,815,490	1,655,860	400,000	950,000
95	AMF	65	1950	301,450	334,880	342,140	588,180	598,480	324,610	82,150	18,690	12,000	40,470	984,830	1,054,260	4,682,140	2,991,550	400,000	950,000
44	AMF	65	1951	575,680	425,360	431,250	431,100	455,560	155,990	44,230	18,430	13,620	30,380	97,760	317,330	2,996,690	1,678,320	400,000	950,000
100	AMF	65	1952	540,460	544,870	501,170	817,250	1,135,530	670,660	240,630	56,150	24,020	20,120	29,510	98,890	4,679,260	3,495,040	400,000	950,000
59	AMF	65	1953	454,360	154,660	217,960	469,160	485,730	511,350	164,420	30,520	16,390	16,480	53,900	64,520	2,639,450	1,965,910	400,000	950,000
41	AMF	65	1954	122,930	210,250	449,790	542,300	363,740	114,650	32,960	14,020	11,390	11,770	28,540	113,990	2,016,330	1,569,160	400,000	950,000

27	AMF	65	1955	133,050	102,900	153,690	239,710	485,310	221,640	41,540	18,600	13,480	13,300	28,600	1,247,000	2,698,820	1,215,870	400,000	950,000
70	AMF	65	1956	951,800	326,900	305,700	407,700	754,000	430,700	124,300	33,900	20,900	32,300	30,700	48,500	3,467,400	2,140,200	400,000	950,000
49	AMF	65	1957	58,100	283,500	442,800	305,400	566,700	289,100	53,300	18,300	7,900	21,800	37,400	97,900	2,182,200	1,742,700	400,000	950,000
97	AMF	65	1958	163,500	588,100	552,600	846,100	1,057,000	536,600	130,500	38,300	20,500	14,500	22,500	24,400	3,994,600	3,218,600	400,000	950,000
13	AMF	65	1959	149,400	203,600	199,600	282,800	205,000	86,400	16,400	6,800	14,800	11,980	12,600	20,040	1,209,420	836,380	400,000	950,000
32	AMF	65	1960	63,110	348,400	431,290	359,230	282,880	121,000	19,720	5,500	4,270	9,000	49,800	39,400	1,733,600	1,282,690	400,000	950,000
11	AMF	65	1961	31,100	122,600	156,600	237,100	272,700	116,800	5,300	-	4,800	10,440	13,700	50,530	1,021,670	817,440	400,000	950,000
54	AMF	65	1962	47,050	418,070	247,300	553,800	419,850	260,500	40,380	4,070	2,960	334,860	44,700	178,010	2,551,550	1,908,420	400,000	950,000
77	AMF	65	1963	258,760	711,770	233,620	651,540	761,240	281,160	62,680	17,050	16,740	32,030	200,790	83,320	3,310,700	2,256,850	400,000	950,000
22	AMF	65	1964	156,250	107,450	126,130	292,060	395,400	186,680	36,550	13,910	1,900	10,800	64,000	1,509,300	2,900,430	1,127,430	400,000	950,000
58	AMF	65	1965	773,900	281,900	238,300	618,300	510,400	315,700	95,400	51,900	14,600	26,000	74,500	80,500	3,081,400	1,945,100	400,000	950,000
17	AMF	65	1966	121,700	112,600	236,900	412,100	276,200	48,300	3,200	-	-	7,300	76,900	277,500	1,572,700	1,060,900	400,000	950,000
94	AMF	65	1967	420,700	266,300	539,700	438,900	897,500	751,400	241,400	34,000	15,000	18,700	45,200	84,500	3,753,300	2,981,800	400,000	950,000
18	AMF	65	1968	143,100	449,900	292,400	291,400	250,200	92,100	10,500	17,600	3,500	14,100	100,400	127,700	1,792,900	1,072,200	400,000	950,000
91	AMF	65	1969	1,090,400	494,600	367,400	674,600	942,700	469,400	115,600	25,200	22,600	28,100	50,000	335,800	4,616,400	2,695,600	400,000	950,000
33	AMF	65	1970	1,315,100	334,300	341,400	208,400	294,900	198,600	39,700	10,100	6,600	9,800	178,800	341,900	3,279,600	1,288,300	400,000	950,000
64	AMF	65	1971	296,700	211,600	404,500	414,000	554,100	419,000	106,800	24,800	10,000	14,300	53,500	134,000	2,643,300	2,001,000	400,000	950,000
38	AMF	65	1972	109,500	194,400	455,500	333,200	381,200	159,700	25,700	5,300	7,300	24,500	93,200	227,300	2,016,800	1,485,600	400,000	950,000
69	AMF	65	1973	597,000	395,100	354,800	419,300	636,700	198,700	33,800	13,000	14,700	30,800	430,300	348,900	3,473,100	2,132,100	400,000	950,000
88	AMF	65	1974	819,400	186,900	585,300	648,700	538,700	467,900	163,200	33,900	17,900	26,890	30,230	46,350	3,565,370	2,512,720	400,000	950,000
79	AMF	65	1975	99,110	252,340	448,020	303,210	762,070	503,060	104,640	30,210	14,110	81,930	83,880	65,530	2,748,110	2,331,130	400,000	950,000
3	AMF	65	1976	44,080	66,870	119,840	141,300	152,300	21,620	3,080	10,990	9,100	15,390	10,440	3,250	598,260	484,060	400,000	950,000
1	AMF	65	1977	22,250	27,070	41,700	74,680	99,750	54,530	-	-	-	-	19,080	181,130	520,190	289,740	400,000	950,000
73	AMF	65	1978	550,190	293,360	567,840	521,970	594,990	376,590	87,970	6,630	23,750	1,910	22,340	32,160	3,079,700	2,203,990	400,000	950,000
47	AMF	65	1979	181,180	217,350	360,460	364,050	652,800	169,670	33,720	4,340	1,530	31,190	66,400	93,680	2,176,370	1,684,160	400,000	950,000
52	AMF	65	1980	1,207,960	716,760	402,850	407,070	486,610	299,270	126,700	19,440	13,150	19,230	18,300	42,280	3,759,620	1,792,620	400,000	950,000
35	AMF	65	1981	92,000	136,210	267,730	291,950	215,610	44,600	-	-	80	42,270	531,390	838,290	2,460,130	1,393,630	400,000	950,000
101	AMF	65	1982	529,490	896,770	687,810	1,130,490	841,900	387,340	135,900	41,100	61,140	168,870	277,900	565,140	5,723,850	3,732,450	400,000	950,000
107	AMF	65	1983	454,160	695,710	1,167,210	605,280	982,720	942,210	382,050	89,930	50,586	48,560	721,590	946,810	7,086,816	4,990,136	400,000	950,000
48	AMF	65	1984	379,420	287,510	379,850	318,790	492,750	237,260	49,790	21,720	17,090	35,670	188,030	101,650	2,509,530	1,740,950	400,000	950,000
23	AMF	65	1985	69,560	140,650	199,930	434,560	282,860	78,530	13,630	4,850	24,310	20,954	69,387	153,923	1,493,144	1,129,011	400,000	950,000
76	AMF	65	1986	357,806	1,866,219	966,836	401,588	419,124	309,635	50,615	25,155	12,042	28,339	12,439	12,084	4,461,882	2,225,773	400,000	950,000
8	AMF	65	1987	49,765	133,030	208,587	211,837	177,227	30,682	8,547	3,398	3,850	9,108	14,533	89,484	940,048	667,769	400,000	950,000
5	AMF	65	1988	160,807	93,148	140,334	165,160	128,222	51,144	1,103	-	50	5,560	85,163	62,283	892,974	576,736	400,000	950,000
62	AMF	65	1989	66,274	109,260	866,372	552,920	315,650	145,186	16,653	2,826	19,278	35,510	39,673	29,099	2,198,701	1,994,068	400,000	950,000
12	AMF	65	1990	101,288	100,917	241,319	270,533	180,519	108,991	5,611	1,593	2,733	3,924	7,108	11,577	1,036,113	822,331	400,000	950,000
25	AMF	65	1991	10,953	24,126	331,179	275,990	327,487	168,965	25,313	-	8,052	17,261	31,679	24,490	1,245,495	1,185,926	400,000	950,000
6	AMF	65	1992	25,007	231,166	209,878	238,521	91,727	16,660	14,350	-	-	14,280	19,511	128,470	989,570	604,927	400,000	950,000
80	AMF	65	1993	520,798	360,730	659,486	516,414	667,799	385,621	96,015	19,905	10,382	17,098	16,497	46,550	3,317,295	2,389,217	400,000	950,000
7	AMF	65	1994	43,830	94,581	162,821	189,433	184,495	43,176	2,914	2,139	7,728	10,128	62,494	152,489	956,228	665,328	400,000	950,000
104	AMF	65	1995	925,975	304,200	1,172,390	755,192	987,948	729,797	341,656	80,641	26,392	9,608	9,106	183,775	5,526,680	4,112,730	400,000	950,000
83	AMF	65	1996	340,099	824,390	572,824	558,676	810,793	256,764	67,068	20,728	13,850	14,564	142,824	1,023,951	4,646,531	2,458,091	400,000	950,000
31	AMF	65	1997	1,988,041	338,243	295,295	359,761	334,509	152,588	32,433	11,296	10,307	18,630	49,280	90,725	3,681,108	1,264,099	400,000	950,000
96	AMF	65	1998	513,996	727,039	587,351	581,776	698,846	787,161	265,239	45,192	32,990	20,493	86,296	146,439	4,492,818	3,105,344	400,000	950,000
65	AMF	65	1999	367,442	698,028	436,014	414,415	644,328	374,971	83,138	25,163	18,835	18,588	34,349	40,630	3,155,901	2,049,801	400,000	950,000
42	AMF	65	2000	316,077	677,762	430,604	437,786	466,113	159,976	45,058	12,258	18,699	19,215	21,342	33,677	2,638,567	1,611,051	400,000	950,000
14	AMF	65	2001	53,569	105,457	227,888	252,862	254,875	32,128	12,761	2,324	6,339	2,034	54,406	180,732	1,185,375	845,617	400,000	950,000
37	AMF	65	2002	226,425	217,978	356,017	424,886	373,695	153,432	21,804	8,324	5,450	-	64,565	194,370	2,046,946	1,408,173	400,000	950,000
46	AMF	65	2003	240,893	160,403	269,248	415,139	634,429	266,176	38,690	16,878	4,593	19,900	16,284	146,695	2,229,328	1,681,337	400,000	950,000
21	AMF	65	2004	132,991	268,085	382,867	315,159	239,595	67,216	10,189	-	1,252	52,312	43,092	124,159	1,636,917	1,111,682	400,000	950,000
90	AMF	65	2005	272,076	223,588	523,671	465,854	974,361	451,967	111,696	22,978	12,410	16,568	33,821	870,987	3,979,977	2,613,326	400,000	950,000
98	AMF	65	2006	591,632	474,587	647,677	1,253,041	903,888	354,018	76,030	14,431	6,578	11,155	35,438	95,125	4,463,600	3,302,256	400,000	950,000
10	AMF	65	2007	69,774	258,448	282,899	251,150	222,306	42,198	-	-	2,149	m	m	m	1,059,150	800,702	400,000	950,000

American River Unimpaired Inflow




Annual Unimpaired Inflow
AF/Year
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
-
1901
1905
1909
1913
1917
1921
1925
1929
1933
1937
1941
1945
1949
1953
1957
1961
1965
1969
1973
1977
1981
1985
1989
1993
1997
2001
2005
Annual Unimpaired Inflow
Drier
Driest

APPENDIX H-2

ATTACHMENT 6
CITY OF ROSEVILLE
WATER SUPPLY CONTRACTS

Long-Term Warren Act Contract
No. 02-WC-20-2217

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Central Valley Project, California

CONTRACT FOR CONVEYANCE OF NON-PROJECT WATER BETWEEN THE UNITED STATES AND CITY OF ROSEVILLE

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Exhibit A – Water Rates

Exhibit B – Sources of Non-Project Water

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Central Valley Project, California

CONTRACT FOR CONVEYANCE OF NON-PROJECT WATER
BETWEEN THE UNITED STATES OF AMERICA
AND
CITY OF ROSEVILLE

THIS CONTRACT, made this 22 day of November, 2006, pursuant to the Act of June 17, 1902 (32 Stat. 388), as amended and supplemented; the Act of February 21, 1911 (36 Stat. 925); Section 305 of the Reclamation States Emergency Drought Relief Act of 1991 (106 Stat. 59); and Title 34 of the Act of October 30, 1992, the Central Valley Project Improvement Act (106 Stat. 4706), all collectively hereinafter referred to as the Federal Reclamation laws, between THE UNITED STATES OF AMERICA, hereinafter referred to as the United States, represented by the officer executing this Contract, hereinafter referred to as the Contracting Officer, and the CITY OF ROSEVILLE, hereinafter referred to as the Contractor;

WITNESSETH, That:

EXPLANATORY RECITALS

WHEREAS, the United States has constructed and is operating the Central Valley Project (Project), California, for diversion, storage, carriage, distribution and beneficial use, for flood control, irrigation, municipal, domestic, industrial, fish and wildlife mitigation, protection and restoration, generation and distribution of electric energy, salinity control, navigation and

other beneficial uses, of waters of the Sacramento River, the American River, the Trinity River, and the San Joaquin River and their tributaries; and

WHEREAS, the Contractor has entered into Water Service Contract No. 14-06-200-3474A dated September 9, 1967, with the United States, which provides for Project Water service from Folsom Reservoir; and

WHEREAS, the Contractor has or will acquire a supply of Non-Project Water which it has requested the United States convey through Excess Capacity in Project Facilities for municipal and industrial (M&I) purposes; and

WHEREAS, the United States is willing to convey said water to the Contractor through Excess Capacity in Project Facilities in accordance with the terms and conditions of this Contract; and

WHEREAS, the Contractor and Contracting Officer recognize that this Contract does not grant any permission or entitlement to the Contractor to extract or divert from its sources the Non-Project Water supply conveyed pursuant to this Contract;

NOW, THEREFORE, in consideration of the covenants herein contained, the parties agree as follows:

DEFINITIONS

1. When used herein, the term:

(a) "Calendar Year" shall mean the period January 1 through December 31, both dates inclusive;

(b) "Contracting Officer" shall mean the Secretary of the Interior's duly authorized representative acting pursuant to this Contract or applicable Reclamation law or regulation;

(c) "Contractor's Point of Delivery" shall mean the 84-inch-pipeline leading from the Folsom Pumping Plant to the Hinkle "Y;"

(d) "Contractor's Water Service Contract" shall mean Contract No. 14-06-200-3474A, dated September 9, 1967, between the Contractor and the United States, which provides for water service from the Project's Folsom Reservoir, and any amendment, extension, or renewal thereof;

(e) "Excess Capacity" shall mean the capacity of the Project Facilities not needed to store and/or convey Project Water as determined by the Contracting Officer;

(f) "M&I Water" shall mean all uses of Non-Project Water for other than the commercial production of agricultural crops or livestock, including domestic use incidental thereto;

(g) "Non-Project Water" shall mean water acquired by or available to the Contractor from the source(s) identified in Exhibit B, a copy of which is attached hereto and incorporated herein by reference, which is not appropriated by the United States;

(h) "PCWA Water Contract" shall mean all applicable agreements and contracts, and any amendment, extension, or renewal, for an annual supply of up to 30,000 acre-feet (AF) of Non-Project Water between the Contractor and Placer County Water Agency (PCWA);

(i) "Project" shall mean the Project owned by the United States and operated by the Department of the Interior, Bureau of Reclamation;

(j) "Project Facilities" shall mean the Folsom Reservoir, Folsom Pumping Plant, and Folsom Pipeline;

(k) "Project Water" shall mean all water that is developed, diverted, stored, or delivered by the United States in accordance with the statutes authorizing the Project and in accordance with the terms and conditions of applicable water rights permits and licenses acquired by and/or issued to the United States pursuant to California law;

(l) "Rates" shall mean the payments determined annually by the Contracting Officer in accordance with the then-current applicable water ratesetting policies for the Project;

(m) "Secretary" shall mean the Secretary of the Interior, a duly appointed successor, or an authorized representative;

(n) "Year" shall mean the period March 1 of each Calendar Year through the last day of February of the following Calendar Year, both dates inclusive.

TERM OF CONTRACT

2. (a) This Contract shall become effective on March 1, 2006, and shall remain in effect through February 28, 2031, unless terminated by operation of law or by mutual agreement of the parties hereto; Provided, that upon 30-days' advance written notice to the Contractor, this Contract may also be terminated by the Contracting Officer at an earlier date, if the Contracting Officer determines that the Contractor has not been complying with one or more of the terms and conditions of this Contract; Provided further, that the Contracting Officer may

make a determination not to terminate this Contract if the Contractor can show full compliance or a time schedule for compliance that is satisfactory to the Contracting Officer within the 30-day notice period.

(b) The Contractor shall promptly notify the Contracting Officer if and when the Contractor ceases to have any right to the use of the Non-Project Water being conveyed pursuant to this Contract.

CONVEYANCE, POINTS OF DELIVERY, AND MEASUREMENT OF NON-PROJECT WATER

3. (a) The Contractor may cause up to 30,000 AF annually of Non-Project Water to be introduced into Folsom Reservoir from the source(s) listed in Exhibit B. The United States shall convey said water to the Contractor's Point of Delivery through Excess Capacity in Project Facilities in accordance with a schedule, or any revision or revisions thereof, submitted by the Contractor and approved by the Contracting Officer during the term hereof. If at any time the Contracting Officer determines that there will not be Excess Capacity in Project Facilities sufficient to receive, transport, and convey the Non-Project Water in accordance with the approved schedule, the Contracting Officer shall so notify the Contractor in writing. Within 24 hours of said notice, the Contractor shall revise its schedule accordingly.

(b) The amount of Non-Project Water conveyed to the Contractor through Project Facilities in any 30-day period shall not exceed the quantity of Non-Project Water previously introduced into Folsom Reservoir by the Contractor. The Contractor will be responsible for requiring PCWA to make releases during the months of July, August, September, and October and any other month the California State Water Resources Control Board

COORDINATE WITH PCWA NORMAL OPERATIONS.

determines that PCWA has no right to divert the natural flow of the American River, from PCWA's upstream reservoirs the quantity of water that equals the quantity of water that the Contractor has scheduled to introduce into Folsom Reservoir during each of those months, plus five percent for transportation losses.

(c) Exhibit B may be modified or replaced by agreement of the parties to reflect any changes made to the sources of the Non-Project Water identified on Exhibit B, without amending this Contract.

(d) The Non-Project Water shall be used for M&I purposes only.

(e) Non-Project Water that is introduced into Folsom Reservoir by the Contractor, and remains there for less than 30 days, shall not be deemed unused water available to the United States for Project purposes. Conversely, Non-Project Water that is introduced into Folsom Reservoir by the Contractor, and remains there for 30 days or more, shall be deemed to be unused water available to the United States for Project purposes. Non-Project Water delivered to Project Facilities shall be accounted for on a "first-in, first-out" basis. Similarly, Non-Project Water that is introduced into Folsom Reservoir but not conveyed prior to the expiration of this Contract shall also be deemed unused water available to the United States for Project purposes.

(f) The Contractor shall be responsible for the acquisition and payment of all electrical power and associated transmission service charges required to pump the Non-Project Water through Project Facilities. Conveyance of Non-Project Water pursuant to this Contract will not be supported with Project-use power.

(g) Non-Project Water conveyed by the United States to the Contractor pursuant to this Contract will be conveyed to the Contractor's Point of Delivery.

(h) The Contractor shall utilize the Non-Project Water conveyed pursuant to this Contract in accordance with all requirements of any applicable Biological Opinion.

(i) All Non-Project Water conveyed to the Contractor pursuant to this Contract shall be measured and recorded with equipment furnished, installed, operated, and maintained by the Contractor. Upon the request of either party to this Contract, the Contractor shall investigate the accuracy of such measurements and shall take any necessary steps to adjust any errors appearing therein.

SCHEDULING AND REPORTING OBLIGATIONS OF THE CONTRACTOR

4. (a) On or before each March 1, or at such other times as the Contracting Officer determines to be necessary, the Contractor shall submit to the Contracting Officer a written schedule, satisfactory to the Contracting Officer, showing the dates, and estimated monthly quantities of Non-Project Water to be introduced into Folsom Reservoir and conveyed by the United States to the Contractor pursuant to this Contract for the upcoming Year. During each month, the Contractor will revise said schedule if necessary to reflect the actual amount of Non-Project Water introduced into Folsom Reservoir and conveyed by the United States to the Contractor pursuant to this Contract.

(b) For each month, before the 10th day of the succeeding month, the Contractor shall furnish a monthly report of daily operations that is satisfactory to the Contracting Officer which tabulates PCWA's right to the natural flow in the American River, the

quantity of releases from PCWA's upstream storage, and the quantity of Non-Project Water scheduled by the Contractor pursuant to this Contract.

(c) The Contractor shall advise the Contracting Officer on or before the 10th calendar day of each month of the actual daily quantities of Non-Project Water taken the previous month by the Contractor at the Contractor's Point of Delivery pursuant to this Contract.

PAYMENT FOR CONVEYANCE

5. (a) The Contractor shall pay the United States as provided in this Article for the conveyance of Non-Project Water pursuant to this Contract at the Rate set forth in Exhibit A, as my be revised annually in accordance with CVP ratesetting policies.

(b) By December 31 of each Calendar Year, the Contracting Officer shall provide the Contractor with the final Rates to be in effect for the upcoming Year, and such notification shall revise Exhibit "A" without amending this Contract.

(c) Omitted.

(d) At the time the Contractor submits an initial schedule for the conveyance of Non-Project Water pursuant to subdivision (a) of Article 4 of this Contract, the Contractor shall pay the Contracting Officer one-half of the total amount payable for the conveyance of Non-Project Water scheduled to be conveyed for the Year. The Contractor shall pay the remainder of the amount payable for conveying Non-Project Water scheduled to be conveyed for the Year on or before September 1 of the respective Year. Non-Project Water will not be conveyed in advance of payment.

(e) All revenues received from the use of Project facilities, pursuant to subdivision (a) of this Article for conveyance of Non-Project Water, shall be deposited into the Reclamation fund as provided in Section 3 of the Act of February 21, 1911 (36 Stat.925); Provided, that if the Act of February 21, 1911, is amended, superseded, or replaced, any new provisions addressing the application of revenues will apply to this Contract at the earliest possible date under the law.

(f) No refund shall be made by the United States to the Contractor of the payments made for conveyance of Non-Project Water described in subdivision (c) of Article 3.

(g) If at any time the Contractor diverts more Non-Project Water from Project Facilities than the quantity that was scheduled pursuant to subdivision (a) of Article 4 of this Contract, that additional amount of water shall be deemed Project Water used for M&I purposes, and payment therefore, shall be made at the applicable rate identified in the Contractor's Water Service Contract or in any amendment, extension, or renewal thereof. Further, this Project Water will be deducted from the quantity of Project Water to which the Contractor is entitled under the Contractor's Water Service Contract or any amendment, extension, or renewal thereof.

(h) If the conditions identified in subdivision (g) of this Article arise, and it is determined by the Contracting Officer that the Contractor has utilized all of its Project Water available under the Contractor's Water Service Contract or any amendment, extension, or renewal thereof, then the Contractor shall require PCWA to introduce additional Non-Project Water into Folsom Reservoir equal to the quantity of water actually used plus five percent for losses, and shall pay for the conveyance of this additional Non-Project Water at the Rates

identified in Exhibit UNITED STATES NOT RESPONSIBLE FOR CONVEYANCE OF NON-PROJECT WATER

6. The United States shall not be responsible for the control, care, or distribution of the Non-Project Water before it is introduced into Folsom Reservoir, or after it is conveyed to the Contractor's Point of Delivery.

ADJUSTMENTS

7. The amount of any overpayment by the Contractor by reason of the quantity of Non-Project Water conveyed for the Contractor pursuant to this Contract, as conclusively determined by the Contracting Officer, having been less than the quantity which the Contractor otherwise under the provisions of this Contract would have been required to pay for, shall be applied first to any accrued indebtedness arising out of this Contract then due and owing to the United States by the Contractor. Any amount of such overpayment then remaining shall be refunded or credited to the Contractor.

UNITED STATES NOT LIABLE

8. The Contractor hereby releases and agrees to defend and indemnify the United States and its officers, agents, and employees, from every claim for damage to persons or property, direct or indirect, resulting from the Contractor's performance of this Contract, including the introduction of Non-Project Water into Folsom Reservoir and diversion and/or extraction of Non-Project Water from Project Facilities. The Contractor further releases the United States and its officers, agents, or employees, from every claim for damage to persons or property, direct or indirect, resulting from the Contracting Officer's determinations of the amount

of Excess Capacity available in Project Facilities for the conveyance of Non-Project Water to the Contractor, and the elimination of the source of the Non-Project Water. Nothing contained in this Article shall be construed as an assumption of liability by the Contractor with respect to such matters.

OPINIONS AND DETERMINATIONS

9. (a) Where the terms of this Contract provide for actions to be based upon the opinion or determination of either party to this Contract, said terms shall not be construed as permitting such action to be predicated upon arbitrary, capricious, or unreasonable opinions or determinations. Both parties, notwithstanding any other provisions of this Contract, expressly reserve the right to relief from and appropriate adjustment for any such arbitrary, capricious, or unreasonable opinion or determination. Each opinion or determination by either party shall be provided in a timely manner.

(b) The Contracting Officer shall have the right to make determinations necessary to administer this Contract that are consistent with the expressed and implied provisions of this Contract, the laws of the United States and the State of California, and the rules and regulations promulgated by the Secretary of the Interior. Such determinations shall be made in consultation with the Contractor to the extent reasonably practicable.

CONTRACTOR TO PAY CERTAIN MISCELLANEOUS COSTS

10. In addition to all other payments to be made by the Contractor pursuant to this Contract, the Contractor shall pay to the United States, within 60 days after receipt of a bill and detailed statement submitted by the Contracting Officer to the Contractor for such specific items

of direct cost incurred by the United States for work requested by the Contractor associated with this Contract plus indirect costs in accordance with applicable Bureau of Reclamation policy and procedures. All such amounts referred to in this Article shall not exceed the amount agreed to in writing in advance by the Contractor. This Article shall not apply to costs for routine contract administration.

WATER CONSERVATION

11. (a) The Contractor hereby acknowledges and agrees that the Contractor is required to implement an effective water conservation program prior to delivery of Project Water under the Contractor's Water Service Contract pursuant to Section 210 of the Reclamation Reform Act of 1982, as amended.

(b) Prior to execution of this conveyance contract, the Contractor shall include in its water conservation program the amount(s) of Non-Project Water to be conveyed through Federal facilities to areas within the Contractor's service area. The Non-Project Water conveyed to the Contractor pursuant to this Contract will be subject to the same water conservation requirements as the Project Water provided to the Contractor under the Contractor's Water Service Contract as amended, extended, or renewed.

MEDIUM FOR TRANSMITTING PAYMENTS

12. (a) All payments from the Contractor to the United States under this Contract shall be by the medium requested by the United States on or before the date payment is due. The required method of payment may include checks, wire transfers, or other types of payment specified by the United States.

(b) Upon execution of the Contract, the Contractor shall furnish the Contracting Officer with the Contractor's taxpayer's identification number (TIN). The purpose for requiring the Contractor's TIN is for collecting and reporting any delinquent amounts arising out of the Contractor's relationship with the United States.

CHARGES FOR DELINQUENT PAYMENTS

13. (a) The Contractor shall be subject to interest, administrative, and penalty charges on delinquent payments. If a payment is not received by the due date, the Contractor shall pay an interest charge on the delinquent payment for each day the payment is delinquent beyond the due date. If a payment becomes 60 days delinquent, in addition to the interest charge, the Contractor shall pay an administrative charge to cover additional costs of billing and processing the delinquent payment. If a payment is delinquent 90 days or more, in addition to the interest and administrative charges, the Contractor shall pay a penalty charge for each day the payment is delinquent beyond the due date, based on the remaining balance of the payment due at the rate of 6 percent per year. The Contractor shall also pay any fees incurred for debt collection services associated with a delinquent payment.

(b) The interest charge rate shall be the greater of the rate prescribed quarterly in the *Federal Register* by the Department of the Treasury for application to overdue payments or the interest rate of 0.5 percent per month. The interest charge rate will be determined as of the due date and remain fixed for the duration of the delinquent period.

(c) When a partial payment on a delinquent account is received, the amount received shall be applied first to the penalty charges, second to the administrative charges, third to the accrued interest, and finally to the overdue payment.

PROTECTION OF WATER AND AIR QUALITY

14. (a) Project facilities used to make available and deliver water to the Contractor shall be operated and maintained in the most practical manner to maintain the quality of the water at the highest level possible as determined by the Contracting Officer: Provided, That the United States does not warrant the quality of the water delivered to the Contractor and is under no obligation to furnish or construct water treatment facilities to maintain or improve the quality of water delivered to the Contractor.

(b) The Contractor shall comply with all applicable water and air pollution laws and regulations of the United States and the State of California; and shall obtain all required permits or licenses from the appropriate Federal, State, or local authorities necessary for the delivery of water by the Contractor; and shall be responsible for compliance with all Federal, State, and local water quality standards applicable to surface and subsurface drainage and/or discharges generated through the use of Federal or Contractor's service area.

(c) This Article shall not affect or alter any legal obligations of the Secretary to provide drainage or other discharge services.

(d) If it is determined by the Contracting Officer that the quality of the source of the Non-Project Water identified in Exhibit B, conveyed pursuant to this Contract will significantly degrade the quality of Project Water in Folsom Reservoir, the Contractor shall, upon

receipt of a written notice from the Contracting Officer, arrange for the immediate termination of the introduction of such source of Non-Project Water into Project Facilities.

GENERAL OBLIGATION--BENEFITS CONDITIONED UPON PAYMENT

15. (a) The obligation of the Contractor to pay the United States as provided in this Contract is a general obligation of the Contractor notwithstanding the manner in which the obligation may be distributed among the Contractor's water users and notwithstanding the default of individual water users in their obligations to the Contractor.

(b) The payments of rates becoming due pursuant to this contract is a condition precedent to receiving benefits under this Contract. The United States shall not make Non-Project Water available to the Contractor through Project Facilities during any period in which the Contractor may be in arrears in the advance payment of water rates due the United States. The Contractor shall not furnish Non-Project Water made available pursuant to this Contract for lands or parties which are in arrears in the advance payment of water rates levied or established by the Contractor.

(c) With respect to subdivision (b) of this Article, the Contractor shall have no obligation to require advance payment for water rates which it levies.

RULES, REGULATIONS, AND DETERMINATIONS

16. The parties agree that the delivery of Non-Project Water or the use of Federal facilities pursuant to this Contract is subject to federal Reclamation law, as amended and supplemented, and the rules and regulations promulgated by the Secretary of the Interior under federal Reclamation law.

EQUAL EMPLOYMENT OPPORTUNITY

17. During the performance of this Contract, the Contractor agrees as follows:

(a) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this nondiscrimination clause.

(b) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without discrimination because of race, color, religion, sex, or national origin.

(c) The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Contracting Officer, advising the said labor union or workers' representative of the Contractor's commitments under Section 202 of Executive Order 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Contractor will furnish all information and reports required by said amended Executive Order and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Contracting Officer and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(f) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended, in whole or in part, and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in said amended Executive Order, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of said amended Executive Order, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions, including sanctions for noncompliance: *Provided*, however, That in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

BOOKS, RECORDS, AND REPORTS

18. (a) The Contractor shall establish and maintain accounts and other books and records pertaining to administration of the terms and conditions of this Contract, including: the Contractor's financial transactions, water supply data, project operation, maintenance and replacement logs, and project land and right-of-way use agreements; the water users' land-use (crop census), landownership, land-leasing and water-use data; and other matters that the Contracting Officer may require. Reports thereon shall be furnished to the Contracting Officer in such form and on such date or dates as the Contracting Officer may require. Subject to applicable Federal laws and regulations, each party to this Contract shall have the right during office hours to examine and make copies of the other party's books and records relating to matters covered by this Contract.

(b) Notwithstanding the provisions of subdivision (a) of this Article, no books, records, or other information shall be requested from the Contractor by the Contracting Officer unless such books, records, or information are reasonably related to the administration or performance of this Contract. Any such request shall allow the Contractor a reasonable period of time within which to provide the requested books, records, or information.

CONTINGENT ON APPROPRIATION OR ALLOTMENT OF FUNDS

19. The expenditure or advance of any money or the performance of any obligation of the United States under this Contract shall be contingent upon appropriation or allotment of funds. Absence of appropriation or allotment of funds shall not relieve the Contractor from any obligations under this Contract. No liability shall accrue to the United States in case funds are not appropriated or allotted.

ASSIGNMENT LIMITED--SUCCESSORS AND ASSIGNS OBLIGATED

20. The provisions of this Contract shall apply to and bind the successors and assigns of the parties hereto, but no assignment or transfer of this Contract or any right or interest therein shall be valid until approved in writing by the Contracting Officer.

OFFICIALS NOT TO BENEFIT

21. No Member of or Delegate to Congress, Resident Commissioner, or official of the Contractor shall benefit from this Contract other than as a water user or landowner in the same manner as other water users or landowners.

COMPLIANCE WITH CIVIL RIGHTS LAWS AND REGULATIONS

22. (a) The Contractor shall comply with Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d), Section 504 of the Rehabilitation Act of 1973 (P.L. 93-112, as amended), the Age Discrimination Act of 1975 (42 U.S.C. 6101, et seq.) and any other applicable civil rights laws, as well as with their respective implementing regulations and guidelines imposed by the U.S. Department of the Interior and/or Bureau of Reclamation.

(b) These statutes require that no person in the United States shall, on the grounds of race, color, national origin, handicap, or age, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving financial assistance from the Bureau of Reclamation. By executing this Contract, the Contractor agrees to immediately take any measures necessary to implement this obligation, including permitting officials of the United States to inspect premises, programs, and documents.

