APPENDIX H

Water Supply Assessment/Water Modeling Study

CITY OF VACAVILLE

THE FARM AT ALAMO CREEK
EIR WATER SUPPLY
AND
WATER MODELING STUDY

DRAFT

OCTOBER 2017

NV5

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CITY OF VACAVILLE
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AND
WATER MODELING STUDY

DRAFT
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This water supply and modeling study is intended to provide a summary of the water modeling tasks completed by NV5, Inc. as they pertain to The Farm at Alamo Creek Specific Plan Development Project (Project) as well as a brief description of water supply and water storage requirements for the Project. Water system modeling and analysis was conducted to assess the impact of the Project on the existing water distribution system for the City of Vacaville (City).

For purposes of this analysis, it is assumed the Farm at Alamo Creek development will be completely developed by 2025.

1.0 WATER SUPPLY SUMMARY

This section contains a description of the existing and planned groundwater, surface water, and water conveyance facilities. The information included herein is referenced from the *SB610 Water Supply Assessment Report for The Farm at Alamo Creek Admin Draft* (WSAR), dated October 2017.

1.1 Description of Existing Facilities

The City's water utility system is a self-supporting City enterprise that was purchased from Pacific Gas and Electric (PG&E) Company in 1959 by issuing voter-approved water revenue bonds. The City water system consists of surface water treatment facilities, wells, pumping facilities, distribution and transmission pipelines, and storage reservoirs. Since purchasing the system, the City has systematically improved and upgraded this infrastructure. The City's Utilities Department is responsible for operation, maintenance, and repair of the City's water treatment and distribution system, as well as water quality and recycled water distribution.

The City receives water from several sources, including Solano Project surface water from Lake Berryessa, State Water Project (SWP) surface water and Settlement Water from the North Bay Aqueduct (NBA), and groundwater from local City wells. Within the City's water entitlements, the percentage of water used from each supply source varies due to conjunctive use. If any one source has limited water availability or poor water quality, use from other sources can increase. Likewise, if unscheduled water becomes available it can be utilized to the City's advantage.

Surface water from Lake Berryessa is provided through contract between the US Bureau of Reclamation and the Solano County Water Agency (SCWA) and is delivered by SID. This water is treated at either the North Bay Regional Water Treatment Plant (NBR Plant) or at the City diatomaceous earth filter water treatment plant (DE Plant). The NBR Plant draws water from the Sacramento River Delta via the NBA, as well as Solano Project water from the Putah South Canal. The DE Plant draws water directly from the Putah South Canal.

Groundwater from most of the existing wells is treated at the wellhead with chlorine to disinfect for pathogens and is then placed directly into the distribution system. Some wells (Well 1, 6, and 13) actively supply water directly to the DE Plant clearwell. From the clearwell, the Treated Water Pump Station pumps the water into the distribution system. In summary, all water is treated to meet Federal and State drinking water standards prior to customer use.

Below is a summary of the various water supply sources as detailed in the 2015 UWMP.

1.2 Groundwater

Currently, groundwater is provided by the City via 10 existing operational wells, 9 of which withdraw water from the deep aquifer in the basal zone of the Tehama Formation. Most City wells are located in the Elmira well field. However, new wells will be more widely distributed, near I-80. Currently, approximately 5,500 ac-ft per year (ac-ft/yr) of groundwater is withdrawn. Vacaville continues to explore well field expansion as a means of maintaining adequate water supply. A regional program is being implemented to monitor groundwater data as a means of ensuring against overdraft or contamination. A discussion of the groundwater basin and historic groundwater pumping follows. Specific future well locations will be determined based on additional field investigations.

Groundwater Basin Descriptions

The City overlies portions of two DWR-designated groundwater basins. Most of the City overlies the northwestern portion of the Solano Sub-basin, which is one of 18 sub-basins in the Sacramento Valley Basin of the Sacramento River Hydrologic Region. A small area of the southern section of the City overlies the Suisun-Fairfield Valley Basin in the San Francisco Bay Hydrologic Region but the City does not own or operate any wells within this area. The western section of the City, west of the Solano Sub-basin boundary, is located in the Sacramento River Hydrologic Study Area but does not overlie any area currently designated by DWR as a groundwater basin or sub-basin. All of the City's existing and proposed municipal wells are located exclusively in the Solano Sub-basin.

The Solano Sub-basin includes the southernmost portion of the Sacramento Valley Basin and extends into the northern portion of the Sacramento-San Joaquin Delta. Sub-basin boundaries are as follows: (1) Putah Creek on the north; (2) Sacramento River on the east (from Sacramento to Walnut Grove); (3) North Mokelumne River on the southeast (from Walnut Grove to San Joaquin River); (4) San Joaquin River on the south (from the North Mokelumne River to Sacramento River); and, (5) boundary between the San Francisco Bay and Sacramento River hydrologic study areas as described in California Department of Water Resource (DWR) Bulletin 118 on the west.

The primary source of groundwater supply for municipal use is the basal zone of the Tehama Formation in the Solano Sub-basin, located east of the English Hills Fault, which is a highly confined aquifer. The Tehama Formation consists of moderately to highly consolidated fluvial, alluvial, and lacustrine deposits. Lithology present within the Tehama Formation includes inter-layered sand, silt, clay, and gravel, a stiff blue lacustrine clay located near the upper portions of the formation, and other continuous clay layers that divide the formation into upper, middle, and basal zones. The basal zone of the formation also includes gravel and cobble deposits, layers of detrital tuff, and calcium carbonate cemented conglomerate. The overlying Quaternary alluvial

deposits and upper and middle zones of the Tehama Formation are not suitable for high production municipal water supply. However, they are used for some domestic and agricultural purposes in unincorporated areas of Vacaville. East of the Vacaville area, these aquifers are utilized by Solano Irrigation District (SID) to supplement surface water supplies and for shallow groundwater pumping for drainage purposes.

Groundwater Management

In September 2014, the California Legislature passed the Sustainable Groundwater Management Act (SGMA). The legislation applies to basins or sub-basins that DWR designates as medium or high priority basins. The Solano Sub-basin was ranked medium priority and the Suisun-Fairfield Valley Basin was ranked as very low priority. SGMA requires that groundwater sustainability agencies (GSAs) are designated by June 30, 2017, and groundwater sustainability plans (GSPs) are adopted by January 31, 2022.

The City cooperates with SCWA (the designated Monitoring Entity for the Solano Sub-basin) by coordinating and reporting water level data for eight active monitoring wells within the City on a semi-annual basis. SCWA oversees a network of monitoring wells that includes seven monitoring wells screened in the Basal Tehama Formation, two monitoring wells in the Upper Tehama Formation, and two monitoring wells in the Quaternary Alluvium/Upper Tehama Formation.

Through managed utilization of both surface water and groundwater resources, including the planned distribution of groundwater pumping in the basal zone of the Tehama Formation, groundwater levels associated with local pumping depressions have been managed and have remained stable relative to "base year" groundwater conditions established in 1992-1993 for the Elmira well field area.

Groundwater monitoring efforts are a critical component of managing water resources in and around the City. Monitoring land subsidence paired with groundwater level measurements lead to a deeper understanding about the water resource and the general conditions of the aquifer underlying the City. Based on information provided in the Groundwater Supply Sufficiency Technical Memorandum (May 2016), there is land subsidence occurring in and around Solano County, though at relatively low rates (between 0.00195 to 0.03238 ft/yr, or 0.594 to 9.869 millimeters (mm)/yr) over about the last eleven years. The locations selected for new wells will be critical to minimize groundwater level declines, particularly to ensure groundwater levels remain at elevations above historical levels to avoid potential for further land subsidence.

The Solano Sub-basin was not listed as in a "critical condition of overdraft" in the *1980 Bulletin 118: Groundwater Conditions in California*. Based on information provided in the Groundwater Supply Sufficiency and Groundwater Management Plan, the sub-basin is not projected to become overdrafted as long as the current management conditions continue.

Historic Groundwater Pumping

The City is the primary groundwater user within the Vacaville area. Unmeasured agricultural and domestic groundwater extractions in unincorporated areas of the Vacaville area, Rural North Vacaville Water District (RNVWD) production wells, and SID are the other groundwater users. Since 1968, the City's annual groundwater pumping has varied from a low of 2,862 ac-ft in year 1968 to a high of 8,165 ac-ft in year 1983. Annual groundwater production, including all wells, is summarized in Table 1 from year 1968 to year 2015.

TABLE 1
CITY OF VACAVILLE
HISTORICAL GROUNDWATER PUMPING

Year	ac-ft/yr	Year	ac-ft/yr	Year	ac-ft/yr
1968	2,862	1985	5,853	2002	6,638
1969	3,046	1986	5,824	2003	6,628
1970	2,871	1987	6,236	2004	6,562
1971	3,198	1988	5,421	2005	6,680
1972	3,255	1989	6,072	2006	6,635
1973	3,125	1990	5,625	2007	6,612
1974	3,316	1991	5,447	2008	5,784
1975	3,970	1992	5,531	2009	4,647
1976	4,965	1993	4,395	2010	5,054
1977	5,093	1994	3,893	2011	5,049
1978	5,707	1995	3,885	2012	5,142
1979	6,185	1996	3,230	2013	5,236
1980	6,990	1997	3,386	2014	5,345
1981	7,740	1998	3,905	2015	5,222
1982	7,683	1999	4,096		
1983	8,165	2000	5,070		
1984	6,089	2001	6,214		

Source: Table 6-H from 2015 UWMP.

The majority of groundwater production in the past was obtained from wells located at the Elmira Road well field. The newer northeast sector well field located near I-80 also contributes to the groundwater production. In the future, groundwater pumping will be more widely distributed in the study area rather than concentrated in the Elmira Road well field.

1.3 Surface Water

The City has three separate sources for surface water. Each source has a different level of reliability. This section describes the City's surface water sources.

Solano Project (Vacaville Supply, SID Agreement)

The Solano Project was constructed by the Bureau of Reclamation in 1958. The water rights permits for the Solano Project are held by the Bureau of Reclamation in trust for the Solano water users. The water rights permits further state that when the permits are converted to a license, the license will be issued in the name of Solano water users. Unlike most federal water projects, the water rights to the Solano Project "belong" to the Solano water users. The main feature of the Solano Project is Monticello Dam, which provides for storage of 1.6 million ac-ft of water in Lake Berryessa. Water from the Lake Berryessa is diverted through the Putah Diversion Dam to the 33-mile Putah South Canal, which transports water to the eight SCWA-member unit contractors for Solano Project water.

SCWA has entered into agreements with cities, districts, and state agencies to provide water from the Solano Project. The Solano Project contracting agencies are: Fairfield, Suisun City, Vacaville, Vallejo, SID, Maine Prairie Water District, University of California at Davis, and California State Prison - Solano. Table 2 summarizes the annual entitlement to each agency.

TABLE 2
SUMMARY OF SOLANO PROJECT
WATER CONTRACTS

Agency	Annual Entitlement (ac-ft/yr)
Fairfield	9,200
Suisun City	1,600
Vacaville	5,750
Vallejo	14,600
SID	141,000
Maine Prairie Water District	15,000
UC Davis	4,000
California State Prison – Solano	1,200
Project Operating Loss (average estimated)	15,000
Total	**207,350**[a]

Source: Table 6-A from 2015 UWMP.

[a] Value approximates a firm yield during the driest hydrologic period on record (1916-1934).

The contracts with the public entities that use Solano Project water provide for the sale and distribution of water made available by the Bureau of Reclamation each year. The Bureau of Reclamation is contractually committed to delivering the full contract amount of water supply from the Solano Project unless the water supply does not physically exist (e.g., an empty reservoir). All Solano Project water contractors, whether they are municipal or agricultural, are impacted by water supply reductions on an equal basis.

In addition to its entitlement from SCWA, Vacaville entered into a 1995 Master Water Agreement (1995 Agreement) with SID. A second amendment to the 1995 Agreement, adopted in June 2010, updated the water purchase schedule. Pursuant to the second amendment,

Vacaville receives an increasing supply from SID through the year 2040 and a consistent supply thereafter until the year 2050. The second amendment allows Vacaville to request additional water if needed to support growth. The agreement provides for changes in the delivery schedule, making the maximum entitlement of 10,050 ac-ft/yr available earlier than the year 2040 if desired by the City. The annual water schedule for SID water available to the City is contained in Table 3.

TABLE 3
ANNUAL WATER SCHEDULE FOR THE
SID 1995 AGREEMENT

Year	Annual Entitlement (ac-ft/yr)	Year	Annual Entitlement (ac-ft/yr)
2010	2,500	2026	5,925
2011	2,625	2027	6,225
2012	2,750	2028	6,525
2013	2,875	2029	6,825
2014	3,000	2030	7,125
2015	3,125	2031	7,425
2016	3,325	2032	7,725
2017	3,525	2033	8,025
2018	3,725	2034	8,325
2019	3,925	2035	8,625
2020	4,125	2036	8,925
2021	4,425	2037	9,225
2022	4,725	2038	9,525
2023	5,025	2039	9,825
2024	5,325	2040 through 2050	10,050
2025	5,625		

Source: Table 6-B from UWMP.

State Water Project (North Bay Aqueduct)

Vacaville receives water allocations from the State Water Project through the SCWA (termed Table A water) that currently expires in 2035, but is renewable, and water from a Year 2001 purchase agreement from Kern County Water Agency (KCWA). Surface water received pursuant to these agreements is delivered through the NBA, a State Water Project facility. The City supply from the State Water Project is 6,100 ac-ft/yr, while KCWA Agreement water totals 2,878 ac-ft/yr. The Solano County branch of the NBA was completed in 1988. The NBA is 28 miles long starting from Barker Slough in the Delta and ending in Napa County. The DWR is the owner and operator of the NBA.

The water supply for the NBA is less reliable than the Solano Project. Supply from the NBA comes from the State Water Project which provides water to a total of 29 contractors. A list of these contractors and their respective allocations is shown in Table 4. Because the NBA is part of the entire State Water Project, any shortages occurring in the State Water Project impact the NBA.

TABLE 4
STATE WATER PROJECT
2016 WATER ALLOCATIONS

Agency	Maximum Allocations (ac-ft/yr)
Upper Feather River Area	
City of Yuba City	9,600
County of Butte	27,500
Plumas County Flood Control and Water Conservation District	2,700
Subtotal	**39,800**
North Bay Area	
Napa County Flood Control and Water Conservation District	29,025
Solano County Water Agency[a]	47,756
Subtotal	**76,781**
South Bay Area	
Alameda County Flood Control and Water Conservation District	80,619
Alameda County Water District	42,000
Santa Clara Valley Water District	100,000
Subtotal	**222,619**
San Joaquin Valley Area	
County of Kings	9,305
Dudley Ridge Water District	45,350
Empire West Side Irrigation District	3,000
Kern County Water Agency	982,730
Oak Flat Water District	5,700
Tulare Lake Basin Water Storage District	87,471
Subtotal	**1,133,556**
Central Coastal Area	
San Luis Obispo County Flood Control and Water Conservation District	25,000
Santa Barbara County Flood Control and Water Conservation District	45,486
Subtotal	**70,486**

Continued on Next Page

TABLE 4 (continued)
STATE WATER PROJECT 2016 WATER ALLOCATIONS (AC-FT/YR)

Agency	Maximum Allocations (ac-ft/yr)
Southern California Area	
Antelope Valley-East Kern Water Agency	144,844
Castaic Lake Water Agency	95,200
Coachella Valley Water District	138,350
Crestline-Lake Arrowhead Water Agency	5,800
Desert Water Agency	55,750
Littlerock Creek Irrigation District	2,300
Metropolitan Water District of Southern California	1,911,500
Mojave Water Agency	85,800
Palmdale Water District	21,300
San Bernardino Valley Municipal Water District	102,600
San Gabriel Valley Municipal Water District	28,800
San Gorgonio Pass Water Agency	17,300
Ventura County Flood Control District	20,000
Subtotal	**2,629,544**
Total	**4,172,786**

Source: Table 6-C from 2015 UWMP.
[a] Vacaville entitlement of 8,978 ac-ft/yr within SCWA allocation.

Within Solano County there are currently seven agencies with NBA water allocations. These include Benicia, Dixon, Fairfield, Rio Vista, Suisun City, Vacaville, and Vallejo. Table 5 summarizes the annual increase in SCWA's contract. Member units using the NBA and their allocations are described in Table 6. Shortages during dry years are proportional to their share of the overall contract with DWR.

Settlement Water (DWR Agreement)

Settlement Water consists of surface water from the Sacramento River and Sacramento-San Joaquin Delta Estuary. The settlement of an Area of Origin litigation case resulted in an annual allocation up to 9,320 ac-ft/yr to the City through the SWP facilities, although it is not considered SWP water. The water is made available by DWR in settlement of area-of-origin water right applications by the cities of Fairfield, Benicia, and Vacaville. The City currently uses only 25 to 30 percent of the Settlement Water, and experiences water quality and delivery challenges. The City is working with SCWA to construct a new intake on the Sacramento River to resolve these challenges. Table 7 is a summary of the Settlement Water for the cities of Fairfield, Benicia, and Vacaville and is detailed in Area of Origin Settlement Solano County Water Agency Contract Amendment No. 20 to the Water Supply Contract between DWR and SCWA on December 31, 2013.

TABLE 5
SUMMARY OF STATE WATER PROJECT ALLOCATIONS
TO THE SOLANO COUNTY WATER AGENCY
THROUGH THE NORTH BAY AQUEDUCT

Year	Annual Allocations (ac-ft/yr)	Year	Annual Allocations (ac-ft/yr)
2001	45,836	2009	47,456
2002	46,296	2010	47,506
2003	46,756	2011	47,556
2004	47,206	2012	47,606
2005	47,256	2013	47,656
2006	47,306	2014	47,706
2007	47,356	2015	47,756
2008	47,406	2016[a]	47,756

Source: Table 6-D from 2015 UWMP.

a Each year thereafter will have an annual allocation of 47,756 ac-ft/yr.