(c) The Contractor makes this agreement in consideration of and for the purpose of obtaining any and all Federal grants, loans, contracts, property discounts or other Federal financial assistance extended after the date hereof to the Contractor by the Bureau of Reclamation, including installment payments after such date on account of arrangements for Federal financial assistance which were approved before such date. The Contractor recognizes and agrees that such Federal assistance will be extended in reliance on the representations and agreements made in this Article, and that the United States reserves the right to seek judicial enforcement thereof.

(d) Complaints of discrimination against the Contractor shall be investigated by the Contracting Officer's Office of Civil Rights.

CONFIRMATION OF CONTRACT

23. The Contractor, after the execution of this Contract, shall furnish to the Contracting Officer evidence that pursuant to the laws of the State of California, the Contractor is a legally constituted entity, and the Contract is lawful, valid, and binding on the Contractor. This Contract shall not be binding on the United States until such evidence has been provided to the Contracting Officer's satisfaction.

CONTRACT DRAFTING CONSIDERATIONS

24. Articles 1 through 25 of this Contract have been drafted, negotiated, and reviewed by the parties hereto, each of whom is sophisticated in the matters to which this Contract pertains, and no one party shall be considered to have drafted the stated articles.

NOTICES

25. Any notice, demand, or request authorized or required by this Contract shall be deemed to have been given, on behalf of the Contractor, when mailed, postage prepaid, or

delivered to the United States Department of Interior, Bureau of Reclamation, Area Manager, 7794 Folsom Dam Road, Folsom, California 95630-1799, and on behalf of the United States, when mailed, postage prepaid, or delivered to the City Manager of the City Of Roseville, 311 Vernon Street, Roseville, California 95678. The designation of the addressee or the address may be changed by notice given in the same manner as provided in this Article for other notices.

IN WITNESS WHEREOF, the parties hereto have executed this Contract as of the day and year first above written.

THE UNITED STATES OF AMERICA

APPROVED AS TO LEGAL FORM AND SUFFICIENCY
OFFICE OF REGIONAL SOLICITOR
DEPARTMENT OF THE INTERIOR

By: _____
FOR Regional Director, Mid-Pacific Region
Bureau of Reclamation

(SEAL)

CITY OF ROSEVILLE

By: _____
City Manager

Attest:

By: _____
City Clerk, City of Roseville

(H:\PUB440\Long-Term Warrren Act Contracts\City of Roseville. LTWA. 09.19.2006.doc)

EXHIBIT A

2006 Water Rates and Charges for the
Conveyance of Non-Project Water for
Municipal and Industrial Purposes under the
Long-Term Warren Act Contract for the
CITY OF ROSEVILLE

O&M and Cost of Service Rates	Cost per acre-foot
Storage Capital: $3.17 O&M: $8.22	$ 11.39
Water Marketing	$ 4.36
Total Cost of Service Rate (Storage + Water Marketing Rates)	**$ 15.75**

Additional detail of rate components is available at www.mp.usbr.gov/cvpwaterrates/ .

Contract No. 02-WC-20-2217

EXHIBIT B

SOURCE(S) OF NON-PROJECT WATER

Placer County Water Agency's Middle Fork American River Project under water right permits Nos. 12856 and 13858 granted by the California State Water Resources Control Board.

RESOLUTION NO. 06-553

APPROVING THE CONTRACT FOR CONVEYANCE OF NON-PROJECT WATER (WARREN ACT CONTRACT) BETWEEN THE CITY OF ROSEVILLE AND UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION AND AUTHORIZING THE CITY MANAGER TO EXECUTE IT ON BEHALF OF THE CITY OF ROSEVILLE

WHEREAS, City of Roseville has water supply contracts with the Bureau of Reclamation (USBR) totaling 32,000 acre-feet; and

WHEREAS, the City has water supply contracts and options with the Placer County Water Agency (PCWA) for an additional 30,000 acre-ft; and

WHEREAS, this water is necessary to meet the needs of the City of Roseville projected through build-out; and

WHEREAS, Roseville has worked with the USBR to develop a long-term contract that will allow conveyance of PCWA water through USBR facilities ultimately for Roseville use; and

WHEREAS, the Long-Term Warren Act Contract for Conveyance of Non-Project Water (Contract No. 02-WC-20-2217), between the City of Roseville and the Bureau of Reclamation, has been reviewed by the Council; and

NOW, THEREFORE, BE IT RESOLVED by the Council of the City of Roseville that said agreement is approved and that the City Manager is authorized to execute it on behalf of the City of Roseville upon receipt and approval of all required documents by the City Attorney.

PASSED AND ADOPTED by the Council of the City of Roseville this 18th day of October, 20 06, by the following vote on roll call:

AYES	COUNCILMEMBERS:	Gray, Allard, Roccucci, Rockholm, Garbolino
NOES	COUNCILMEMBERS:	None
ABSENT	COUNCILMEMBERS:	None

MAYOR

ATTEST:

City Clerk

The foregoing instrument is a correct copy of the original on file in this office.

ATTEST:
City Clerk of the City of Roseville, California

AGREEMENT BETWEEN PLACER COUNTY WATER AGENCY AND CITY OF ROSEVILLE FOR A WATER SUPPLY

Sup. Bieg for your records

THIS AGREEMENT is made this 20th day of November, 1991, by and between City of Roseville (the "City") a municipal corporation and the Placer County Water Agency (the "Agency"), and

W I T N E S S E T H:

WHEREAS, on May 17, 1989, the Agency and the City entered into a contract relating to the interconnection of their water systems which provided, among other things, an option to Roseville to purchase up to 10,000 acre feet annually of raw water which the Agency has permits to divert from the North Fork of the American River and Folsom Reservoir and a further option to increase that amount, under certain circumstances, from 10,000 to 20,000 acre feet annually. That agreement also provided that the delivery of the option water shall be from either the Agency's present Auburn or Folsom Reservoir diversion points, or from any other diversion points acceptable to the parties that may be approved by the State Water Resources Control Board, and that the delivery shall be pursuant to subsequent agreements and arrangements to be made between the City, the Agency, the USBR and the State Water Resources Control Board.

WHEREAS, on January 25, 1991, the City notified the Agency that it was exercising its option to purchase the 10,000 acre feet

of water annually and that it was also exercising its right to obtain an option to the second 10,000 acre feet annually.

WHEREAS, the parties now desire to enter into a agreement to set forth the terms and conditions for the annual delivery of the 10,000 acre feet of water which the City elected to purchase on January 25, 1991.

NOW, THEREFORE, the parties mutually agree as follows:

1. DEFINITIONS - When used in this agreement, the following terms shall have the meanings hereinafter set forth.

(a) "USBR" shall mean the United States Department of the Interior, Bureau of Reclamation.

(b) "YEAR" shall mean the 12-month period from January 1 through December 31, both dates inclusive.

2. TERM OF AGREEMENT - This agreement shall be effective upon the date first above written and shall remain in effect through the year 2011; provided, however, that if within three years from the date of this agreement (a) the Agency and the City fail to secure adequate assurances from the USBR that the USBR will permit the City to take delivery of the water provided for in this agreement from Folsom Reservoir, or (b) the Agency after using its best efforts fails to obtain from the State Water Resources Control Board approval of any point of rediversion from Folsom Reservoir under the Agency's water right Permits No. 13856 and 13858 that may be needed to enable such water to be delivered to the City, either party may terminate this agreement within 30 days after the end of

the three years by giving the other written notice of its election to do so. Upon such termination by either party the City shall be entitled to a refund of all amounts paid to the Agency pursuant to this agreement, and the City's right to purchase the 10,000 acre feet annually shall cease.

3. AGREEMENT RENEWAL - Renewals of this agreement may be made for successive periods not to exceed twenty (20) years each. The terms and conditions of each renewal shall be agreed upon not later than one year prior to the expiration of the then existing agreement.

4. WATER TO BE FURNISHED TO THE CITY - Each year of this agreement the Agency will provide the City a firm supply of 10,000 acre feet of water from the water available to the Agency annually under its water right permits 13856 and 13858, which amount is hereinafter referred to as the City's annual entitlement.

5. DELIVERY OF WATER - All water to be furnished pursuant to this agreement will be delivered by the Agency into Folsom Reservoir and the City shall be responsible for the transportation of the water out of Folsom Reservoir into the City's facilities, including the payment of any charges made by the USBR relating to the delivering of this water out of Folsom Reservoir. Also, if it is necessary to construct facilities to divert this water out of Folsom Reservoir, the City shall be responsible for all costs of such construction and for processing any necessary approvals for such construction.

6. DELIVERY SCHEDULE - Upon the execution of this agreement, the City shall submit a written schedule to the Agency indicating the times and quantities of water to be taken from Folsom Reservoir by and for the benefit of the City pursuant to this agreement during the remainder of 1991. Thereafter, on or before December 1 of each year, beginning in 1991, the City shall submit a written schedule to the Agency indicating the times and quantities of water to be taken from Folsom Reservoir by or for the benefit of the City pursuant to this agreement during the following year. The Agency shall, consistent with its water rights, the provisions hereof and to the maximum extent feasible, furnish water in accordance with the schedules submitted by the City or any revisions thereof that are satisfactory to the Agency.

7. MEASUREMENT - The City shall measure or cause to be measured all water furnished pursuant to this agreement at the USBR's point of delivery into City facilities. Such measurement shall be with equipment satisfactory to the Agency and the City, and the Agency shall be furnished written reports on the daily deliveries to City. The Agency may inspect such measuring equipment for the purpose of determining the accuracy thereof at any time and any errors appearing therein will be adjusted.

8. WATER SHORTAGES - (a) There may occur at times a shortage or shortages during any year or years in the quantity of water available to the Agency for delivery to the City. In such events no liability shall accrue against the Agency or any of its respective officers, agents or employees for any damage, direct or

indirect, arising from such shortage or shortages. In any year in which there may occur a shortage, from any cause, the Agency reserves the right to equitably apportion in proportion its available water supply among the City and others entitled to receive water from the Agency. If in any year the City is delivered less than the quantity of water which the City otherwise would be entitled to receive hereunder, an adjustment with interest at the legal rate shall be made in the amounts to be paid by the City provided for in Article 11. To the extent of such deficiency in delivery, such adjustment shall constitute the sole remedy of the City or anyone having or claiming to have by, through or under the City, the right to the use of any of the water supply provided for herein.

(b) The Agency may temporarily discontinue or reduce the amount of water to be furnished to the City as provided for herein for the purpose of maintaining, repairing, replacing, investigating or inspecting any of the facilities necessary for the storage or furnishing of water to the City. Insofar as it is feasible, the Agency will give the City due notice in advance of such temporary discontinuances or reductions, except in cases of emergency, in which case no notice need be given. In the event of any such discontinuance or reduction, the Agency will, upon the resumption of service, attempt to approximate delivery of the quantity of water which would have been furnished to the City in the absence of such contingency.

9. WATER QUALITY - The Agency assumed no responsibility with respect to the quality of the water to be furnished pursuant to this agreement and does not warrant the quality of any such water.

10. RESPONSIBILITIES FOR DELIVERY AND DISTRIBUTION OF WATER - Neither the Agency nor its officers, agents or employees shall be liable for the control, carriage, handling, use, disposal, or distribution of water furnished to City hereunder outside of facilities then being operated or maintained by the Agency, nor for claims of damages of any nature whatsoever, including but not limited to property damage, personal injury or death, arising out of or connected with the control, carriage, handling, use, disposal, or distribution of such water beyond said facilities and the City shall indemnify and hold harmless the Agency and its officers, agents and employees from any such damages or claims of damages.

11. RATE AND METHOD OF PAYMENT FOR WATER - For each acre-foot of annual entitlement deliverable to be delivered to the City pursuant to this agreement through 1994, the City shall pay the Agency $7.25. For each acre-foot of annual entitlement deliverable to the City pursuant to this agreement after January 1, 1995, the City shall pay the Agency an amount equal to the price then being quoted by the USBR for new or renewed agreements for water delivered from Folsom Reservoir for domestic, municipal and industrial purposes for that year, but in no event less than $7.25 per acre-foot. Payments for the City's annual entitlements shall

be made to the Agency quarterly in advance on or before January 1, April 1, July 1 and October 1 of each year beginning in 1992.

The parties acknowledge that water was delivered to City by Agency during 1991 prior to this Agreement. City shall pay Agency for such water delivered during 1991 at the rate of $7.75 per acre-foot actually delivered. Payment shall be made on or before January 31, 1992. City shall have no further liability for water delivered or held available during 1991 except for that 10,000 acre feet of water still held available under the unexercised portion of the option agreement.

12. INTEREST ON OVERDUE PAYMENTS - The City shall pay the Agency interest at the legal rate for interest on judgments on any charges that remain unpaid after they become due and payable.

13. OBLIGATION OF CITY TO MAKE PAYMENTS -

(a) Character of Obligation.

The obligations of the City arising out of or pursuant or incidental to this agreement shall constitute general obligations of the City, and the City shall use all the powers and resources available to it under the law to collect the funds necessary for and to pay its obligations to the Agency under this agreement. The City as a whole is obligated to pay to the Agency the payments becoming due under this agreement, notwithstanding any individual default by its water users, constituents or others in the payment to the City of assessments, taxes, tolls, or other charges levied by the City.

(b) Refusal of Water Does Not Affect Obligation.

The City's Failure or refusal to accept delivery of any of its annual entitlement in any year shall in no way relieve it of its obligation to make payments to the Agency for that year's annual entitlement as provided for herein.

14. REMEDIES NOT EXCLUSIVE - The use by either party of any remedy specified for the enforcement of this agreement is not exclusive and shall not deprive the party using such remedy of, or limit the application of, any other remedy provided by law.

15. WAIVER OF RIGHTS - Any waiver at any time by either party of its rights with respect to a breach or default, or any other matter arising in connection with this agreement, shall not be deemed to be a waiver with respect to any other breach, default or matter.

16. ASSIGNMENT - The provisions of this agreement shall apply to and bind the successors and assigns of the respective parties, but no assignment or transfer of this agreement, or any part hereof or interest herein, shall be valid until and unless approved by the Agency.

17. AREA SERVED BY THE CITY - Water delivered to the City pursuant to this agreement shall not be sold or otherwise disposed of by the City for use outside of the City's boundaries, as they may exist from time to time, without the prior written consent of the Agency.

18. OPINIONS AND DETERMINATIONS - Where the terms of this agreement provide for action to be based upon, judgment, approval,

review, or determination of either party, such terms are not intended to be and shall never be construed as permitting such opinion, judgment, approval, review, or determination to be arbitrary, capricious, or unreasonable.

19. NOTICES - All notices that are required either expressly or by implication to be given by any party to the other under this agreement shall be signed for the Agency and for the City by such officers as they may, from time to time, authorize in writing to so act.

Any notices to parties required by this agreement shall be delivered or mailed, U.S. first class postage prepaid, addressed as follows:

CITY

Jerry Jackson
Environmental Utilities
Director
316 Vernon Street, Room 100
Roseville, CA 95678

and

Steve Dillon
Community Development Director
316 Vernon Street, Room 104
Roseville, CA 95678

AGENCY

Richard Milbrodt
General Manager
P.O. Box 6570
Auburn, CA 95604

Either party may amend its address for notice by sending notice to the other party.

20. INSPECTION OF BOOKS AND RECORDS - The proper officers or agents of the City shall have full and free access at all reasonable times to the account books and official records of the

Agency insofar as the same pertain to the matters and things provided for in this agreement, with the right at any time during office hours to make copies thereof at the City's expense, and the proper representatives of the Agency shall have similar rights in respect to the account books and records of the City.

21. INTEGRATION. This is an integrated agreement and contains all of the terms, considerations, understanding and promises of the parties. It shall be read as a whole.

22. ATTORNEY'S FEES. In any action brought by either party to enforce the terms of this agreement, the prevailing party shall be entitled to recover its reasonable attorney's fees.

IN WITNESS WHEREOF, the City of Roseville, a municipal corporation, has authorized the execution of this agreement in duplicate by its City Manager and attested to by its City Clerk under the authority of Resolution No. 91-299, adopted by the Council of the City of Roseville on the 20th day of November, 1991, and Agency has caused this agreement to be executed.

CITY OF ROSEVILLE, a municipal corporation

BY: _____
ALLEN E. JOHNSON
City Manager

PLACER COUNTY WATER AGENCY, a public agency

BY: _____
RICHARD MILBRODT
General Manager

ATTEST:

HELEN FLORANCE
City Clerk

ATTEST:

Secretary

APPROVED AS TO FORM:

MICHAEL F. DEAN
City Attorney

APPROVED AS TO SUBSTANCE:

JERRY JACKSON
Environmental Utilities Director

STEVEN DILLON
Community Development Director

RESOLUTION NO. 91-299

RESOLUTION OF THE COUNCIL OF THE CITY OF ROSEVILLE APPROVING AN AGREEMENT BETWEEN THE CITY OF ROSEVILLE AND PLACER COUNTY WATER AGENCY AND AUTHORIZING THE CITY MANAGER TO EXECUTE IT ON BEHALF OF THE CITY OF ROSEVILLE

WHEREAS, an agreement for Purchase of Water Supply between the City of Roseville and Placer Couty Water Agency has been prepared and has been reviewed by the Council;

NOW THEREFORE, BE IT RESOLVED by the Council of the City of Roseville that said agreement is approved and that the City Manager is authorized to execute it on behalf of the City of Roseville.

PASSED AND ADOPTED by the Council of the City of Roseville this 20th day of November , 1991, by the following vote on roll call:

AYES COUNCILMEMBERS: Pauline Roccucci, Fred M. Jackson, Harry Crabb, Jr., Mel Hamel, Bill Santucci

NOES COUNCILMEMBERS: None

ABSENT COUNCILMEMBERS: None

Bill Santucci
MAYOR

ATTEST:

Helen Florance
City Clerk

The foregoing is a true and correct copy of the original on file in this office.

ATTEST:
City Clerk of the City of Roseville, California

Deputy Clerk

CITY CLERK
CITY OF ROSEVILLE
TRADITION • PRIDE • PROGRESS

311 VERNON STREET, #208 • ROSEVILLE, CA 95678
(916) 774-5263 • TDD (916) 774-5220 • FAX (916) 786-9175

January 22, 1996

Placer County Water Agency
P.O. Box 6570
Auburn, CA 95604

PLACER COUNTY WATER AGENCY CONTRACT AMENDMENT

The Roseville City Council at the meeting of January 17, 1996, approved the above agreement between your company and the city. I am enclosing three copies of the agreement, which have been executed by the City Manager along with a certified copy of authorizing Resolution No.96-27. Please return a completely executed copy to our office, for our records.

If you have any questions, please contact Environmental Utilities at 774-5330.

CAROLYN PARKINSON
City Clerk

by:

Elly Allen,
Deputy Clerk

cc: City Attorney
Finance
Env. Utilities ✓

Draft 1/3/96

AGREEMENT BETWEEN PLACER COUNTY WATER AGENCY AND CITY OF ROSEVILLE AMENDING NOVEMBER 20, 1991 WATER SUPPLY CONTRACT

This agreement is made this 17th day of January, 1996, by and between the City of Roseville ("the City"), a municipal corporation, and the Placer County Water Agency (the "Agency").

W I T N E S S E T H

WHEREAS, on November 20, 1991, the Agency and the City entered into two contracts, one in which the Agency agreed to furnish the City a water supply in Folsom Reservoir (the "Water Supply Contract") and the other in which the City agreed to wheel Agency water through the City from the Intertie Line to a delivery point in the vicinity of Baseline and Cook Riolo Roads (the "Wheeling Contract"); and

WHEREAS, on October 6, 1994 the Agency and the City supplemented their May 17, 1989 contract which, among other things, provided the City options to purchase water;

WHEREAS, the Water Supply Contract provided that the price to be paid for water made available to the City after January 1, 1995, would be an amount equal to the price then being quoted by the United States Bureau of Reclamation ("USBR") for new or renewed agreements for water delivered from Folsom Reservoir for domestic,

municipal and industrial purposes, but in no event less than $7.25 per acre-foot; and

WHEREAS, in November 1991, both parties assumed that in 1995 and thereafter the USBR would have one uniform price for new or renewed agreements for water delivered from Folsom Reservoir and neither foresaw the passage by Congress of the Central Valley Project Improvement Act in 1992 which requires the addition of a mitigation and restoration payment to USBR charges for water; and

WHEREAS, the parties desire to (a) amend the Water Supply Contract to specify the price the City is to pay the Agency for water in 1995 and thereafter, (b) clarify that there will be no charge by the City for wheeling water for the Agency pursuant to the Wheeling Contract, and (c) to revise the option provisions in the May 17, 1989 contract as supplemented by the October 6, 1994 agreement.

NOW THEREFORE, THE PARTIES MUTUALLY AGREE AS FOLLOWS:

1. Article 11 of the Water Supply Contract is amended to read:

> 11. RATE AND METHOD OF PAYMENT FOR WATER - For each acre foot of annual entitlement deliverable to the City pursuant to this agreement through June 30, 1995, the City shall pay the Agency $7.25. For each acre foot of annual entitlement deliverable to the City from July 1, 1995 through June 30, 1998, the City shall pay the Agency $10.

For each acre foot of annual entitlement deliverable to the City from July 1, 1998 through June 30, 2000, the City shall pay the Agency $11. Beginning on July 1, 2000 and each fiscal year thereafter, the City shall pay the Agency for each acre foot of annual entitlement deliverable to the City an amount equal to the average of the acre foot prices the City, San Juan Water District and the Agency are required to pay to the USBR, exclusive of any mitigation or restoration payments, during that year for water made available to them by the USBR in Folsom Reservoir for domestic, municipal and industrial purposes. If in any year any of the three (the City, San Juan and the Agency) are not required to pay the USBR for water that year, the price the City shall pay the Agency shall be the average of the acre foot prices the other two are required to pay to the USBR that year. Payments for the City's annual entitlements shall be made to the Agency quarterly in advance on or before July 1, October 1, January 1 and April 1 of each fiscal year.

2. The City's option to purchase 20,000 acre-feet annually from the Agency, which runs until June 20, 2011 as

provided for in the May 17, 1989 contract, as modified by the October 6, 1994 contract, is modified as follows:

(a) The City will not purchase more than 5,000 of the 20,000 acre-feet before July 1, 1999.

(b) The City will not purchase more than 10,000 of the 20,000 acre-feet before July 1, 2004.

(c) The City will not purchase more than 15,000 of the 20,000 acre-feet before July 1, 2009.

(d) The City will not purchase any of the 20,000 acre-feet in blocks of less than 5,000 acre-feet.

Except in the case of an emergency, as provided below, in order to exercise any portion of its option to purchase water, the City shall give the Agency 24 months advance written notice of its intent to do so. The annual fee for the option for the first 10,000 acre-feet shall be either $1 per acre foot or ten percent of the acre foot price which the City is required to pay the Agency during that year for water pursuant to Article 11 of the Water Supply Contract, whichever is higher. The annual fee for the

option for the remaining 10,000 acre-feet shall be either $0.50 per acre foot or five percent of the acre foot price the City is required to pay the Agency during that year for water pursuant to Article 11 of the Water Supply Contract, whichever is higher. Notwithstanding any other provisions of this paragraph, if in the event of an emergency the City needs water in addition to that which it has already contracted to purchase from the Agency, and the Agency can make such additional water available to the City during the emergency without jeopardizing the Agency's other customers, the Agency shall offer such water to the City and the City may purchase additional water, up to the amount of the City's then unexercised option rights, at the then current per acre foot price for water provided under the Water Supply Contract. Purchases of such additional water for emergencies shall not be deemed to be exercises of any of the City's option rights provided for in this paragraph 2 and shall not adversely affect such option rights.

3. The City shall not charge the Agency for wheeling water through the City's system pursuant to the provisions of the Wheeling Contract; however, the Agency shall be required to pay for maintenance and repairs on pipelines as provided for in Article 4 of the Wheeling Contract.

IN WITNESS WHEREOF, the City of Roseville, a municipal corporation, has authorized the execution of this agreement in duplicate by its City Manager and attested to by its City Clerk

under the authority of Resolution No. 96-27, adopted by the City of Roseville on the 17th day of January, 199[illegible], and the Agency has authorized the execution of this agreement by its Chairman by its Resolution No. 9[illegible]-____ adopted by the Board of Directors of the Agency on the ___ day of _____, 1995.

CITY OF ROSEVILLE,
A municipal corporation

By: _____
Allen E. Johnson
City Manager

ATTEST:

_____
City Clerk

APPROVED AS TO FORM:

_____
City Attorney

PLACER COUNTY WATER AGENCY,
A public agency

By: _____
Chairman, Board of Directors

ATTEST:

_____
Secretary

APPROVED AS TO FORM:

_____
Edward J. Tiedemann
Placer County Water Agency
Attorney

198274.3

RESOLUTION NO. 96-27

APPROVING AN AMENDMENT TO 1991 WATER SUPPLY AGREEMENT BETWEEN CITY OF ROSEVILLE AND THE PLACER COUNTY WATER AGENCY, AND AUTHORIZING THE CITY MANAGER TO EXECUTE IT ON BEHALF OF THE CITY OF ROSEVILLE

WHEREAS, an amendment to the Agreement for water supply dated November 20, 1991, between City of Roseville and The Placer County Water Agency, has been reviewed by the Council;

NOW, THEREFORE, BE IT RESOLVED by the Council of the City of Roseville that said agreement amendment is approved and that the City Manager is authorized to execute it on behalf of the City of Roseville.

PASSED AND ADOPTED by the Council of the City of Roseville this 17th day of January, 1996, by the following vote on roll call:

AYES COUNCILMEMBERS: Mel Hamel, Claudia Gamar, Randolph Graham, Pauline Roccucci, Harry Crabb

NOES COUNCILMEMBERS: None

ABSENT COUNCILMEMBERS: None

MAYOR

ATTEST:

City Clerk

United States Department of the Interior

BUREAU OF RECLAMATION

MID-PACIFIC REGIONAL OFFICE
2800 COTTAGE WAY
SACRAMENTO, CALIFORNIA 95825

IN REPLY
REFER TO: MP-440
832.

FILED
DEC 8 1976
CITY OF ROSEVILLE
BY

RECEIVED
DEC 1 1976
OFFICE OF
CITY CLERK

City Council
City of Roseville
316 Vernon Street
Roseville, California 95673

Gentlemen:

This letter serves as an amendment to Article 3 of your Contract No. 14-06-200-3474A. Article 3 states that in order to maintain the right to ultimately purchase the maximum quantity of water, the City must purchase certain minimum annual quantities throughout the life of the contract.

Article 3 projected the average annual use as 8,300 acre-feet for the period of January 1, 1971, through December 31, 1975. Bureau records show that the City used or paid for a total of 32,966 acre-feet of water during that period which is an average annual use of 6,640 acre-feet. The City's average annual use was, therefore, 80% of the original projected quantity.

Based on the above figures and the provisions of article 3, it is necessary to reduce the maximum quantity of water the United States is obligated to furnish the City in any one year to 32,000 acre-feet (80% of the original maximum quantity). The projected average annual use is also reduced to 80% of the original quantity. The following table shows both the original and the revised projected average annual use for each contract period.

Contract Period	Projected Average Annual Use Original Acre-Feet	Revised Acre-Feet
1971 through 1975	8,300	6,640
1976 through 1980	10,800	8,640
1981 through 1985	14,100	11,280
1986 through 1990	18,300	14,640
1991 through 1995	24,000	19,200
1996 through 2000	32,000	25,600
2000 on	40,000	32,000
Maximum Quantity	40,000	32,000

Article 3(d) provides for amending the contract if joint Bureau and City studies indicate that there is a substantial difference between actual water needs and the amounts to be provided in the remaining periods of the existing contract. If, in the future, the need for an amendment appears necessary, we will be pleased to consider your request for such a contract.

Sincerely yours,

M. A. Catino

M. A. Catino
Acting Regional Director

R.O. Draft 7/21-1967

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Central Valley Project, California

CONTRACT NO.
14-06-200-3474A

CONTRACT BETWEEN THE UNITED STATES AND THE CITY OF ROSEVILLE PROVIDING FOR WATER SERVICE

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FILED
SEP [illegible] 7
CITY OF ROSEVILLE
BY [illegible]

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Central Valley Project, California

CONTRACT NO.
14-06-200-3474A

CONTRACT BETWEEN THE UNITED STATES AND THE CITY OF ROSEVILLE PROVIDING FOR WATER SERVICE

THIS CONTRACT, made this 7th day of September, 1967, in pursuance generally of the Act of June 17, 1902 (32 Stat. 388), and acts amendatory thereof or supplementary thereto, all collectively hereinafter referred to as the Federal reclamation laws, between THE UNITED STATES OF AMERICA, hereinafter referred to as the United States, and the CITY OF ROSEVILLE, hereinafter referred to as the City, a political subdivision of the State of California, duly organized, existing, and acting pursuant to the laws thereof, with its principal place of business in Roseville, California,

WITNESSETH, That:

EXPLANATORY RECITALS

WHEREAS, the United States is constructing and operating the Central Valley Project, California, for the purpose, among others, of furnishing water for irrigation, municipal, industrial, domestic, and beneficial uses; and

WHEREAS, the United States has constructed and is operating Folsom Dam and Lake as a unit of said Project; and

WHEREAS, investigations of the streamflow of the American River and its tributaries indicate that there will be available for the City a water supply from Folsom Lake for municipal, industrial, and domestic uses; and

WHEREAS, the City desires to contract, pursuant to the Federal reclamation laws and the laws of the State of California, for a water supply from Folsom Lake for the City at the rate and under the conditions hereinafter set forth;

NOW, THEREFORE, in consideration of the covenants herein contained, it is agreed as follows:

DEFINITIONS

1. When used herein, unless otherwise distinctly expressed or manifestly incompatible with the intent hereof, the terms:

(a) "Contracting Officer" shall mean the Secretary of the United States Department of the Interior or his duly authorized representative.

(b) "Project" shall mean the Central Valley Project, California, of the Bureau of Reclamation.

TERM OF CONTRACT

2. (a) This contract shall be effective on January 1, 1971, and shall remain in effect for forty (40) years: Provided, That under

terms and conditions agreeable to the parties, renewals of this contract may be made for successive periods not to exceed forty (40) years each. The terms and conditions of each renewal shall be agreed upon not later than one (1) year prior to the expiration of the then existing contract.

(b) If on January 1, 1971, the City does not own or have available to it for the remainder of the term hereof facilities which in the opinion of the Contracting Officer are adequate for the diversion and conveyance of the water to be made available pursuant to the terms of this contract, this contract shall terminate: Provided, That if such facilities are under construction on that date the Contracting Officer at his option may grant an extension on an annual basis to permit completion of said facilities. Such extension by the Contracting Officer shall not affect the obligation of the City provided in Article 3 of this contract.

WATER TO BE FURNISHED TO CITY

3. (a) The City shall submit in writing to the Contracting Officer not less than fifteen (15) days prior to the date on which it wishes to take initial delivery of water hereunder and on or before December 15 of each year during the term of this contract a schedule, subject to the provisions of subdivisions (c) and (d) of this article and satisfactory to the Contracting Officer, indicating the desired times and quantities for the taking of all water pursuant to this contract during the following year, and the United States within the provisions hereof shall attempt to furnish said water in accordance with said schedule, or any revision thereof satisfactory to the Contracting Officer submitted by the City within a reasonable time before the desired change of the time or quantities for delivery as nearly as may be feasible, as conclusively determined by the Contracting Officer. The City agrees to pay for such scheduled quantities of water.

(b) Each year for a period of five (5) years commencing with 1971 the United States shall furnish and the City each such year shall pay as provided in Article 4 for water from Folsom Lake in the quantities specified in the schedule or any revision thereof submitted by the City in accordance with subdivision (a) and as limited by subdivision (d) of this article:

Provided, That during 1971 the City shall schedule and pay for a minimum of three thousand (3,000) acre-feet of water: Provided further, That the City shall schedule and pay for a minimum of five thousand (5,000) acre-feet of water for each remaining year of the first 5-year period.

(c) Commencing with the year following the period described in subdivision (b) of this article and each year for the remaining period of the contract, the minimum amount of water which the City shall be obligated to schedule and pay for shall be the average annual quantity of water furnished to the City pursuant to this contract during the immediately preceding five years: Provided, however, That the City shall schedule and pay for a minimum of five thousand (5,000) acre-feet for each such year. For the purpose of determining said average annual quantity, the use for the month of December of the last year of the preceding 5-year period will be considered the same as the use during the month of December of the 4th year of such period.

(d) The maximum quantity of water which the United States shall be obligated to furnish to the City in any one year shall be forty thousand (40,000) acre-feet. This maximum quantity of water is based on studies which indicate the City's use of water will be as follows:

Period	Projected Average Annual Use
1971 through 1975	8,300 acre-feet
1976 through 1980	10,800 acre-feet
1981 through 1985	14,100 acre-feet
1986 through 1990	18,300 acre-feet
1991 through 1995	24,000 acre-feet
1996 through 2000	32,000 acre-feet

If the average annual quantity of water furnished to the City pursuant to this contract for any of the above periods is less than the respective projected average annual use as shown in this subdivision, then the projected average annual use for each of the remaining periods and the maximum quantity of forty thousand (40,000) acre-feet shall be reduced to the respective quantities obtained by multiplying the larger quantities by the percentage that the average annual quantity furnished during said period is of the projected average annual use indicated for said period. If during any subsequent period the average annual quantity furnished to the City is less than the respective revised projected average annual use, then further revisions shall be made in the manner set forth in this subdivision: Provided, That the parties may by agreement at any time increase the amount of water required thereafter to be furnished each year to the City during the remainder of the term of this contract.

(e) The right to the beneficial use of water furnished to the City pursuant to the terms of this contract shall not be disturbed so long as the City shall fulfill all of its obligations under this contract and any renewal thereof.

RATE AND METHOD OF PAYMENT FOR WATER

4. (a) The rate for water to be paid pursuant to this contract shall be Nine Dollars ($9) an acre-foot.