TABLE 6
STATE WATER PROJECT
ALLOCATION TO SOLANO COUNTY CITIES SERVED
BY THE NORTH BAY AQUEDUCT IN YEAR 2040

City	Annual Allocations (ac-ft/yr)
Benicia	17,200
Dixon	0[a]
Fairfield	14,678
Rio Vista	0[a]
Suisun City	1,300
Vacaville	8,978[b]
Vallejo	5,600
Total	**47,756**

Source: Table 6-E from 2015 UWMP.

[a] Dixon and Rio Vista currently do not use their individual allocation of 1,500 ac-ft/yr. If Dixon and/or Rio Vista decide to use the NBA water supply, supplies to Benicia, Fairfield and Vallejo are reduced commensurately.

[b] Vacaville allocations from State Water Project (including KCWA Agreement).

TABLE 7
SUMMARY OF SETTLEMENT WATER FOR THE CITIES OF FAIRFIELD, BENICIA, AND VACAVILLE

Agency	Annual Allocations (ac-ft/yr)
Fairfield	11,800
Benicia	10,500
Vacaville	9,320
Total	**31,620**

Source: Table 6-G from 2015 UWMP.

1.4 Recycled Water

Reclaimed or recycled water is an important and viable resource for urban irrigation and other potential uses. Use of reclaimed water where appropriate may help further reduce demand for domestic water supply.

Tertiary Treated Recycled Water from Easterly
The City owns and operates the Easterly Wastewater Treatment Plant (Easterly) located two miles east of Leisure Town Road in the town of Elmira. Treated effluent from Easterly discharges into Old Alamo Creek, thence to New Alamo Creek, thence to Cache Slough, and into the Sacramento-San Joaquin River Delta.

Easterly's treatment process consists of headworks, primary sedimentation basins, activated sludge aeration basins, secondary clarifiers, tertiary filtration, chlorination contact basins, and dechlorination facilities. The aeration basins provide nitrification and denitrification in addition to biological secondary treatment. The City's National Pollutant Discharge Elimination System (NPDES) wastewater permit for Easterly requires tertiary treatment seasonally, from May 1 to October 31. Deep bed sand and anthracite filters provide tertiary filtration treatment in compliance with California Code of Regulations, Title 22. Easterly is rated for an average dry weather flow capacity of 15 million gallons per day (mgd) and a peak wet weather flow capacity of 55 mgd.

The City is initiating a Recycled Water Master Plan that will consist of three major elements, a Recycle Water Feasibility Study ("Feasibility Study"), a supporting programmatic environmental document or EIR ("Program EIR"), and Recycled Water Implementation and Financing Plan ("Implementation and Financing Plan"). The Feasibility Study shall identify potential alternative beneficial uses of recycled water from Easterly. The Program EIR will evaluate the potential alternative beneficial uses identified in the Feasibility Study to identify potential environmental impacts. The Recycled Water Implementation and Financing Plan will develop a recommended integrated recycled water program that maximizes the benefits of the City's recycled water resource.

1.5 Future Water Projects

On January 12, 2016, the Vacaville City Council adopted a series of water service rate increases that are designed to generate an annual increase in revenues over the next five years. Through the combination of increased water rates, capital replacement funds, water connection fees (impact fees), direct developer construction, and various long-term financing options, the City has the ability to raise funding and implement the construction of the needed water production, treatment, and transmission facilities currently defined in the Capital Improvements Plan (CIP) and Water Master Plan.

Implementation of the CIP and Water Master Plan will provide needed upgrades to the existing water system and facilities and continue to provide an adequate water supply for the currently planned new developments within the City's sphere of influence.

1.6 Summary of Existing and Planned Water Supply

The total water supply rights or safe yield to the City in 2015 from groundwater, surface water, and recycled water was 34,173 ac-ft/yr. Table 8 is a summary of the 2015 and projected Year 2020 to 2040 water supply rights or safe yields for the City from the various existing sources as discussed in previous sections.

TABLE 8
CITY OF VACAVILLE
PROJECTED TOTAL WATER SUPPLY YEAR 2015 TO YEAR 2040

Source of Supply	Year 2015 (ac-ft/yr)	Year 2020 (ac-ft/yr)	Year 2025 (ac-ft/yr)	Year 2030 (ac-ft/yr)	Year 2035 (ac-ft/yr)	Year 2040 (ac-ft/yr)
Solano Project						
Vacaville Entitlement [a]	5,750	5,750	5,750	5,750	5,750	5,750
SID 1995 Agreement [b]	3,125	4,125	5,625	7,125	8,625	10,050
State Water Project						
Vacaville Table A	6,100	6,100	6,100	6,100	6,100	6,100
KCWA Agreement	2,878	2,878	2,878	2,878	2,878	2,878
Settlement Water [c]	9,320	9,320	9,320	9,320	9,320	9,320
Groundwater Pumping [d]	7,000	7,000	7,300	7,700	8,100	8,100
Recycled Water [e]	0	0	0	0	0	0
Total	**34,173**	**35,173**	**36,973**	**38,873**	**40,773**	**42,198**

[a] See Table 2
[b] See Table 3
[c] See Table 7
[d] Per maximum groundwater pumping.
[e] Recycled water not considered a viable water supply source

Each water supply source has a different availability under normal, single dry, and multiple dry years. Table 9 is a summary of the projected available total water supply from 2020 to 240.

TABLE 9
CITY OF VACAVILLE
PROJECTED AVAILABLE TOTAL WATER SUPPLY YEAR 2020 TO YEAR 2040

Year	Normal Year	Single Dry Year	Multiple Dry Year
2020	26,092	19,973	19,999
2025	27,877	21,863	21,754
2030	29,762	23,753	23,509
2035	31,647	25,763	25,384
2040	33,058	27,159	26,652

Source: Table 26 from The Farm at Alamo Creek WSAR

2.0 WATER DEMAND SUMMARY

Presented in this section are land use summaries and projected water demands for the proposed Farm at Alamo Creek project. The water demand factors that serve as the basis for the demand projections are also described below.

2.1 Year 2015 Baseline Water Demand

The Year 2015 baseline City water demand is estimated using the 164 gallons per capita per day (gpcd) target for Year 2020 and the 2015 adjusted population of 89,267 for a total demand of 16,465 ac-ft/yr or 14.7 million gallons per day (mgd). The City's existing (2016) water demand was recently estimated and included in the *2016 Water System Master Plan, Revised Final Draft* (2016 Water Master Plan), dated August 2017, as 16,300 ac-ft/yr (14.55 mgd). The 2016 water demand estimate is based on existing land use quantities and demand factors. The City Base Year (2015) demand (16,465 ac-ft/yr) is conservatively within estimate based on land use quantities.

2.2 Water Demand Factors

The City currently uses two sets of water demand factors (existing and growth) for planning and analysis of water supply and distribution systems. The existing demand factors are used to calculate the total existing water demand and the growth factors are applied to land use quantities designated in the City's land use database for development. Table 10 is a summary of the current water demand factors. These factors are from the of the 2016 Water Master Plan. The difference between the two sets of demand factors (existing versus growth) includes a contingency to reflect uncertainties in projecting future land use. It also includes increases in the water demand for new development versus existing within a given land use category.

TABLE 10
SUMMARY OF CURRENT WATER DEMAND FACTORS USED BY CITY OF VACAVILLE FOR MASTER PLANNING PURPOSES

Land Use Description	Land Use Designation	Unit	Water Demand Factors, GPD/unit			
			Existing		Growth	
			Potable	Irrigation	Potable	Irrigation
Residential						
Residential Estates	RE	du	545	0	600	0
Residential High Density	RHD	du	210	0	230	0
Residential Urban High Density	RUHD	du	170	0	185	0
Residential Low Density	RLD	du	305	0	335	0
Residential Low Medium Density	RLMD	du	270	0	295	0
Residential Medium Density[a]	RMD	du	240	0	265	0
Residential Rural	RR	du	680	0	750	0
Retired Single Family Residential	Ret SF	du	240	0	265	0
Retired Multiple Family Residential	Ret MF	du	240	0	265	0
Manufactured Homes	MH	du	210	0	230	0
Mixed Use - units	MX	du	0	0	0	0
Non-Residential						
Commercial Highway	CH	ac	3,800	360	4,180	430
Commercial Office[a]	CO	ac	800	400	880	480
Medical Office	MO	ac	800	400	880	480
Commercial Service	CS	ac	1,120	320	1,230	385
Downtown	D	ac	3,120	80	3,430	95
Mixed Use - Area	MX	ac	800	320	880	385
Retail Service	RS	ac	800	320	880	385
Church	CH	ac	1,200	320	1,320	385
Hospital	HOS	ac	3,120	320	3,430	385
Industrial	IND	ac	960	320	1,055	385
Elementary School - Area	ESC	ac	0	720	0	865
Elementary School - Students	ESC	stu	20	0	20	0
High School - Area	HSC	ac	0	720	0	865
High School - Students	HSC	stu	30	0	35	0
College - Area	COL	ac	0	720	0	865
Public Park	PK	ac	0	1,040	0	1,250
Private Recreation	PR	ac	80	1,200	90	1,440
Public Low[a]	PL	ac	0	0	0	0
Public Medium	PM	ac	800	320	880	385
Public High	PH	ac	800	320	880	385
Public Open Space	OS	ac	0	0	0	0
Miscellaneous	MISC	ac	0	0	0	0
Landscape Buffer	BUFF	ac	0	0	0	0
Agriculture	AG	ac	0	0	0	0
Hillside Agriculture	HIAG	ac	0	0	0	0

2.3 Projected Water Demands for The Farm at Alamo Creek

The Farm at Alamo Creek Specific Plan included the proposed land uses and corresponding dwelling units or acreage by neighborhood for the Project. In addition to residential units of various densities, public parks, and neighborhood commercial, public/institutional, agricultural buffer, and public open space land uses are planned for the Farm at Alamo Creek project. This study assumes the Farm at Alamo Creek development project will be constructed by 2025.

The Project is subdivided into twenty-six (26) neighborhoods that comprise an area of approximately 210.5 acres. Figure 1 is a schematic representation of the Project neighborhoods and land use summary. Table 11 is a summary of the total Farm at Alamo Creek water demand to be provided by the City.

The irrigation demand for the proposed parks and commercial land uses is conservatively assumed to be supplied by the City with the understanding that the Solano Irrigation District (SID) may provide this demand with non-potable water in the future. The total City supplied water demand for the Project is approximately 277,011 gpd (310 ac-ft/yr).

2.4 Summary of Projected Water Demands

Table 12 includes projected water demands for the City and future developments in five-year increments through the Year 2040. The 2015 baseline City water demand is estimated using the 164 gallons per capita per day (gpcd) target for Year 2020 and the 2015 adjusted population of 89,267 for a total demand of 16,465 ac-ft/yr or 14.7 million gallons per day (mgd). Water demands for the Year 2020 through 2040 were based on the demand projections presented in the 2015 UWMP Update. These projections take into consideration the Year 2020 target per capita per day usage and applying that to the future population projections by the Association of Bay Area Governments.

As summarized in Table 12, total average annual demand for the existing City, proposed growth and The Farm at Alamo Creek will reach 17,937 ac-ft/yr in the Year 2025. This value is less than the total water supply available in Year 2025 (27,877 ac-ft/yr, see Table 9) as discussed in the previous section. The Farm at Alamo Creek demand includes both potable and irrigation demands.

TABLE 11
THE FARM AT ALAMO CREEK PROJECT
LAND USE AND DEMAND SUMMARY AT YEAR 2025

Area[a]	Land Use[a]	Designation	Quantity[a] du	Quantity[a] ac	Demand Factors		Estimated Water Demand			
					Potable gpd/du	Irrigation[b] gpd/ac	Potable gpd	Irrigation gpd	Total gpd	Annual ac-ft/yr
1	Residential Low Density	RLD	48	10.8	335	0	16,080	0	16,080	18.0
2	Residential Low Medium Density	RLMD	51	8.0	295	0	15,045	0	15,045	16.9
3	Neighborhood Commercial[c]	RS	0	4.2	880	385	3,696	1,617	5,313	6.0
4	Residential Low Medium Density	RLMD	44	7.6	295	0	12,980	0	12,980	14.5
5	Residential Low Medium Density	RLMD	47	8.3	295	0	13,865	0	13,865	15.5
6	Residential Low Medium Density	RLMD	39	7.5	295	0	11,505	0	11,505	12.9
7	Residential Low Medium Density	RLMD	69	10.2	295	0	20,355	0	20,355	22.8
8	Residential Low Density	RLD	34	6.9	335	0	11,390	0	11,390	12.8
9	Residential Medium High Density	RMD	40	2.8	265	0	10,600	0	10,600	11.9
10	Residential Medium High Density	RMD	124	8.8	265	0	32,860	0	32,860	36.8
11	Public/Institutional	P/INST	0	1.2	0	0	0	0	0	0
12	Neighborhood Commercial[c]	RS	0	3.2	880	385	2,816	1,232	4,048	4.5
13	Residential Medium High Density	RMD	20	1.4	265	0	5,300	0	5,300	5.9
14	Public Park	PK	0	4.7	0	1,250	0	5,875	5,875	6.6
15	Public Park	PK	0	2.5	0	1,250	0	3,125	3,125	3.5
16	Open Space	OS	0	4.7	0	0	0	0	0	0
17	Public Park	PK	0	8.2	0	1,250	0	10,250	10,250	11.5
18	Public Park	PK	0	11.2	0	1,250	0	14,000	14,000	15.7
19	Open Space	OS	0	4.4	0	0	0	0	0	0
20	Public/Institutional	PL	0	9.6	0	0	0	0	0	0
21	Public/Institutional	PL	0	3.8	0	0	0	0	0	0
22	Public/Institutional	PL	0	11.4	0	0	0	0	0	0
23	Public/Institutional	PL	0	8.2	0	0	0	0	0	0
24	Residential Low Density	RLD	90	18.2	335	0	30,150	0	30,150	33.8
25	Residential Low Density	RLD	162	38.5	335	0	54,270	0	54,270	60.8
26	Agriculture Buffer	BUFF	0	4.3	0	0	0	0	0	0
Total Demand – The Farm at Alamo Creek			**768**	**210.6**			240,912	36,099	**277,011**	**310.3**

[a] Neighborhood numbers, land use, and quantities from The Farm at Alamo Creek Specific Plan.
[b] Domestic irrigation demand (for residential land uses) will be met with potable water, and therefore is included in potable demand factor.
[c] Demand factors for Public Low, Retail Service, and Residential Medium Density, were used for Public/Institutional, Neighborhood Commercial, and Residential Medium High Density land uses respectively.

HAWKINS ROAD

LEISURE TOWN ROAD

CAROLL WAY

OLD ALAMO CREEK

OLD ALAMO CREEK

ELMIRA ROAD

THE FARM AT
ALAMO CREEK

BRIGHTON LANDING

LEGEND

- RESIDENTIAL LOW DENSITY
- RESIDENTIAL LOW MEDIUM DENSITY
- RESIDENTIAL MEDIUM HIGH DENSITY
- NEIGHBORHOOD COMMERCIAL
- PARK
- PUBLIC INSTITUTIONAL
- OPEN SPACE
- AGRICULTURE BUFFER
- NEIGHBORHOOD BOUNDARY
- NEIGHBORHOOD NUMBER

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FIGURE 1

THE FARM AT ALAMO CREEK EIR
WATER SUPPLY AND WATER MODELING STUDY

LAND USE MAP

NV5

N□□6□□□-0000008□□□T□□F□r□ SB6□0-EIR S□□□□r□CADD E□□□□□EIR TM F□□□d□□□ CEH 9□□8□0□□

TABLE 12
CITY OF VACAVILLE
SUMMARY OF NORMAL YEAR ANNUAL WATER DEMAND
IN FIVE YEAR INCREMENTS

Demand	2015	2020	2025	2030	2035	2040
City Base Year (2015)[a]	16,465	16,465	16,465	16,465	16,465	16,465
Future Growth in City [b]	0	520	1,162	1,772	2,634	3,423
Farm at Alamo Creek Project [c]	0	0	310	310	310	310
Total Demand	**16,465**	**16,985**	**17,937**	**18,547**	**19,409**	**20,198**

[a] Existing 2015 City demand based on Year 2020 gpcd target (164 gpcd) and Year 2015 adjusted population of 89,267.
[b] Based on Year 2020 gpcd target (164 gpcd) and future population projections provided by ABAG.
[c] The Farm at Alamo Creek Project assumed complete development by Year 2025.

3.0 WATER MODELING ASSUMPTIONS

The existing city-wide water distribution system hydraulic computer model was updated to include the Farm at Alamo Creek development including the proposed water mains as suggested in the Specific Plan. The Project water demand of 277,011 gpd including irrigation demand of 36,099 gpd (from Table 11) was distributed among junction nodes for the proposed water system. Figure 2 is a schematic representation of the proposed water distribution system for the Farm at Alamo Creek Project based on the *The Farm at Alamo Creek Tentative Map 2nd Submittal*, dated June 30, 2017 by Phillippi Engineering, Inc.

The fire flow requirement for RLD land use is 1,500 gpm. For RLMD land use, the fire flow requirement is 3,000 gpm. However, this requirement can be reduced to 1,500 gpm if dwelling units are constructed with a minimum eave to eave separation of six feet.

The RLMD dwelling units proposed for the Farm at Alamo Creek Project will be constructed with a minimum eave to eave separation of six feet according to the information currently provided by Phillippi Engineering, Inc. (PEI) per email dated 8/30/2017. Thus, the fire flow requirement for RLMD is reduced to 1,500 gpm. For RMD land uses and for Neighborhood Commercial (assumed as Retail Sales land use) land uses the fire flow requirement is 4,500 gpm.

3.1 Production Facilities Summary

For average day simulations, sufficient production facilities are assumed to be operating to meet the total average day demand. During maximum day simulations, all the available water production facilities are in service with the exception of Wells #3, #7, #9, and De Mello. During fire flow simulations, same as maximum day simulations with Well #9 assumed off line (not in service) because it is the closest production facility to The Farm at Alamo Creek Project development and it will represent the most stressful condition of the existing system forcing water to flow from the reservoirs and other production facilities to the project area.

At peak hour all the production facilities are assumed in service with the exception of Wells #3, #7, and De Mello. Table 13 is a summary of the water production facilities in service (operating) during the specific simulations for each of the scenarios listed above.

TABLE 13
CITY OF VACAVILLE
SUMMARY OF PRODUCTION FACILITIES IN SERVICE DURING MODELING SIMULATIONS

Simulation	Production Capacity, gpm												Total Production Capacity, gpm	Total Demand gpm
	Well										TWPS at	NBR		
	2	3	5	7	8	9	14	15	16	De Mello	DE Plant	Plant		
Avg Day Demand	1,100	OOS	1,300	OOS	OFF	OFF	1,740	OFF	OFF	OOS	OFF	9,030	13,170	11,120
Max Day Demand	1,100	OOS	1,300	OOS	1,530	OFF	1,740	1,740	1,740	OOS	4,450	9,030	22,630	22,240
Max Day Demand w/Fire Flow (1,500 gpm)	1,100	OOS	1,300	OOS	1,530	OFF	1,740	1,740	1,740	OOS	4,450	9,030	22,630	23,740
Peak Hour	1,100	OOS	1,300	OOS	1,530	1,400	1,740	1,740	1,740	OOS	4,450	9,030	24,030	38,920

Note that Wells #3, #7, and De Mello are always out of service due to various operational issues with those wells.

4.0 WATER MODELING SIMULATIONS

The following simulations were executed using the City's water distribution system model (including the Farm at Alamo Creek project):

- Existing Conditions + Project at Maximum Day Demand
- Existing Conditions + Project at Max Day and 1,500 gpm fire flow at JL19-28 (RLD)
- Existing Conditions + Project at Max Day and 1,500 gpm fire flow at JL19-43 (RLD)
- Existing Conditions + Project at Max Day and 1,500 gpm fire flow at JL20-17 (RLD)
- Existing Conditions + Project at Max Day and 1,500 gpm fire flow at JL20-25 (RLD)
- Existing Conditions + Project at Max Day and 1,500 gpm fire flow at JK19-45 (RLMD)
- Existing Conditions + Project at Max Day and 1,500 gpm fire flow at JL19-11 (RLMD)
- Existing Conditions + Project at Max Day and 1,500 gpm fire flow at JL20-3 (RLMD)
- Existing Conditions + Project at Max Day and 1,500 gpm fire flow at JL20-15 (RLMD)
- Existing Conditions + Project at Max Day and 4,500 gpm fire flow at JL19-17 (RMHD)
- Existing Conditions + Project at Max Day and 4,500 gpm fire flow at JL20-30 (RMHD)
- Existing Conditions + Project at Max Day and 4,500 gpm fire flow at JK20-4 (Commercial)
- Existing Conditions + Project at Max Day and 4,500 gpm fire flow at JL19-5 (Commercial)
- Existing Conditions + Project at Peak Hour

Figure 2 is a schematic of the proposed water system improvements for The Farm at Alamo Creek as connected to the existing water system.

Junction nodes JL19-28, JL19-43, JL20-17, and JL20-25 were selected for the fire flow simulations (1,500 gpm) at RLD land uses and located at the end of a cul-de-sacs. Junction nodes JK19-45, JL19-11, JL20-3, and JL20-15 were selected for the fire flow simulations (1,500 gpm) at RLMD land uses and located at end of a cul-de-sacs. Junction nodes JL19-17 and JL20-30 were selected for the fire flow simulations (4,500 gpm) at Residential Medium High Density (RMHD) land uses. The fire flow requirement of 4,500 gpm for Residential High Density was conservatively used this type of land use. Junction nodes JK20-4 and JL19-5 were selected for the fire flow simulations (4,500 gpm) near the proposed Neighborhood Commercial parcels.

HAWKINS ROAD

LEISURE TOWN ROAD

CARROLL WAY

ELMIRA ROAD

WELL 9

WELL 8

WELL

LEGEND

- EXISTING 8-INCH WATERLINE
- EXISTING □□-INCH WATERLINE
- EXISTING □8-INCH WATERLINE
- PROPOSED 8-INCH WATERLINE
- PROPOSED □□-INCH WATERLINE
- L□0-33 ● □UNCTION NODE
- L□9-□3 ● FIRE FLOW LOCATION

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FIGURE 2

THE FARM AT ALAMO CREEK EIR
WATER SUPPLY AND WATER MODELING STUDY

WATER SYSTEM IMPROVEMENTS

N|V|5

N□□6□□□-0000008□□□T□□F□r□ SB6□0-EIR S□□□□r□CADD E□□□□□EIR TM F□□□d□□□ CEH □0 6 □0□□

The selection of fire flow junction nodes at the cul-de-sacs provide a means to readily observe the capacity of the proposed water mains to deliver the required fire flow throughout the Project.

5.0 WATER MODELING RESULTS

For Existing Conditions + Project at Maximum Day Demand, the model predicts acceptable results for residual pressures and pipe flow velocities. Pressures within the Project area range from 94 psi to 100 psi. In addition, all pipe flow velocities are anticipated to be less than 5 feet/second (ft/s) in accordance with the City's Water Master Plan.

For the Existing Conditions + Project at Max Day and 1,500 gpm fire flow (RLD) at junction nodes JL19-28, JL19-43, and JL20-17 simulations, the model predicts residual pressures in the Project area ranging from 90 psi to 98 psi. The pipe flow velocity is approximately 9.6 ft/s in the proposed dead-end water mains connected to these junction nodes. Both pressure and velocity results are acceptable and within the level of service required by the City.

For the Existing Conditions + Project at Max Day and 1,500 gpm fire flow (RLMD) at junction nodes JK19-45, JL19-11, JL20-3, and JL20-15 simulations, the model predicts residual pressures in the Project area ranging from 88 psi to 98 psi. In addition, the maximum pipe flow velocity is approximately 9.6 ft/s in the proposed dead-end water mains connected to these junction nodes. These results are within the level of service required by the City.

For the Existing Conditions + Project at Max Day and 4,500 gpm fire flow (RMHD) at junction nodes JL19-17, and JL20-30 simulations, the model predicts residual pressures in the Project area ranging from 90 psi to 95 psi. In addition, the maximum pipe flow velocity is approximately 7.7 ft/s in the proposed water mains connected to these junction nodes. These results are within the level of service required by the City.

For the Existing Conditions + Project at Max Day and 4,500 gpm fire flow (Commercial) at junction nodes JK20-4 and JL19-5 simulations, the model predicts residual pressures in the Project area ranging from 88 psi to 96 psi. The maximum pipe flow velocity is approximately 4.3 ft/s in the proposed or existing water mains near these junction nodes. These results are within the level of service required by the City.

For Existing Conditions + Project at Peak Hour, the model predicts acceptable results for residual pressures and pipe flow velocities. Pressures in the Project area ranged from 86 psi to 92 psi with acceptable pipe flow velocities.

Partial pipe and node maps with modeling results for each simulation discussed above are included in Appendix A for reference.

6.0 WATER STORAGE REQUIREMENTS

The water storage requirements for the main zone include three components: operational, emergency, and fire storage.

- Operational storage is equal to 25 percent of the maximum day demand
- Fire storage is equal to the most critical combination of flow rate and duration in the pressure zone
- Emergency storage is equal to 12 hours of maximum day demand, equivalent to 50 percent of maximum day demand, less the production of water from DE Plant and Well 8 (these facilities have standby power that can supply water)

The existing water storage requirements and available storage was summarized in the 2016 Water Master Plan as follows:

- Existing average day demand: 14.55 mgd
- Existing maximum day demand: 1.7 x average day = 24.74 mgd
- Operational Storage: 0.25 x 24.74 mgd = 6.18 million gallons (MG)
- Fire Storage: 4,500 gpm x 4 hours = 1.08 MG
- Emergency Storage: 0.50 x 24.74 mgd = 12.37 MG, this is reduced by 3.6 MG (production from DE Plant and Well 8), actual emergency storage required = 8.77 MG
- Total Storage Requirement: 16.03 MG

The City currently has five main zone reservoirs with a combined storage capacity of 18.94 MG. Based on this information, the City has a total storage surplus of approximately 2.9 MG at existing conditions.

The Farm at Alamo Creek Project has an average day demand of approximately 0.27 mgd and a maximum day demand of 0.46 mgd. The storage required for the Farm at Alamo Creek Project can be calculated as follows:

Operational (25% of Maximum Day Demand):	0.12 MG
Emergency Storage (50% of Maximum Day Demand):	0.23 MG
Total Additional Storage Required:	0.35 MG

The fire flow storage is not included because it is already accounted for in the existing storage.

The Farm at Alamo Creek Project, when fully develop will use 0.35 MG of the existing storage surplus reducing the current storage surplus to approximately 2.55 MG. Thus, additional storage is not required for this Project.

7.0 WATER SUPPLY ASSESSMENT REPORT (SB610)

Cities and counties with proposed development projects are required by SB610 (Part 2.10 Division 6 of the California Water Code enacted in 2001) to prepare a Water Supply Assessment Report. An SB610 Water Supply Assessment Report is currently being prepared by NV5 for the Project.

8.0 FINDINGS AND RECOMMENDATIONS

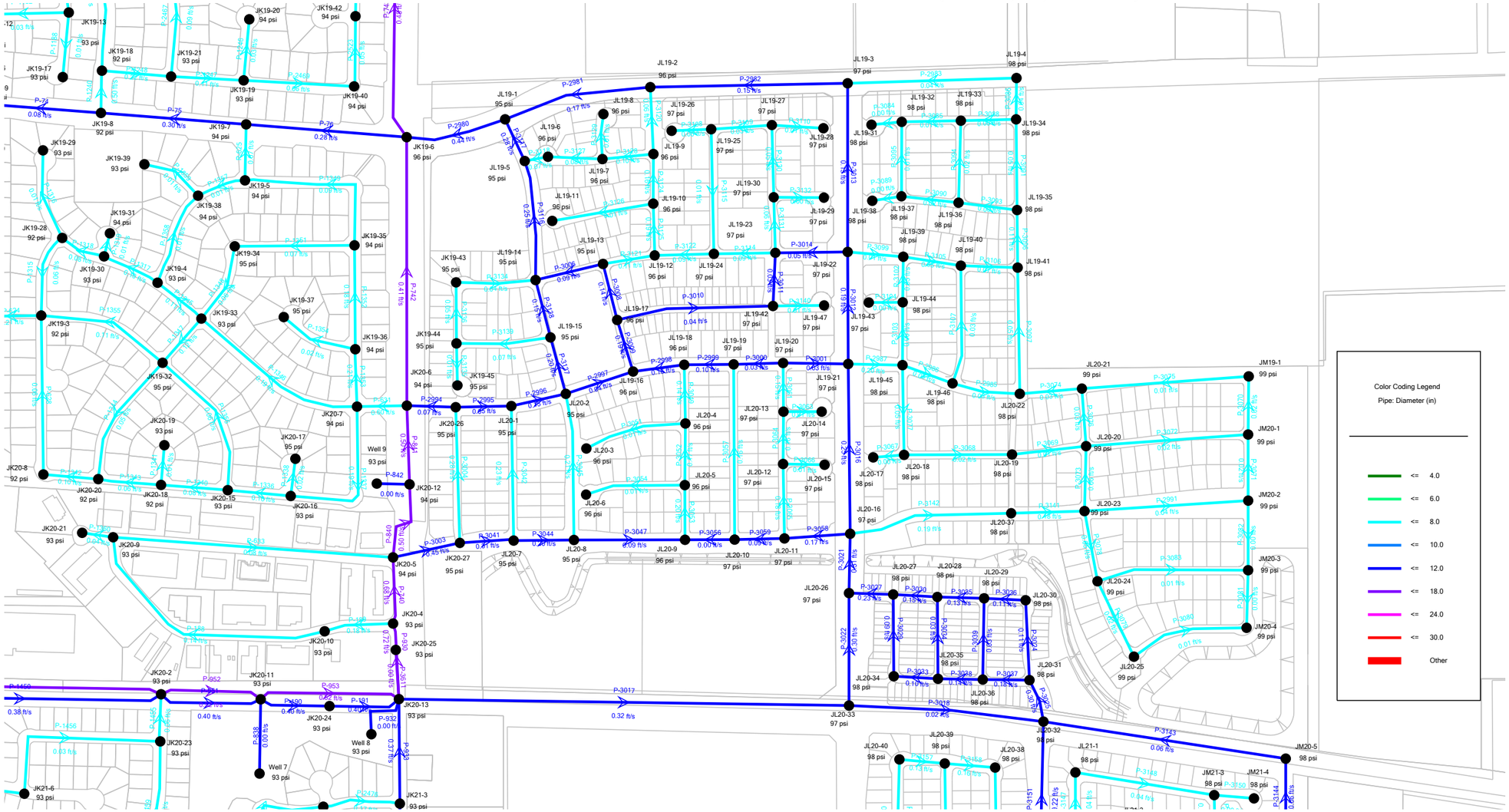
The following is a summary of the findings and recommendations concluded from this modeling study:

- The City has sufficient water supply to meet the projected demand from The Farm at Alamo Creek Project.
- The buildout condition of The Farm at Alamo Creek was analyzed in this study. A phasing plan for the Project is currently in the preliminary stages of development and the information is incomplete on how the phases will be connected to the existing water system. The Project will require a modeling analysis for every phase of the development to confirm each phase can be served by the City's water distribution system.
- The RLMD land use areas will have dwelling units with a minimum eave to eave separation of 6 ft and qualify for the reduced fire flow requirement of 1,500 gpm.
- According to the City's existing water model, the proposed distribution system is adequate to provide an acceptable level of service to the Project.
- An SB610 Water Supply Assessment Report is required for the Project and NV5 is currently preparing this document.