(b) Each year the City shall make payment for the amount of water which the City is required to accept and pay for during such year pursuant to Article 3. The City shall pay one-half (1/2) of the amount payable for each year before the first day of each year and shall pay the remainder of said amount before July 1 of said year, or such other later date or dates of the respective year as may be specified by the Contracting Officer in a written notice to the City: Provided, That before initial delivery is made under this contract the City shall pay one-half (1/2) of the amount payable for that year and shall pay the remainder of said amount before July 1 of that year or such later date or dates as may be specified by the Contracting Officer in a written notice to the City: Provided further, That at any time during any year that the quantity of water furnished equals the quantity for which payment has been made as provided for in this article, the City shall pay in advance of any further delivery of water for the total quantity to be furnished to it during that year.

(c) In the event the City is unable, fails, or refuses to divert the quantities of water available in Folsom Lake for diversion by it and required to be paid for pursuant to this contract or in the event the City in any year fails to submit a schedule for delivery as provided in Article 3, said inability, failure, or refusal shall not relieve the City of its obligation to pay for such water, and the City agrees to make payment therefor in the same manner as if said water had been delivered to it in accordance with this contract.

POINTS OF DELIVERY--CONSTRUCTION AND OPERATION OF FACILITIES--MEASUREMENT AND RESPONSIBILITY FOR DISTRIBUTION OF WATER

5. (a) The water to be furnished to the City pursuant to this contract will be delivered at the outlet from the 84-inch pipeline leading from Folsom pumping plant to Hinkle Reservoir or at such other points of delivery as may be agreed upon between the parties. All pumps, pipelines, storage tanks, distribution lines, and other facilities beyond the point of delivery required to take, measure, convey, and distribute water to the water users served by the City shall be constructed or installed by the City without expense to the United States. Operation and maintenance of such facilities and the expense thereof also shall be the sole responsibility of the City. The facilities may be installed, operated, and maintained

on or across property of the United States in the area of such delivery point subject to such restrictions and regulations as to type, location, method of installation, operation, and maintenance as may be prescribed by the Contracting Officer. It is specifically recognized and agreed that this contract does not grant to the City right of access to the waters of Folsom Lake or to the adjacent lands of the United States for any purpose except as provided in this article for installation, operation, and maintenance of facilities.

(b) All water taken pursuant to this article shall be measured by the United States at the points of delivery provided in subdivision (a) of this article with equipment installed, operated, and maintained by the United States. Upon request of the City the accuracy of such measurements may be investigated by either of the parties and any errors appearing therein adjusted.

(c) The United States shall not be responsible for the control, carriage, handling, use, disposal, or distribution of water which may be furnished hereunder beyond the points of delivery, and the City shall hold the United States harmless on account of damage or claim of damage of any nature whatsoever, including property damage, personal injury, or death, arising out of or connected with the control, carriage, handling, use, disposal, or distribution of such water

beyond the points of delivery: Provided, however, That the United States reserves the right to the use of all waste, seepage, and return-flow water derived from water furnished to the City which escapes or is discharged beyond the boundaries of the water users served by the City's distribution system and nothing herein shall be construed as an abandonment or a relinquishment by the United States of the right to such water.

(d) In no event shall the United States at any time be obligated to furnish water at a point of delivery at a rate in excess of sixty-five (65) cubic feet per second. The facilities of the City shall include devices satisfactory to the Contracting Officer which will limit the rate of flow to the City to sixty-five (65) cubic feet per second. The United States shall not be responsible for maintaining or limiting the heads or pressures at which the water is delivered. In the event the City's requirements exceed the above rate of flow the United States will at the request of the City install additional pumping and related facilities, which will remain the property of the United States, to provide water at a higher rate of flow not to exceed one hundred and fifty (150) cubic feet per second. The cost of such facilities shall be paid by the City. Unless otherwise agreed by the parties, said payment shall be made in full upon completion of the facilities.

UNITED STATES NOT LIABLE FOR WATER SHORTAGE OR TEMPORARY REDUCTION

6. (a) There may occur at times a shortage during any year in the amount of water available for furnishing to the City by the United States pursuant to this contract through and by means of the Project, but in no event shall any liability accrue against the United States, or any of its officers, agents, or employees for any damage, direct or indirect, arising therefrom. In any year in which there may occur a shortage from any cause, the Contracting Officer reserves the right to apportion the available water supply among the City and others entitled to receive water from the Project, including but not restricted to those entitled to receive water in satisfaction of rights acquired pursuant to the laws of the State of California. In the event that in any year there is delivered hereunder by reason of such shortage or apportionment or any discontinuance or reduction of service as set forth in subdivision (b) of this article less than the quantity of water which the City otherwise would be entitled to receive hereunder, an adjustment shall be made of the amounts paid or payable by the City in the manner provided in Article 7. Such adjustment shall constitute the sole remedy of the City or anyone having or claiming to have through the City the right to the use of any of the water supply provided for herein.

(b) The United States may temporarily discontinue or reduce the quantity of water to be furnished hereunder for the purpose of investigation, inspection, maintenance, repair, or replacement as may be necessary of any of the Project facilities used for the furnishing of water hereunder, but so far as feasible the Contracting Officer will give the City thirty (30) days notice in advance of such temporary discontinuance or reduction except in cases of emergency when no notice need be given. In the event of any such discontinuance or reduction, upon the resumption of service and if requested by the City, the United States will attempt to deliver the quantity of water which would have been furnished hereunder in the absence of such contingency.

ADJUSTMENTS

7. The amount of any overpayment by the City by reason of the quantity of water actually available hereunder from the Project during any year, as conclusively determined by the Contracting Officer, having been less than the quantity which the City otherwise would have been required to receive and pay for under the provisions of this contract shall be applied first to any accrued indebtedness arising out of this contract then due and owing to the United States by the City and any amount of such overpayment then remaining shall at the option of the City be refunded or credited

upon amounts to become due to the United States from the City under the provisions hereof in the ensuing year.

QUALITY OF WATER

8. The operation and maintenance of Project facilities and the construction of new Project facilities for the provision of Project water under this contract shall be performed in such manner as is practicable to maintain the quality of raw water to be furnished hereunder. The United States is under no obligation to construct or furnish water treatment facilities to maintain or to better the quality of water except to the extent such facilities are part of the Project facilities to be constructed by the United States pursuant to reclamation law or as otherwise required by law. Further, the United States does not warrant the quality of water to be furnished pursuant to this contract.

CHARGES A GENERAL OBLIGATION--LEVIES THEREFOR

9. (a) The City as a whole is obligated to pay to the United States the charges becoming due as provided in this contract notwithstanding the default in the payment to the City by individual water users of assessments, tolls, or other charges levied by the City.

(b) The City will cause to be established, levied, and collected all necessary assessments, tolls, and other charges, and will use all of the authority and resources of the City to meet its obligations hereunder.

ALL BENEFITS CONDITIONED UPON PAYMENT

10. Should any assessment or assessments levied by the City against any tract of land or water user in the City and necessary to meet the obligations of the City under this contract be judicially determined to be irregular or void, or should the City or its officers be enjoined or restrained from making or collecting any assessments upon such land or from such water user as provided for herein, then such tract shall have no right to any water furnished to the City pursuant to this contract, and no water made available by the United States pursuant hereto shall be furnished for the benefit of any such lands or water users, except upon the payment by the landowner of his assessment or a toll charge for such water, notwithstanding the existence of any contract between the City and the owner or owners of such tract. Contracts, if any, between the City and water users involving water furnished pursuant to this contract shall provide that such use shall be subject to the terms hereof. It is further agreed that the payment of charges at the rates and upon the terms and conditions provided for herein is a prerequisite to the right to water furnished to the City pursuant to this contract and no irregularity in levying taxes or assessments by the City nor lack of authority in the City, whether affecting the validity of City taxes or assessments or not, shall be held to authorize or permit any water

user of the City to demand water made available pursuant to this contract unless charges at the rate and upon the terms and conditions provided for herein have been paid by such water user.

REMEDIES UNDER CONTRACT NOT EXCLUSIVE--WAIVERS

11. Nothing contained in this contract shall be construed as in any manner abridging, limiting, or depriving the United States of any means of enforcing any remedy, either at law or in equity, for the breach of any of the provisions hereof which it would otherwise have. Any waiver at any time by either party to this contract of its rights with respect to a default, or any matter arising in connection with this contract, shall not be deemed to be a waiver with respect to any subsequent default or matter.

BOOKS, RECORDS, AND REPORTS

12. The City shall establish and maintain accounts and other books and records pertaining to its financial transactions, water supply, water use, and to such other matters as the Contracting Officer may require. Reports thereon shall be furnished to the United States in such form and on such date or dates as may be required by the Contracting Officer. Each party shall have the right during office hours to examine and make copies of the other party's books and official records relating to matters covered by this contract.

PENALTY FOR DELINQUENT PAYMENTS

13. The City shall pay a penalty on installments or charges which become delinquent computed at the rate of one-half of one percent per month of the amount of such delinquent installments or charges for each day from the date of such delinquency until paid: Provided, That no penalty shall be charged to the City unless such delinquency continues for more than thirty days.

CONTINGENT UPON APPROPRIATION OR ALLOTMENT OF FUNDS

14. The expenditure of any money or the performance of any work by the United States hereunder which may require appropriation of money by the Congress or the allotment of funds shall be contingent upon such appropriation or allotment being made. The failure of the Congress so to appropriate funds or the absence of any allotment of funds shall not relieve the City from any obligations then accrued under this contract and no liability shall accrue to the United States in case such funds are not appropriated or allotted.

OFFICIALS NOT TO BENEFIT

15. (a) No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this contract or to any benefit that may arise herefrom, but this restriction shall not be construed to extend to this contract if made with a corporation or company for its general benefit.

(b) No official of the City shall receive any benefit that may arise by reason of this contract other than as a water user and in the same manner as other water users under this contract.

NOTICES

16. (a) Any notice authorized or required to be given to the United States shall be deemed to have been given when mailed, postage prepaid, or delivered to the Regional Director, Region 2, Bureau of Reclamation, Post Office 15011, Sacramento, California 95813. Any notice authorized or required to be given to the City shall be deemed to have been given when mailed in a postage-prepaid or franked envelope, or delivered to the office of the Mayor, City of Roseville.

(b) The designation of the addressee or the address given above may be changed by notice given in the same manner as provided in this article for other notices.

(c) This article shall not preclude the effective service of any such notice or announcement by other means.

ASSIGNMENT LIMITED--SUCCESSORS AND ASSIGNS OBLIGATED

17. The provisions of this contract shall apply to and bind the successors and assigns of the parties hereto, but no assignment or transfer of this contract or any part or interest therein shall be valid until approved by the Contracting Officer.

DETERMINATIONS

18. (a) Where the terms of this contract provide for action to be based upon the opinion or determination of either party to this contract, whether or not stated to be conclusive, said terms shall not be construed as permitting such action to be predicated upon arbitrary, capricious, or unreasonable opinions or determinations.

(b) In the event the City questions any factual determination made by any representative of the Secretary as required in the administration of this contract, any findings as to the facts in dispute thereafter made by the Secretary shall be made only after consultation with the City's governing body.

(c) Except as otherwise provided herein, the Secretary's decision on all questions of fact arising under this contract shall be conclusive and binding upon the parties hereto.

WATER POLLUTION CONTROL

19. The City agrees that it will comply fully with all applicable Federal laws, orders, and regulations, and the laws of the State of California, all as administered by appropriate authorities, concerning the pollution of streams, reservoirs, groundwater, or water courses with respect to thermal pollution or the discharge of refuse, garbage, sewage effluent, industrial waste, oil, mine tailings, mineral salts, or other pollutants. The City further agrees that any contract it may

enter into with a third party for the furnishing of Project water will contain a similar water pollution control article.

ASSURANCE RELATING TO VALIDITY OF CONTRACT

20. Promptly after the execution and delivery of this contract the City shall file and prosecute to a final decree, including any appeal therefrom to the highest court of the State of California, in a court of competent jurisdiction a special proceeding for the judicial examination, approval, and confirmation of the proceedings of the City Council leading up to and including the making of this contract and the validity of the provisions thereof, and this contract shall not be binding on the United States until said proceedings and contract shall have been so confirmed by a court of competent jurisdiction or pending appellate action in any court if ground for appeal be laid.

IN WITNESS WHEREOF, the parties hereto have executed this contract the day and year first above written.

Appd. Sol. Off.

THE UNITED STATES OF AMERICA

By _____
Regional Director, Region 2
Bureau of Reclamation

CITY OF ROSEVILLE

(SEAL)

By _____

Title Vice Mayor

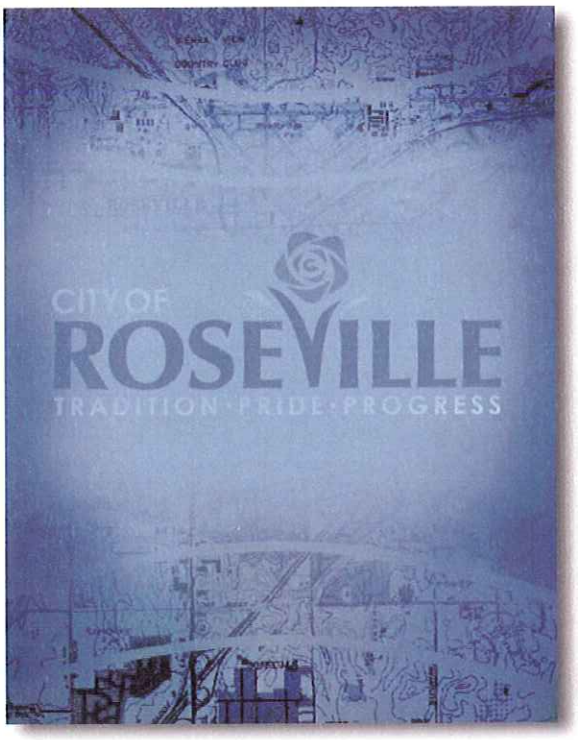
Attest:

_____

Title Councilman

APPENDIX H-2

ATTACHMENT 7
GROUNDWATER IMPACT ANALYSIS FOR PROPOSED REASON FARMS LAND RETIREMENT PLAN



Groundwater Impact Analysis for Proposed Reasons Farms Land Retirement Plan

MWH
MONTGOMERY WATSON HARZA

June 2003

1.1 BACKGROUND

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

Before obligating itself to providing water service to the MOU area, the City is evaluating its ability to provide long-term, reliable water supplies to this area while maintaining service to its existing and future customers within the current City limits. Additionally, the City has adopted the policy that the cost of delivering water supplies to the MOU Area must not negatively impact the City's existing ratepayers financially.

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

In November 2002, EU staff and MWH completed a water supply strategy memorandum identifying "portfolios" of water supply sources that could meet the projected water demands of the WRSP area on a stand-alone basis, as well as the entire MOU area, under any hydrologic conditions. Groundwater extractions were an integral part of those portfolios, particularly in dry years. [Note: The use of groundwater in dry years is also part of the City's planned water supplies for the City's existing customers. The City's Water Forum Agreement (WFA) [1] identifies the extraction of up to 7,400 acre-feet per year (AF/year) of groundwater in dry years.]

The volumes of groundwater identified for delivery to the WRSP or MOU areas in dry years are not included in the City's WFA "water balance". Consequently, as a matter of policy, the City intends to implement measures to mitigate for any potential impacts to the groundwater basin that may result from the extraction of groundwater to meet demands in the WRSP area (or the MOPU area). One potential mitigation measure being contemplated is an "in-lieu" groundwater

[1] Begun in 1993, the Sacramento Area Water Forum (Water Forum) is comprised of representatives from the business, environmental, public interest, and water purveyor communities (including the Cooperating Agencies). The co-equal objectives of the Water Forum are 1) to provide a reliable and safe water supply for the region's economic health and planned development through the year 2030, and 2) to preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River. The Water Forum Agreement prescribed a conjunctive use plan for Folsom Lake, the lower American River, and the adjacent groundwater basins to achieve those goals.

banking program accomplished through the annual fallowing or permanent retirement of agricultural lands currently irrigated with groundwater.

1.2 OBJECTIVE OF THIS STUDY

The primary objective of this study is to estimate the potential impacts on groundwater conditions resulting from an increase in groundwater extractions to meet a portion of the water demand associated with the **WRSP area** in dry years and to evaluate the potential mitigation of such impacts through the permanent retirement of agricultural lands currently irrigated with groundwater. [Note: This study addresses only the groundwater extractions anticipated to serve the water demands in the WRSP area.]

1.3 OVERVIEW OF MEMORANDUM

Previous memoranda provided estimates of existing and projected water demands for the existing City, the WRSP area, and the entire MOU area, and identified water supply alternatives for meeting those demands. This memorandum summarizes the results of those memoranda, and describes and summarizes the results of the groundwater impact analyses. This memorandum is organized into the following sections:

- **Section 1: Introduction** provides background information and a brief description of investigation objectives.
- **Section 2: Project Description** reviews water demand and water supply alternatives for the existing City, the WRSP area, and the entire MOU area.
- **Section 3: Geohydrology** characterizes the groundwater basin underlying the project area and provides a conceptual model on which the groundwater modeling application is based.
- **Section 4: Evaluation Scenarios** describes the methodology applied to complete the investigation and the various scenarios investigated.
- **Section 5: Modeling Results and Discussion** provides a summary of the modeling results and discusses potential impacts that may result the extraction of groundwater based on those modeling results.
- **Section 6: Principal Findings and Conclusions** describes the principle findings of the analyses and provides a conclusion of whether the proposed mitigation measures can meet the City's objectives.

Figures and tables are interspersed throughout the text. **Appendix A** presents groundwater elevation contour maps and hydrographs for all model runs. **Appendix B** includes a description of the numerical model used to complete the analysis.

2.1 INTRODUCTION

The City is located in the western Placer County (see **Figure 2.1**). The City currently relies predominately on surface water to meet potable water demand within its service area. Groundwater is extracted for peaking and emergency use, and for water supply reliability in dry years. Some non-potable demand is met with recycled wastewater.

The City overlies the regional Sacramento Valley groundwater basin. Sources of groundwater recharge include the American, Sacramento, Feather, and Bear Rivers; subsurface inflow from the foothills of the High Sierra; small streams and drainage canals; and deep percolation from rainfall and applied irrigation water.

2.2 CURRENT AND PROJECTED WATER DEMANDS

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

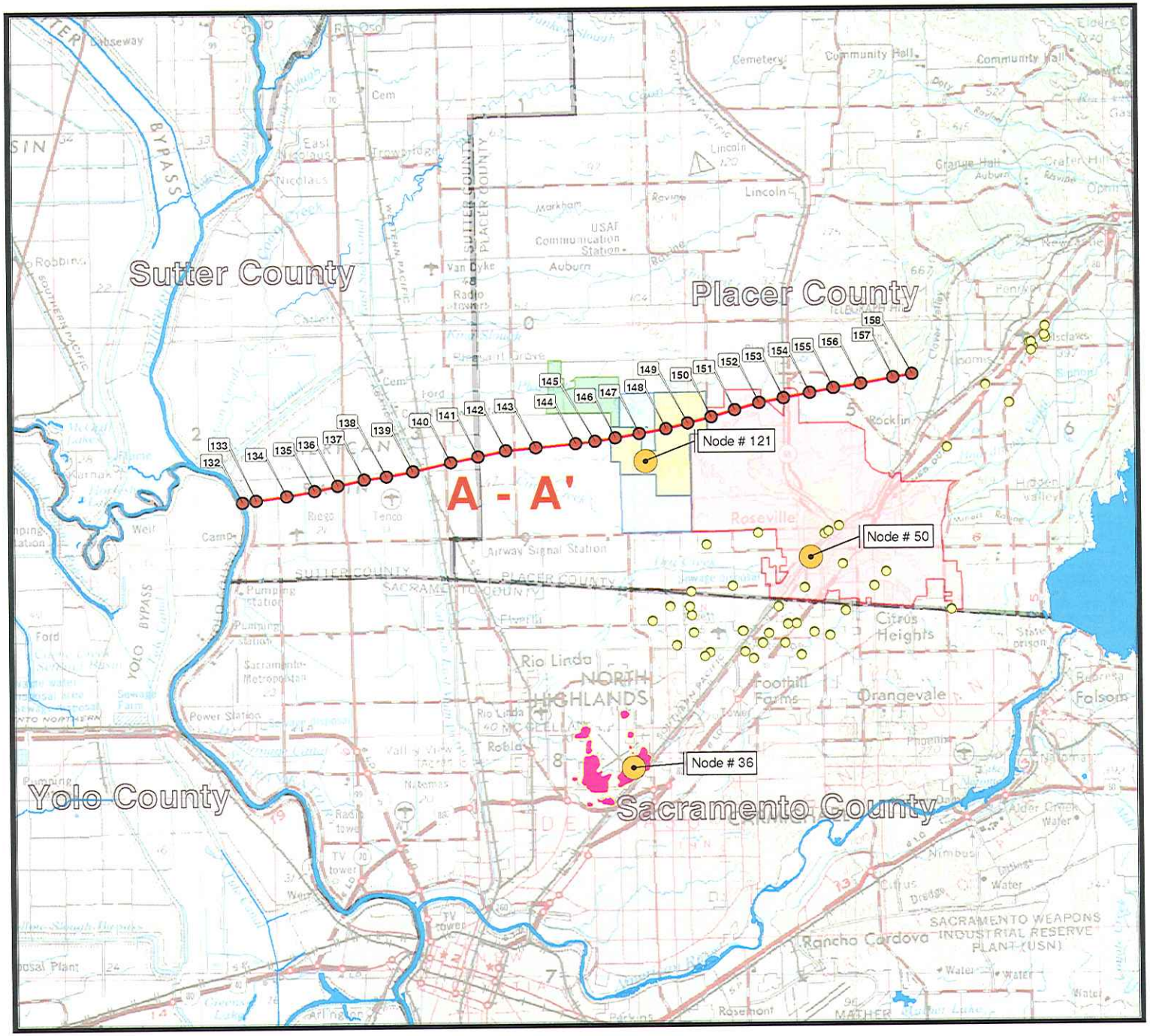
The *General Plan Update Water System Study* (Spink, August 1993) served as the City's initial basis for the estimates of water demand. "Revised" estimates of current and projected water demands were determined utilizing recently gathered water meter information. The new data indicate that unit water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

Table 2.1 presents the land use categories and total projected water demand for the City's existing service area, the WRSP area, and the entire MOU Area. The projected water demands include that portion of the City served with supplies contracted from the San Juan Water District (namely, Doctor's Ranch and the Foothills Business Park). **Table 2.1** presents water demands based on the revised unit demand factors.

Use of the revised unit water demand factors results in an estimated ultimate water demand for the City of 51,620 AF/year (see **Table 2.1**). The estimated ultimate water demand for the existing City plus the WRSP area is 58,662 AF/year, with 7,042 AF/year estimated for the WRSP area based on the proposed land use plan. The estimated ultimate water demand for the existing City plus the entire MOU area is 64,093 AF/year, with 12,473 AF/year estimated for the MOU area based on the proposed land use plan.

The City's current maximum surface water diversion from Folsom Lake under the WFA is 55,700 AF/year. This is also the total volume of water which the City is currently planning to provide on a reliable basis. This volume is 4,080 AF/year greater than the existing City's revised projected water demand shown on **Table 2.1** of 51,620 AF/year. The intent of the City is to make a portion of this water supply available for use in the MOU area.

The projected deficiency in the City's current water supply, assuming annexation of the entire MOU area is 8,393 AF/year (64,093 AF/year minus 55,700 AF/year). The projected deficiency



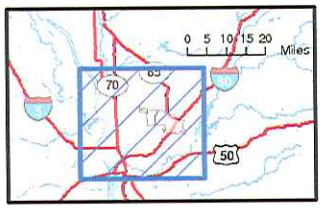
CITY OF ROSEVILLE
TRADITION · PRIDE · PROGRESS

Water Supply Strategy: Groundwater Impact Analyses

Figure 2.1
Study Area Map

Legend

- Reasons Farm
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- City of Roseville
- Node ID — Cross Section and Groundwater Model Node
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Well



0 0.5 1 2 3 4 Miles

MWH
Prepared by Sacramento GIS Lab

June 2003

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in the City's current water supply assuming only the WRSP area develops is 2,962 AF/year (58,662 AF/year minus 55,700 AF/year).

Table 2.1 Estimated City of Roseville Average Annual Water Demands Based on Revised Unit Demand Factors

Land Use Category		City of Roseville (AF/year)		West Roseville Specific Plan		Entire MOU Area	
				West Roseville Specific Plan (WRSP) Only (AF/year)	WRSP Combined with City (AF/year)	MOU Area Only (AF/year)	MOU Area Combined with City (AF/year)
		Estimated Existing Demand	Estimated Ultimate Demand	Estimated Ultimate Demand	Estimated Ultimate Demand	Estimated Ultimate Demand	Estimated Ultimate Demand
Residential	LDR (< 3.5 DU's/Ac)	4,943	5,903	1,523	7,426	1,523	7,426
	LDR (3.5 to 5.0 DU's/Ac)	8,222	13,524	2,339	15,863	5,741	19,265
	LMDR (>5.0 to 6.0 DU's/Ac)	2,880	3,301	228	3,592	228	3,529
	LMDR (>6.0 to 8.0 DU's/Ac)	1,594	2,030	214	2,244	570	2,600
	MDR (>8.0 to 12.0 DU's/Ac)	401	761	157	918	157	918
	HDR (>12.0 to 16.0 DU's/Ac)	32	115	229	344	229	344
	HDR (>16.0 DU's/Ac)	1,347	1,948	211	2,159	534	2,482
Commercial/Other	Commercial/Retail	2,323	4,929	95	5,024	302	5,231
	Business Professional	987	2,267	57	2,324	203	2,470
	Light Industrial	858	4,120	258	4,378	258	4,378
	Industrial	1,599	3,002	98	3,100	98	3,100
	Railroad Yard	87	72	-	72	-	72
	Elementary Schools	648	573	211	784	478	1,051
	High Schools	408	597	242	839	242	839
	Public (Fire Station, etc)	1,199	1,290	-	1,290	-	1,290
	Park/Recreation	4,628	6,176	1,042	7,218	1,665	7,841
	Open Space/Major ROW	-	-	-	-	-	-
	Vacant/Unassigned	-	-	-	-	-	-
Sub-Total		32,155	50,608	6,904	57,512	12,228	62,836
Assumed System Losses (2%)		638	1,012	138	1,150	245	1,257
TOTAL:		32,794	51,620	7,042	58,662	12,473	64,093

2.3 CITY'S WATER SUPPLY ALTERNATIVES

2.3.1 CITY'S EXISTING WATER SUPPLIES

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

The MFP supply is derived from reservoirs on the Middle Fork of the American River operated by PCWA for purposes of power generation for the Pacific Gas & Electric (PG&E) Company, as

well as for water supply. The MFP supply is assumed to be 100 percent reliable (absent a catastrophic event) in all hydrologic year types. The City's CVP contract provides for a diversion from Folsom Lake. This water is considered to be less reliable than the MFP water and is currently subject to up to 25% deficiencies in accordance with CVP shortage provisions.

The WFA provides a framework for future surface water and groundwater supplies in the region through the year 2030. The City's WFA prescribes a pattern of surface water diversions based on unimpaired inflow into Folsom Lake [2]. Diversions by the City are restricted in drier and driest years with the objective of supporting environmental needs in the lower American River. In particular, the City is obligated to provide water for instream flows in the lower American River to the confluence with the Sacramento River under certain hydrologic conditions. This water is made available through re-operation of the MFP by PCWA. The principal consequence of this obligation is that the availability and reliability for diversions by the City out of Folsom Lake are impacted under certain hydrologic conditions.

Under the WFA, the maximum surface water diversion by the City in wet/average years is limited to 55,700 AF/year. In the "driest" (or critically dry) years, the maximum diversion is limited to 39,800 AF/year [3]. In between (i.e., in the years in which unimpaired inflow ranges between the volumes established for wet/average and driest years), the City may divert a pro rata amount between 55,700 and 39,800 AF/year based on unimpaired inflow into Folsom Lake. Based on the 70-year hydrologic period of record used for analyses conducted in support of the WFA, the entire 55,700 AF/year will be available for diversion by the City in about 83 percent of the years. Consequently, in 17 percent of the years the City must develop supplemental supplies potentially totaling up to 15,900 AF/year to make up for deficiencies (55,700 AF/year minus 39,800 AF/year). The City's current supplemental supply strategy includes the development of up to 3,000 AF/year of recycled water supplies (for non-potable use), development of up to 7,400 AF/year of sustainable groundwater supplies, and the implementation of up to 5,500 AF/year of additional conservation efforts, including rationing, in the driest years (this represents a 10% reduction in water use).

The total volume of American River water available for diversion by the City in a given year is also dependent on hydrologic availability; that is, the WFA provides for only a potential maximum diversion. In wet/average years, the WFA maximum amount of 55,700 AF/year will typically be available for diversion by the City. In the drier and driest years, however, it is likely that hydrologic conditions will impact surface water availability for the City. It is anticipated that CVP deficiencies will decrease the availability of surface water supplies to the City relative to the City's WFA in approximately 30 percent of the years. As a result, the entire 55,700 AF/year is estimated to be available for diversion by the City in about 63 percent of the years (versus the 83 percent potential availability provided for in the WFA).

As indicated on **Table 2.1**, the revised ultimate water demand projection for the City and the entire MOU area is 64,093 AF/year. If only the WRSP develops, the demand is 58,662 AF/year.

[2] The WFA categorizes hydrologic years as "wet/average", "drier", or "driest" based on unimpaired inflow to Folsom Lake.

[3] The wet/average-year volume includes the 800 AF/year supply contracted from the San Juan Water District for service to Doctor's Ranch and the Foothill Business Park. That supply is not available in the driest years.

These demands exceed both the City's available dry-year surface water supply of 39,800 AF/year and the wet/average-year available surface water supply of 55,700 AF/year. Thus, if the entire MOU area develops, the City must implement its current plan to provide for up to 15,900 AF/year of supplemental supplies in critically dry years and develop an additional 8,393 AF/year of supplemental supplies (64,093 AF/year minus 55,700 AF/year). Similarly, if only the WRSP area develops, the City must develop 2,962 AF/year of supplies (58,662 AF/year minus 55,700 AF/year) in addition to the planned 15,900 AF/year of supplemental supplies.

2.3.2 POTENTIAL WATER SUPPLY ALTERNATIVES INVESTIGATED

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

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

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

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

2.3.3 GROUNDWATER EXTRACTION AND IMPACT MITIGATION

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

The City also intends to consider the use of groundwater resources to meet water demand within the WRSP area in drier and driest years. Such use of groundwater is not explicitly considered in

the WFA water balance. Consequently, the City intends to implement measures to mitigate for any potential impacts to the groundwater basin resulting from the extraction of groundwater to meet demands within the WRSP area. Two potential mitigation measures are currently being contemplated: 1) in-lieu groundwater recharge accomplished through the permanent fallowing of lands currently under irrigation, or 2) direct groundwater recharge through an aquifer storage and recovery (ASR) program. In particular, the Reasons Farms property (see **Figure 2.1**) is being evaluated from a physical standpoint to estimate the potential yield of an in-lieu groundwater banking program.

The proposed water supply strategies for the WRSP area and the entire MOU area developed in previous memorandum are shown on **Tables 2.2** and **2.3,** respectively. **Figures 2.2** through **2.4** illustrate the water supply strategy for the City, the WRSP area, and the entire MOU area, respectively.