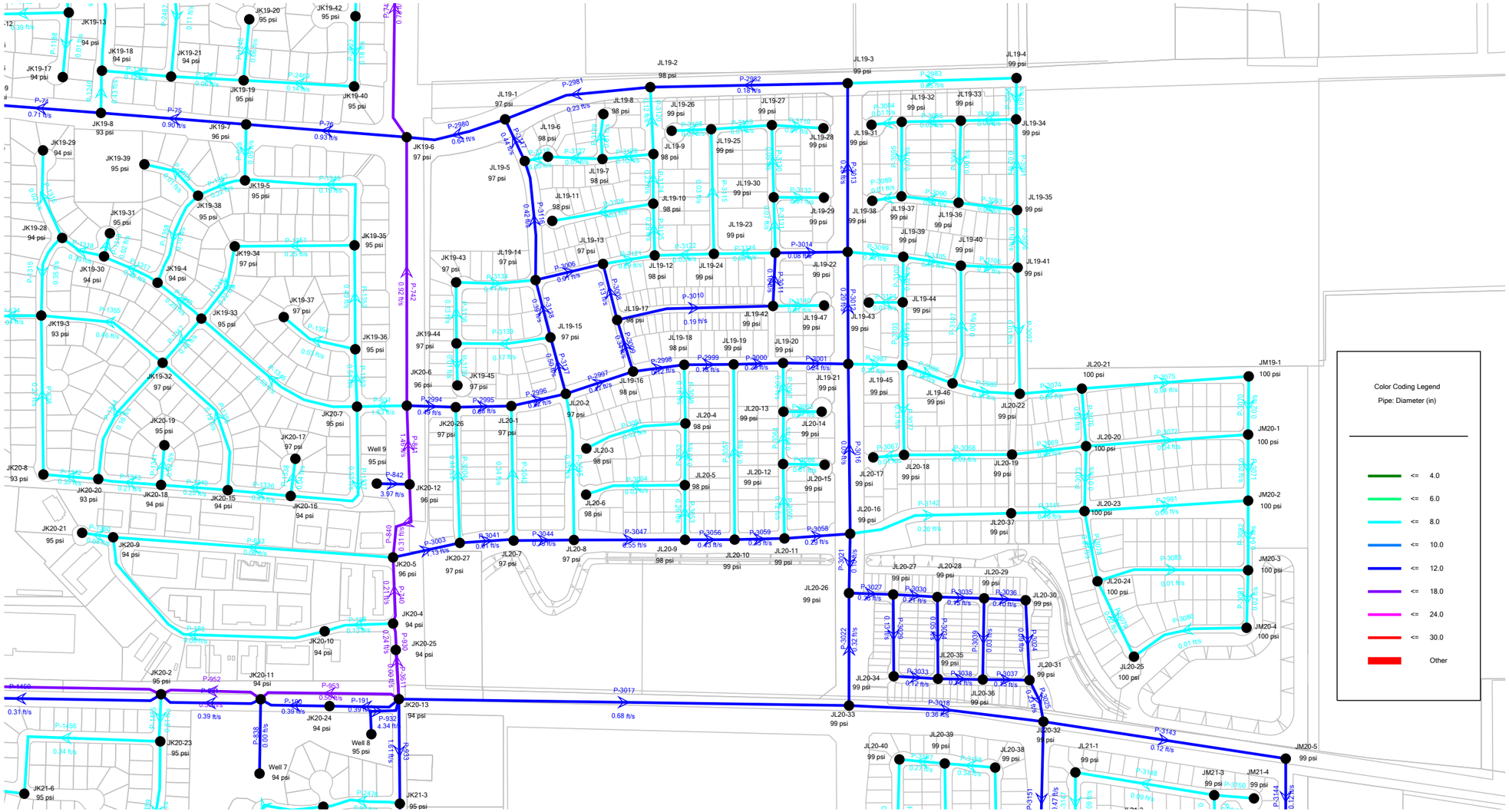
APPENDIX A

PARTIAL PIPE AND NODE MAPS WITH MODELING RESULTS

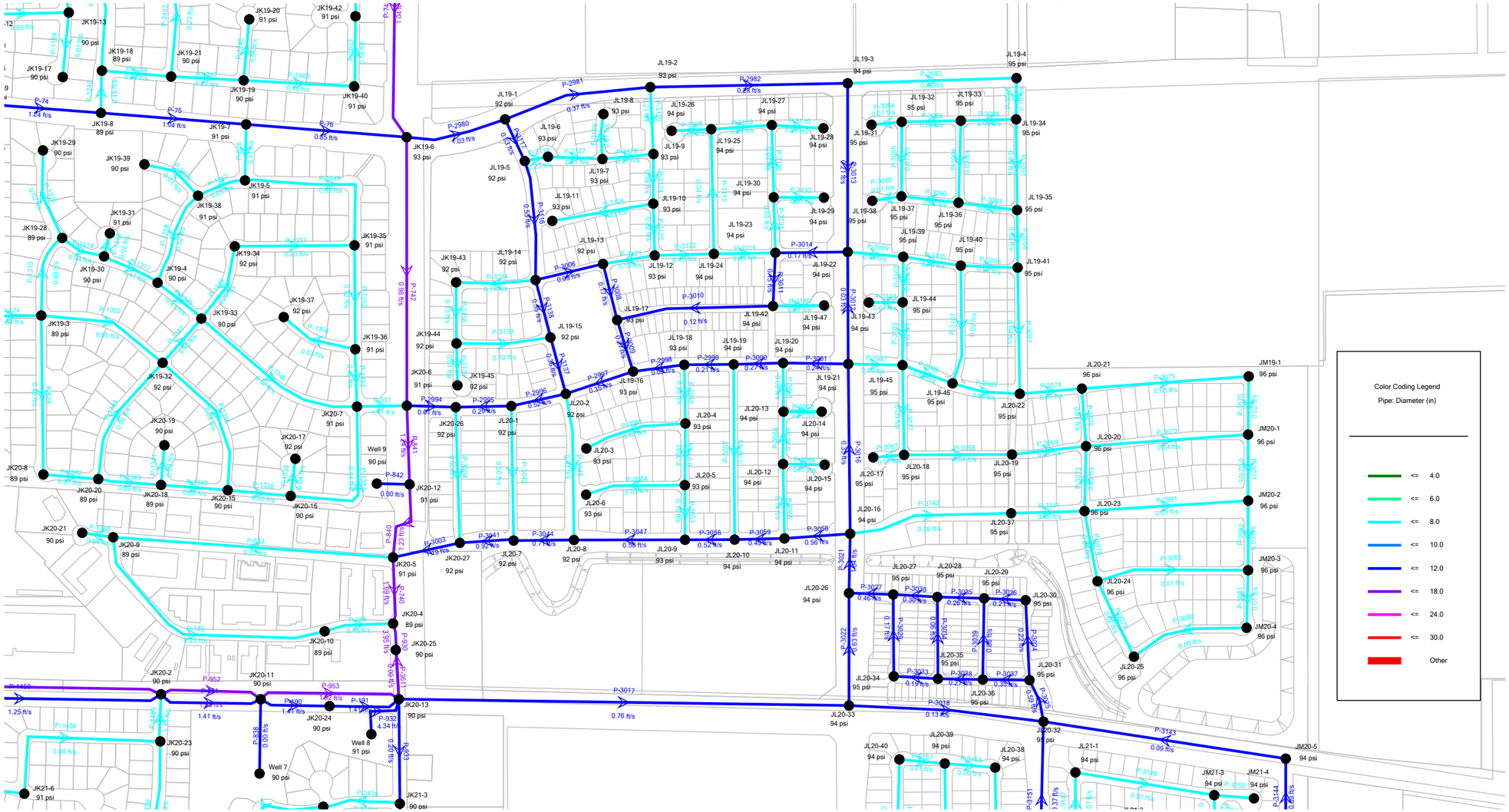
Scenario: ADD Farm at Alamo (Well 2,14,NBR ON)



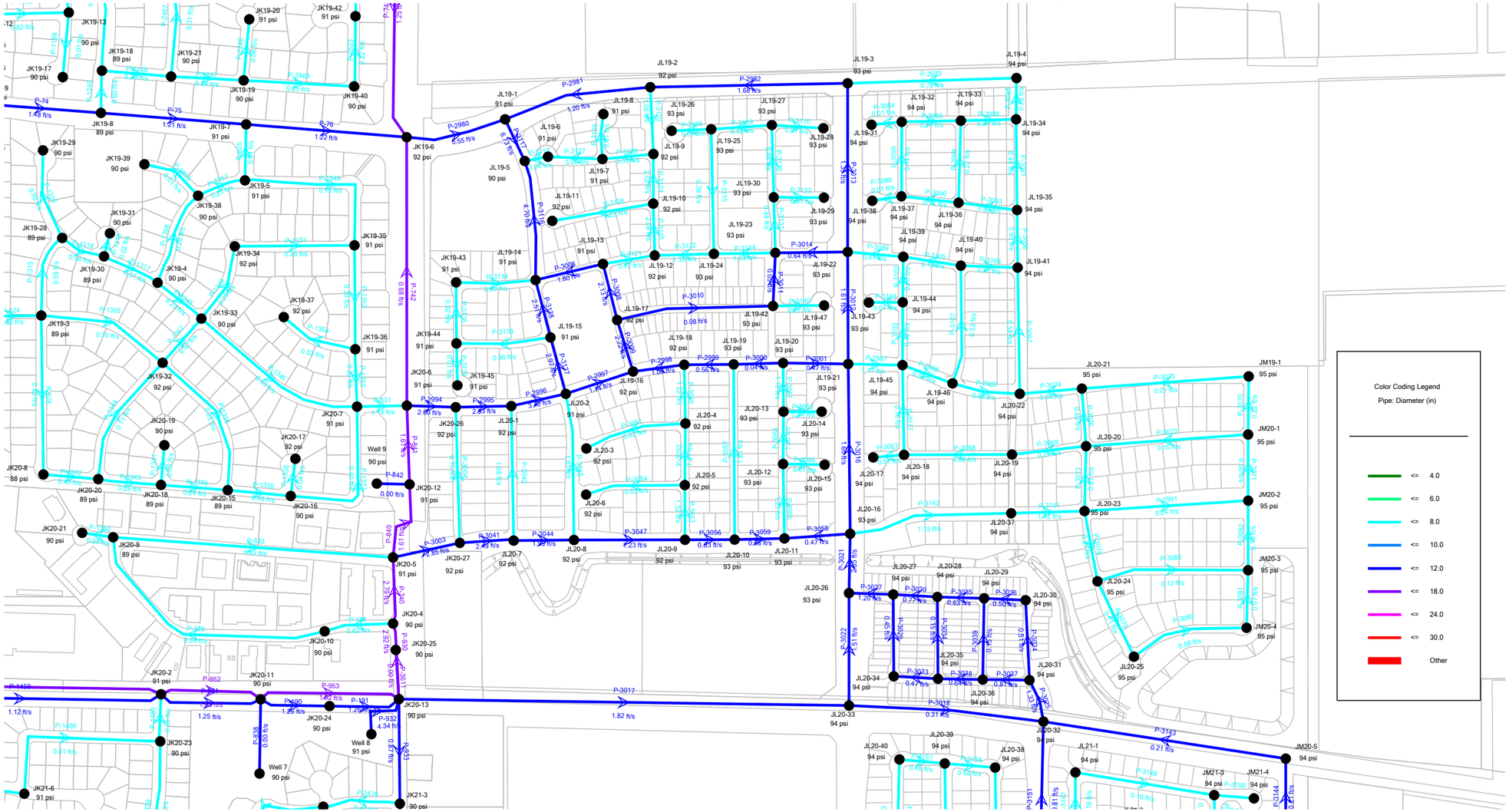
Scenario: MDD Farm at Alamo (Well 3,7,DeMello OFF)



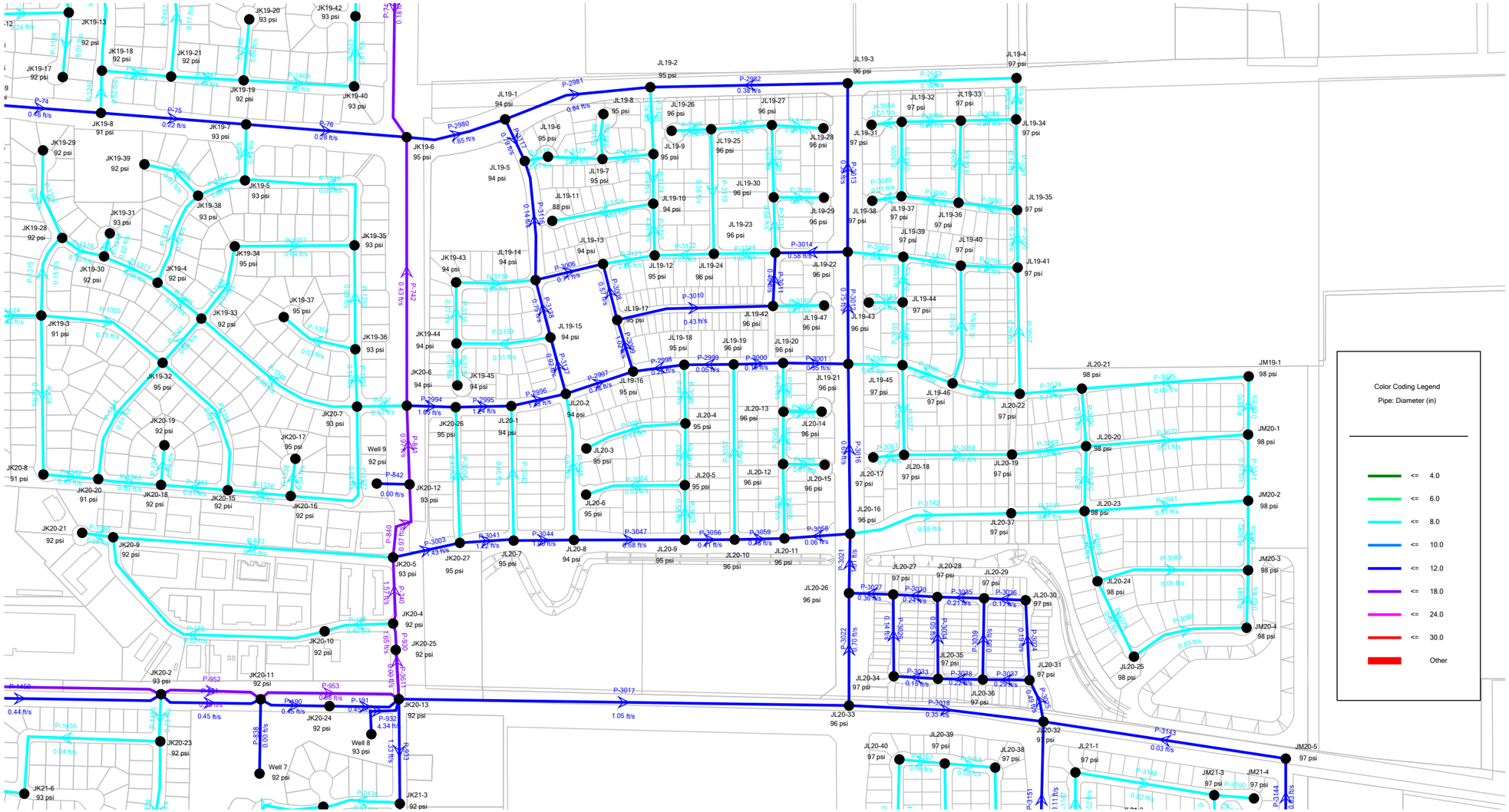
Scenario: MDD Farm at Alamo + FF at JK20-4 (4,500 gpm) w/ Well 9 OFF



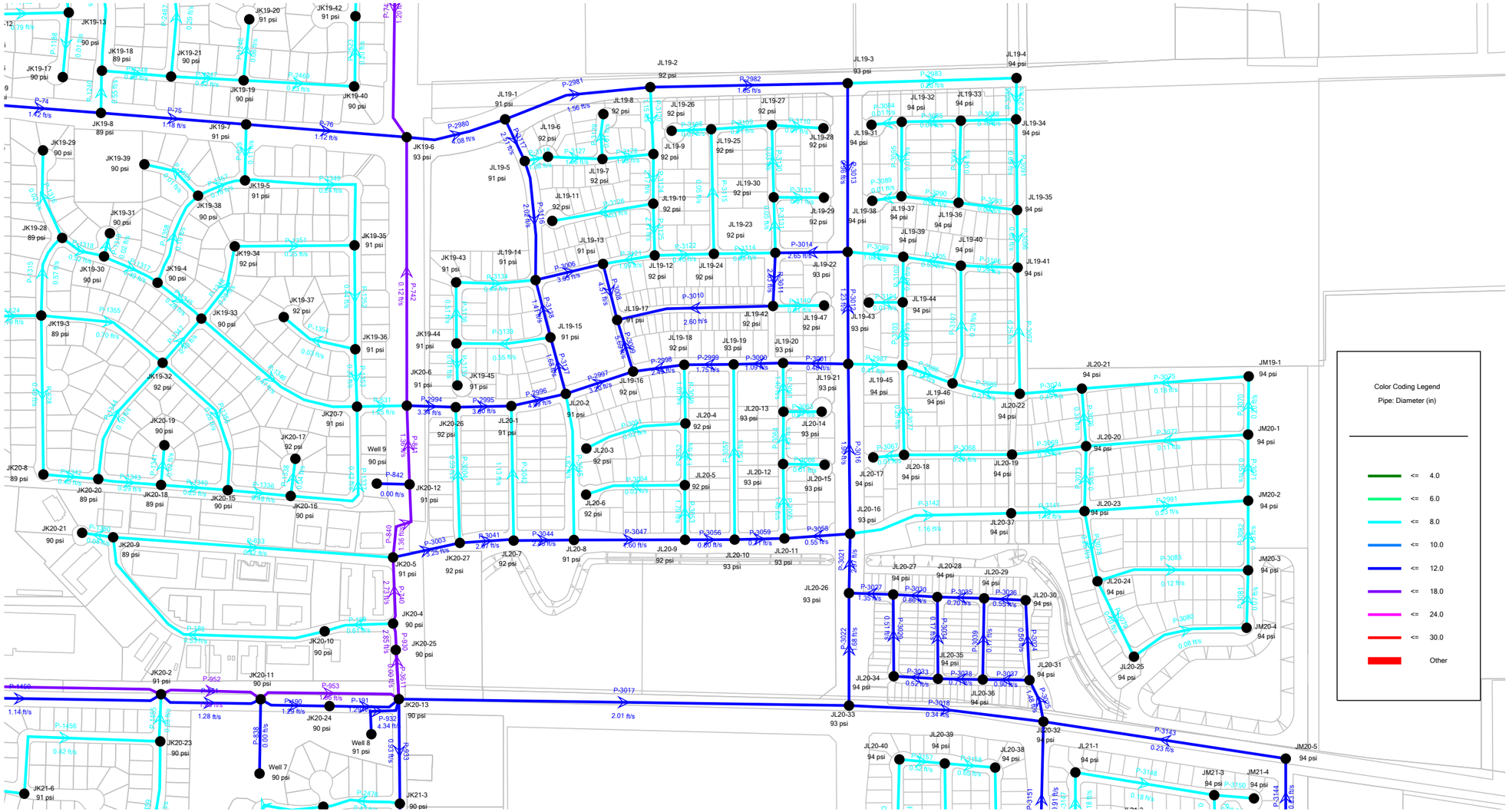
Scenario: MDD Farm at Alamo + FF at JL19-5 (4,500 gpm) w/ Well 9 OFF