Table 2.2 Proposed Water Supply Strategy for the WRSP Area

WFA Water Year Type	Source of Water Supply	Quantity of Water (AF/year)
Wet/Average years	Recycled Water	1,526
	City Demand Reduction	2,316
	San Juan Entitlement	3,200
	Total:	**7,042**
Drier and Driest years	Recycled Water	1,526
	City Demand Reduction	2,316
	Conservation	352
	Groundwater Extraction	2,848
	Total:	**7,042**

Table 2.3 Proposed Water Supply Strategy for the Entire MOU Area

WFA Water Year Type	Source of Water Supply	Quantity of Water (AF/year)
Wet/Average years	Recycle Water	2,638
	City Demand Reduction	4,080
	San Juan Entitlement	3,200
	Sacramento River Diversion	2,555
	Total:	**12,473**
Drier and Driest years	Recycle Water	2,638
	City Demand Reduction	4,080
	Conservation	620
	Sacramento River Diversion and/or Groundwater Extraction	5,135
	Total:	**12,473**

Figure 2.2 Water Supplies for City of Roseville under WFA (Estimated Demand: 51,620 AF/year in Year 2030)

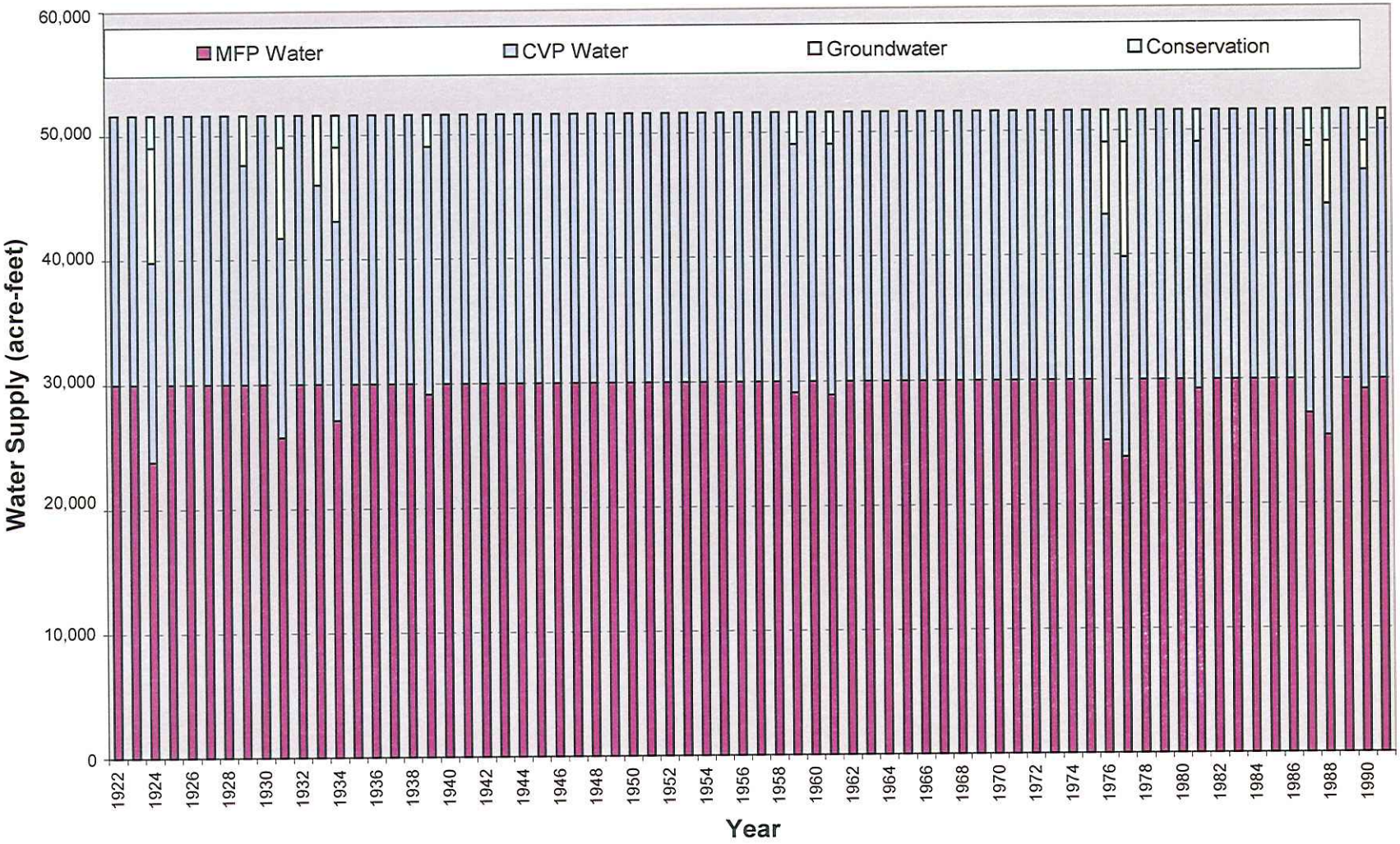


Figure 2.3 Proposed Water Supply Strategy for the WRSP Area (Estimated Demand: 7,042 AF/year at Buildout)

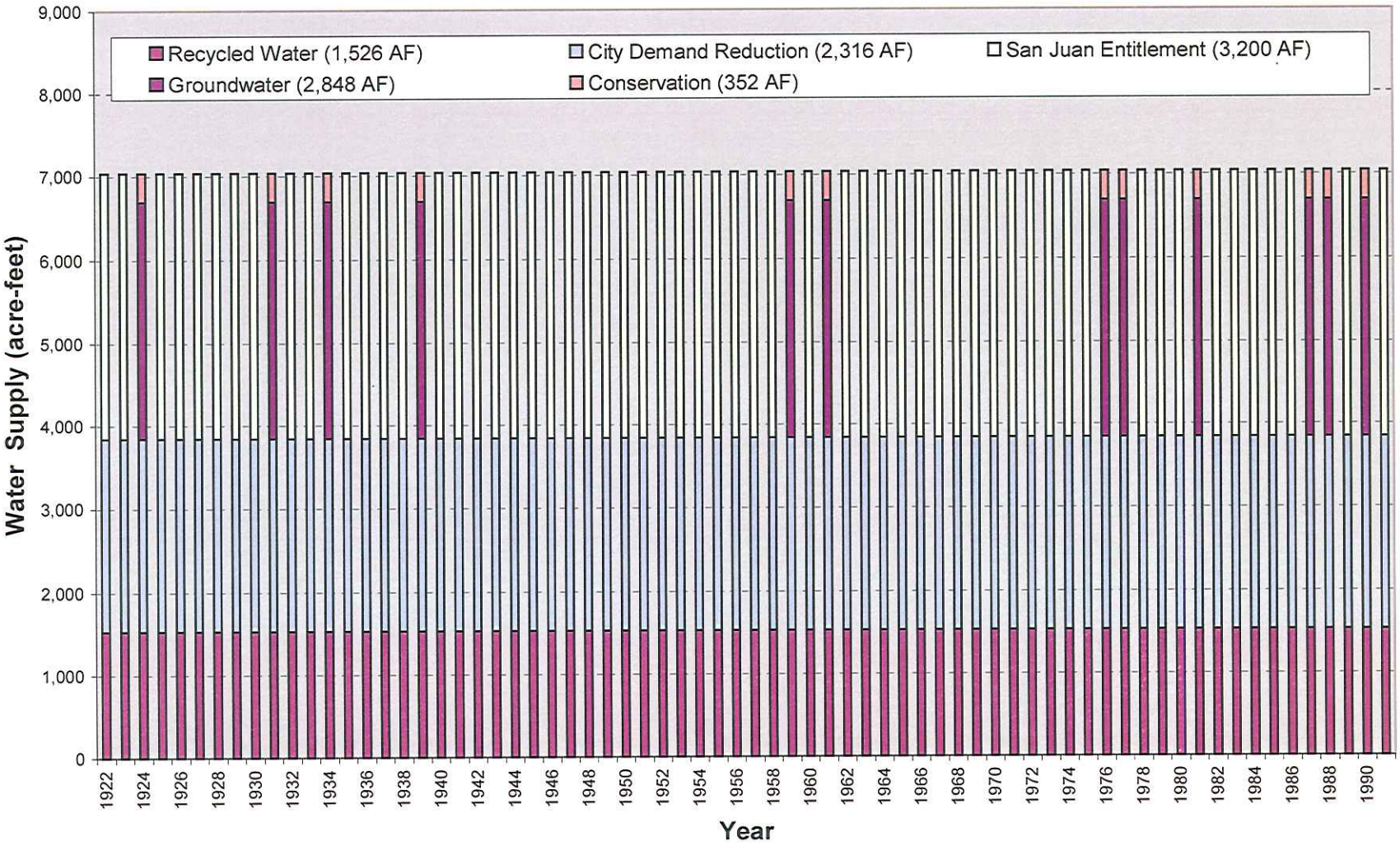
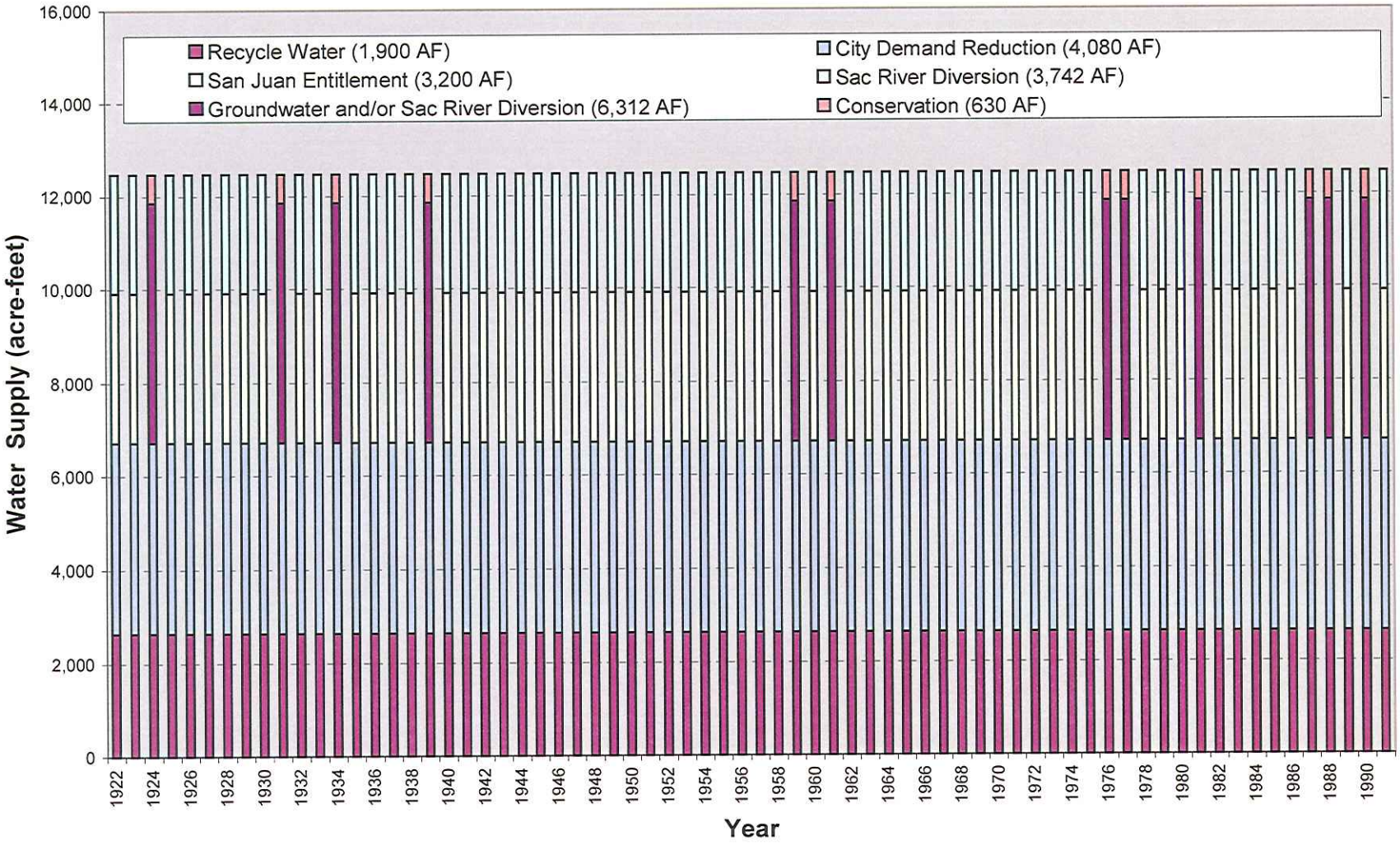


Figure 2.4 Proposed Water Supply Strategy for the Entire MOU Area (Estimated Demand: 12,473 AF/year at Buildout)



3.1 INTRODUCTION

The California Department of Water Resources (DWR) previously investigated groundwater resources in north Sacramento County. The results of this investigation are reported in *Bulletin 118-3, Evaluation of Ground Water Resources: Sacramento County* (DWR, July 1974). *Bulletin 118-3* identifies and describes the various geologic formations that constitute the water-bearing deposits underlying the project area. **Figure 3.1** at the end of this section presents a conceptual cross-section of the aquifer underlying the project area. These formations include an upper aquifer system (referred to as Aquifer 1 in this study) consisting of the Victor, Fair Oaks, and Laguna Formations, and a lower aquifer system (referred to as Aquifer 2) 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 that generally thickens from east to west to a maximum thickness of about 2,000 feet under the Sacramento River.

Groundwater occurs in unconfined to semi-confined states throughout northern Sacramento County, western Placer County, and southern Sutter County [4]. Semi-confined conditions occur in localized areas; the degree of confinement typically increases with depth below the ground surface. Groundwater in the Victor, Fair Oaks, and Laguna Formations is typically unconfined. The deeper Mehrten Formation exhibits semi-confined conditions.

The water quality in the upper aquifer system is regarded as superior to that of the lower aquifer system. The upper aquifer is preferred over the lower aquifer principally because the lower aquifer system (specifically the Mehrten formation) manifests low concentrations of iron, manganese, and arsenic, which must often be removed through treatment. Water from the upper aquifer generally does not require treatment other than disinfection. The upper aquifer is typically targeted for development by private domestic wells.

The lower aquifer system also has higher concentrations of total dissolved solids (TDS, a measure of salinity). In general, at depths of approximately 1,200 feet or greater, the total dissolved solids concentration exceeds 2,000 milligrams per liter (mg/L). At such concentrations, the groundwater is no longer considered potable without treatment. For modeling purposes in this investigation, an artificial boundary was created over much of the model to distinguish between potable and non-potable groundwater supplies. The resulting low quality deep aquifer (referred to as Aquifer 3) was used to evaluate the potential for upwelling of poor quality water into the upper aquifer systems.

3.2 GROUNDWATER HYDRAULIC PRINCIPLES

Evaluating changes in groundwater conditions requires an understanding the dynamic processes and interactions that occur during groundwater extraction and recharge. Descriptions of induced groundwater recharge, changes in aquifer storage, and differences between localized and regional effects on the aquifer are presented below. These discussions are meant to clarify

[4] The groundwater elevation is the elevation of the water surface in an unconfined aquifer. 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 to which water will rise within a well screened in a confined or semi-confined aquifer.

concepts. Not all aspects of groundwater hydraulics are described. Some of the concepts presented pertain only to the northern Sacramento County and western Placer County aquifer systems.

3.2.1 GROUNDWATER RECHARGE

Groundwater in the region generally moves from sources of recharge to areas of discharge. Recharge to a groundwater system occurs along active stream channels where extensive sand and gravel deposits exist. Locally, the highest groundwater elevations typically occur near the American River, Sacramento River, Feather River, and Bear River stream channels. Other sources of recharge include subsurface recharge from fractured geologic formations to the east, and deep percolation from applied irrigation water, precipitation, and small streams.

Changes in groundwater surface elevations result from changes in groundwater recharge, discharge, or extraction. In some instances within northern Sacramento County and western Placer County, this movement can induce natural recharge at locations where the river and aquifer are hydraulically connected. To the extent that a hydraulic connection exists, as groundwater conditions change, the slope or gradient of the groundwater surface may change as well. A steeper gradient away from the stream can induce additional recharge from surface streams.

The rate of recharge from streams that are hydraulically disconnected from the groundwater surface is indifferent to changes in groundwater elevations or gradient. This is typically true with smaller streams where the groundwater surface is located far below the streambed. In such cases, surface water percolates through the unsaturated zone to the groundwater and is a function of the aquifer materials underlying the streambed. As mentioned above, the rate of infiltration under these conditions is not governed by the gradient of the underlying groundwater.

3.2.2 CHANGES IN GROUNDWATER STORAGE

When a well first begins extracting groundwater from an aquifer, groundwater is initially extracted from aquifer storage. The result is a localized cone of depression that fluctuates with operation of the well. Over time, a well can also induce an incremental decline in regional groundwater elevations. The total amount of water lost from aquifer storage as a result of such well operation is the volume needed to induce an amount of recharge equal to the extraction rate of the well. This assumes that the induced recharge is sufficient to balance the groundwater system at the higher extraction rate. The period of time over which this balance occurs is typically measured in years.

3.2.3 LOCALIZED WELL IMPACTS

When extractions occur from a single well, a localized cone of depression is formed around the well. The shape and depth of the localized cone of depression depends on many factors including (but not limited to): 1) the rate of extraction, 2) the presence of nearby sources of recharge and extraction, 3) the volume of water stored in the aquifer, 4) aquifer transmissivity, and 4) the confined or unconfined state of the aquifer. Over a period of time, extraction from an unconfined aquifer can de-water the aquifer around the well. However, when extraction ceases, the aquifer often recharges back to its pre-extraction condition.

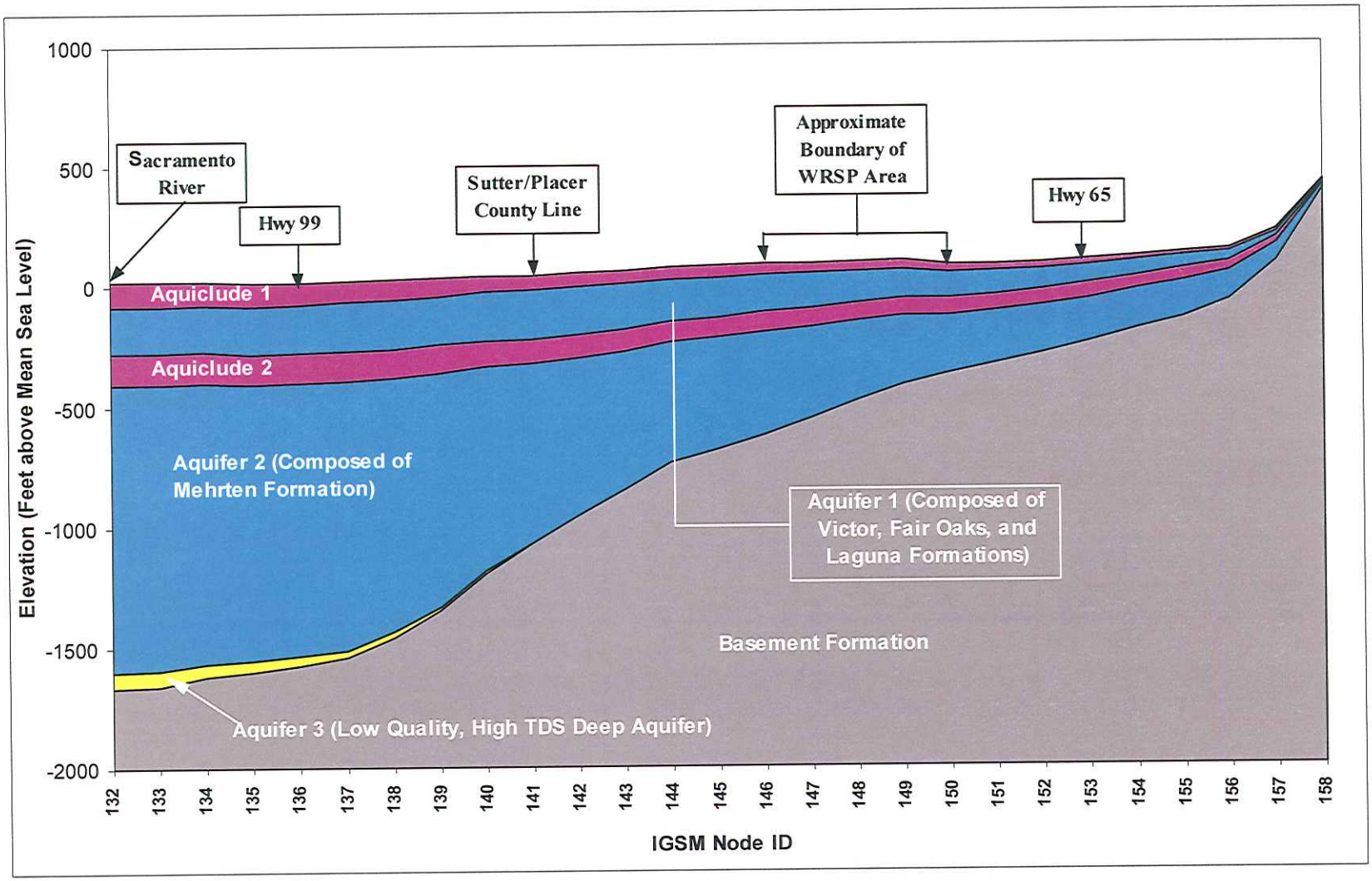
Confined or semi-confined aquifers behave differently than unconfined aquifers since the water is under pressure from a recharge source. Instead of de-watering the aquifer, a change in confining pressure occurs as a result of extractions. However, the aquifer remains saturated. In

a confined aquifer, the pressure or piezometric surface elevation decline is more dramatic than in an unconfined aquifer; however, the recovery to pre-extraction conditions is much faster and the loss in aquifer storage is spread over a larger area.

3.2.4 REGIONAL GROUNDWATER IMPACTS

Cones of depression with a larger aerial extent can form in areas where multiple groundwater extraction wells are in operation. The location and shape of a regional cone of depression is influenced by the same factors as a single well. Fluctuations in regional cones of depression are measured over years and can result from: 1) changes in recharge, and 2) changes in volumes of groundwater extraction from increasing and decreasing water demands. A sequence of successive dry years can decrease the amount of natural recharge to the aquifer, creating an imbalance between natural recharge and extractions. To overcome the imbalance, the aquifer elevations lower to include more natural recharge. Over time, the shape and location of the aquifer's regional cone of depression fluctuates. Controlling the fluctuation within an acceptable range is often a principal focus of groundwater management efforts.

Figure 3.1 Conceptual Cross Section for Aquifer Underlying Project Area (See Cross Section A-A' in Figure 2.1)



4.1 INTRODUCTION

For this investigation, groundwater extraction and in-lieu recharge were simulated using the North American River and Sacramento County Combined Integrated Groundwater and Surface Water Model (IGSM). 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. **Appendix B** presents information regarding development of the IGSM. The modeling approach applied for this investigation is discussed below.

4.2 STATIC RUN/INCREMENTAL IMPACT ANALYSIS

4.2.1 Static Run

A "Static Run/Incremental Impact" analysis approach was utilized for this study. With the static run approach, model parameters related to land use and water demand are set to certain values anticipated to prevail at some point in time. For modeling purposes, these anticipated levels of land use and water demand are assumed to occur in the first year of the groundwater simulation and in every subsequent year (that is, land use and water demand are held "static"). There is no "phasing" of water demand or changes in land use.

After water demand and land use parameters have been set, the simulation model is executed through the historical 70-year hydrologic record (1922 through 1991) used for the WFA. Approximately the first 10 to 20 years of the simulation are characterized by falling groundwater elevations as the model of the groundwater system achieves a quasi-equilibrium state in which the groundwater system is no longer affected by the initial conditions. Subsequent to the equilibration period, groundwater elevations in the model continue to fluctuate, but do so primarily in response to changing hydrologic conditions and operations of associated conjunctive use programs. The range within which the groundwater elevations fluctuate prescribes the estimated long-term response of the groundwater system to the assumed land use and water demand under the historical 70-year hydrologic sequence.

4.2.2 Incremental Impact

For purposes of this work, groundwater impacts were defined as the incremental changes between groundwater conditions corresponding to a "baseline" condition that does not include the proposed project and groundwater conditions resulting after the proposed project has been implemented. As the term is typically used for purposes of the California Environmental Quality Act ("CEQA"), a "baseline" is generally equated with the existing conditions in an area in which a project is proposed. For other planning purposes, a "baseline" condition can be defined as conditions that can reasonably be expected to occur in the future absent implementation of the proposed project. This second approach to defining a "baseline" is commonly referred to as a "cumulative without project" analysis, in that it predicts what the future would look like without the project. Both types of "baselines" provide useful information to the public and decision-makers. Consistent with this general discussion, two baselines are of interest in this work: 1) existing groundwater conditions, and 2) projected year 2030 groundwater conditions without the proposed project (i.e., a "cumulative without project" analysis).

The existing groundwater conditions "baseline", although somewhat self-explanatory, requires definition. It is, of course, representative of current groundwater conditions throughout northern

Sacramento County and western Placer County. However, it also is representative of how the groundwater basin is projected to respond over the historical 70-year hydrologic record if current land use and water demand were to remain unchanged. It is important to note that the groundwater basin will fluctuate in response to changing hydrologic conditions even if current land use and levels of water demand remain unchanged.

Although for land use projects such an inflexible "snapshot in time" approach is typical, projects involving water supply typically take a different approach in order to account for the variability of hydrological conditions in California. Consequently, as is discussed in more detail below, the projected year 2030 "cumulative without project" condition was used as the baseline against impacts were evaluated for this study. This baseline builds upon the extensive environmental and technical analyses prepared as part of the environmental review for the WFA.

4.3 EVALUATION SCENARIOS

Three scenarios were evaluated in this study: 1) a "Cumulative without Project Baseline" condition; 2) a "Project without Mitigation" condition; and 3) a "Project with Mitigation" condition. Each is discussed separately in the following sections.

4.3.1 CUMULATIVE WITHOUT PROJECT BASELINE CONDITION

The year 2030 cumulative without project baseline condition was evaluated for this investigation. Specifically, this baseline condition corresponds to the groundwater condition variations expected to result from implementation of the WFA in the City and all other areas of Placer and Sacramento counties, with the exception of the WRSP area. This baseline condition was selected for two principle reasons:

- First, the WFA reflects projected land use and water demand throughout Placer County and Sacramento County in the year 2030 pursuant to the current approved general plans
- Second, the WFA currently represents the most likely long-term plan for development of groundwater and surface water supplies in Placer County and Sacramento County.

The baseline condition for this investigation originates from the ARWRI version of IGSM used for the "Draft Water Forum Solution Model" developed for the WFA. The selection of this model (with the modifications described below) provides an estimate of how the groundwater basin would respond if elements of the WFA are implemented. Modifications to the model made for purposes of this study include:

- A reduction in frequency of delivery of PCWA transfer water to the Sacramento Suburban Water District (SSWD). The WFA simulation assumed delivery of 29,000 AF/year to SSWD in approximately 83% of the years. Then adopted pattern assumes these deliveries occur in 65% of the years. This assumption is more consistent with the terms and condition of the PCWA/SSWD transfer agreement.
- An update of the water demands for the City based on the revised unit demand factors as discussed in a previous memorandum. The revised built-out annual water demand for the City is 51,620 AF/year as compared to the original 54,900 AF/year.
- Under the WFA, the maximum surface water diversion by the City in wet/average years is limited to 55,700 AF/year. In critically dry years, the maximum diversion is limited to 39,800 AF/year. In below average to dry years, the City may divert an amount between

55,700 and 39,800 AF/year based on unimpaired inflow into Folsom Lake. In years that the surface water supply is less than the water demand, groundwater extraction is assumed to satisfy the unmet water demand (see **Figure 2.3**).

- In order to investigate the potential maximum impact of the development of the WRSP area on regional groundwater conditions, the land use in the WRSP area was changed to "native" (rather than "urban" or "agriculture" land uses). "Native" land use assumes zero water demand in IGSM model. Consequently, this modification will maximize groundwater extractions after the development of the WRSP area.

4.3.2 PROJECT WITHOUT MITIGATION CONDITION

The MOU area is planned to develop in two phases. It is assumed the WRSP area will develop first, followed by the development of the remainder of the MOU area in the future. The project without mitigation condition for the groundwater investigation here considers only the first phase of development (i.e., the WRSP area) for the following reasons:

- The development of the entire MOU area is dependent upon the implementation of Sacramento River Water Reliability Program. A feasibility study is currently being completed for this project.
- If the Sacramento River Water Reliability Program is implemented, the City anticipates potential delivery of up to 7,100 AF/year of additional surface water supplies. Under such a scenario, the need for groundwater extraction could potentially be avoided (see **Table 2.3**).
- The anticipated date for the operation of the Sacramento River Water Reliability Program is year 2010. Therefore, assuming reliance of the WRSP area on groundwater in dry years for a portion of its water supply represents a "worst case" scenario for groundwater extraction.

Modifications to the baseline condition model made to reflect the project without mitigation condition included:

- Land use in the WRSP area was changed from "native" to "urban" to maximize the water demand increase from the baseline. With the land use change in the project without mitigation condition, the urban water demand was changed to the estimated build-out urban water demand for the WRSP area.
- The ultimate water demand for the WRSP area is 7,042 AF/year based on the revised unit water demand factors and proposed land use plan of the WRSP area. As indicated in **Table 2.2**, the City demand reduction (2,316 AF/year) and water conservation in dry years (352 AF/year) were identified as part of the water supply. These water supplies are made available by conservation (that is, they are not actually "wet" water supply). The "actual" water demand for the WRSP area was input to the IGSM model by subtracting these two water supplies from the total water demand based on hydrologic conditions. As a result, the "net" water demand was 4,726 AF/year (7,042 minus 2,316) in wet/average years, and 4,374 AF/year (7,042 minus the sum of 2,316 and 352) in driest years.
- As indicated in **Table 2.2**, the water supply strategy is different for wet/average years and the drier and driest years. The water supplies were input in the IGSM model in a manner consistent with **Figure 2.3.** In wet/average years, water supplies included recycled water supplies of 1,526 AF/year and a San Juan entitlement of 3,200 AF/year. In the drier and driest years, the San Juan entitlement is not available. Thus, water supplies consisted of

recycled water of 1,526 AF/year and groundwater extraction of 2,848 AF/year. Note that the City demand reduction and conservation are excluded as water supplies because "net" water demand is used.

- The potential maximum amount of groundwater extraction modeled was 2,848 AF/year. Currently, the specific locations of the groundwater extraction wells have not been proposed. For modeling purposes, groundwater extraction was assumed at three locations within the WRSP area (which is the number of wells anticipated to meet water demand on a max day basis). Each of these locations is represented by a small area (or, computational element) over which groundwater extraction was assumed to occur uniformly. For each well, groundwater was assumed to be extracted from both the unconfined layer (Aquifer 1) and the confined layer (Aquifer 2). Each layer was assigned 50 percent of the total extraction volume.

4.3.3 PROJECT WITH MITIGATION CONDITION

Fallowing of the Reasons Farm has been proposed as a mitigation measure for the groundwater extraction contemplated for the WRSP area. Reasons Farm is a rice farm located in the area northwest to the WRSP area that is currently irrigated with groundwater. A total area of approximately 1,080 acres is currently under irrigation. By fallowing, the amount of groundwater currently used to irrigate Reasons Farm could be "banked" to alleviate (or eliminate) groundwater impacts associated with the development of WRSP area.

The groundwater conditions under this project with mitigation condition were also evaluated using the IGSM. The IGSM was modified from the project without mitigation to reflect the fallowing of the Reasons Farm. Modifications included:

- The land use for the Reasons Farm was changed from "agricultural" to "native" to reflect the fallowing of the Reasons Farm. This change reduces the agricultural water demand for Reasons Farm to zero.
- The estimated water demand for Reasons Farms (assuming rice production) is 6,483 AF/year (on average). Since a portion of the groundwater extracted and applied as irrigation water will return to groundwater basin through deep percolation, the actual recharge to the groundwater basin is equal to 6,483 AF/year minus the returning deep percolation. Results from the IGSM estimate that about 2,632 AF/year return to the groundwater via deep percolation. Consequently, the volume of groundwater recharge resulting from the fallowing of Reasons Farms is estimated to be 3,851 AF/year (6,483 AF/year minus 2,632 AF/year).

5.1 INTRODUCTION

The objective of this study is to estimate the potential impacts on groundwater conditions that would result from an increase in groundwater extractions to meet a portion of the water demand associated with the WRSP area and to evaluate the mitigation of such impacts through the permanent fallowing of agricultural lands (namely, Reason Farms) currently irrigated with groundwater. Specific impacts evaluated during this study included:

- Impacts on regional and local groundwater and piezometric surface elevations
- Impacts on groundwater and piezometric surface elevations in and around existing adjacent wells
- Impacts on groundwater elevations, piezometric surface elevations, and groundwater and piezometric surface gradients in and around adjacent known contaminant plumes
- Impacts on groundwater quality

To evaluate potential impacts and the effectiveness of the proposed mitigation measure, two principal types of information were developed: 1) groundwater and piezometric surface elevation contour maps, and 2) groundwater and piezometric surface elevation hydrographs at selected locations. The results of the groundwater modeling analyses are presented and discussed below. The principal findings and conclusions drawn from these results are presented in Section 6.

5.2 MODELING RESULTS

5.2.1 ELEVATION CONTOUR MAPS

Groundwater and piezometric surface elevation contour maps were developed for Aquifers 1 and 2, respectively, based on the results of the groundwater modeling. Elevation contour maps were generated to illustrate projected groundwater conditions at two times in the 70-year hydrologic period of record used in these analyses (from 1922 through 1991). The two times selected were at the end of simulation water year 15 (or, water year 1937) and at the end of simulation water year 62 (or, water year 1984). [Note: Water years run from October 1st of the first year through September 30th of the subsequent year.]

Simulation water year 15 occurs at the end of a sequence of drought years and is representative of the basin in a highly stressed condition. Conversely, simulation water year 62 occurs at the end of series of wet years and is representative of groundwater conditions at the end of a recovery period.

"Dry year" and "wet year" elevation contour maps (that is, at the ends of water years 15 and 62, respectively) were developed for the baseline condition, the project without mitigation condition, and project with mitigation condition for Aquifers 1 and 2. In addition, "difference contour" maps were developed to illustrate the incremental impacts to the basin resulting from changes in groundwater extraction and recharge.

Elevation contour maps are presented in **Appendix A.** Groundwater and piezometric surface elevation contours for the baseline condition are presented in **Figures A.1** through **A.4.** Groundwater and piezometric surface elevation contours for the project without mitigation are presented in **Figures A.5** through **A.12.** **Figures A.9** through **A.12** are difference contour maps

that illustrate the incremental change between the baseline condition and the project without mitigation condition. Groundwater and piezometric surface elevation contours for the project with mitigation are presented in **Figures A.13** through **A.20**. **Figures A.17** through **A.20** are difference contour maps that illustrate the incremental change between the baseline condition and the project with mitigation condition.

Table 5.1 summarizes the modeling results for the project without and with mitigation based on **Figures A.9** through **A.12** and **Figures A.17** through **A.20**. The results are displayed to illustrate the difference between the project with and without mitigation relative to the baseline condition.

Table 5.1 Impacts on Elevations for the Project Without and With Mitigation

Project Conditions	Maximum Difference in Groundwater Elevation for Aquifer 1 in Dry Year [1] (ft)	Maximum Difference in Piezometric Surface Elevation for Aquifer 2 in Dry Year (ft)	Maximum Difference in Groundwater Elevation for Aquifer 1 in Wet Year [2] (ft)	Maximum Difference in Piezometric Surface Elevation for Aquifer 2 in Wet Year (ft)
Project without Mitigation	-3	-6	3	1.5
Project with Mitigation	4	2	9	8

1) The differences in groundwater elevation from baseline condition (1937 Hydrologic Year). Negative values represent a decline in groundwater elevation from the baseline condition. See figures in **Appendix A**.

2) The differences in groundwater elevation from baseline condition (1986 Hydrologic Year). Negative values represent a decline in groundwater elevations from the baseline condition. See figures in **Appendix A**.

5.2.2 GROUNDWATER HYDROGRAPHS

Hydrographs were developed at various locations to evaluate changes in elevations under different hydrologic conditions (see **Figures A.21** through **A.32**). Hydrographs were developed at the following locations (see **Figure 2.1**):

- **Within the WRSP area** – located in the center of the project area
- **Southern Pacific Roseville Railyard (SPRR)** – site of a known contaminant plume
- **McClellan Air Force Base (AFB)** – site of a known contaminant plume

Figures A.21 and **A.22** present the groundwater elevation hydrograph for aquifer 1 and the piezometric surface elevation hydrograph for aquifer 2 underlying the WRSP area, respectively. **Figures A.23** and **A.24** illustrate the differences in elevations at the same location for the project with and without mitigation. **Figures A.25** through **A.28** present similar hydrographs for the SPRR. In the same manner, **Figures A.29** through **A.32** represent hydrographs for McClellan AFB.

5.3 DISCUSSIONS OF MODELING RESULTS

The IGSM modeling results presented above were used to evaluate both 1) the potential impacts of groundwater extraction to meet a portion of the water demands of the WRSP area, and 2) the effectiveness of the proposed mitigation plan (i.e., the fallowing of Reasons Farm).

5.3.1 IMPACTS ON REGIONAL ELEVATIONS

5.3.1.1 Project without Mitigation

As discussed in Section 2, groundwater will be extracted in "dry" years to meet a portion of the water demand in the WRSP area (see **Figure 2.3**). Potential impacts identified based on IGSM modeling results included:

- In "dry" years, although groundwater extraction to serve water demands in the WRSP area do not result in an apparent cone of depression in either Aquifer 1 or Aquifer 2 (see **Figures A.5** and **A.6**), there are impacts versus the baseline condition (see **Figures A.9** and **A.10**). Groundwater surface elevations are up to three feet lower within the WRSP area; piezometric surface elevations are up six feet lower (see also the summary presented in **Table 5.1**). However, the impacts are largely confined to the boundaries of the MOU area and the City. To the extent that impacts extend beyond those boundaries, those impacts are positive (i.e., elevations are higher), even though mitigation measures have not been put in place. This is a consequence of the conversion of the WRSP area to an urban environment and the delivery of surface water (see also the hydrographs shown on **Figures A.21** through **A.24**).
- In "wet" years, there is no significant impact on groundwater or piezometric surface elevations because no groundwater is being extracted. In fact, similar to the dry years, to the extent there are impacts, these impacts are positive relative to the baseline condition (see **Figures A.11** and **A.12** and the hydrographs shown on **Figures A.21** through **A.24**).

5.3.1.2 Project with Mitigation

Reasons Farms is currently under agriculture production for rice. An estimated annual average of 6,483 AF/year of groundwater extracted from the aquifer underlying the property is applied for irrigation purposes each year to the approximate 1,080-acre site. Part of that water is lost to evapotranspiration (ET); however, part of that water returns to the groundwater through deep percolation. The City is purchasing the Reasons Farms property for use as a stormwater detention basin and has the option of fallowing that land on either an annual or permanent basis.

Permanent fallowing of the Reasons Farms property would result in the "banking" of groundwater [5]. The amount of groundwater banked is equal to the groundwater amount applied to the Reasons Farm minus the deep percolation. With the implementation of this mitigation plan (i.e., the permanent fallowing of Reasons Farm), the following potential benefits could be achieved:

[5] "Banking" means that groundwater that would have been extracted for irrigation purposes is left in the aquifer, in essence, "banked" for future use. The volume of banked groundwater is roughly equal to the groundwater lost to ET. [Note: The portion of the applied water that normally returns to the groundwater through deep percolation is not considered banked].

- Fallowing Reasons Farm would result, on average, I the banking of approximately 3,851 AF/year. The banking volume was obtained by subtracting the estimated deep percolation (approximately 2,632 AF/year) from the total groundwater extraction (6,483 AF/year).
- The decline in groundwater and piezometric surface elevations relative to the baseline condition resulting from groundwater extraction to serve a portion of the water demand in the WRSP area can be eliminated. In fact, fallowing Reasons Farms results in higher groundwater and piezometric surface elevations regionally (see **Figures A.17** and **A.20**). The hydrographs shown **Figures A.21** through **A.24** also indicate that groundwater and piezometric surface elevations with mitigation are higher relative to the baseline condition.
- With the fallowing of Reasons Farm, banked water would accumulate in the groundwater basin. This cumulative banked storage would result in a continuing increase in groundwater elevations until the groundwater system reaches a new equilibrium condition (see **Figures A.23** and **A.24**). In "dry" years, the groundwater extraction will decrease this storage, but elevations will recover rapidly. The rising portion of the curve in **Figure A.23** shows a groundwater level increase rate of four to five feet per year for Aquifer 1. **Figure A.24** shows a piezometric surface elevation increase rate of two to three feet per year.

5.3.2 POTENTIAL LOCAL IMPACTS ON GROUNDWATER ELEVATIONS

When extractions occurs from a single well, a concentrated localized cone of depression is formed around the well. The shape and depth of the localized cone of depression depends on many factors including but not limited to: 1) the rate of extraction, 2) the presence of nearby sources of recharge and extraction, 3) the volume of water stored in the aquifer, 4) aquifer transmissivity, and 4) the "confined" or "unconfined" state of the aquifer. Over a period of time, extraction from an unconfined aquifer can de-water the aquifer around the well. However, when extraction ceases, the aquifer typically recharges back to its pre-extraction condition.

A confined or semi-confined aquifer behaves differently since the water is under pressure from a recharge source. Instead of de-watering the aquifer, a change in confining pressure occurs as a result of extractions; the aquifer remains saturated. In a confined aquifer, the pressure or piezometric surface elevation decline is more dramatic than in an unconfined aquifer; however, the recovery to pre-extraction conditions is much faster and the loss in aquifer storage is spread over a larger area.

5.3.3 POTENTIAL IMPACTS ON SHALLOW DOMESTIC WELLS

In northern Sacramento and western Placer County, changes groundwater elevations in the upper aquifer will have the most effect on private domestic wells. [Note: Most domestic wells in the region are completed in the upper unconfined aquifer because of superior water quality of the upper aquifer.] As shown on **Figures A.17** and **A.19**, with the proposed mitigation plan in place, groundwater elevations in the upper aquifer are higher than they would have been relative to the baseline condition. In fact, even without mitigation groundwater extraction to serve a portion of the demands of the WRSP area should not negatively affect adjacent shallow domestic wells. (see **Figures A.9** and **A.11**).

5.3.4 POTENTIAL IMPACTS ON KNOWN CONTAMINANT PLUMES

As a consequence of past industrial, remedial, and waste management practices, a number of known groundwater contaminant plumes exist adjacent to the WRSP area. Two known

contaminant plumes that could potentially be impacted by groundwater extraction in the WRSP area include (see **Figure 2.1**):

- Southern Pacific Roseville Railyard (SPRR)
- McClellan Air Force Base (AFB)

These sites are described below.

5.3.4.1 Site Descriptions

South Pacific Roseville Railyard

The SPRR site is an active railyard covering several hundred acres in Roseville. It is owned and operated by the Southern Pacific Transportation Company. Railyard activities have been carried out at the site for more than 80 years. The California Department of Toxic Substances Control (DTSC) files identify the site as SP-Roseville. Within the boundaries of the SPRR site, there are three separate operable units: SP Roseville – Area A; SP Roseville – Diesel Shop; and SP Roseville overall site. Known contaminants at the SPRR include: fuel oil; lubrication oils; solvents; volatile organics; polynuclear aromatic hydrocarbons (PAHs); and heavy metals. Additional detail on these sites can be found in the DTSC's "Site Cleanup/Site Mitigation and Brownfields Reuse Program Database".

McClellan AFB

The McClellan AFB site is currently subject to active remediation efforts. Known contaminants at McClellan AFB include: fuel oil; lubrication oils; solvents; volatile organics; polynuclear aromatic hydrocarbons (PAHs); and heavy metals.

5.3.4.2 Potential Impacts Evaluation

As shown on **Figures A.1** through **A.4**, there is a regional groundwater gradient from east to west/southwest away from the WRSP area. The McClellan AFB plumes are down-gradient from the WRSP area; the SPRR plumes are cross-gradient. It is highly unlikely that either plume could migrate onto the WRSP site or threaten the proposed groundwater extraction wells. In addition, as shown on **Figures A.9** through **A.12** and **A.17** through **A.20**, with or without the proposed mitigation measures in place, the groundwater and piezometric surface elevations and gradients are largely unaffected by the proposed project relative to the baseline condition. The change in elevations are negligible (several feet). The gradients are essentially unchanged.

5.3.5 GROUNDWATER QUALITY

The groundwater below the City is not currently used actively for municipal water supply. The City operates four wells within the City limits for emergency supply only. Two of these wells are located in downtown Roseville; two are located to the south near Interstate 80.

Specific laboratory analyses for groundwater quality were not conducted in this study. However, data were available from current efforts to develop the Diamond Creek Well located near the western boundary of the City (adjacent to the WRSP area). Groundwater quality at the Diamond Creek site is believed to be representative of the quality anticipated to be found beneath the WRSP area.

The Diamond Creek Well was developed recently and a well completion analysis was conducted in October 2002. **Table 5.2** provides a summary of the water quality results, along with historical data (from 1992 through 2002) in the City's other four wells.

Table 5.2 Summary of Selected Groundwater Quality Constituents at Diamond Creek Well

Constituent	Maximum Concentration	
	Diamond Creek Well [1]	Existing City Wells
Chloride, mg/L	170	81
Fluoride, mg/L	<0.5	0.4
Iron, mg/L	<0.05	0.1
Manganese, mg/L	<0.01	<0.03
Nitrate (as N), mg/L	7	21
Nitrite (as N), mg/L	<0.05	<0.4
pH, units	7.1	7.8
Sodium, mg/L	78	62
Total Dissolved Solids, mg/L	460	410

[1] Based on single sample collected during well operation test

The data in **Table 5.2** indicate that the groundwater below the WRSP area can be characterized as a highly mineralized. There are high levels of minerals and salts, but generally low levels of metals. The pH is neutral and nitrate appears to have contaminated some areas of the region. This water is treatable to potable water standards. Groundwater quality underlying the WRSP area will not be affected by the implementation of the WRSP.

5.3.6 SENSITIVITY ANALYSES

5.3.6.1 Sensitivity Analysis on Groundwater Elevation Impacts

Sensitivity analyses were conducted for the project without mitigation condition assuming 10 percent extraction Aquifer 1 and 90 percent extraction from Aquifer 2. The purpose of increasing the groundwater extraction percentage in Aquifer 2 is to investigate the sensitivity of the groundwater impacts to well construction.

Model results indicate that the groundwater elevation changes will not be significantly affected. The maximum decrease in elevations for the "10/90 case" were two feet in Aquifer 1 and eight feet in Aquifer 2, as compared to three feet in Aquifer 1 and six feet in Aquifer 2 for the "50/50 case". Consequently, the 50/50 groundwater extraction assumption was more conservative in estimating the groundwater impacts for Aquifer 1. For Aquifer 2, the declining piezometric surface elevation represents the decrease in pressure in the lower confined aquifer instead of dewatering as in the unconfined upper aquifer.

5.3.6.2 Sensitivity Analysis on Proposed Mitigation Measure

Sensitivity analyses were conducted to investigate the sensitivity of the impacts of the mitigation measures to change in the fallowed acreage. **Table 5.3** and **Figure 5.1** summarize the modeling results for water year 1977 to represent "dry" year conditions.

Results indicate that the fallowing of Reasons Farm is more effective on Aquifer 1 than on Aquifer 2 in restoring groundwater elevations. As shown in **Figure 5.1**, the groundwater

elevation in Aquifer 1 can be restored to the baseline condition by fallowing approximately 500 acres of Reasons Farm. However, 850 acres is required to mitigate the impact for Aquifer 2.

Table 5.3 Results of Sensitivity Analysis on Proposed Mitigation Measure

No.	IGSM Model Runs	Acres of Fallowed Rice Land in the Reasons Farm	Maximum Difference in Groundwater Elevation for Aquifer 1 in Dry Year [1] (ft)	Maximum Difference in Piezometric Surface Elevation for Aquifer 2 in Dry Year (ft)
1	Without Fallowing Reasons Farm	0	-3	-6
2	Fallowing northern portion of Reasons Farm	584	0.5	-2
3	Fallowing northern portion plus half south portion of Reasons Farm	848	2.5	0
4	Fallowing entire Reasons Farm	1,080	4	2

1) The differences in groundwater elevation from "baseline condition" (1977 Hydrologic Year). Negative values represent a decline in groundwater levels from the "baseline condition".

Figure 5.1 Plot of Sensitivity Analysis Results

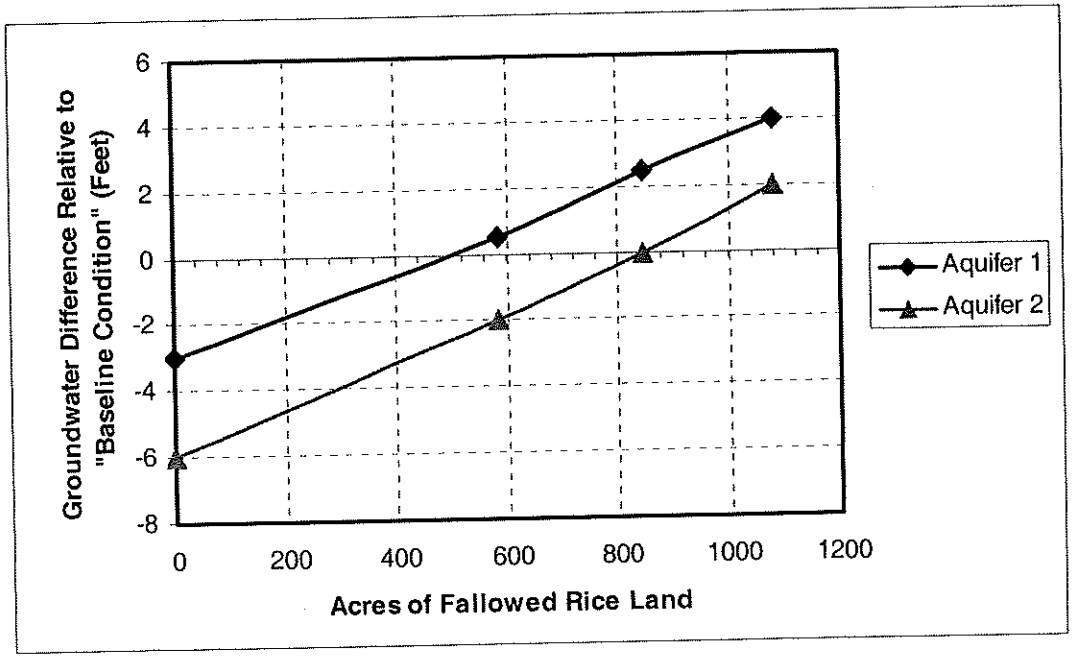


Table 5.4 shows the groundwater amount can be banked by fallowing various acres of the Reasons Farm.

Table 5.4 Groundwater "Banking" by Fallowing Various Acres of the Reasons Farm

No.	IGSM Model Runs	Acres Fallowed on Reasons Farm	Groundwater Supply (acre-feet)	Deep Percolation (acre-feet)	Banked Volume (acre-feet)
1	Fallowing north portion of the Reasons Farm	584	3,539	1,541	1,998
2	Fallowing north portion plus half south portion of the Reasons Farm	848	5,111	2,131	2,980
3	Fallowing the entire Reasons Farm	1,080	6,483	2,632	3,851

6.1 PRINCIPAL FINDINGS

Three conditions were evaluated in this study to investigate potential groundwater impacts associated with the development of the WRSP area and the proposed mitigation measure of fallowing Reasons Farm on a permanent basis.

- If the City extracts groundwater for the purpose of meeting water demands in the WRSP area as estimated under the proposed water supply strategy, the resulting impacts on groundwater basin without mitigation would be include a maximum decrease in groundwater surface elevations in Aquifer 1 of about three feet and a maximum decrease in piezometric surface elevation in Aquifer 2 of about six feet.
- The Reasons Farms property is currently under agriculture production for rice. About 6,483 AF/year of groundwater, extracted from the aquifer underlying the property, is applied for irrigation purposes each year to the 1,080-acre site. The major portion of that water is lost to ET while a small amount returns to the groundwater through deep percolation (about 2,632 AF/year). The City has the option of purchasing the Reasons Farms property and of fallowing that land on either an annual or permanent basis. Permanent fallowing of the Reasons Farms property would result in the "banking" of about 3,851 AF/year of groundwater.
- The City's proposed water supply strategy for the WRSP area contemplates extraction of up to 2,848 AF/year of groundwater under certain hydrologic conditions. Permanent fallowing of the Reasons Farms property fully mitigates for impacts to groundwater elevations resulting from the extraction of groundwater to serve a portion of the water demand of the WRSP area.
- The impacts resulting from groundwater extraction are largely limited to the MOU area. The groundwater extraction will not significantly affect the groundwater quality, the movement of known contaminant plumes, or adjacent shallow domestic wells.

6.2 CONCLUSIONS

The permanent fallowing of the Reasons Farms property provides sufficient groundwater banking to fully mitigate for the anticipated groundwater extraction under the City's proposed water supply strategy for meeting water demands in the WRSP area.

APPENDIX A

Contour Maps and Hydrographs From IGSM Modeling Results

LIST OF FIGURES

Figure A.1 – Baseline Condition Aquifer 1 Groundwater Surface Elevation Contours Dry Year

Figure A.2 – Baseline Condition Aquifer 2 Piezometric Surface Elevation Contours Dry Year

Figure A.3 – Baseline Condition Aquifer 1 Groundwater Suface Elevation Contours Wet Year

Figure A.4 – Baseline Condition Aquifer 2 Groundwater Piezometric Surface Elevation Contours Wet Year

Figure A.5 – Project without Mitigation Aquifer 1 Groundwater Surface Elevation Contours Dry Year

Figure A.6 – Project without Mitigation Aquifer 2 Piezometric Surface Elevation Contour Dry Year

Figure A.7 – Project without Mitigation Aquifer 1 Groundwater Surface Elevation Contours Wet Year

Figure A.8 – Project without Mitigation Aquifer 2 Piezometric Surface Elevation Contours Wet Year

Figure A.9 – Project without Mitigation Aquifer1 Groundwater Surface Elevation Difference Contours Dry Year

Figure A.10 – Project without Mitigation Aquifer 2 Piezometric Surface Elevation Difference Contours Dry Year

Figure A.11 – Project without Mitigation Aquifer 1 Groundwater Surface Elevation Difference Contours Wet Year

Figure A.12 – Project without Mitigation Aquifer 2 Piezometric Surface Elevation Difference Contours Wet Year

Figure A.13 – Project with Mitigation Aquifer 1 Groundwater Surface Elevation Contours Dry Year

Figure A.14 – Project with Mitigation Aquifer 2 Piezometric Surface Elevation Contours Dry Year

Figure A.15 – Project with Mitigation Aquifer 1 Groundwater Surface Elevation Contours Wet Year

Figure A.16 – Project with Mitigation Aquifer 2 Piezometric Surface Elevation Contours Wet Year

Figure A.17 - Project with Mitigation Aquifer 1 Groundwater Surface Elevation Difference Contours Dry Year

Figure A.18 - Project with Mitigation Aquifer 2 Piezometric Surface Elevation Difference Contours Dry Year

Figure A.19 - Project with Mitigation Aquifer 1 Groundwater Surface Elevation Difference Contours Wet Year

Figure A.20 - Project with Mitigation Aquifer 2 Piezometric Surface Elevation Difference Contours Wet Year

Figure A.21 Groundwater Elevation Hydrograph for Aquifer 1 Underlying the WRSP Area (Node #151)

Figure A.22 Groundwater Piezometric Surface Elevation Hydrograph for Aquifer 2 Underlying the WRSP Area (Node #151)

Figure A.23 Groundwater Elevation Difference Relative to "Baseline Condition" for Aquifer 1 Underlying the WRSP Area (Node #151)

Figure A.24 Groundwater Piezometric Surface Elevation Difference Relative to "Baseline Condition" for Aquifer 2 Underlying the WRSP Area (Node #151)

Figure A.25 Groundwater Elevation Hydrograph for Aquifer 1 Underlying South Pacific Roseville Railyard (Node #50)

Figure A.26 Groundwater Elevation Hydrograph for Aquifer 2 Underlying South Pacific Roseville Railyard (Node #50)

Figure A.27 Groundwater Elevation Difference Relative to "Baseline Condition" for Aquifer 1 Underlying South Pacific Roseville Railyard (Node #50)

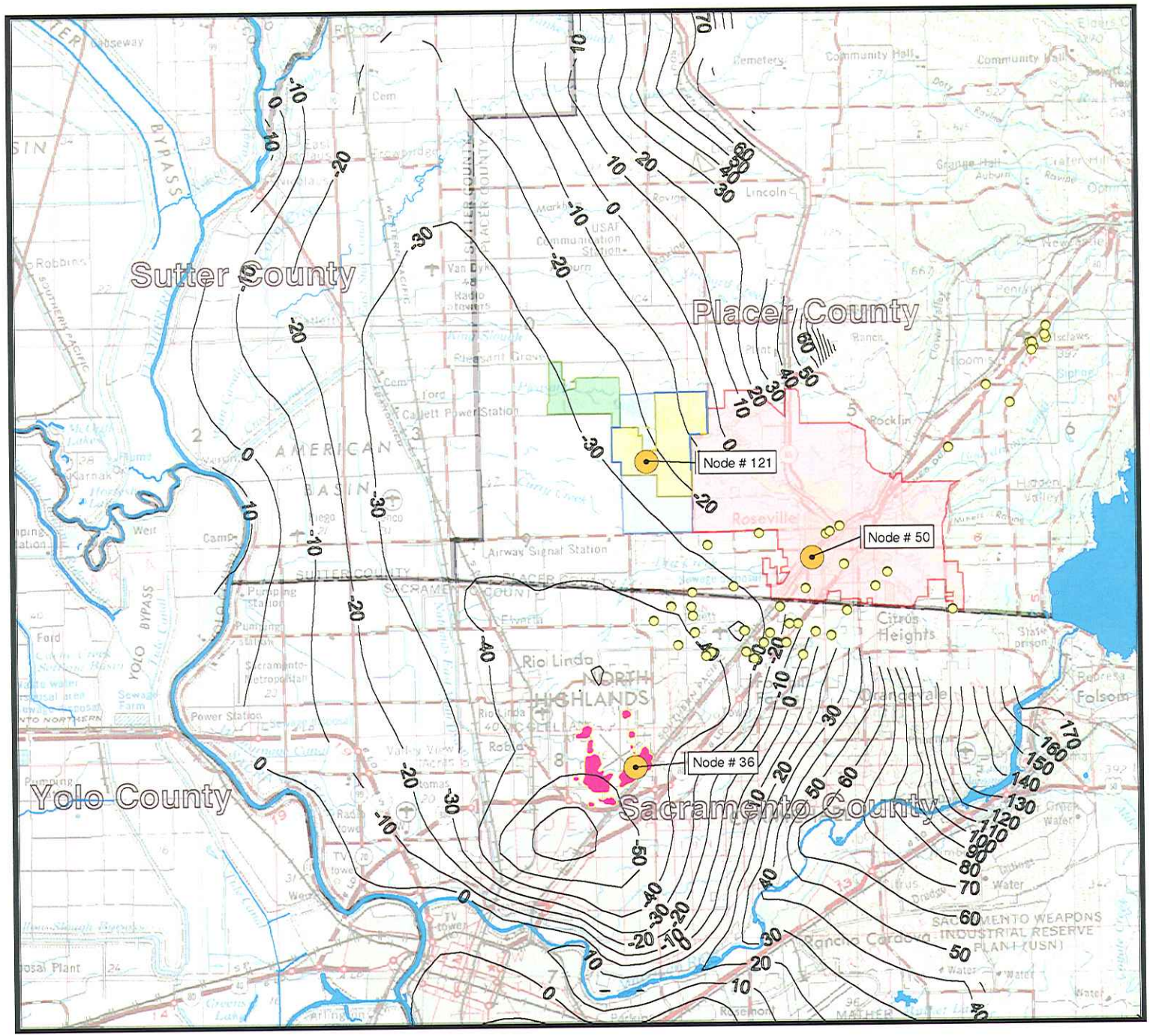
Figure A.28 Groundwater Elevation Difference Relative to "Baseline Condition" for Aquifer 2 Underlying South Pacific Roseville Railyard (Node #50)

Figure A.29 Groundwater Elevation Hydrograph for Aquifer 1 Underlying McClellan Contaminant Plumes (Node #36)

Figure A.30 Groundwater Elevation Hydrograph for Aquifer 2 Underlying McClellan Contaminant Plumes (Node #36)

Figure A.31 Groundwater Elevation Difference Relative to "Baseline Condition" for Aquifer 1 Underlying McClellan Contaminant Plumes (Node #36)

Figure A.32 Groundwater Elevation Difference Relative to "Baseline Condition" for Aquifer 2 Underlying McClellan Contaminant Plumes (Node #36)



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Water Supply Strategy: Groundwater Impact Analyses

Figure A.1
Baseline Condition
Aquifer 1 Groundwater Surface Elevation Contours
Dry Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- —20— Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

June 2003

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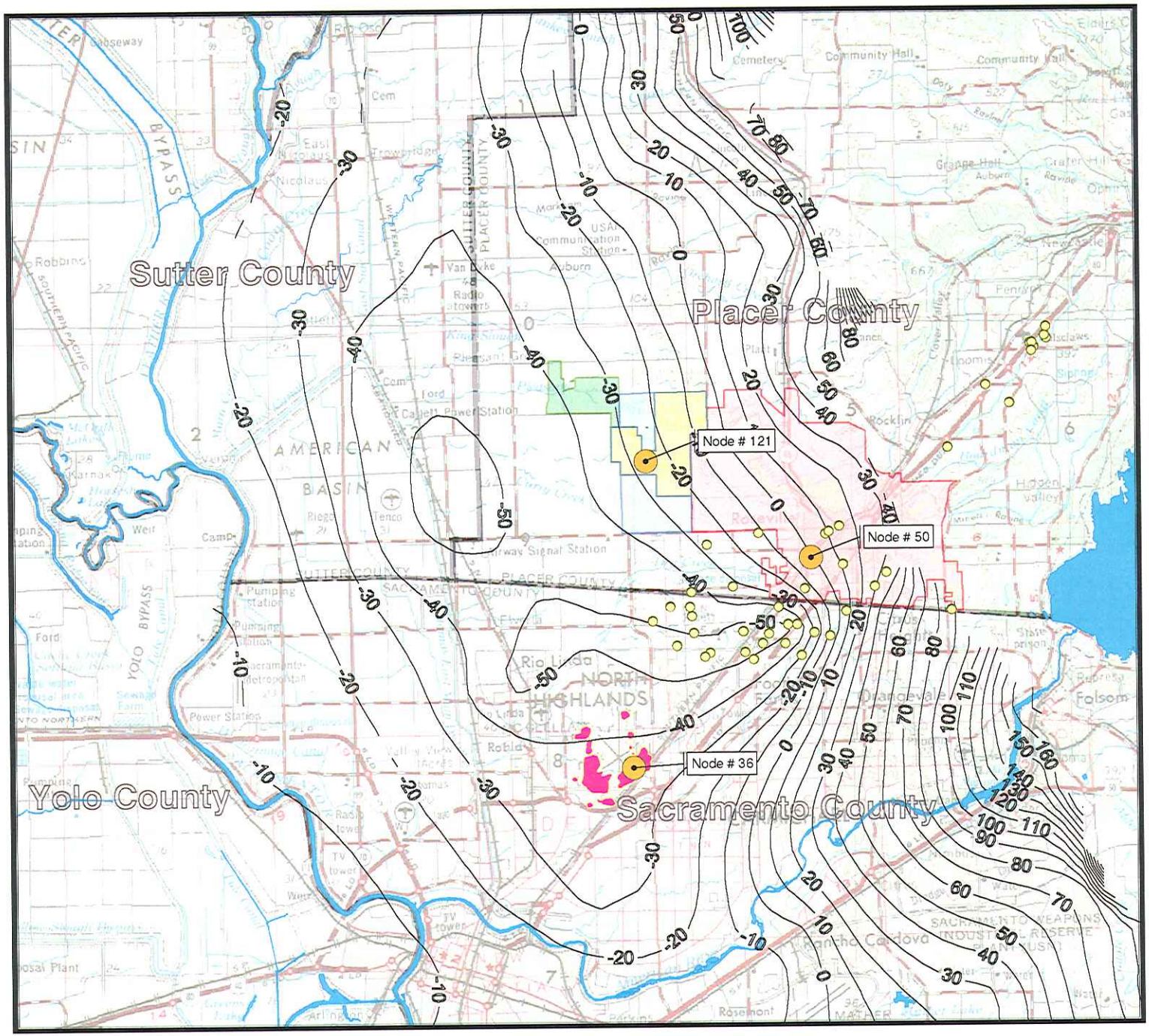
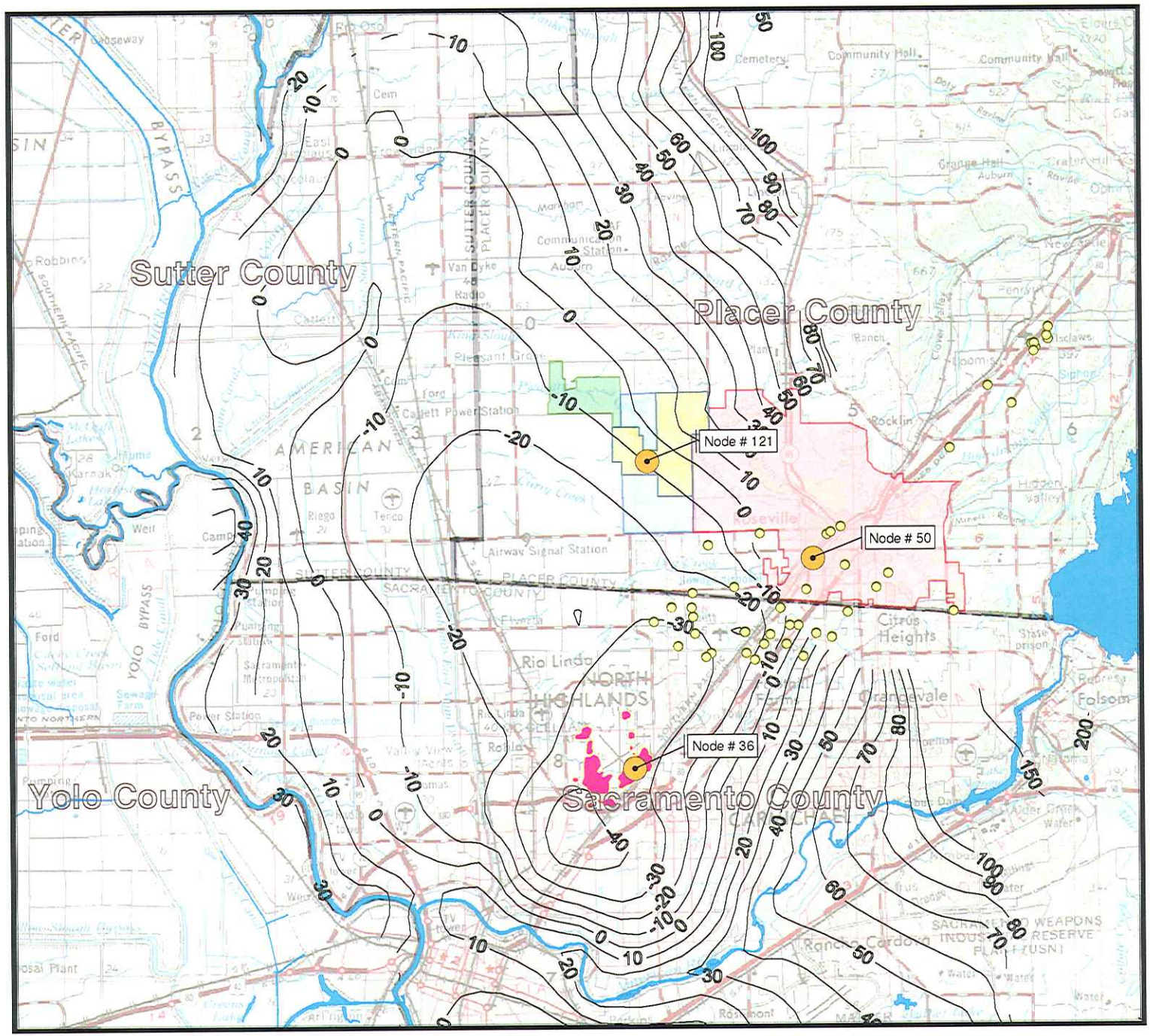

Sutter County
Placer County
Yolo County
Sacramento County
Node # 121
Node # 50
Node # 36
AMERICAN BASIN
NORTH HIGHLANDS
Folsom
Rocklin
Roseville
Rio Linda
Elverta
Antelope
Rosemont
Cordova
Citrus Heights
Orangevale
Fair Oaks
Carmichael
Auburn
Loomis
Penryn
Newcastle
Lincoln
Robbins
Wheatland
Marysville
Yuba City
Oroville
Sacramento
Davis
Woodland
Vacaville
Fairfield
Vallejo
Napa
Petaluma
Santa Rosa
Ukiah
Clear Lake
Lake Berryessa
Lake Oroville
Folsom Lake
Sacramento River
American River
Feather River
Bear River
Yuba River
Natomas
Pleasant Grove
Virginia Ranch
Camp Far West
Reservoir
Dam
Power Station
Pumping Station
Weir
Levee
Airport
Golf Course
Cemetery
Community Hall
Radio Towers
TV Tower
Fire Station
Sewage Farm
Sewage Plant
Railroad
Highway
Freeway
Bypass
Canal
Ditch
Creek
Slough
Lake
Reservoir
Dam



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Water Supply Strategy: Groundwater Impact Analyses

Figure A.3
Baseline Condition
Aquifer 1 Groundwater Surface Elevation Contours
Wet Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area
- West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