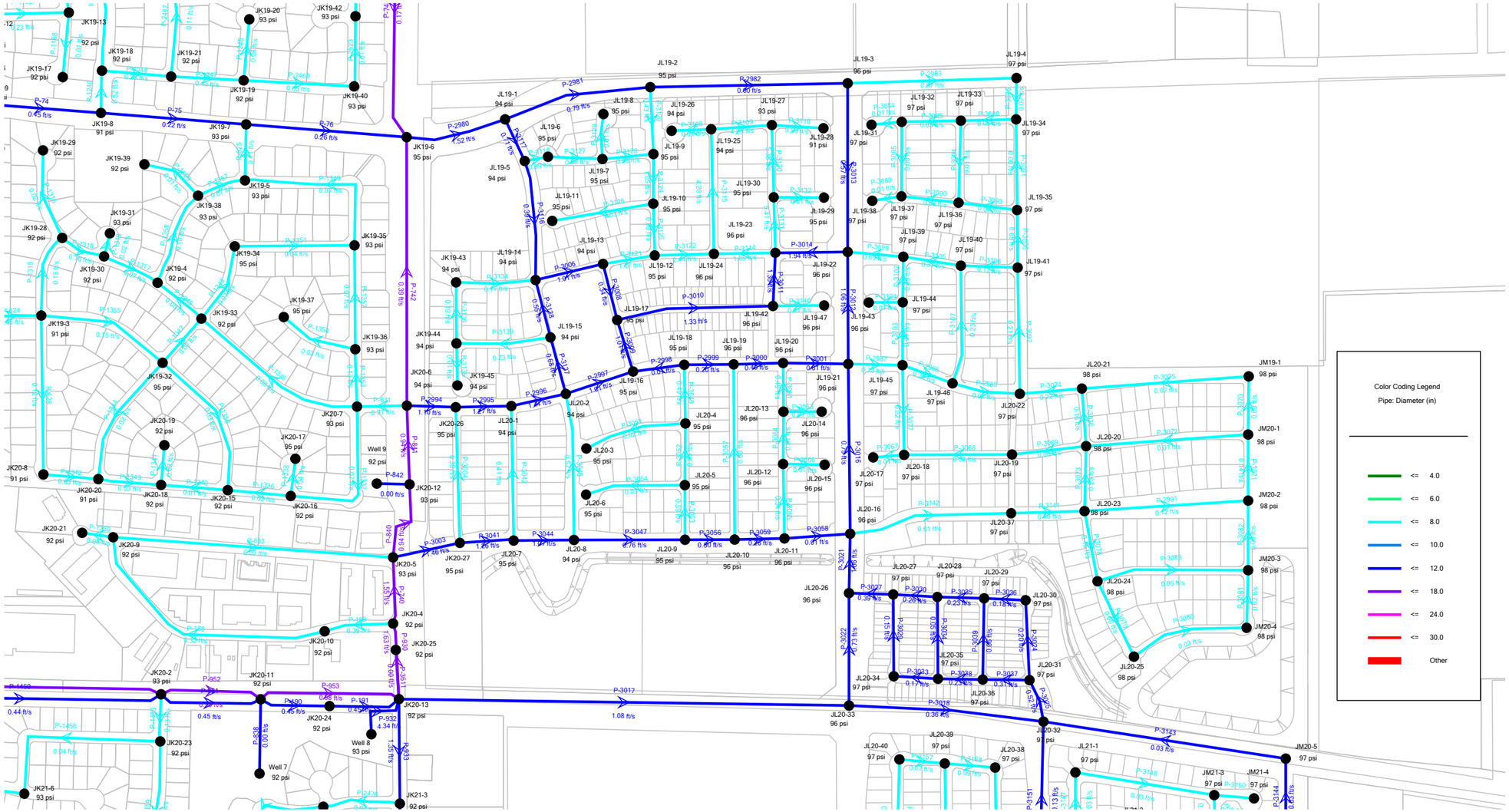
Scenario: MDD Farm at Alamo + FF at JL19-11 (1,500 gpm) w/ Well 9 OFF



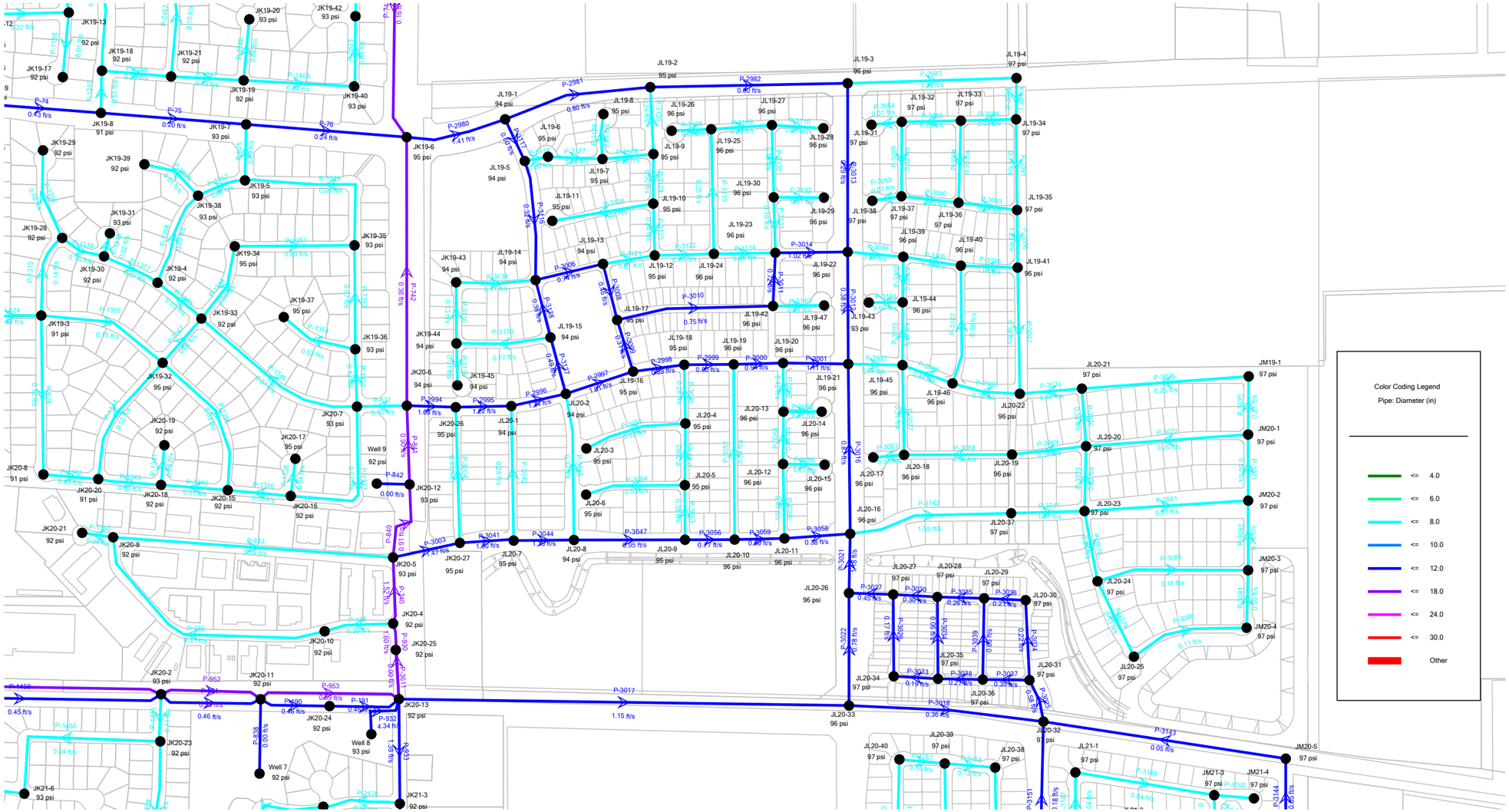
Scenario: MDD Farm at Alamo + FF at JL19-17 (4,500 gpm) w/ Well 9 OFF



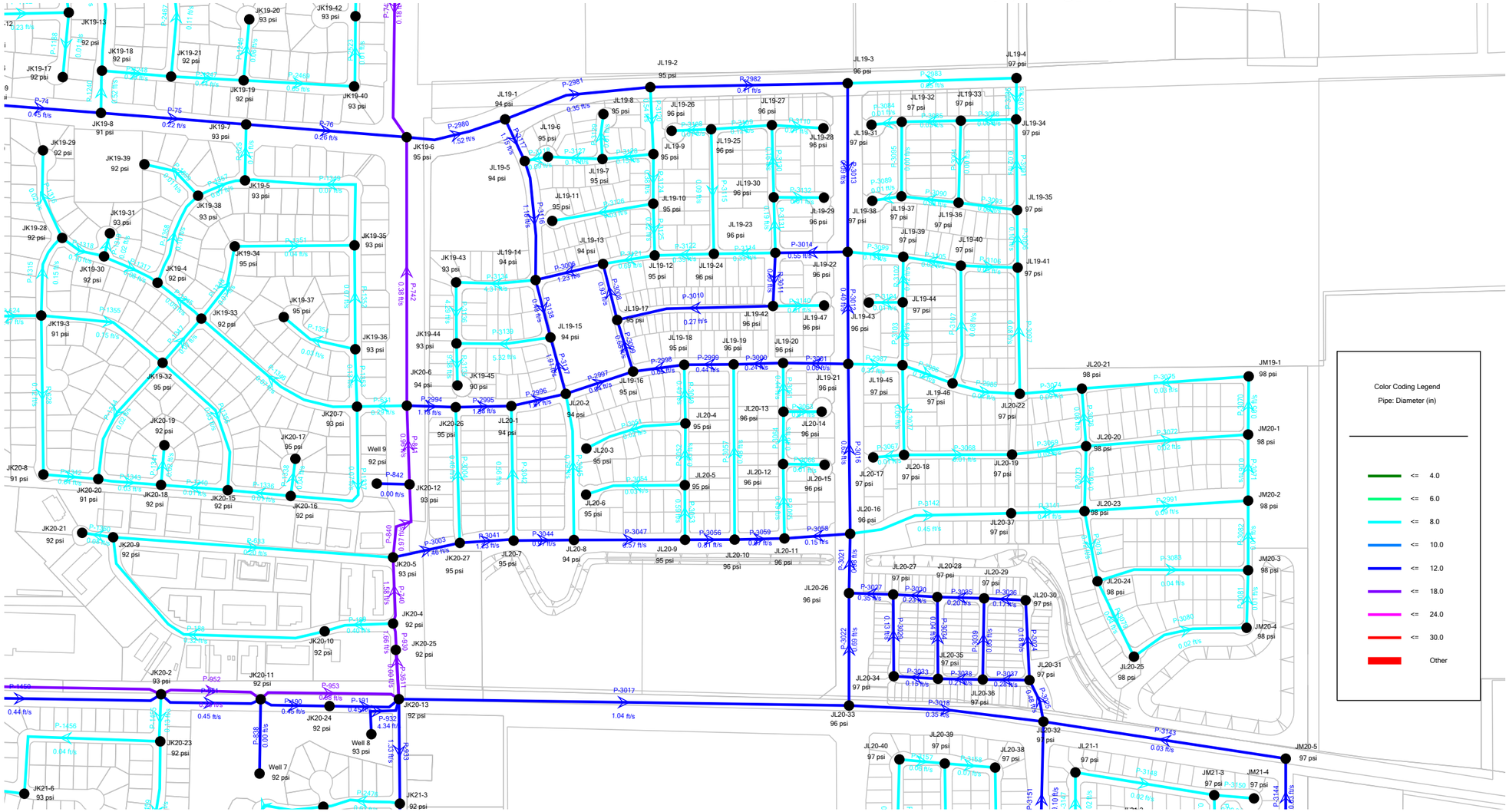
Scenario: MDD Farm at Alamo + FF at JL19-28 (1,500 gpm) w/ Well 9 OFF



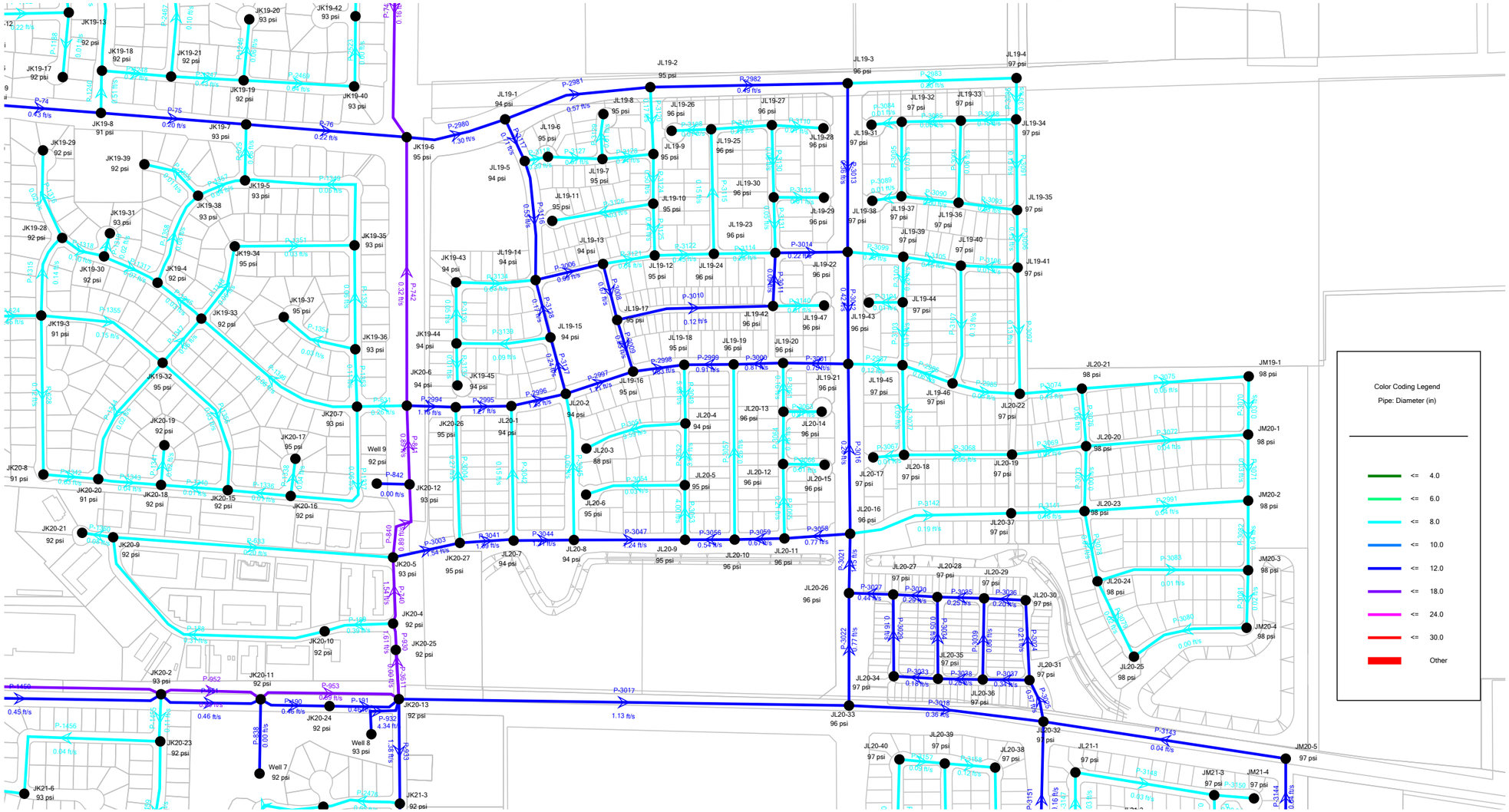
Scenario: MDD Farm at Alamo + FF at JL19-43 (1,500 gpm) w/ Well 9 OFF



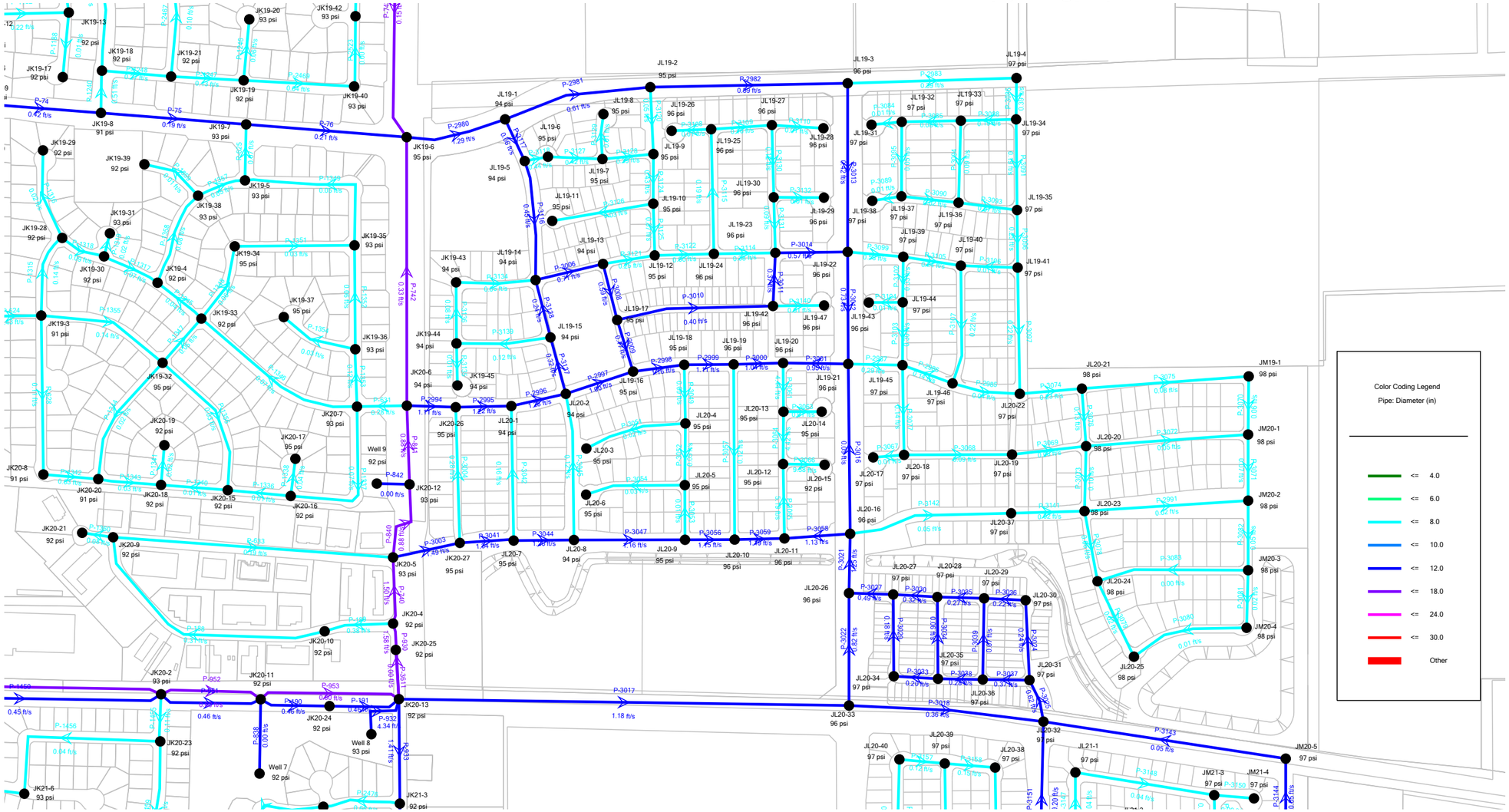
Scenario: MDD Farm at Alamo + FF at JK19-45 (1,500 gpm) w/ Well 9 OFF



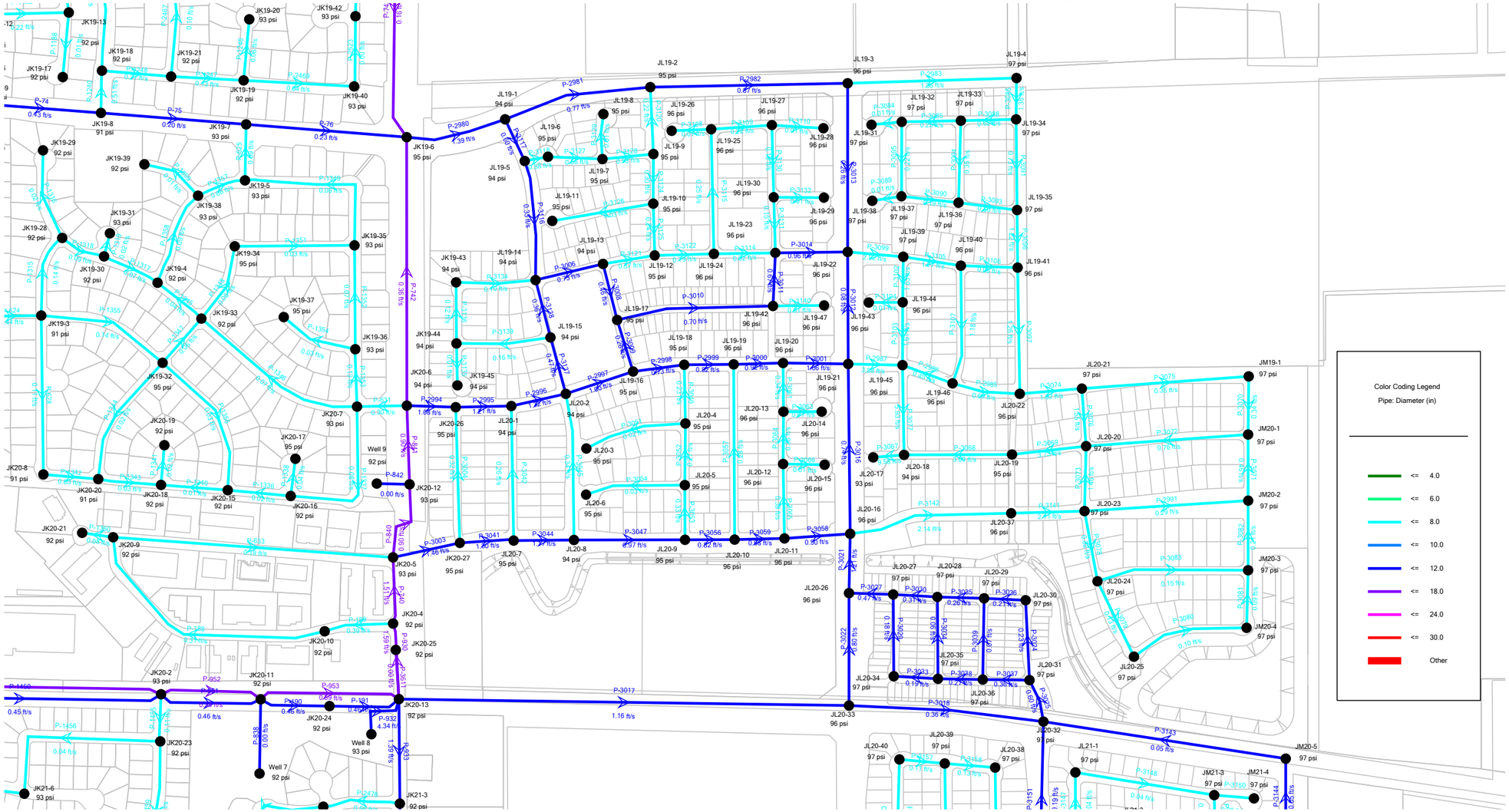
Scenario: MDD Farm at Alamo + FF at JL20-3 (1,500 gpm) w/ Well 9 OFF



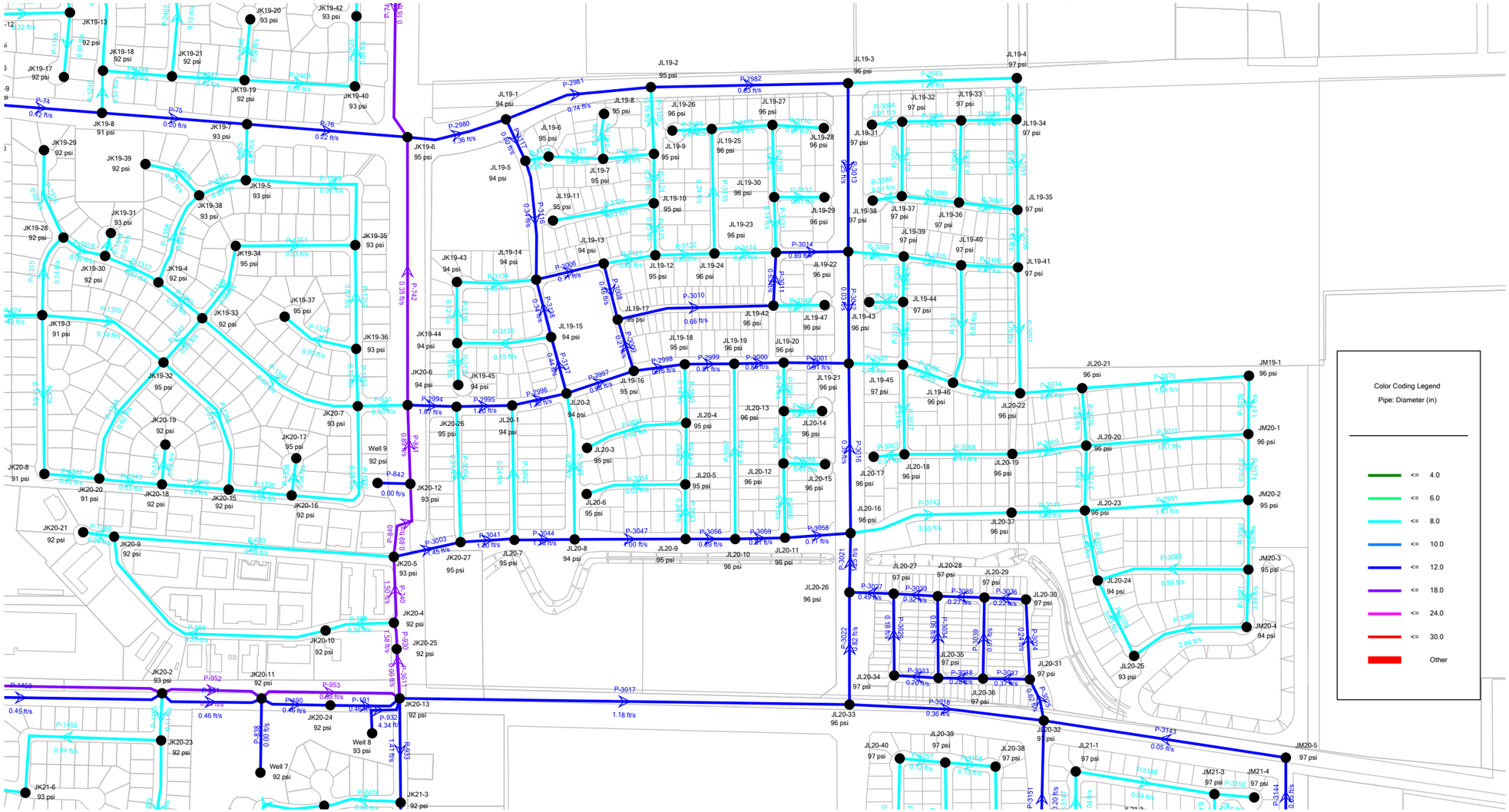
Scenario: MDD Farm at Alamo + FF at JL20-15 (1,500 gpm) w/ Well 9 OFF



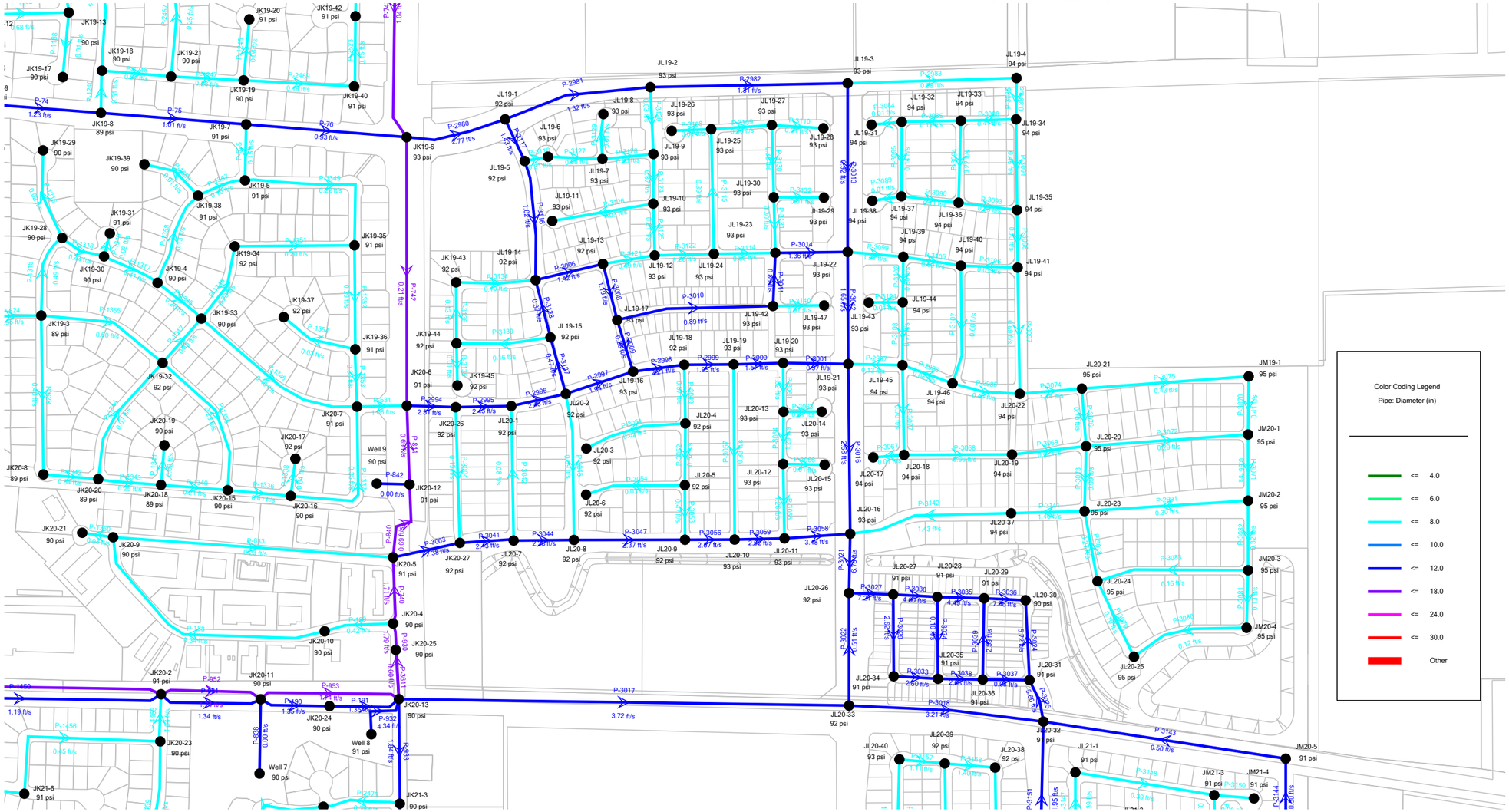
Scenario: MDD Farm at Alamo + FF at JL20-17 (1,500 gpm) w/ Well 9 OFF



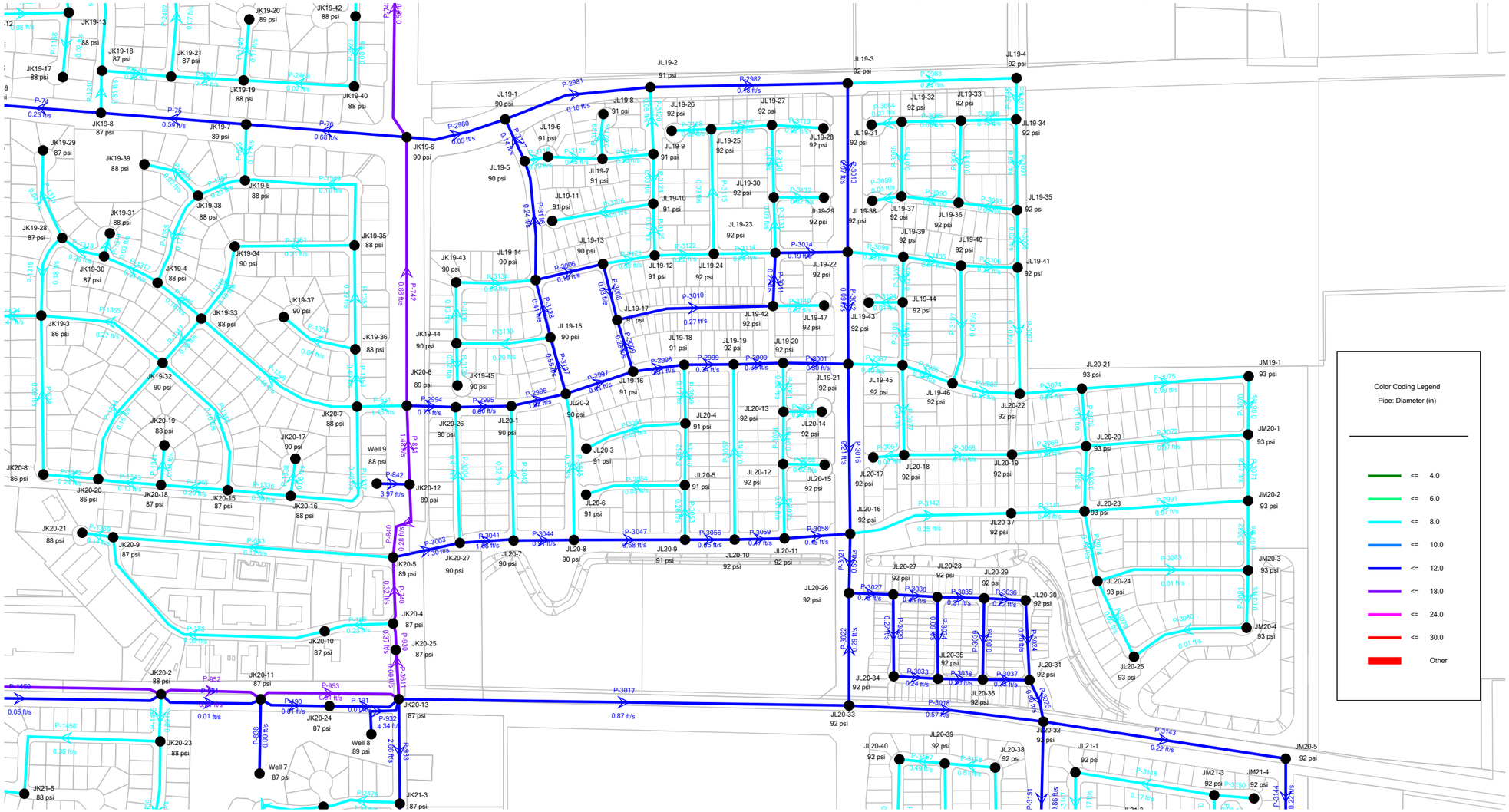
Scenario: MDD Farm at Alamo + FF at JL20-25 (1,500 gpm) w/ Well 9 OFF



Scenario: MDD Farm at Alamo + FF at JL20-30 (4,500 gpm) w/ Well 9 OFF



Scenario: PH Farm at Alamo (Well 3,7,DeMello OFF)



CITY OF VACAVILLE

SB 610 WATER SUPPLY ASSESSMENT REPORT FOR THE FARM AT ALAMO CREEK

ADMIN DRAFT

OCTOBER 2017

NV5

CITY OF VACAVILLE

SB 610 WATER SUPPLY ASSESSMENT REPORT FOR THE FARM AT ALAMO CREEK

ADMIN DRAFT

OCTOBER 2017

Submitted to:

City of Vacaville – Utilities Department
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Elmira, CA 95625

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CITY OF VACAVILLE
SB 610 WATER SUPPLY ASSESSMENT REPORT
FOR THE FARM AT ALAMO CREEK

ADMIN DRAFT
October 2017

Cities and counties with large development projects are required by Senate Bill 610 (Part 2.10, Division 6 of the California Water Code enacted in 2001) to prepare a Water Supply Assessment Report (WSAR). The purpose of this legislation is to ensure that adequate water is, or will be, available to accommodate a proposed large development. While an Urban Water Management Plan (UWMP) evaluates water demand at a programmatic level for the entire service area of an urban water supplier, a WSAR evaluates the specific water needs of a proposed project in relation to existing, present, and future water demand and supply within a service area. This WSAR will evaluate the projected water needs for existing and currently planned developments including the proposed Farm at Alamo Creek project.

Figure 1 is a schematic of the City of Vacaville (City) depicting the location of currently planned developments as well as the proposed Farm at Alamo Creek Subdivision project (Project). The WSAR includes a review of entitlements, water rights, and delivery contracts as well as incorporates information presented in the 2015 City of Vacaville UWMP [1]. This WSAR is intended to be included in the California Environmental Quality Act (CEQA) documents for the Farm at Alamo Creek development project. A copy of the Resolution approving this WSAR is included in Appendix A.