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MWH

June 2003

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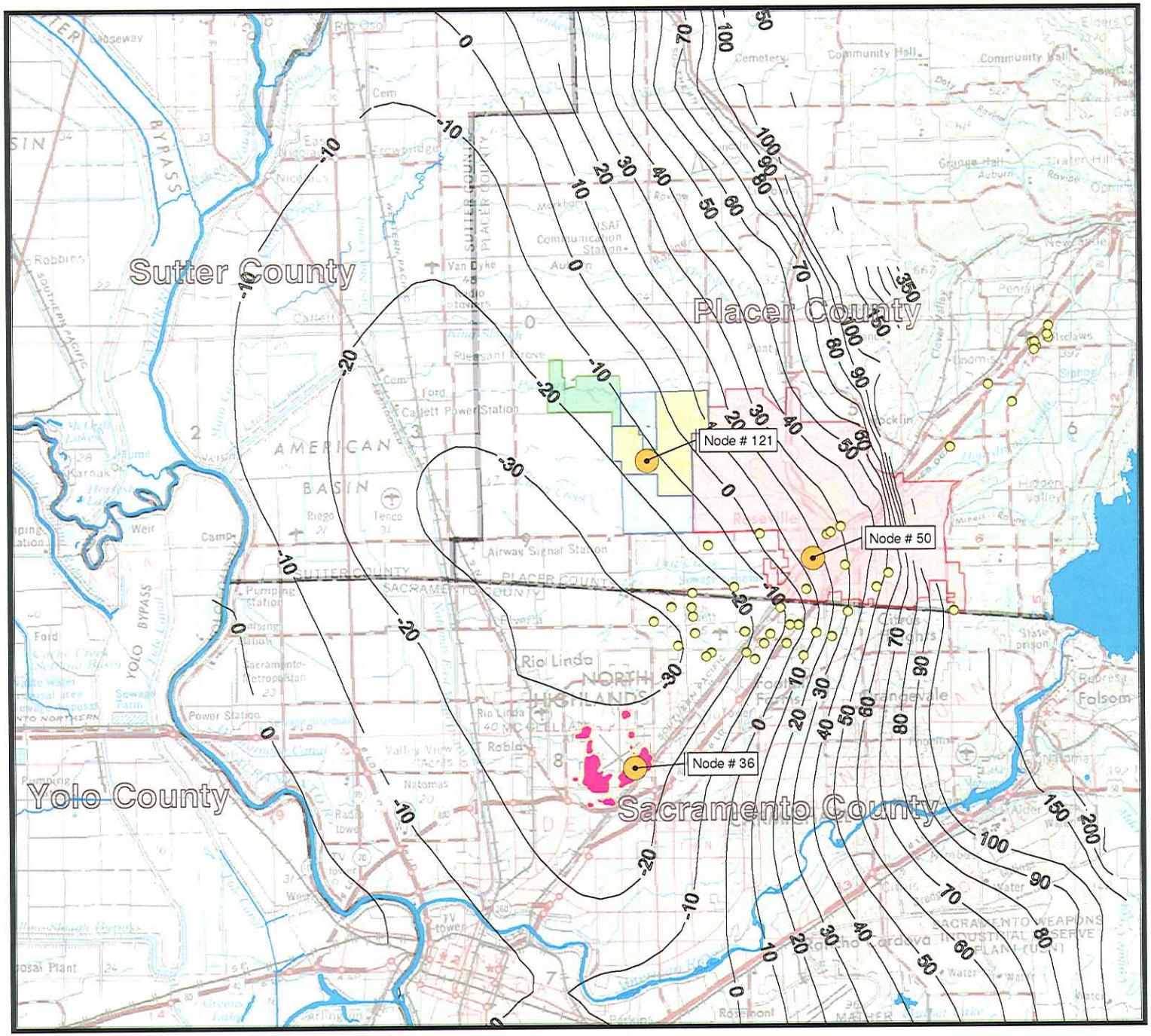

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.4
Baseline Condition
Aquifer 2 Piezometric Surface Elevation Contours
Wet Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- —20— Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

June 2003

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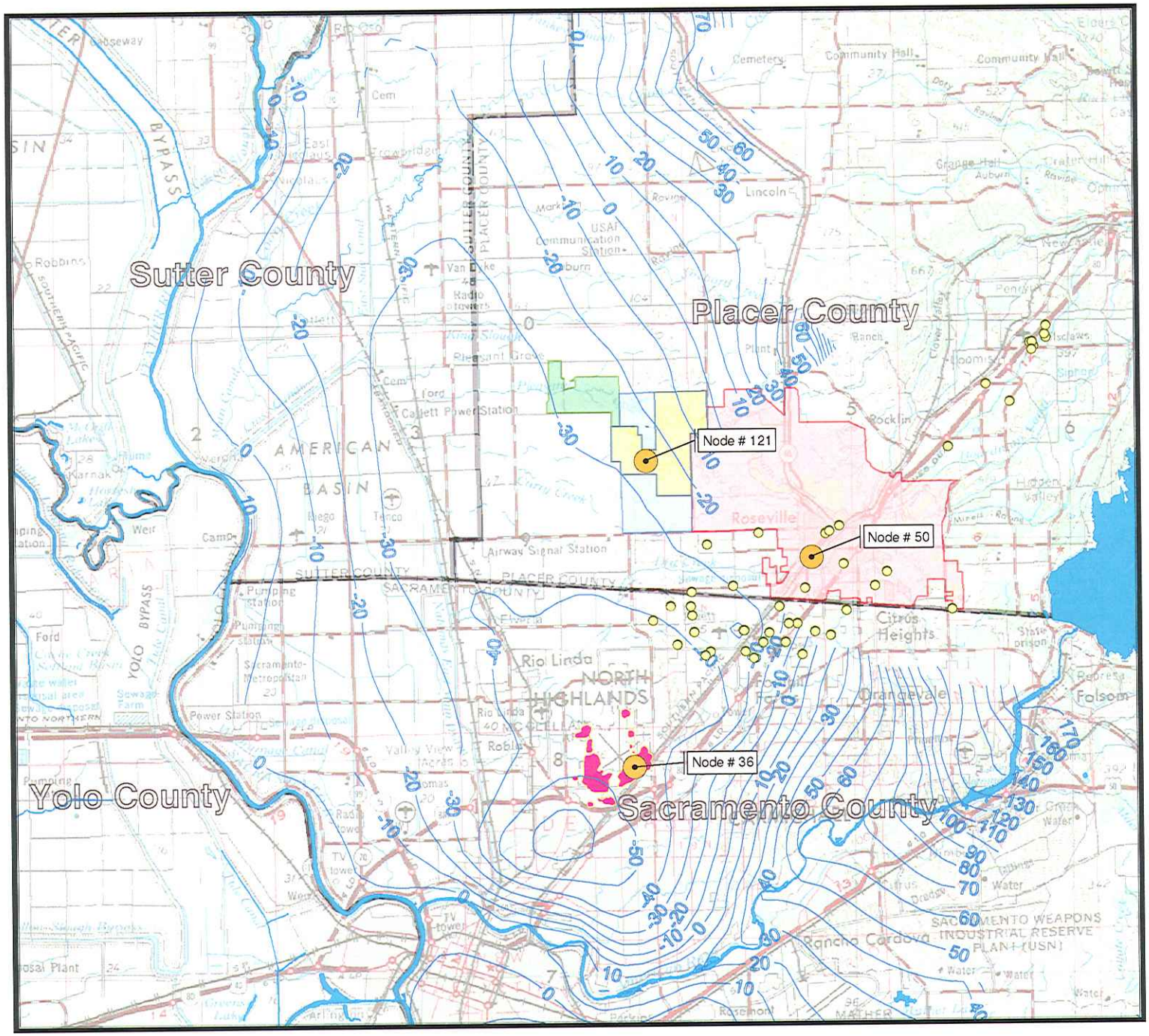

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.5
Project without Mitigation
Aquifer 1 Groundwater Surface Elevation Contours
Dry Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

0 1 2 4 Miles

MWH

June 2003

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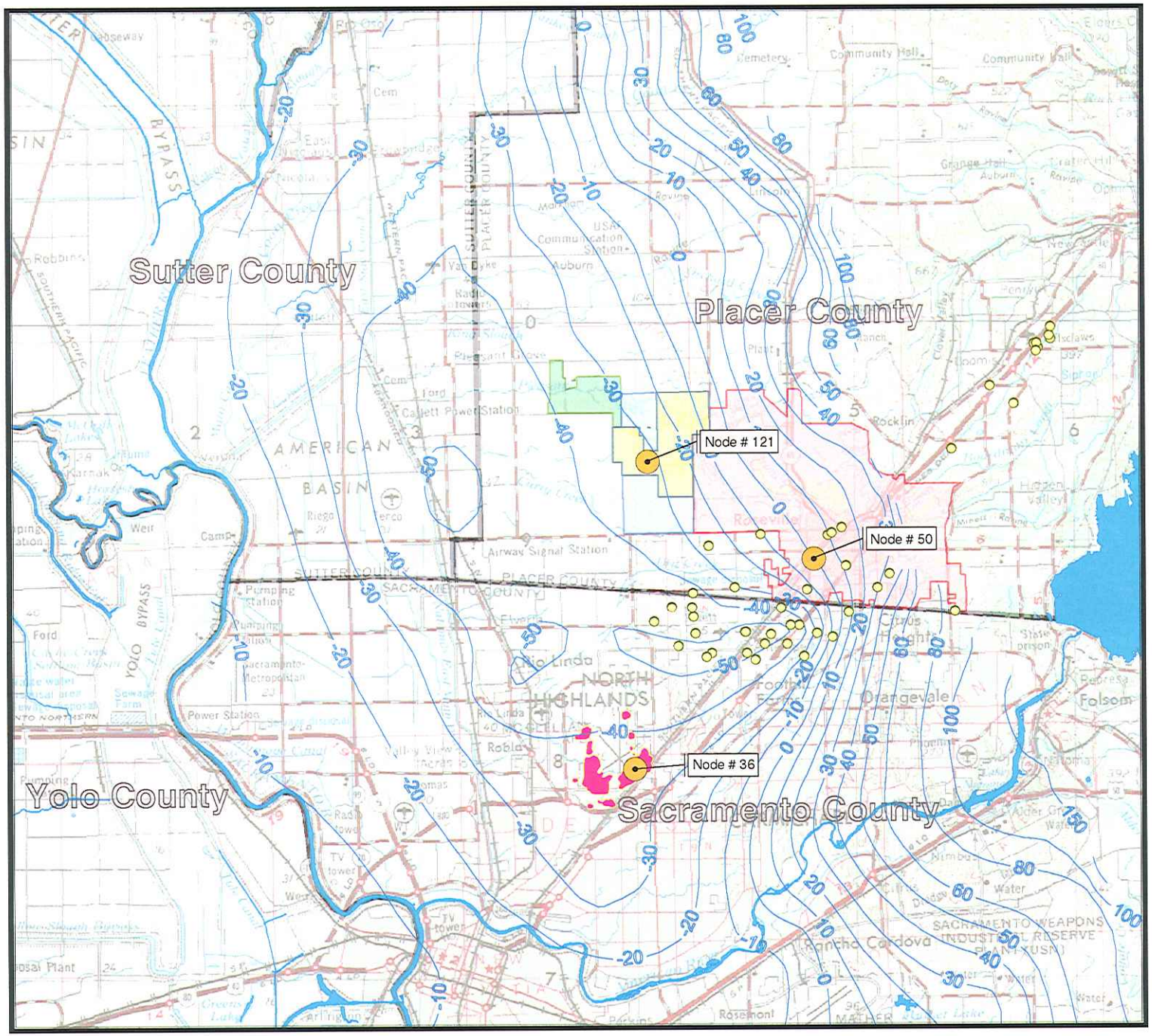

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.6
Project without Mitigation
Aquifer 2 Piezometric Surface Elevation Contours
Dry Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- —20— Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

June 2003

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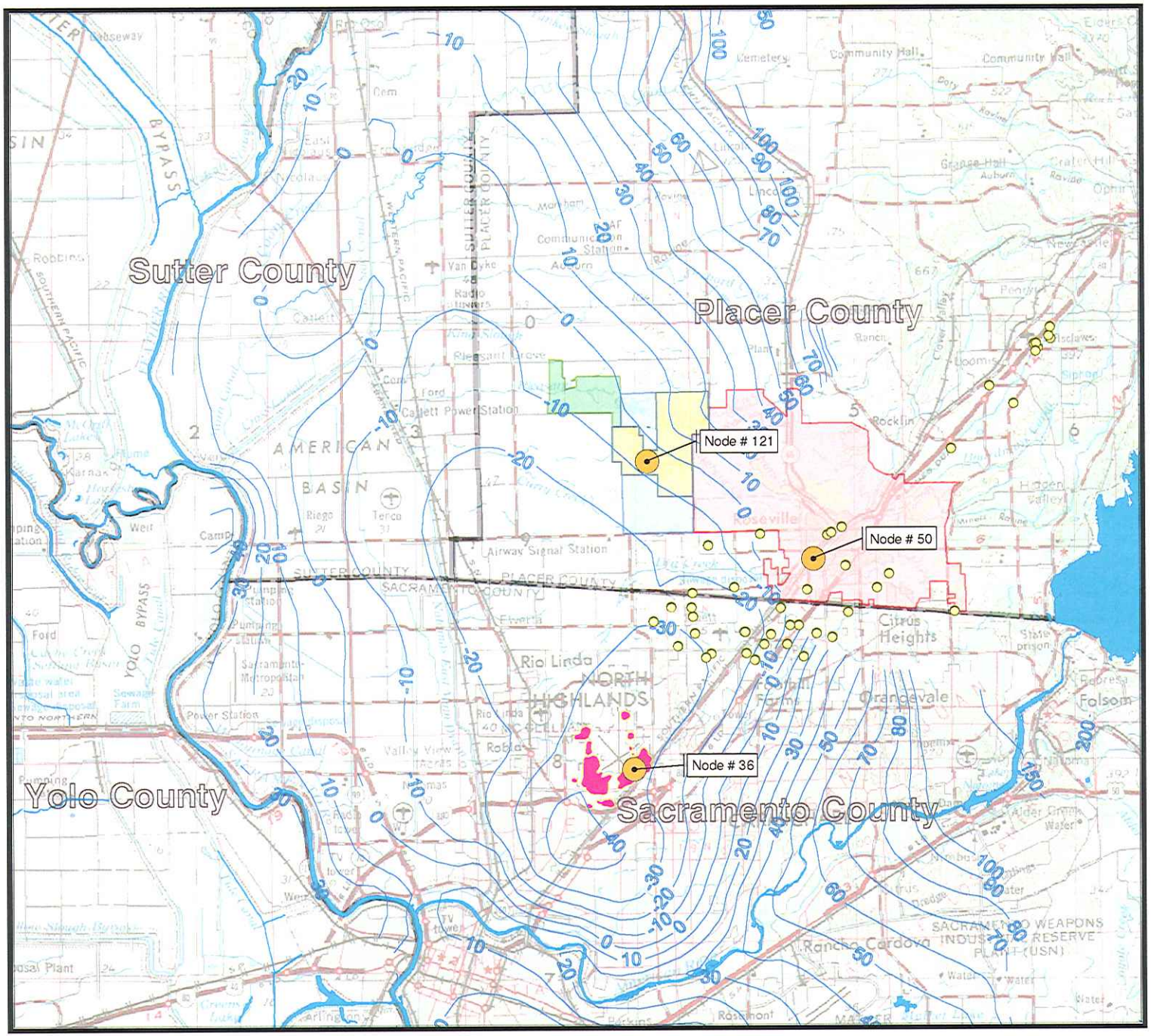

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.7
Project without Mitigation
Aquifer 1 Groundwater Surface Elevation Contours
Wet Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- —20— Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

June 2003

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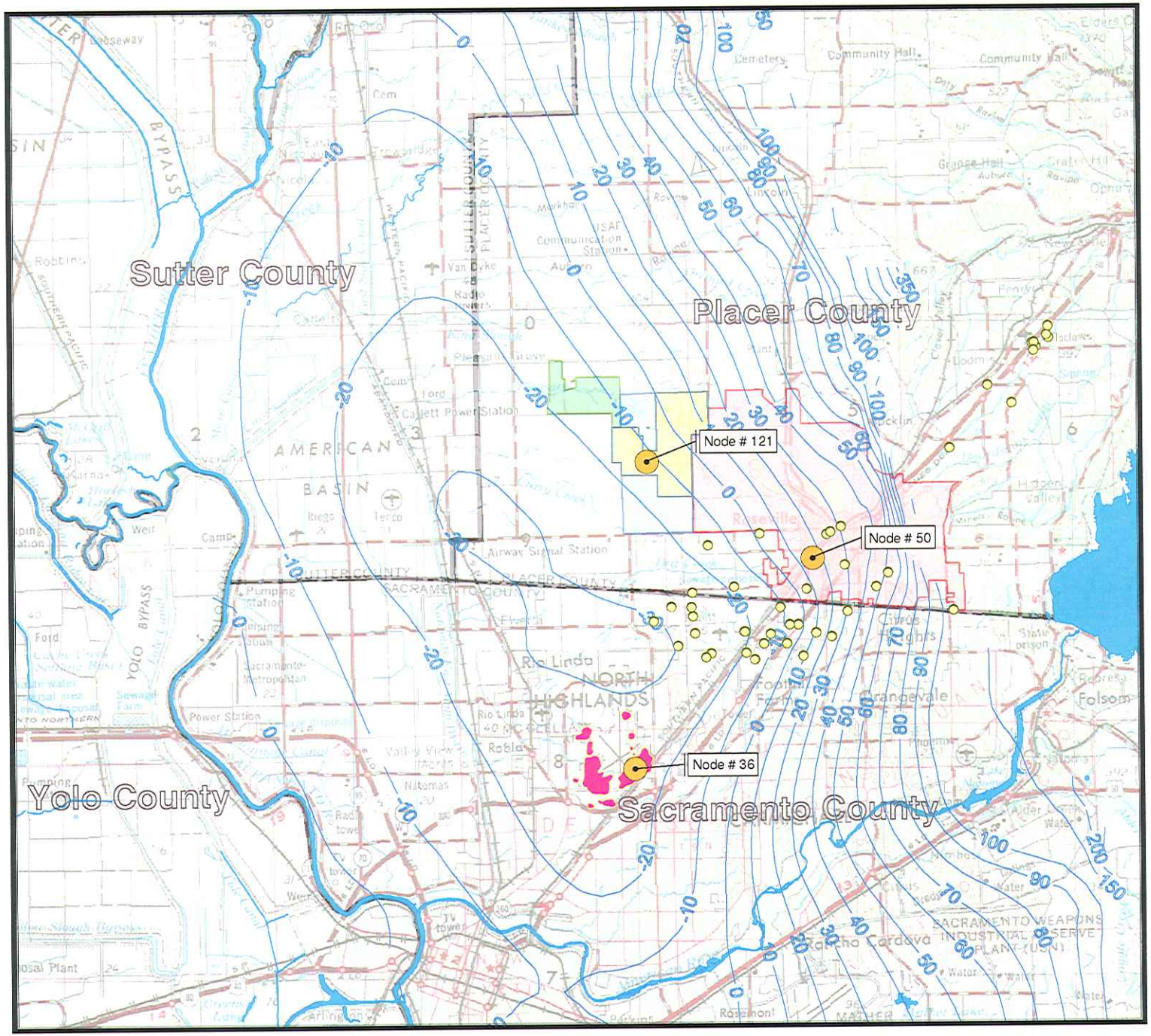

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.8
Project without Mitigation
Aquifer 2 Piezometric Surface Elevation Contours
Wet Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- —20— Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

June 2003

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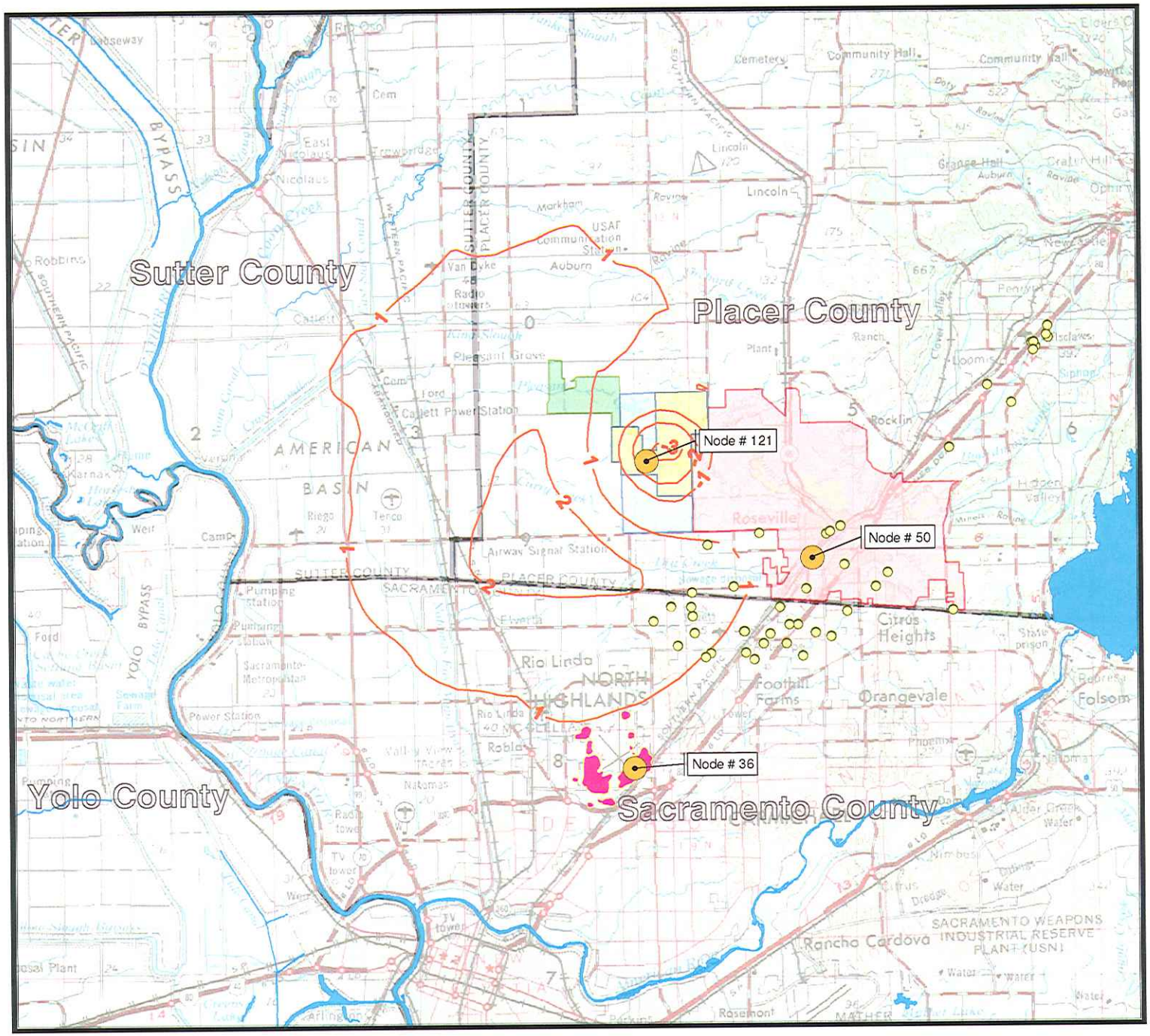

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.9
Project without Mitigation
Aquifer 1 Groundwater Surface Elevation Difference Contours
Dry Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area
- West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

0 1 2 4 Miles

MWH

June 2003

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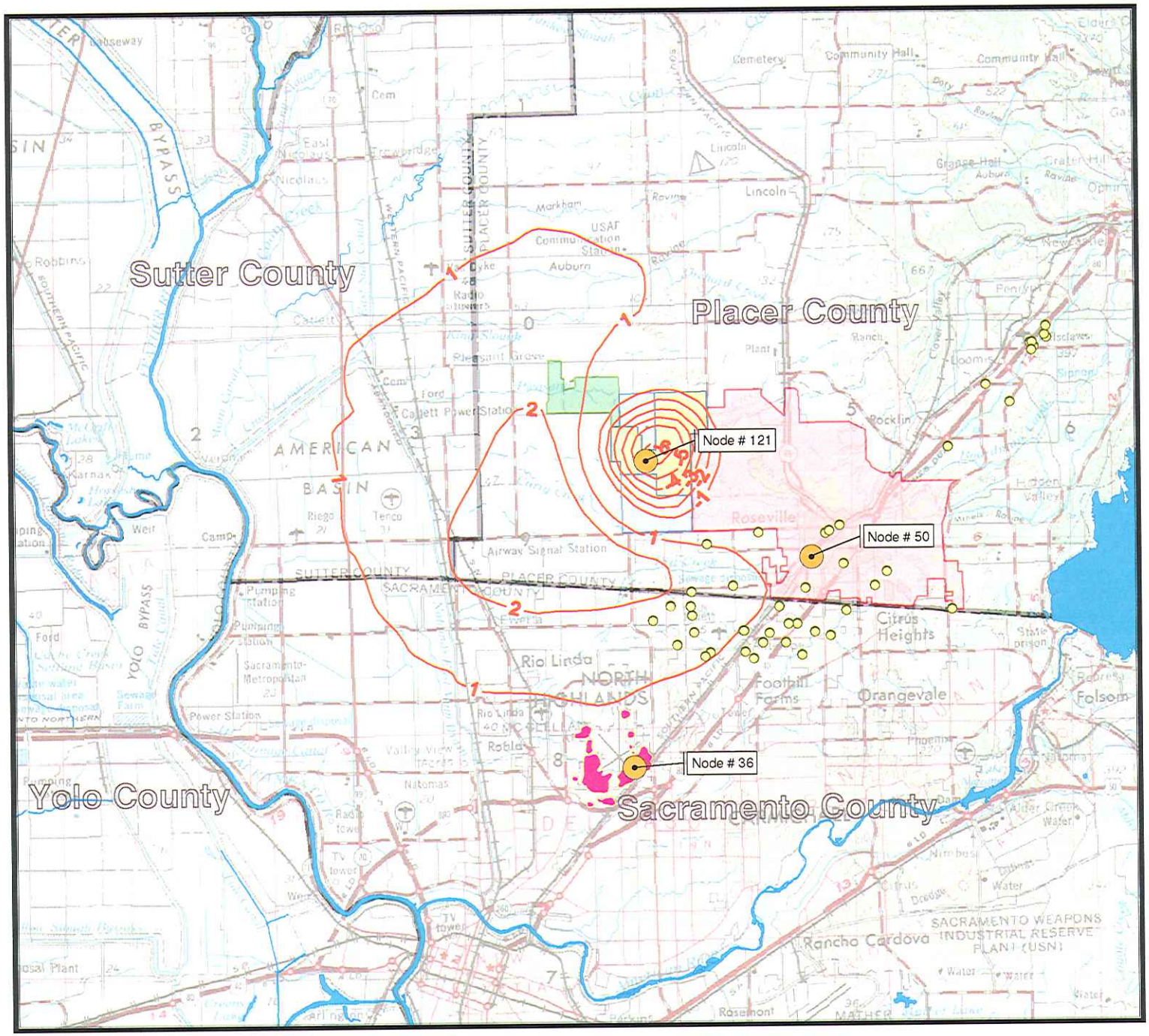

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.10
Project without Mitigation
Aquifer 2 Piezometric Surface Elevation Difference Contours
Dry Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

0 1 2 4 Miles

MWH

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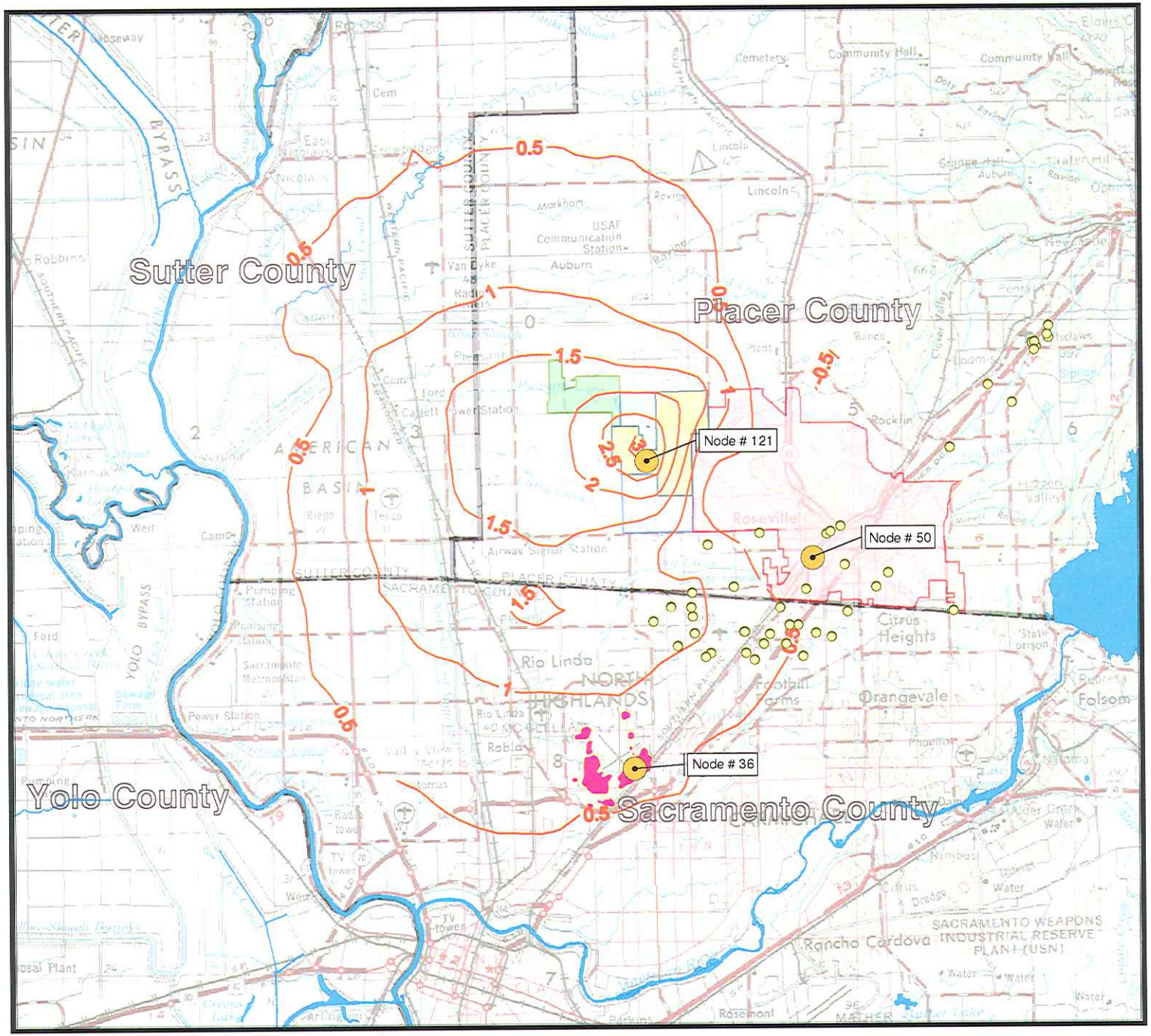

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.11
Project without Mitigation
Aquifer 1 Groundwater Surface Elevation Difference Contours
Wet Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area
- West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

0 1 2 4 Miles

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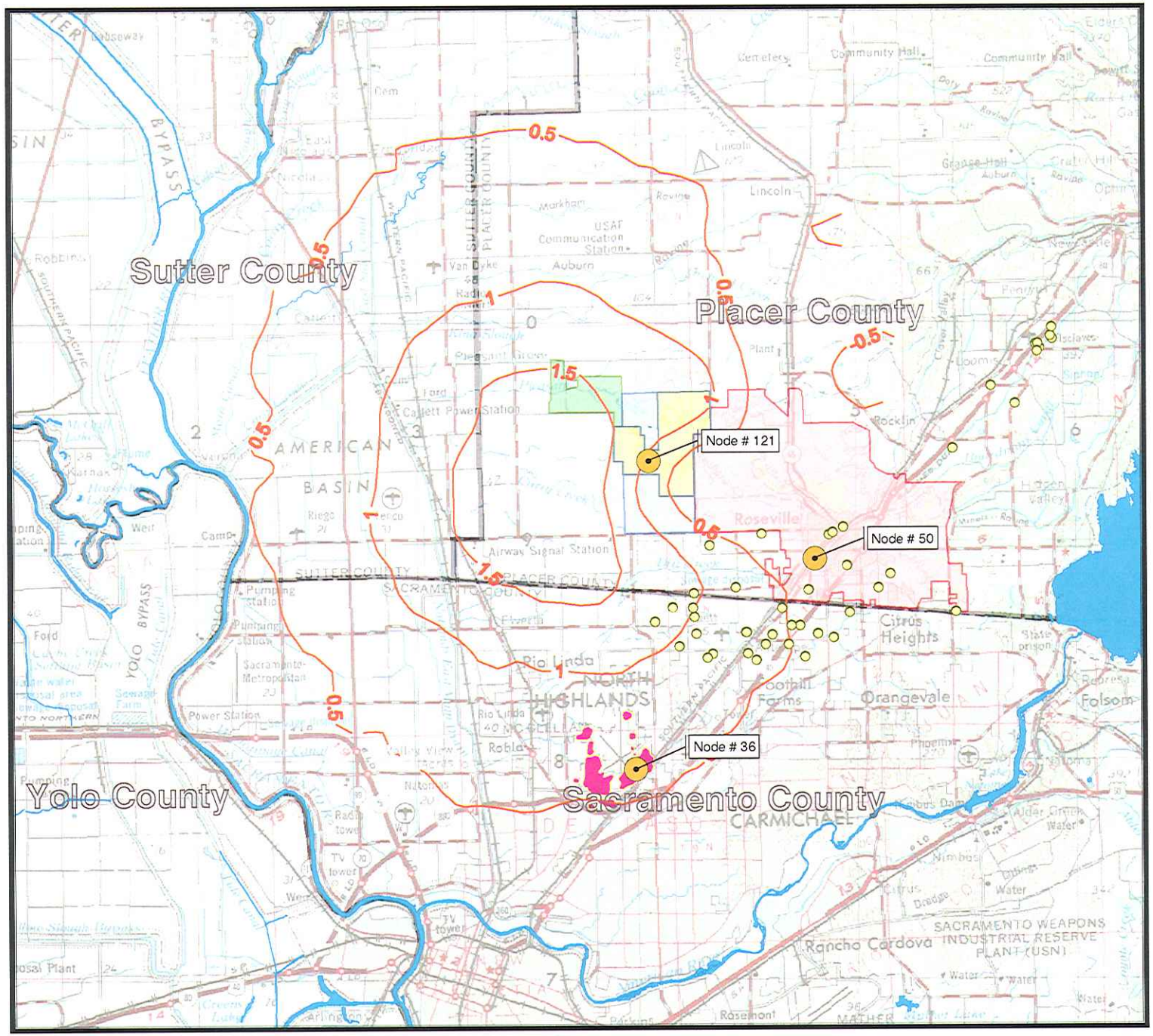