For purposes of this assessment and based on discussions with Phillippi Engineering, Inc., the developer's engineer, it is assumed the Farm at Alamo Creek development will begin in 2020 and completely buildout by 2025.

1.0 INTRODUCTION

The City, founded in 1850, is nestled at the base of the Vaca Mountains and centrally located between Sacramento and San Francisco on Interstate 80 (I-80). The City limits encompass over 29 square miles with a 2016 population of approximately 89,627, which makes Vacaville the third largest city in Solano County behind Vallejo and Fairfield. Additional information concerning the City population, climate/precipitation, and mechanism for financing water system infrastructure are provided below.

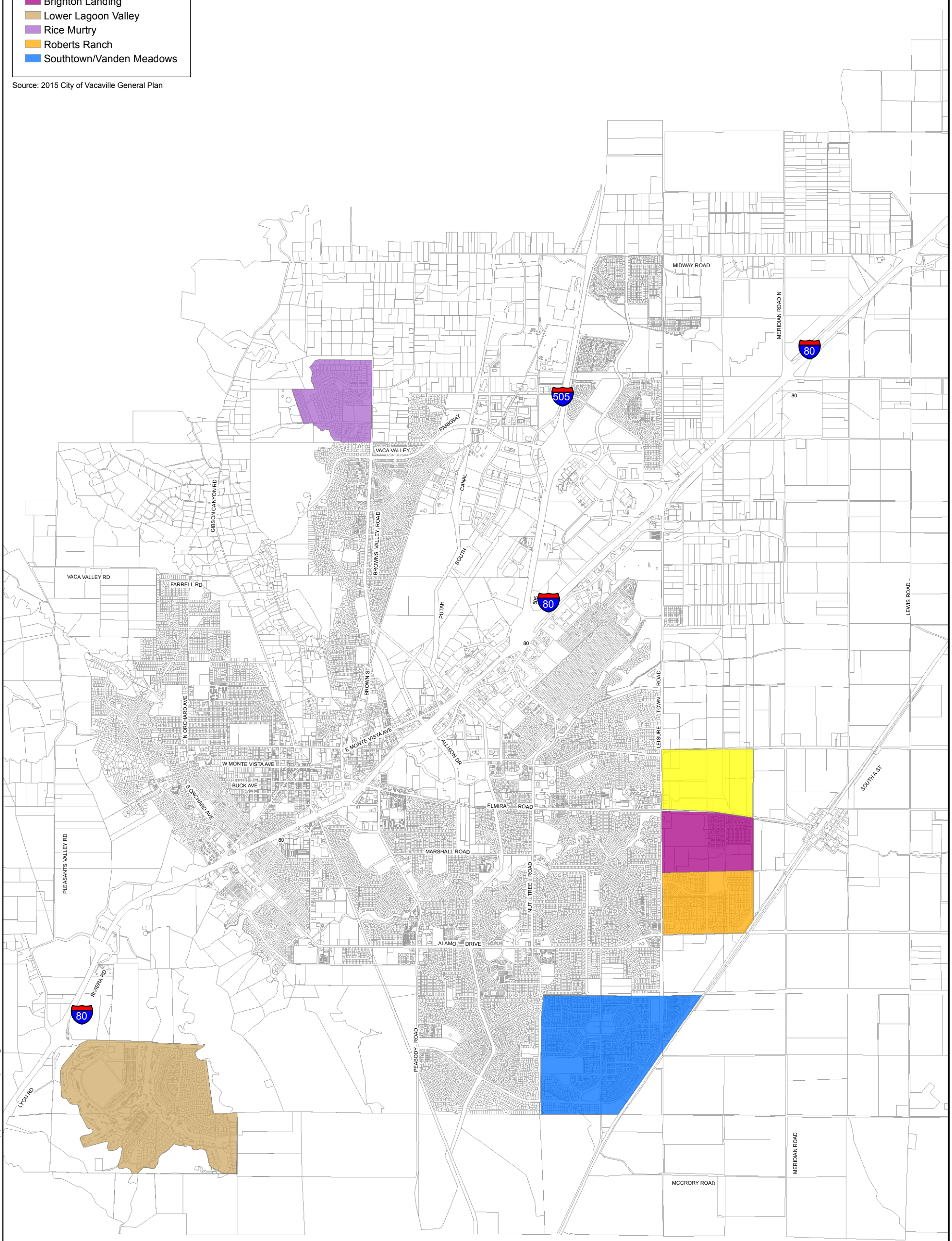
1.1 Current/Projected City Population

The population of Vacaville increased by 63 percent from 1980 to 1990 and increased an additional 24 percent from 1990 to 2000. The growth rate from 2000 to 2010 was approximately 10 percent. It is anticipated that the population will grow by an additional 20 percent from 2015 to 2040. This population projection is based on slower growth than previous population projections, due to decreasing population growth trends caused by the economic downturn of 2010. Table 1 is a summary of the population projections for the City.

LEGEND

- The Farm at Alamo Creek
- Brighton Landing
- Lower Lagoon Valley
- Rice Murtry
- Roberts Ranch
- Southtown/Vanden Meadows

Source: 2015 City of Vacaville General Plan



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4,000 2,000 0 4,000 8,000 Feet

FIGURE 1

THE FARM AT ALAMO CREEK SB610
WATER SUPPLY ASSESSMENT REPORT

PROPOSED DEVELOPMENTS LOCATION MAP

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TABLE 1
CITY OF VACAVILLE POPULATION AND PROJECTIONS 2015 – 2040

	Year					
	2015	**2020**	**2025**	**2030**	**2035**	**2040**
Adjusted Population [a]	89,627	92,464	95,964	99,764	103,964	108,264

[a] Adjusted population values are per Table 3-1 from the *City of Vacaville 2015 Urban Water Management Plan Update* [1]. These values have been adjusted to exclude the prison population that is served by Solano County Water Agency (SCWA).

1.2 Climate/Precipitation

The climate in Vacaville is characterized by mild winters and hot summers. The average annual precipitation is 25 inches, 85 percent of which occurs from December through March. Temperatures during the winter usually drop into the forties at night and occasionally fall below the freezing point. Snow is rare. In the summer, temperatures occasionally rise above 100 degrees. The days are typically hottest between 4 and 5 p.m., and temperatures cool off noticeably in the evenings.

The climate has significant influence on water demands in the City. Winters are characterized by relatively low water demands, while the summers have substantially higher demands. Landscape irrigation in the summer is a major contributor to the higher summer demands.

1.3 Development Impact Fee for Water System Infrastructure

The goal of the Development Impact Fee (DIF) for water is to provide adequate financing for water facilities required to implement the City's General Plan. The fees are used to finance the planning, design, construction, and inspection of water supply and distribution system projects.

The fee programs are based on a market rate of growth constrained by the limits of the General Plan. Fee programs are adjusted annually to reflect inflation and other changes in the cost estimates, and are subject to a major revision every five years or whenever a major change occurs that would impact the fees.

Water system impact fees are assessed on water meter size and average citywide consumption for each meter size. The charges are based on equivalent dwelling unit (EDU) factors and assessed relative to a single-family home which is one EDU. Table 2 is a summary of the City water connection impact fees as of August 1, 2017. It is anticipated that water system infrastructure improvements required to support the proposed Farm at Alamo Creek project will be funded through the proposed development project and existing DIF funds.

An additional annexation water supply and delivery cost is assessed to projects as a condition for annexation. Because a project's boundaries require annexation into the City limits, water supplies and infrastructure costs for these projects were not part of the City's General Plan and are not fully covered in the DIF. Therefore, an additional fee is assessed per EDU to cover acquisition and delivery costs of water purchased to meet the increased annexation demands. According to a City memorandum titled *Annexation Water Supply Costs – Revised 2008* dated September 26, 2008, the 2008 annexation water supply costs are $2,139 per EDU or $3,753 per acre-foot (ac-ft).

TABLE 2
CITY OF VACAVILLE WATER CONNECTION FEES

Land Use Type	EDU	Meter Size, inch	Fee, $[a]
Single-Family	1.0	¾	8,530
Single Family - Senior	1.0	1	8,530
Second Unit - Granny Flat	2.5	1	21,325
	5.0	1-½	42,650
	8.0	2	68,240
Multiple - Family Multiple Family - Senior	2.0	¾	17,060
	2.6	1	22,178
	7.0	1-½	59,710
	13.4	2	114,302
	23.2	3	197,896
	37.4	4	319,022
Commercial/Industrial Public/Private Schools	2.0	¾	17,060
	2.6	1	22,178
	7.0	1-½	59,7106
	13.4	2	114,302
	23.2	3	197,896
	37.4	4	319,022

[a] City of Vacaville, Connection and Development Fees [2], as of August 1, 2017.

For current costs, the fees should be updated with Engineering News Record (ENR) construction cost index adjustments. The Farm at Alamo Creek lies entirely outside the current City limits and the Solano Irrigation District (SID) currently serves the Farm at Alamo Creek area. The Farm at Alamo Creek must de-annex from SID and be subject to the City's Annexation Water Supply Fee at the time of development.

2.0 EXISTING AND PLANNED WATER SOURCES

This section contains a description of the existing and planned groundwater, surface water, and water conveyance facilities. The City's water utility system was purchased from Pacific Gas and Electric (PG&E) Company in 1959 by issuing voter-approved water revenue bonds. Since purchasing the system, the City has systematically improved and upgraded the infrastructure. The water utility system is a self-supporting City enterprise. The water utility is responsible for operation, maintenance, and repair of the City's water treatment and distribution system, as well as water quality and potential recycled water distribution.

2.1 Overview of Water Supply Sources

The City water system consists of surface water treatment facilities, wells, pumping facilities, distribution and transmission pipelines, and storage reservoirs. The City receives water from several sources, including Solano Project surface water from Lake Berryessa, State Water Project (SWP) surface water and Settlement Water from the North Bay Aqueduct (NBA), and groundwater from local City wells. Within the City's water entitlements, the percentage of water used from each supply source varies due to conjunctive use. If any one source has limited water

availability or poor water quality, use from other sources can increase. Likewise, if unscheduled water becomes available it can be utilized to the City's advantage.

Surface water from Lake Berryessa is provided through contract between the US Bureau of Reclamation and the Solano County Water Agency (SCWA) and is delivered by SID. This water is treated at either the North Bay Regional Water Treatment Plant (NBR Plant) or at the City diatomaceous earth filter water treatment plant (DE Plant). The NBR Plant draws water from the Sacramento River Delta via the NBA, as well as Solano Project water from the Putah South Canal. The DE Plant draws water directly from the Putah South Canal. Figure 2 is a schematic of regional water supply facilities and includes the location of the NBA and Putah South Canal.

Groundwater from most of the existing wells is treated at the wellhead with chlorine to disinfect for pathogens and is then placed directly into the distribution system. Some wells (Well 1, 6, and 13) actively supply water directly to the DE Plant clearwell. From the clearwell, the Treated Water Pump Station pumps the water into the distribution system. In summary, all water is treated to meet Federal and State drinking water standards prior to customer use.

Below is a summary of the various water supply sources as detailed in the 2015 UWMP.

2.1.1 Groundwater

The first municipal water supply source for the City was groundwater developed in the 1930s. Currently, groundwater is provided via 10 existing and operational wells, 9 of which withdraw water from the deep aquifer in the basal zone of the Tehama Formation, located in the Solano Sub-basin of the Sacramento Valley Basin of the Sacramento River Hydrologic Region (see Appendix B). Most City wells are located in the Elmira well field. However, new wells will be more widely distributed, near I-80. Currently, approximately 5,500 ac-ft per year (ac-ft/yr) of groundwater is withdrawn.

Two wells (3 and 7) are not currently in operation and one (De Mello) is not in continuous operation and is used only as a standby well in emergency conditions. The City is planning to rehabilitate and/or provide treatment for some of the existing wells and install new wells in the future. Vacaville continues to explore well field expansion as a means of maintaining adequate water supply. A regional program is being implemented to monitor groundwater data as a means of ensuring against overdraft or contamination. This program is described in Appendix B and Appendix C along with an investigation of groundwater pumping impacts [3]. A discussion of the groundwater basin and historic groundwater pumping follows. Specific future well locations will be determined based on additional field investigations. Figure 3 is a schematic of the City depicting the locations of the existing City wells and DE Plant as well as the area identified for future wells.

Lake Berryessa

Winters

PUTAH CREEK

Davis

SOLANO DIVERSION DAM

I-80

Dixon

PUTAH SOUTH CANAL

I-505

Vacaville

DEEP WATER SHIP CHANNEL

PUTAH SOUTH CANAL

NORTH BAY REGIONAL WATER TREATMENT PLANT

Napa

Fairfield

NORTH BAY AQUEDUCT

BARKER SLOUGH PUMPING STATION

Suisun City

N

I-80

SOLANO COUNTY

American Canyon

I-680

N

20,000 10,000 0 20,000 Feet

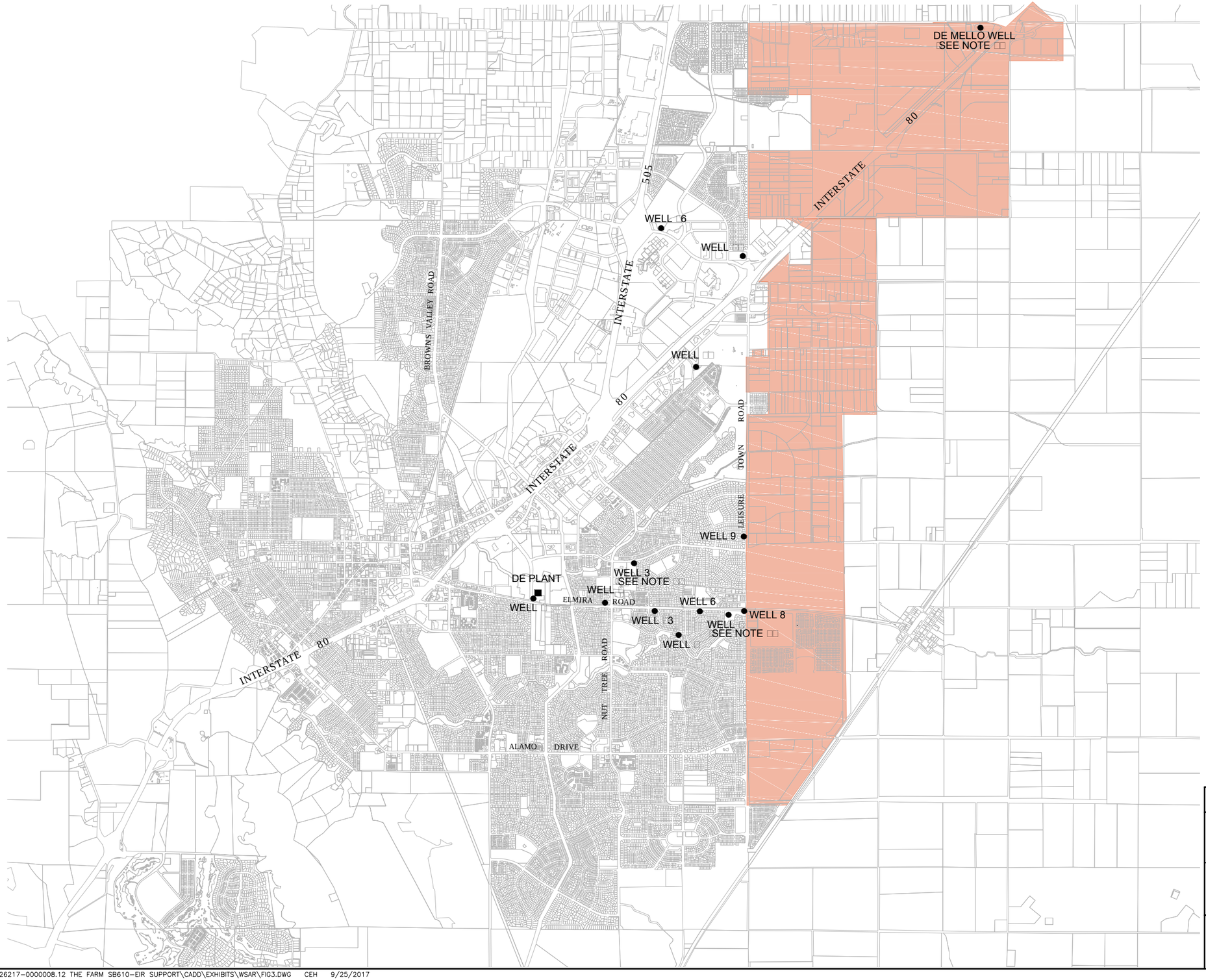
FIGURE 2

THE FARM AT ALAMO CREEK SB610
WATER SUPPLY ASSESSMENT REPORT

REGIONAL WATER SUPPLY FACILITIES

NV5

N:\226217-0000008.12 The Farm SB610-EIR Support\GIS\Maps\Fig2.mxd MN 9/25/2017



N

0 2,000 4,000

SCALE: 1"=4000'

LEGEND

- VACAVILLE CITY WELL
- VACAVILLE DE PLANT
- AREA OF NEW WELL LOCATION

NOTES

1. THE LOCATION OF FUTURE WELLS IS PRELIMINARY. LOCATIONS WILL BE DETERMINED BASED ON FIELD INVESTIGATIONS.
2. WELLS 3 AND . ARE CURRENTLY NOT IN OPERATION AND DE MELLO IS ON STANDBY.