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.12
Project without Mitigation
Aquifer 2 Piezometric Surface Elevation Difference Contours
Wet Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

0 1 2 4 Miles

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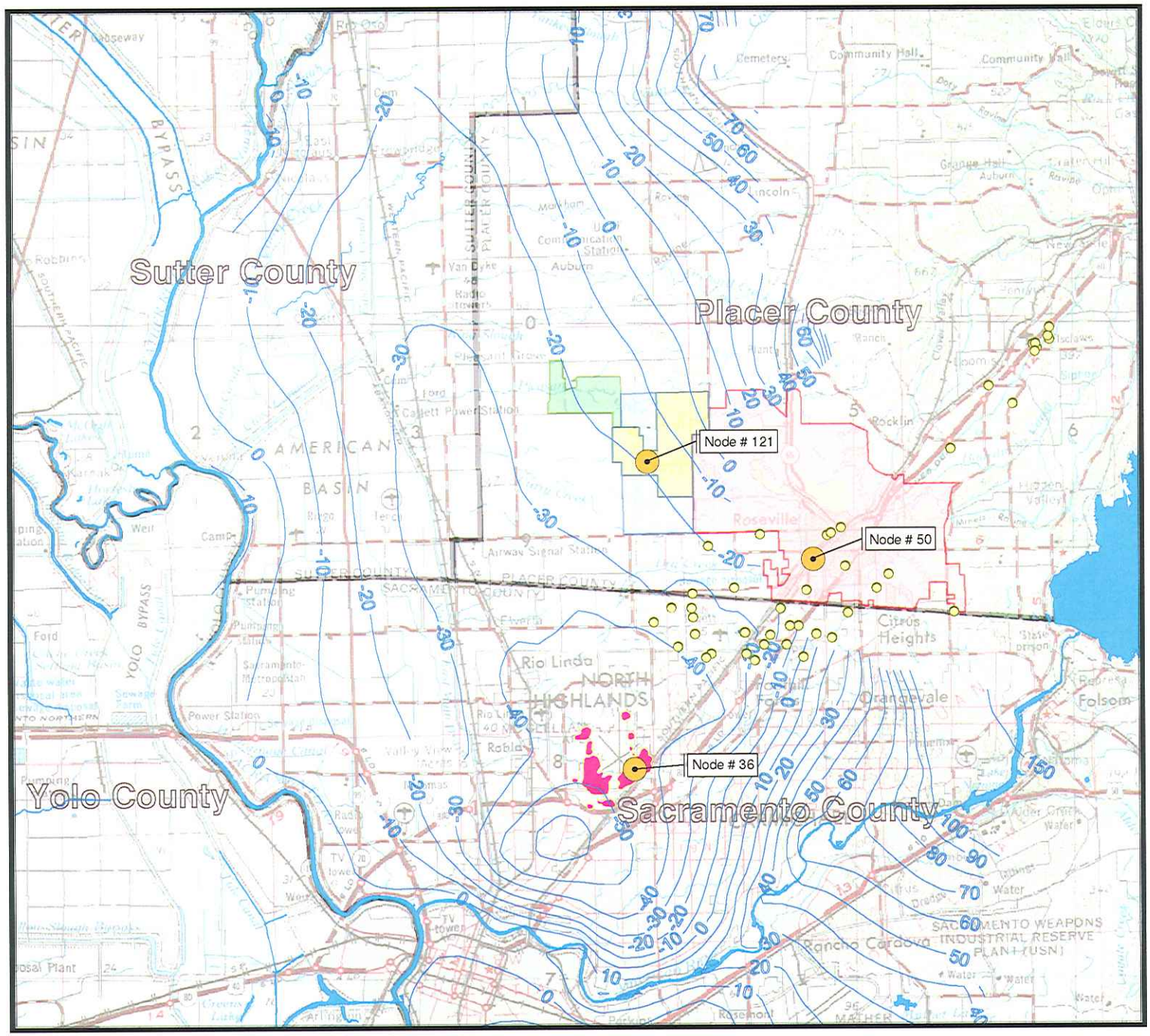

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.13
Project with Mitigation Aquifer 1 Groundwater Surface Elevation Contours Dry Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area
- West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

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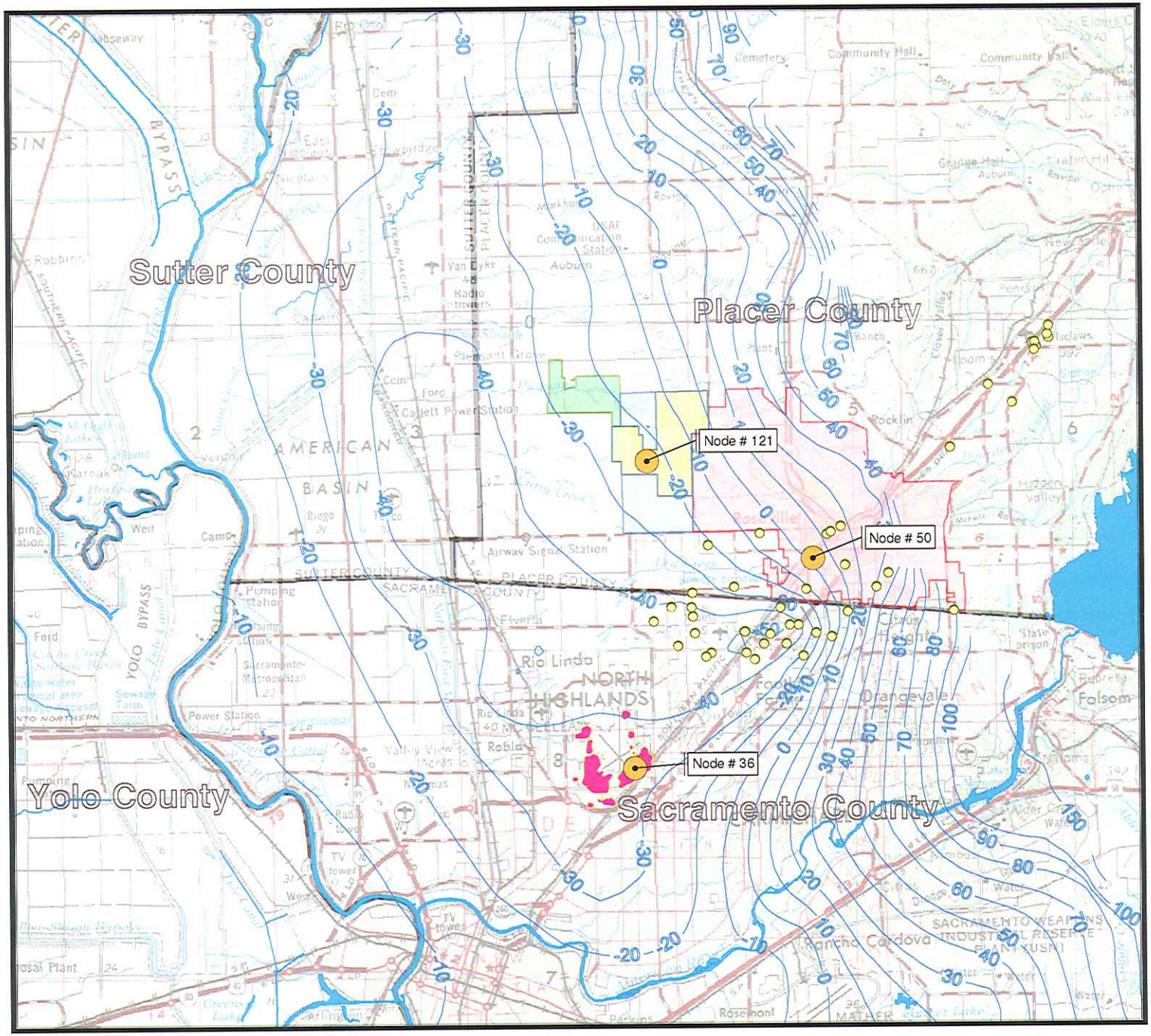

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.14
Project with Mitigation Aquifer 2 Piezometric Surface Elevation Contours Dry Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area
- West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

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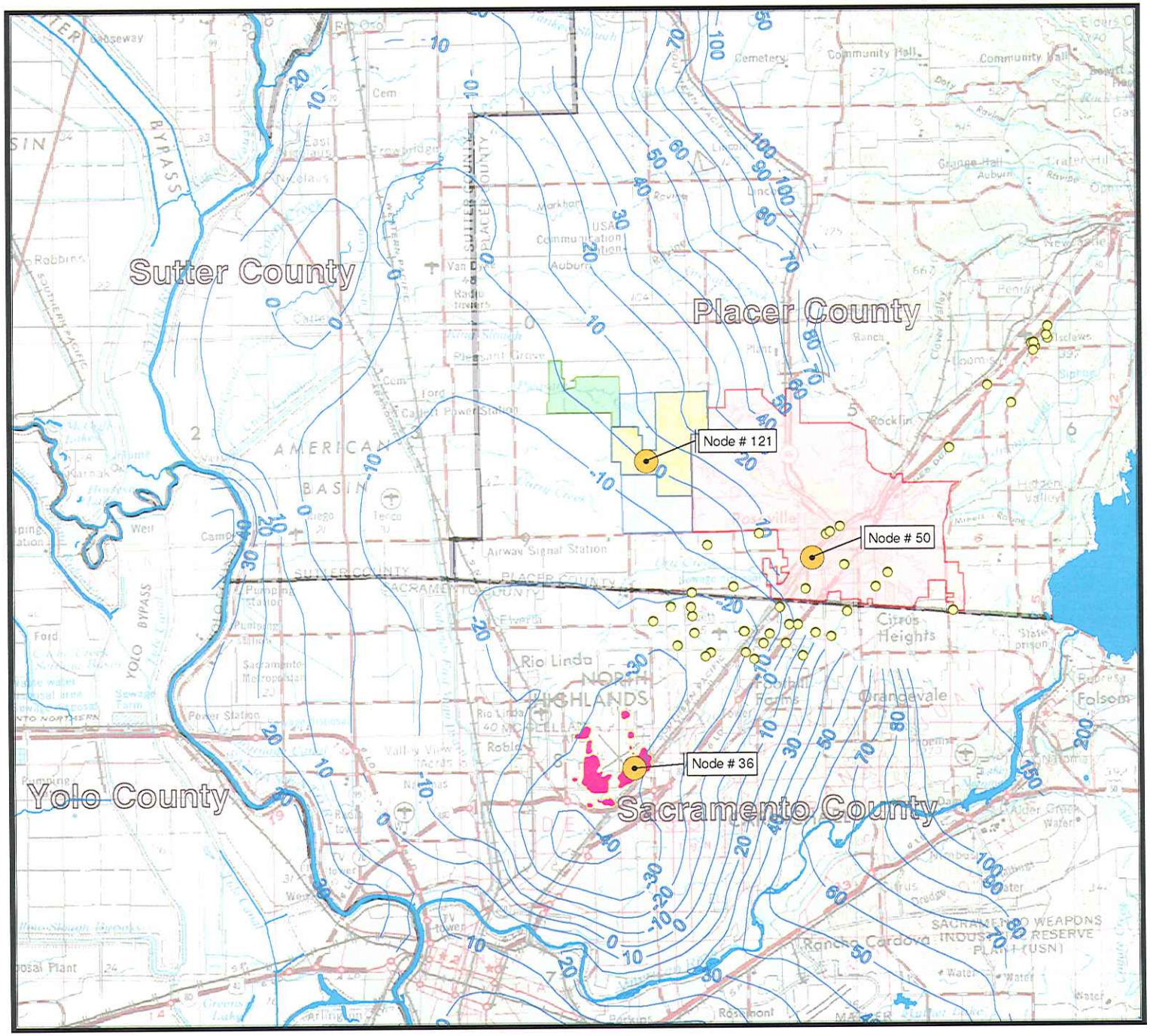

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.15
Project with Mitigation
Aquifer 1 Groundwater Surface Elevation Contours
Wet Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- 20 — Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

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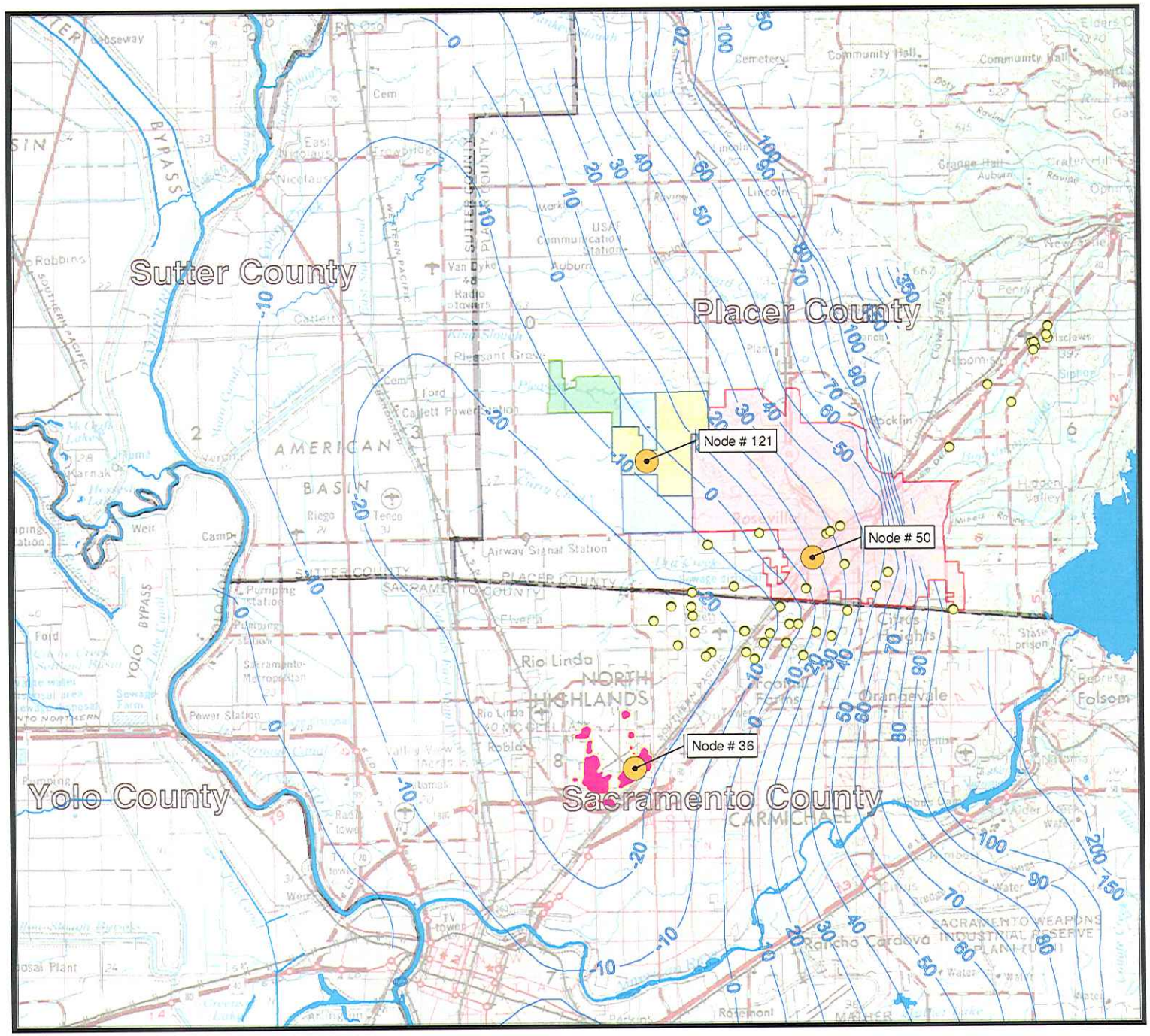

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.16
Project with Mitigation
Aquifer 2 Piezometric Surface Elevation Contours
Wet Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area
- West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

0 1 2 4 Miles

MWH

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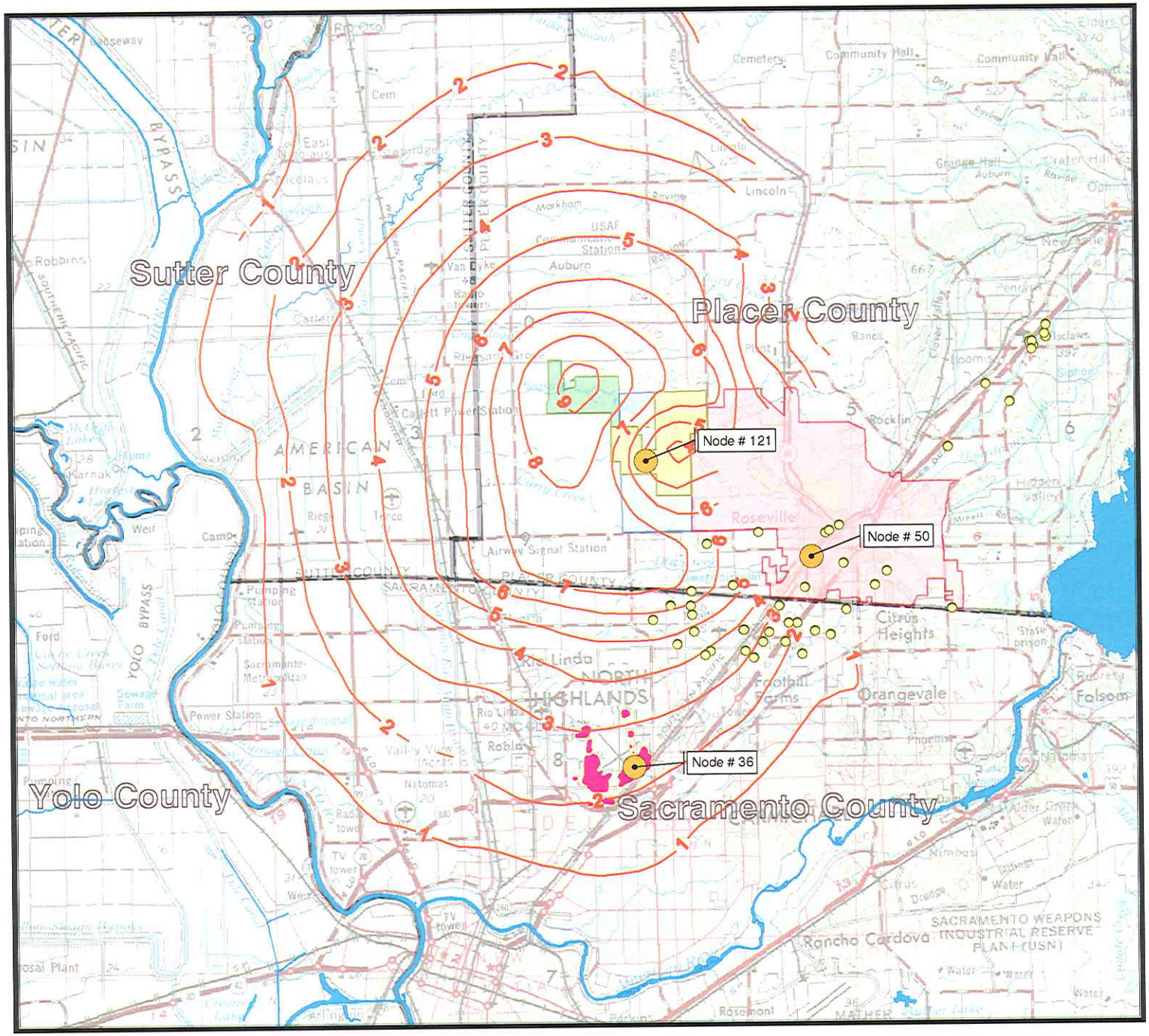

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.17
Project with Mitigation
Aquifer 1 Groundwater Surface Elevation Difference Contours
Dry Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area
- West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

June 2003

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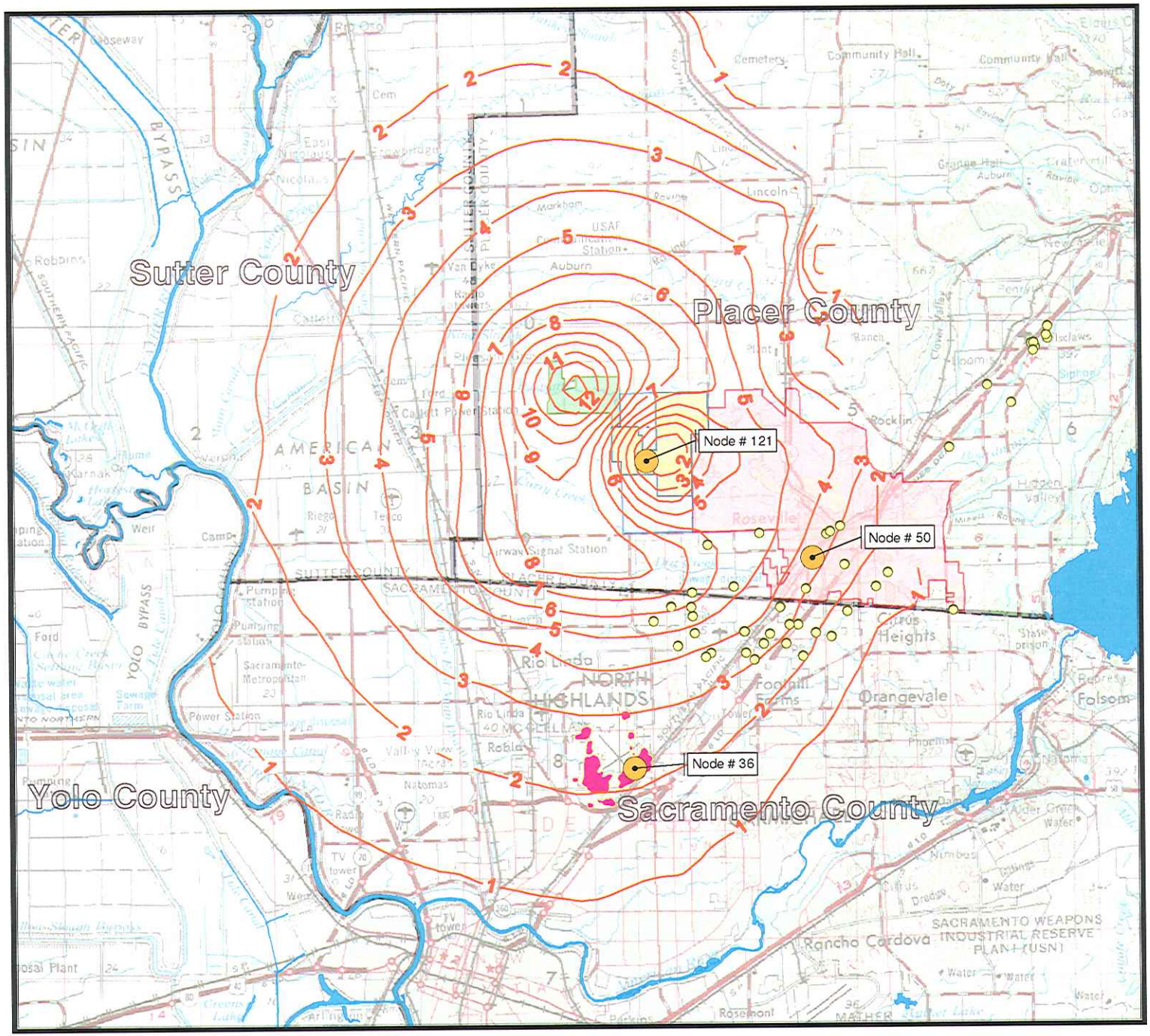

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.18
Project with Mitigation
Aquifer 2 Piezometric Surface Elevation Difference Contours
Dry Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area
- West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

June 2003

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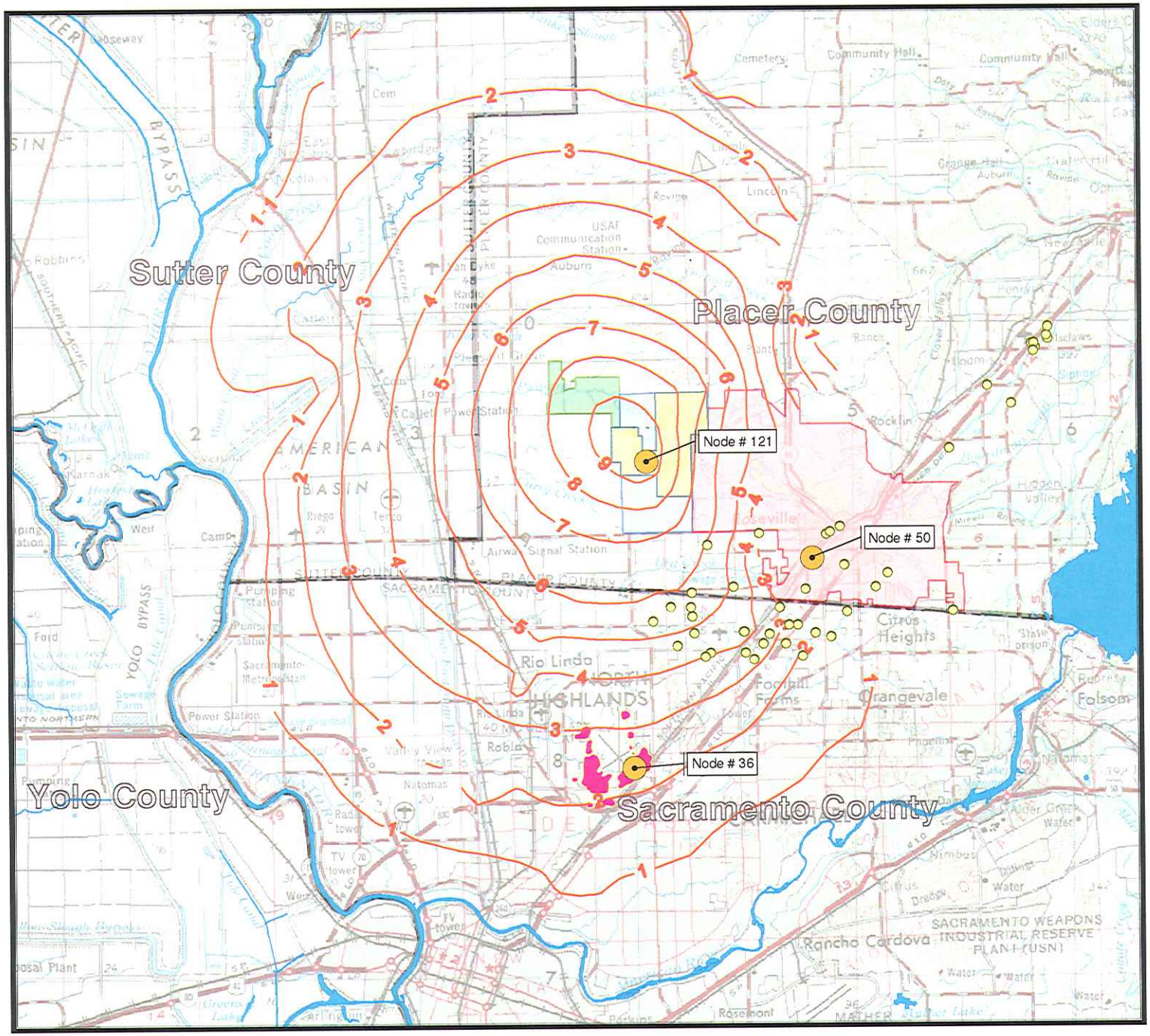

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.19
Project with Mitigation
Aquifer 1 Groundwater Surface Elevation Difference Contours
Wet Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area — West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

0 1 2 4 Miles

MWH

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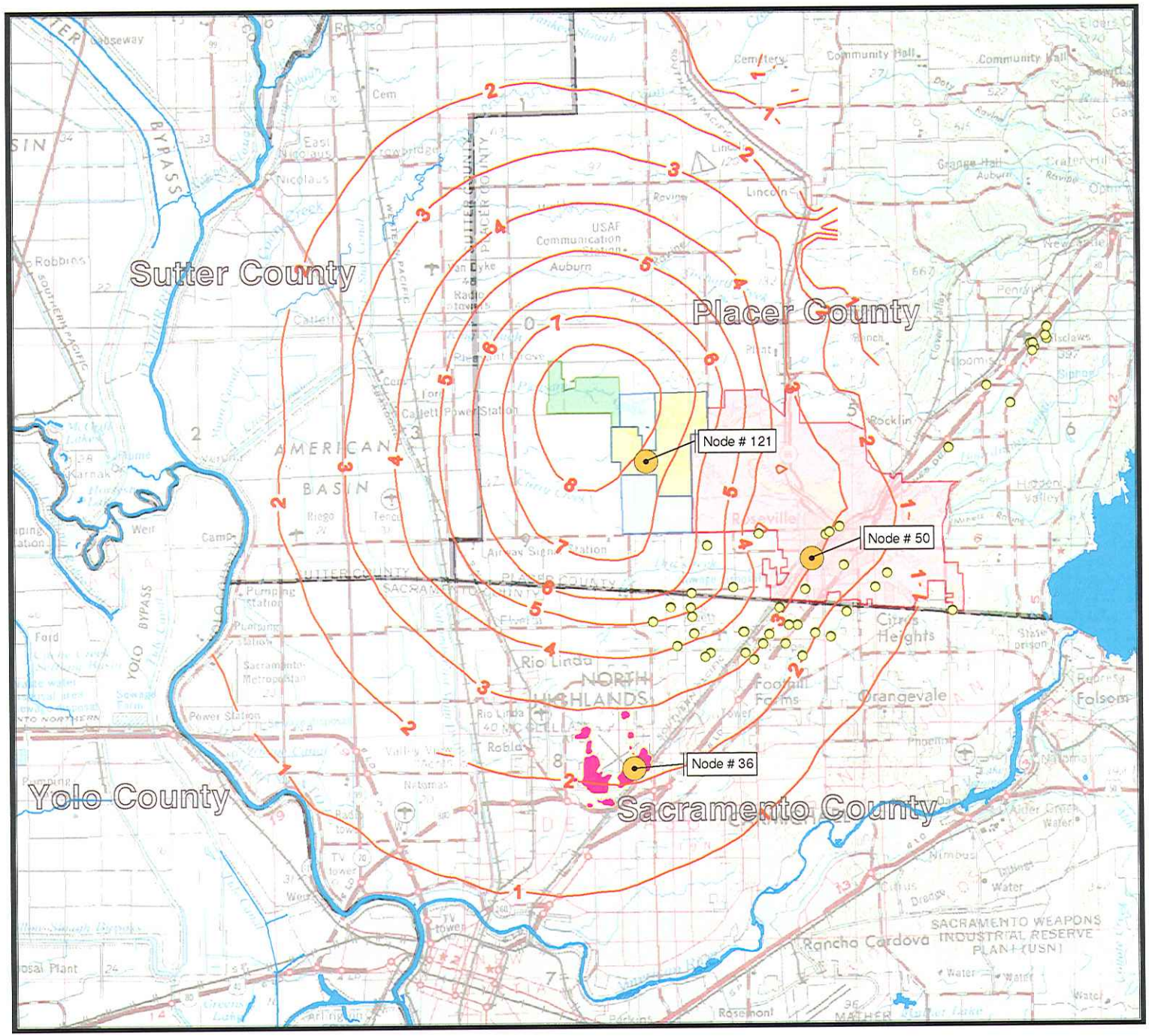

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Water Supply Strategy: Groundwater Impact Analyses

Figure A.20
Project with Mitigation
Aquifer 2 Piezometric Surface Elevation difference Contours
Wet Year

Legend

- Reasons Farm
- City of Roseville
- WRSP Area
- West Roseville Specific Plan Area inside the MOU Area
- Piezometric Surface Elevation Contour in feet above Mean Sea Level
- Location of Groundwater Hydrograph
- Known Contaminant Plumes
- Known Domestic Well

N

0 1 2 4 Miles

MWH

June 2003

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Figure A.21 Groundwater Elevation Hydrograph for Aquifer 1 Underlying the WRSP Area (Node #151)

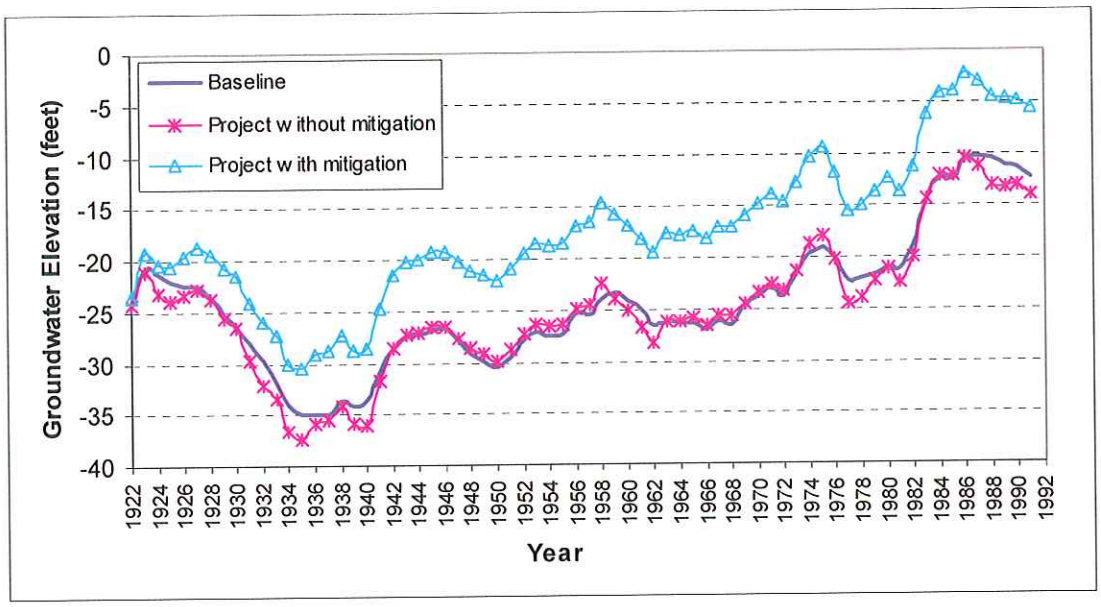


Figure A.22 Groundwater Piezometric Surface Elevation Hydrograph for Aquifer 2 Underlying the WRSP Area

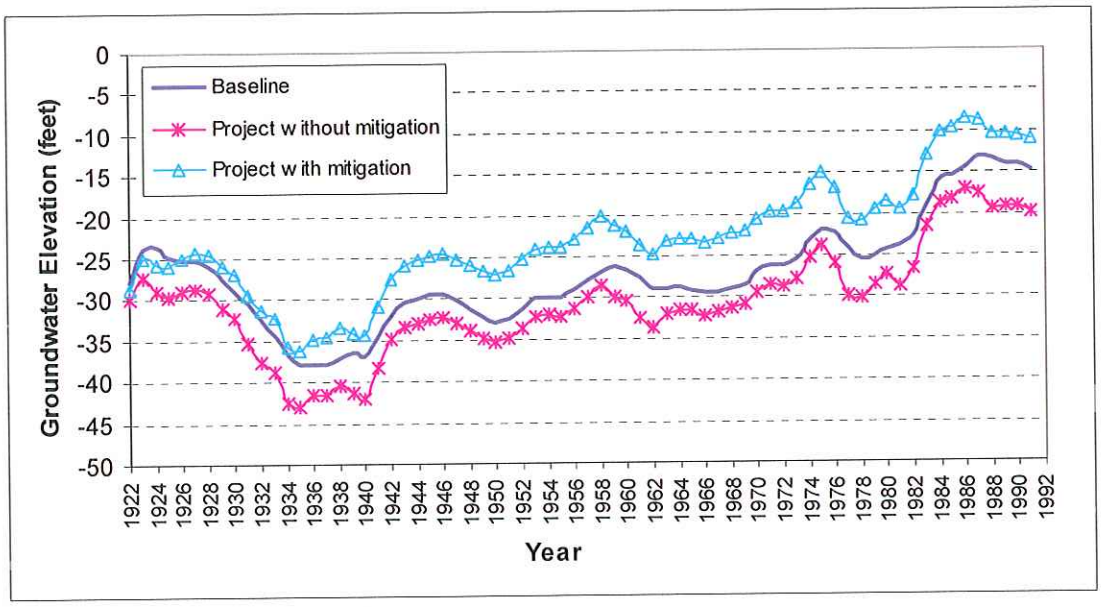


Figure A.23 Groundwater Elevation Difference Relative to "Baseline Condition" for Aquifer 1 Underlying the WRSP Area (Node #151)

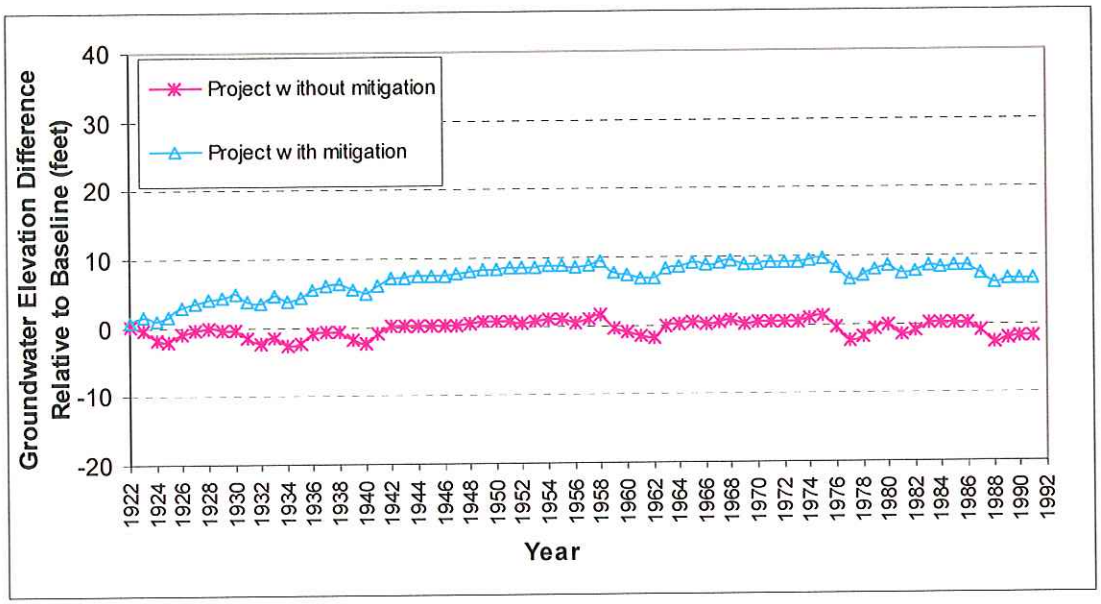


Figure A.24 Groundwater Piezometric Surface Elevation Difference Relative to "Baseline Condition" for Aquifer 2 Underlying the WRSP Area (Node #151)

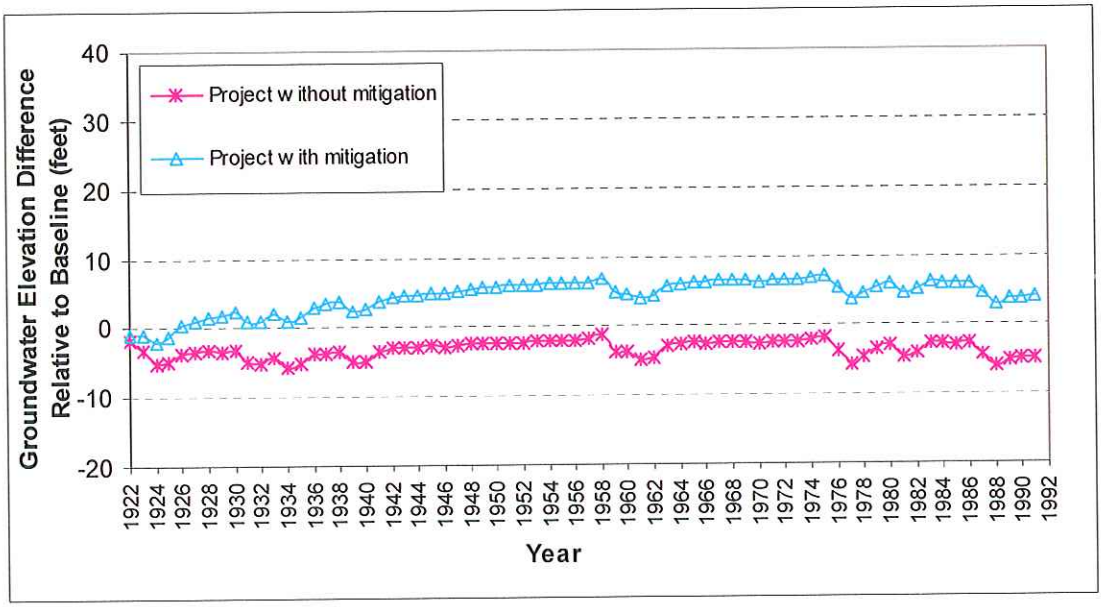


Figure A.25 Groundwater Elevation Hydrograph for Aquifer 1 Underlying South Pacific Roseville Railyard (Node #50)

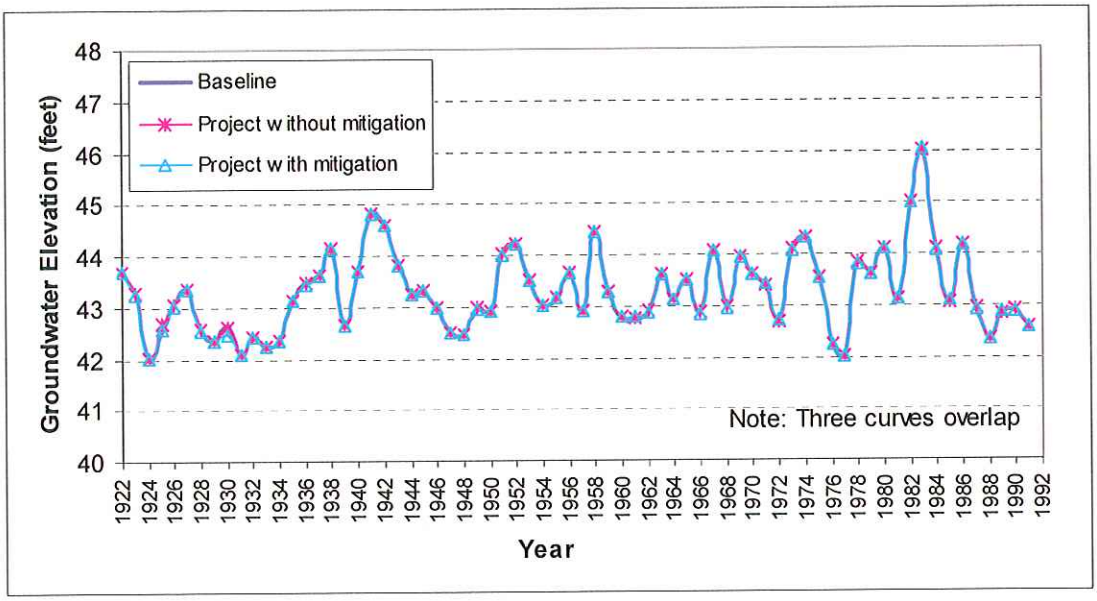


Figure A.26 Groundwater Elevation Hydrograph for Aquifer 2 Underlying South Pacific Roseville Railyard (Node #50)

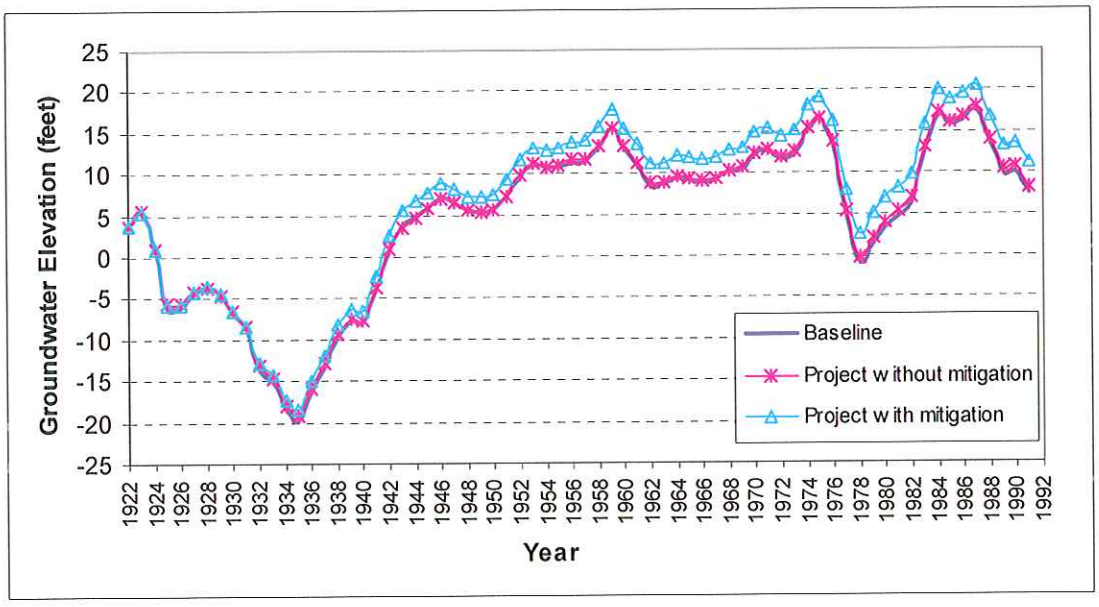


Figure A.27 Groundwater Elevation Difference Relative to "Baseline Condition" for Aquifer 1 Underlying South Pacific Roseville Railyard (Node #50)

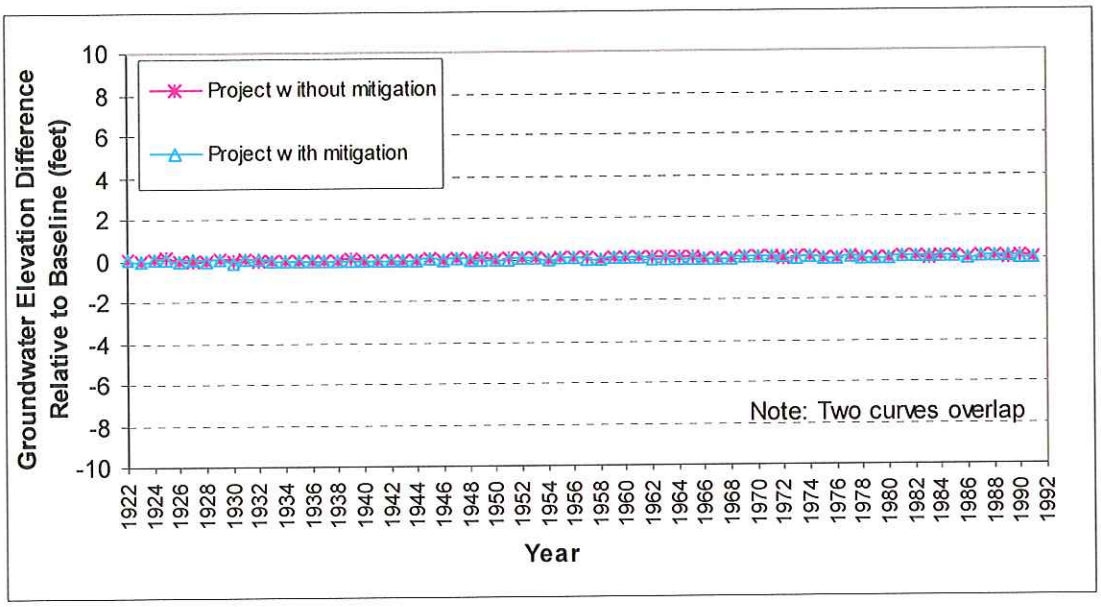


Figure A.28 Groundwater Elevation Difference Relative to "Baseline Condition" for Aquifer 2 Underlying South Pacific Roseville Railyard (Node #50)

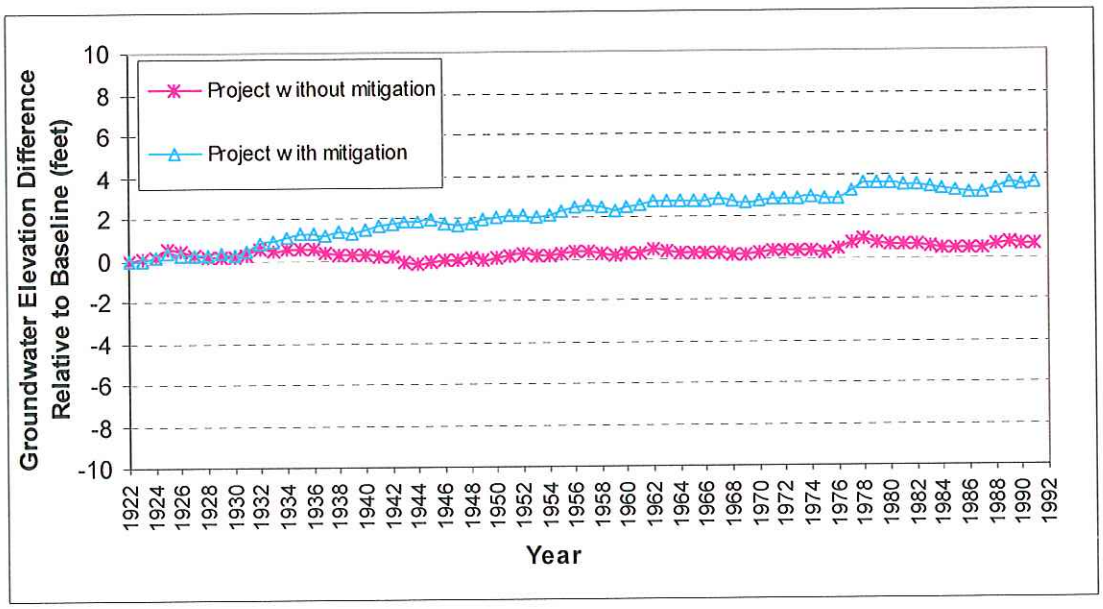


Figure A.29 Groundwater Elevation Hydrograph for Aquifer 1 Underlying McClellan Contaminant Plumes (Node #36)

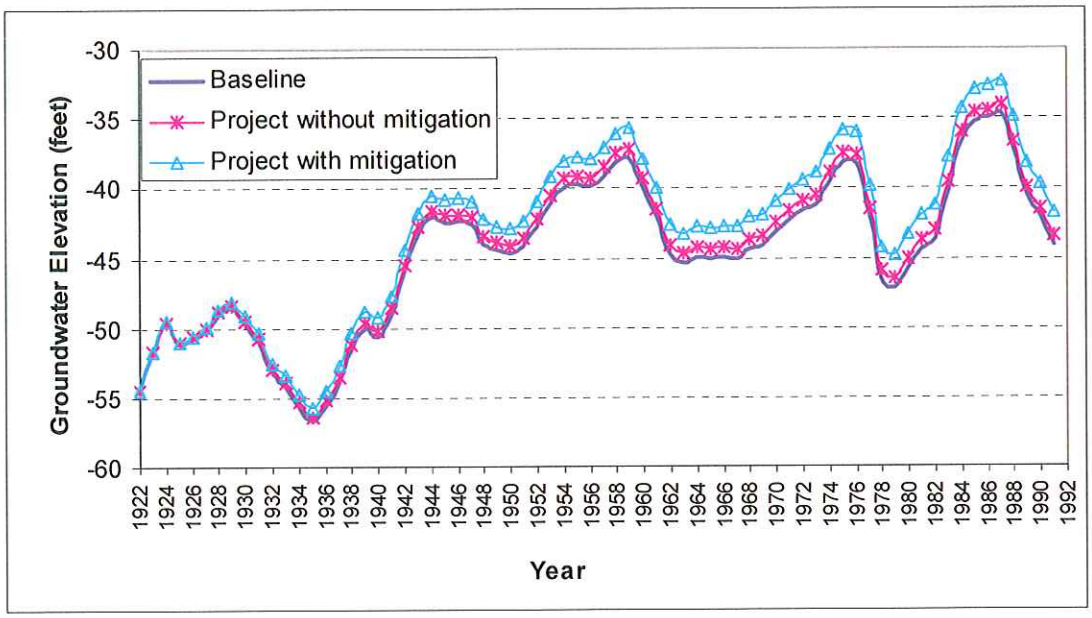


Figure A.30 Groundwater Elevation Hydrograph for Aquifer 2 Underlying McClellan Contaminant Plumes (Node #36)

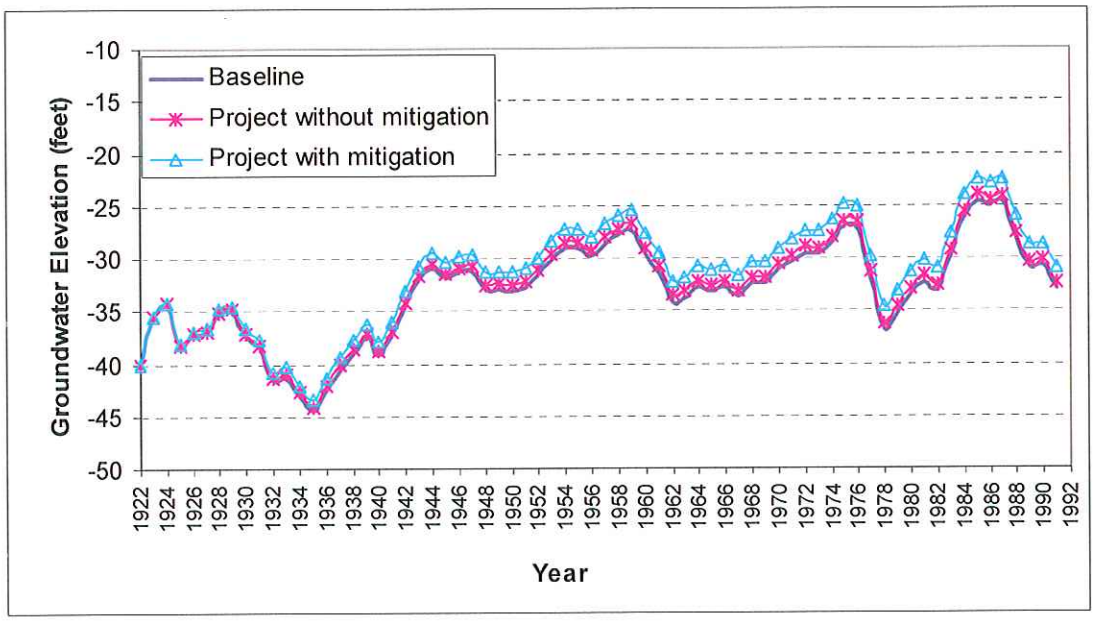


Figure A.31 Groundwater Elevation Difference Relative to "Baseline Condition" for Aquifer 1 Underlying McClellan Contaminant Plumes (Node #36)

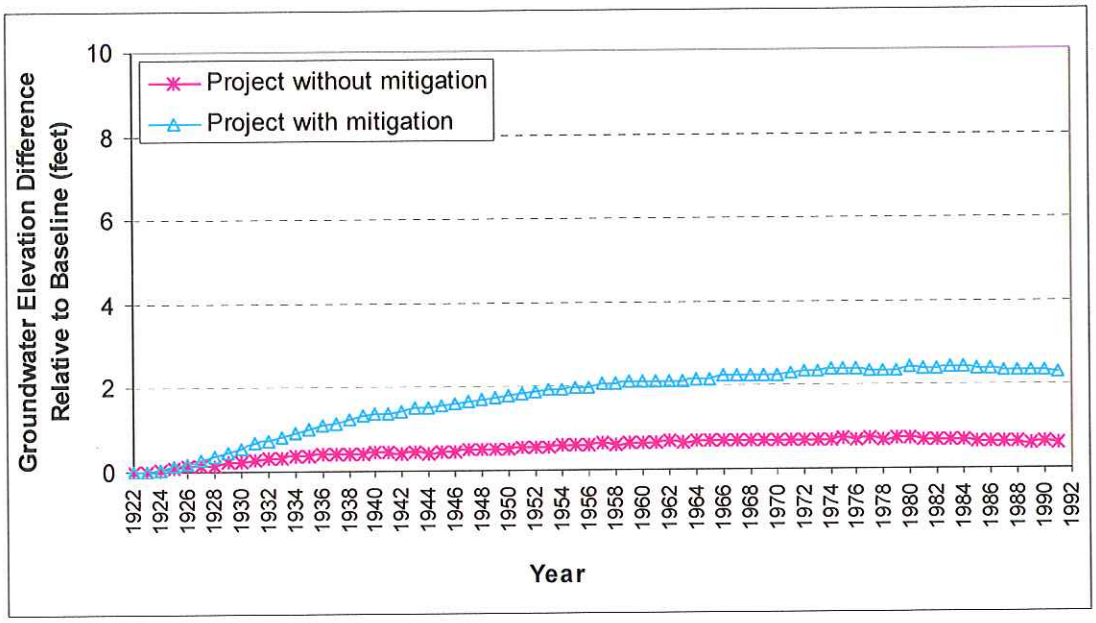
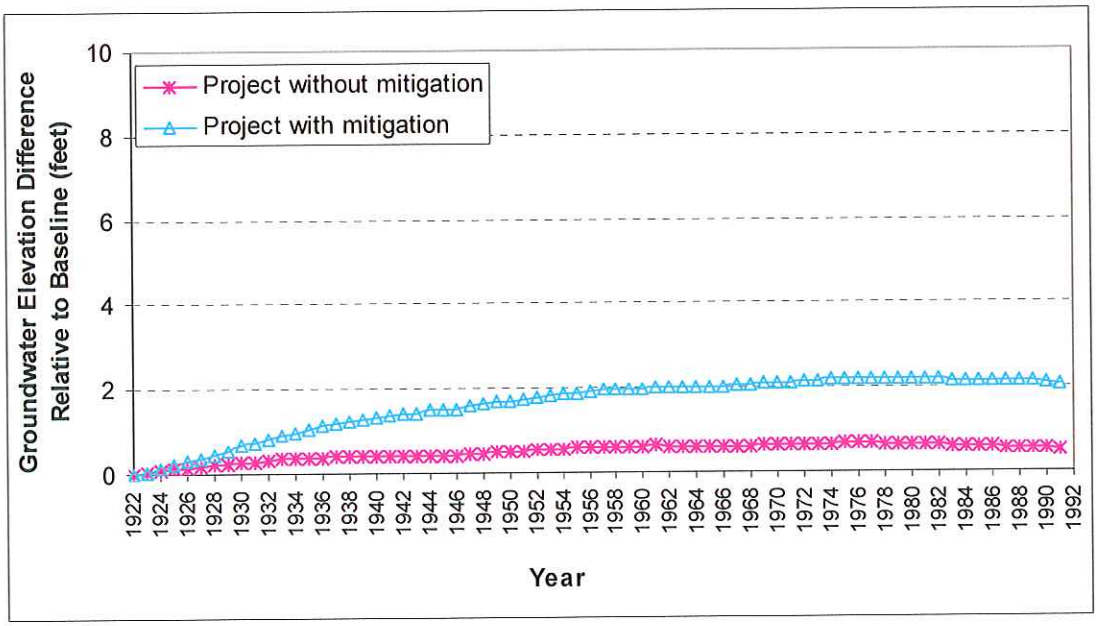


Figure A.32 Groundwater Elevation Difference Relative to "Baseline Condition" for Aquifer 2 Underlying McClellan Contaminant Plumes (Node #36)



APPENDIX B

Description of Integrated Groundwater/Surface Water Model (IGSM)

BACKGROUND

The North American River Integrated Groundwater and Surface Water Model (IGSM) was originally developed through the American River Water Resources Investigation (ARWRI) completed cooperatively between the United States Bureau of Reclamation and the State Department of Water Resources in the mid 1990's. The model was later used in the Sacramento Area Water Forum process in the evaluation of acceptable groundwater yields and conjunctive use alternatives. The model in its current form was further developed by the American River Basin Cooperating Agencies for the Regional Water Master Plan to be used for evaluation of conjunctive use alternatives. The model used for this analysis is referred to as the "Draft Water Forum Solution Model" and includes 2030 levels of water demand for Sutter, Placer, San Joaquin, and Sacramento counties with proposed conjunctive use of surface water and groundwater.

MODEL OVERVIEW

The North American River IGSM is a finite element computer model that provides a comprehensive simulation of all major components of the hydrologic cycle in accordance with mass balance and water budget accounting procedures. The model consists of three models that are linked so that data at the boundary of one model can be transferred to the adjacent model. The three models are the Sutter/Placer Model, the Sacramento County Model, and the San Joaquin Model.

Elements of the hydrologic cycle addressed by the IGSM include precipitation, runoff, groundwater surface recharge, evaporation, consumptive use, groundwater extraction and injection, and subsurface inflow and outflow. The simulation also includes the interaction between surface streams and the regional groundwater aquifer.

The model is data intensive, requiring hydrogeologic, hydrostratigraphic, land use, water use, precipitation, and other hydrologic data. Water and land use budget accounting are performed on a subregion-by-subregion basis (see **Figure B.1** for subregion boundaries within the investigation area). General statistics of the Sutter/Placer County Model include:

- Total model area - 340 square miles
- Average element size - 0.64 square miles, or approximately 410 acres
- Number of model subregions - 13
- Number of model aquifer layers - 3
- Simulation period hydrology - Water years 1922 through 1991

The model boundaries of the North American River IGSM correspond roughly to the Sacramento and San Joaquin Rivers to the West, the Feather and Bear River to the North, and the Stanislaus River to the South. The eastern boundary of the model is the eastern edge of the underlying aquifer where it rises and surfaces in the foothills.

IGSM CONCEPTUAL MODEL

The geology and geohydrology in western Placer County and northern Sacramento County, and in particular portions of the investigation area, are complex. Consequently, the IGSM is based

on a conceptual model of the groundwater basin represented by a three-layer aquifer system. **Figure 3.1** (in the body of this report) illustrates a cross section of the basin as modeled in the IGSM. As illustrated on the figure, important assumptions of the conceptual model include:

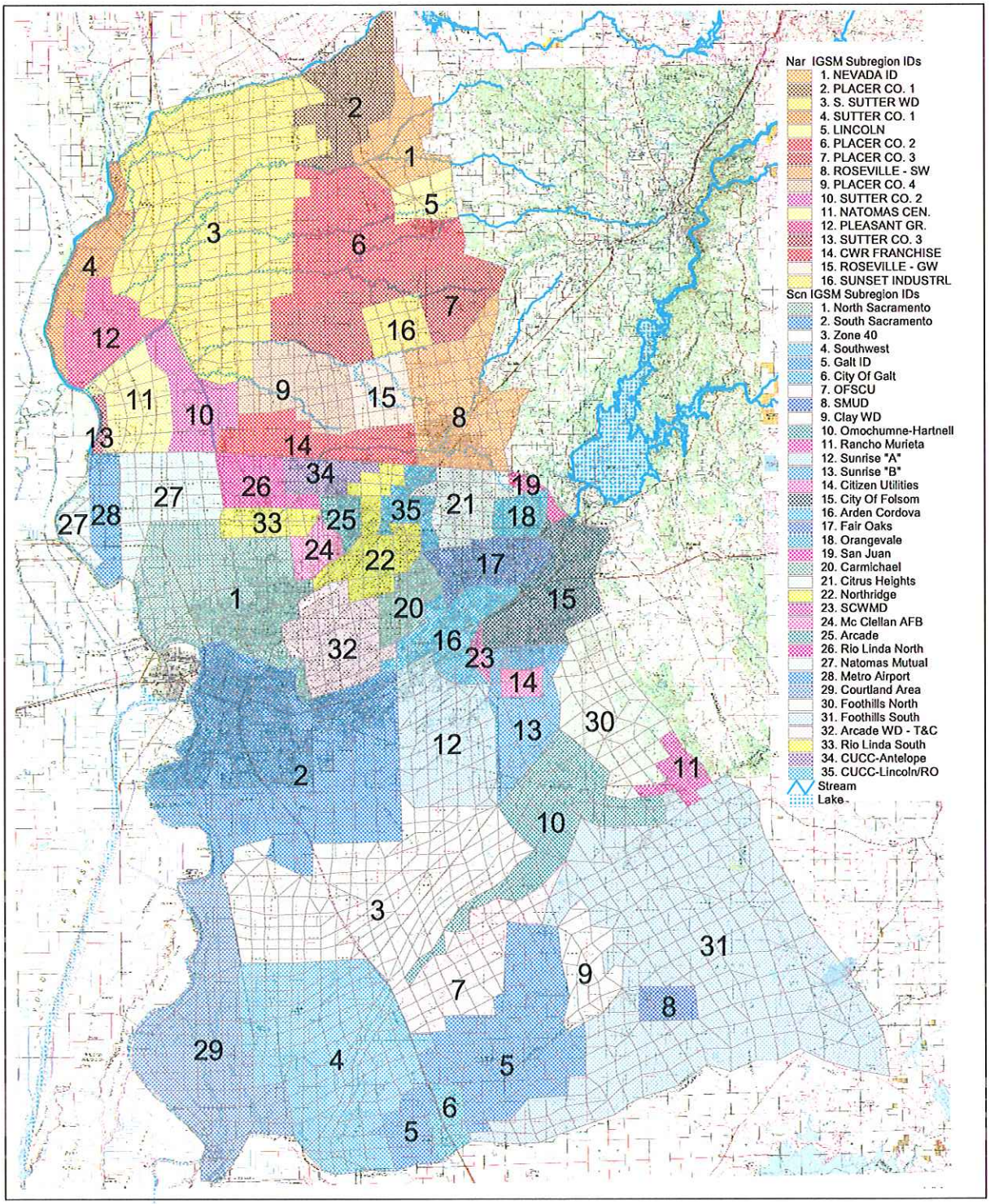
- Aquiclude 1 - A discontinuous semi-confining layer near the ground surface
- Aquifer 1 - Water bearing deposits overlain by Aquiclude 1
- Aquiclude 2 - A discontinuous semi-confining clay layer between Aquifers 1 and 2
- Aquifer 2 - Water bearing deposits between Aquiclude 2 and the base of high quality groundwater with low total dissolved solids (TDS)
- Aquifer 3 - Non-potable groundwater above the base of the usable aquifer with high TDS

The conceptual model is largely based on geologic, hydrologic, and geohydrologic information presented in *Bulletin 118-3* (DWR, July 1974) supplemented by additional local studies.

MODELING PARAMETERS

A set of aquifer parameters was developed for the aquifers and aquicludes of the conceptual model described above. Aquifer parameters (specifically, horizontal hydraulic conductivity within an aquifer and vertical leakance though an aquiclude) were estimated and refined during the IGSM calibration process. Although all pertinent information available was used during calibration, these parameters were sometimes estimated using best judgement.

Figure B.1
Subregion Map



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SACRAMENTO, CALIFORNIA