FIGURE 3

THE FARM AT ALAMO CREEK SB6.0
WATER SUPPLY ASSESSMENT REPORT

CITY OF VACAVILLE
MUNICIPAL WELLS AND DE PLANT

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N:\226217-0000008.12 THE FARM SB610-EIR SUPPORT\CADD\EXHIBITS\WSAR\FIG3.DWG CEH 9/25/2017

A. Boundaries, Soils, Storage Capacity

The City pumps groundwater primarily from the basal zone of the Tehama Formation in the Solano Sub-basin, located east of the English Hills Fault. Well 1 is the only well currently in operation that extracts water from a different formation, the Markley Formation, located west of the English Hills Fault. Tehama Formation consists of moderately to highly consolidated fluvial, alluvial, and lacustrine deposits. Lithology present within the Tehama Formation includes inter-layered sand, silt, clay, and gravel, a stiff blue lacustrine clay located near the upper portions of the formation, and other continuous clay layers that divide the formation into upper, middle, and basal zones. The basal zone of the formation also includes gravel and cobble deposits, layers of detrital tuff, and calcium carbonate cemented conglomerate [4].

The primary source of groundwater supply for municipal use is the basal zone of the Tehama Formation, which is a highly confined aquifer. The overlying Quaternary alluvial deposits and upper and middle zones of the Tehama Formation are not suitable for high production municipal water supply. However, they are used for some domestic and agricultural purposes in unincorporated areas of Vacaville. East of the Vacaville area, these aquifers are utilized by SID to supplement surface water supplies and for shallow groundwater pumping for drainage purposes.

The Solano Sub-basin includes the southernmost portion of the Sacramento Valley Basin and extends into the northern portion of the Sacramento-San Joaquin Delta. Sub-basin boundaries are as follows: (1) Putah Creek on the north; (2) Sacramento River on the east (from Sacramento to Walnut Grove); (3) North Mokelumne River on the southeast (from Walnut Grove to San Joaquin River); (4) San Joaquin River on the south (from the North Mokelumne River to Sacramento River); and, (5) boundary between the San Francisco Bay and Sacramento River hydrologic study areas as described in California Department of Water Resource (DWR) Bulletin 118 on the west.

B. Groundwater Management

In September 2014, the California Legislature passed the Sustainable Groundwater Management Act (SGMA). The legislation applies to basins or sub-basins that DWR designates as medium or high priority basins. The Solano Sub-basin was ranked medium priority and the Suisun-Fairfield Valley Basin was ranked as very low priority. SGMA requires that groundwater sustainability agencies (GSAs) are designated by June 30, 2017, and groundwater sustainability plans (GSPs) are adopted by January 31, 2022.

The City cooperates with SCWA, the designated Monitoring Entity for the Solano Sub-basin, by coordinating and reporting water level data for eight active monitoring wells within the City on a semi-annual basis. SCWA oversees a network of monitoring wells that includes seven monitoring wells screened in the Basal Tehama Formation, two monitoring wells in the Upper Tehama Formation, and two monitoring wells in the Quaternary Alluvium/Upper Tehama Formation.

Through managed utilization of both surface water and groundwater resources, including the planned distribution of groundwater pumping in the basal zone of the Tehama Formation, groundwater levels associated with local pumping depressions have been managed and have

remained stable relative to "base year" groundwater conditions established in 1992-1993 for the Elmira well field area.

Groundwater monitoring efforts are a critical component of managing water resources in and around the City. Monitoring land subsidence paired with groundwater level measurements lead to a deeper understanding about the water resource and the general conditions of the aquifer underlying the City. Based on information provided in the Groundwater Supply Sufficiency Technical Memorandum (May 2016), there is land subsidence occurring in and around Solano County, though at relatively low rates (between 0.00195 to 0.03238 ft/yr, or 0.594 to 9.869 millimeters (mm)/yr) over about the last eleven years. The locations selected for new wells will be critical to minimize groundwater level declines, particularly to ensure groundwater levels remain at elevations above historical levels to avoid potential for further land subsidence.

C. Historic Groundwater Pumping

The City is the primary groundwater user within the Vacaville area. Unmeasured agricultural and domestic groundwater extractions in unincorporated areas of the Vacaville area, Rural North Vacaville Water District (RNVWD) production wells, and SID are the other groundwater users. Since 1968, the City's annual groundwater pumping has varied from a low of 2,862 ac-ft in year 1968 to a high of 8,165 ac-ft in year 1983. Annual groundwater production, including all wells, is summarized in Table 3 from year 1968 to year 2015.

The majority of groundwater production in the past was obtained from wells located at the Elmira Road well field. The newer northeast sector well field located near I-80 also contributes to the groundwater production. In the future, groundwater pumping will be more widely distributed in the study area rather than concentrated in the Elmira Road well field.

2.1.2 Surface Water

The City has three separate sources for surface water. Each source has a different level of reliability. This section describes the City's surface water sources. Appendix D contains information regarding specific contracts between the City and various water supply agencies.

A. Solano Project (Vacaville Supply, SID Agreement)

The Solano Project was constructed by the Bureau of Reclamation in 1958. The water rights permits for the Solano Project are held by the Bureau of Reclamation in trust for the Solano water users. The water rights permits further state that when the permits are converted to a license, the license will be issued in the name of Solano water users. Unlike most federal water projects, the water rights to the Solano Project "belong" to the Solano water users. The main feature of the Solano Project is Monticello Dam, which provides for storage of 1.6 million ac-ft of water in Lake Berryessa. Water from the Lake Berryessa is diverted through the Putah Diversion Dam to the 33-mile Putah South Canal, which transports water to the eight SCWA-member unit contractors for Solano Project water.

TABLE 3
CITY OF VACAVILLE
HISTORICAL GROUNDWATER PUMPING [1]

Year	ac-ft/yr	Year	ac-ft/yr	Year	ac-ft/yr
1968	2,862	1985	5,853	2002	6,638
1969	3,046	1986	5,824	2003	6,628
1970	2,871	1987	6,236	2004	6,562
1971	3,198	1988	5,421	2005	6,680
1972	3,255	1989	6,072	2006	6,635
1973	3,125	1990	5,625	2007	6,612
1974	3,316	1991	5,447	2008	5,784
1975	3,970	1992	5,531	2009	4,647
1976	4,965	1993	4,395	2010	5,054
1977	5,093	1994	3,893	2011	5,049
1978	5,707	1995	3,885	2012	5,142
1979	6,185	1996	3,230	2013	5,236
1980	6,990	1997	3,386	2014	5,345
1981	7,740	1998	3,905	2015	5,222
1982	7,683	1999	4,096		
1983	8,165	2000	5,070		
1984	6,089	2001	6,214		

Source: Table 6-H from 2015 UWMP.

SCWA has entered into agreements with cities, districts, and state agencies to provide water from the Solano Project. The Solano Project contracting agencies are: Fairfield, Suisun City, Vacaville, Vallejo, SID, Maine Prairie Water District, University of California at Davis, and California State Prison - Solano. Table 4 summarizes the annual entitlement to each agency.

The contracts with the public entities that use Solano Project water provide for the sale and distribution of water made available by the Bureau of Reclamation each year. The Bureau of Reclamation is contractually committed to delivering the full contract amount of water supply from the Solano Project unless the water supply does not physically exist (e.g., an empty reservoir). All Solano Project water contractors, whether they are municipal or agricultural, are impacted by water supply reductions on an equal basis.

In addition to its entitlement from SCWA, Vacaville entered into a 1995 Master Water Agreement (1995 Agreement) with SID. A second amendment to the 1995 Agreement, adopted in June 2010, updated the water purchase schedule. Pursuant to the second amendment, Vacaville receives an increasing supply from SID through the year 2040 and a consistent supply thereafter until the year 2050. The second amendment allows Vacaville to request additional water if needed to support growth. The agreement provides for changes in the delivery schedule, making the maximum entitlement of 10,050 ac-ft/yr available earlier than the year 2040 if desired by the City. The annual water schedule for SID water available to the City is contained in Table 5.

TABLE 4
SUMMARY OF SOLANO PROJECT
WATER CONTRACTS (AC-FT/YR) [1]

Agency	Annual Entitlement
Fairfield	9,200
Suisun City	1,600
Vacaville	5,750
Vallejo	14,600
SID	141,000
Maine Prairie Water District	15,000
UC Davis	4,000
California State Prison – Solano	1,200
Project Operating Loss (average estimated)	15,000
Total	**207,350[a]**

Source: Table 6-A from 2015 UWMP.

[a] Value approximates a firm yield during the driest hydrologic period on record (1916-1934).

TABLE 5
ANNUAL WATER SCHEDULE FOR THE
SID 1995 AGREEMENT (AC-FT/YR) [5]

Year	Annual Entitlement	Year	Annual Entitlement
2010	2,500	2026	5,925
2011	2,625	2027	6,225
2012	2,750	2028	6,525
2013	2,875	2029	6,825
2014	3,000	2030	7,125
2015	3,125	2031	7,425
2016	3,325	2032	7,725
2017	3,525	2033	8,025
2018	3,725	2034	8,325
2019	3,925	2035	8,625
2020	4,125	2036	8,925
2021	4,425	2037	9,225
2022	4,725	2038	9,525
2023	5,025	2039	9,825
2024	5,325	2040 through 2050	10,050
2025	5,625		

Source: Table 6-B from UWMP.

B. State Water Project (North Bay Aqueduct)

Vacaville receives water allocations from the State Water Project through the SCWA (termed Table A water) that currently expires in 2035, but is renewable, and water from a Year 2001 purchase agreement from Kern County Water Agency (KCWA). Surface water received pursuant to these agreements is delivered through the NBA, a State Water Project facility. The City supply from the State Water Project is 6,100 ac-ft/yr, while KCWA Agreement water totals 2,878 ac-ft/yr. The Solano County branch of the NBA was completed in 1988. The NBA is 28 miles long starting from Barker Slough in the Delta and ending in Napa County. The location of the NBA can be seen in Figure 2. The DWR is the owner and operator of the NBA.

The water supply for the NBA is less reliable than the Solano Project. Supply from the NBA comes from the State Water Project which provides water to a total of 29 contractors. A list of these contractors and their respective allocations is shown in Table 6. Because the NBA is part of the entire State Water Project, any shortages occurring in the State Water Project impact the NBA.

Within Solano County there are currently seven agencies with NBA water allocations. These include Benicia, Dixon, Fairfield, Rio Vista, Suisun City, Vacaville, and Vallejo. Table 7 summarizes the annual increase in SCWA's contract. Member units using the NBA and their allocations are described in Table 8. Shortages during dry years are proportional to their share of the overall contract with DWR.

TABLE 6
STATE WATER PROJECT
2016 WATER ALLOCATIONS (AC-FT/YR) [1]

Agency	Maximum Allocations
Upper Feather River Area	
City of Yuba City	9,600
County of Butte	27,500
Plumas County Flood Control and Water Conservation District	2,700
Subtotal	**39,800**
North Bay Area	
Napa County Flood Control and Water Conservation District	29,025
Solano County Water Agency[a]	47,756
Subtotal	**76,781**
South Bay Area	
Alameda County Flood Control and Water Conservation District	80,619
Alameda County Water District	42,000
Santa Clara Valley Water District	100,000
Subtotal	**222,619**
San Joaquin Valley Area	
County of Kings	9,305
Dudley Ridge Water District	45,350
Empire West Side Irrigation District	3,000
Kern County Water Agency	982,730
Oak Flat Water District	5,700
Tulare Lake Basin Water Storage District	87,471
Subtotal	**1,133,556**
Central Coastal Area	
San Luis Obispo County Flood Control and Water Conservation District	25,000
Santa Barbara County Flood Control and Water Conservation District	45,486
Subtotal	**70,486**

Continued on Next Page

TABLE 6 (continued)
STATE WATER PROJECT 2016 WATER ALLOCATIONS (AC-FT/YR) [1]

Agency	Maximum Allocations
Southern California Area	
Antelope Valley-East Kern Water Agency	144,844
Castaic Lake Water Agency	95,200
Coachella Valley Water District	138,350
Crestline-Lake Arrowhead Water Agency	5,800
Desert Water Agency	55,750
Littlerock Creek Irrigation District	2,300
Metropolitan Water District of Southern California	1,911,500
Mojave Water Agency	85,800
Palmdale Water District	21,300
San Bernardino Valley Municipal Water District	102,600
San Gabriel Valley Municipal Water District	28,800
San Gorgonio Pass Water Agency	17,300
Ventura County Flood Control District	20,000
Subtotal	**2,629,544**
Total	**4,172,786**

Source: Table 6-C from 2015 UWMP.
[a] Vacaville entitlement of 8,978 ac-ft/yr within SCWA allocation.

TABLE 7
SUMMARY OF STATE WATER PROJECT ALLOCATIONS
TO THE SOLANO COUNTY WATER AGENCY
THROUGH THE NORTH BAY AQUEDUCT (AC-FT/YR) [1]

Year	Annual Allocations	Year	Annual Allocations
2001	45,836	2009	47,456
2002	46,296	2010	47,506
2003	46,756	2011	47,556
2004	47,206	2012	47,606
2005	47,256	2013	47,656
2006	47,306	2014	47,706
2007	47,356	2015[a]	47,756
2008	47,406	2016	47,756

Source: Table 6-D from 2015 UWMP.
[a] Each year thereafter will have an annual allocation of 47,756 ac-ft/yr.

TABLE 8
STATE WATER PROJECT
ALLOCATION TO SOLANO COUNTY CITIES SERVED
BY THE NORTH BAY AQUEDUCT (AC-FT/YR) IN YEAR 2040 [1]

City	Annual Allocations
Benicia	17,200
Dixon	0[a]
Fairfield	14,678
Rio Vista	0[a]
Suisun City	1,300
Vacaville	8,978[b]
Vallejo	5,600
Total	**47,756**

Source: Table 6-E from 2015 UWMP.

[a] Dixon and Rio Vista currently do not use their individual allocation of 1,500 ac-ft/yr. If Dixon and/or Rio Vista decide to use the NBA water supply, supplies to Benicia, Fairfield and Vallejo are reduced commensurately.

[b] Vacaville allocations from State Water Project (including KCWA Agreement).

C. Settlement Water (DWR Agreement)

Settlement Water consists of surface water from the Sacramento River and Sacramento-San Joaquin Delta Estuary. The settlement of an Area of Origin litigation case resulted in an annual allocation up to 9,320 ac-ft/yr to the City through the SWP facilities, although it is not considered SWP water. The water is made available by DWR in settlement of area-of-origin water right applications by the cities of Fairfield, Benicia, and Vacaville. The City currently uses only 25 to 30 percent of the Settlement Water, and experiences water quality and delivery challenges. The City is working with SCWA to construct a new intake on the Sacramento River to resolve these challenges. Table 9 is a summary of the Settlement Water for the cities of Fairfield, Benicia, and Vacaville and is detailed in Area of Origin Settlement Solano County Water Agency Contract Amendment No. 20 to the Water Supply Contract between DWR and SCWA on December 31, 2013.

TABLE 9
SUMMARY OF SETTLEMENT WATER FOR THE CITIES OF
FAIRFIELD, BENICIA, AND VACAVILLE (AC-FT/YR) [1]

Agency	Annual Allocations
Fairfield	11,800
Benicia	10,500
Vacaville	9,320
Total	**31,620**

Source: Table 6-G from 2015 UWMP.

2.1.3 Recycled Water

Reclaimed or recycled water is an important and viable resource for urban irrigation and other potential uses. Use of reclaimed water where appropriate may help further reduce demand for domestic water supply.

A. Tertiary Treated Recycled Water from Easterly

The City owns and operates the Easterly Wastewater Treatment Plant (Easterly) located two miles east of Leisure Town Road in the town of Elmira. Treated effluent from Easterly discharges into Old Alamo Creek, thence to New Alamo Creek, thence to Cache Slough, and into the Sacramento-San Joaquin River Delta.

Easterly's treatment process consists of headworks, primary sedimentation basins, activated sludge aeration basins, secondary clarifiers, tertiary filtration, chlorination contact basins, and dechlorination facilities. The aeration basins provide nitrification and denitrification in addition to biological secondary treatment. The City's National Pollutant Discharge Elimination System (NPDES) wastewater permit for Easterly requires tertiary treatment seasonally, from May 1 to October 31. Deep bed sand and anthracite filters provide tertiary filtration treatment in compliance with California Code of Regulations, Title 22. Easterly is rated for an average dry weather flow capacity of 15 million gallons per day (mgd) and a peak wet weather flow capacity of 55 mgd.

The City is initiating a Recycled Water Master Plan that will consist of three major elements, a Recycle Water Feasibility Study ("Feasibility Study"), a supporting programmatic environmental document or EIR ("Program EIR"), and Recycled Water Implementation and Financing Plan ("Implementation and Financing Plan"). The Feasibility Study shall identify potential alternative beneficial uses of recycled water from Easterly. The Program EIR will evaluate the potential alternative beneficial uses identified in the Feasibility Study to identify potential environmental impacts. The Recycled Water Implementation and Financing Plan will develop a recommended integrated recycled water program that maximizes the benefits of the City's recycled water resource.

2.2 Future Water Projects

Early in 2016 (January 12, 2016) the City adopted a series of water service rate increases designed to generate an annual increase in revenues over the next five years. The City intends to combine the increased water rates, capital replacement funds, water connection fees, direct develop construction, and various long-term financing options, to raise the necessary revenue to fund and implement the construction of water production, treatment, and transmission facilities currently defined in the Capital Improvements Plan (CIP) and Water Master Plan.

Implementing the CIP and Water Master Plan will provide the City with the necessary improvements to the existing water system facilities and continue to provide adequate water supply for the currently planned developments within the City's sphere of influence. Figure 4 is a schematic representation of the proposed water projects to meet buildout water demand as currently presented in the *2016 Water System Master Plan, Revised Final Draft* (August 2017).

N

0 2000 4000

SCALE: 1"=4000'

REYNOLD'S RANCH PUMP STATION

M□MURTRY RESERVOIR

REYNOLD'S RANCH RESERVOIR

BROWNS VALLEY RESERVOIR

NEW RESERVOIR

PUTAH SOUTH CANAL

HIDDEN VALLEY PUMP STATION

VINE STREET PUMP STATION

WYKOFF PUMP STATION

BUCK RESERVOIR

BUTCHER RESERVOIR □

BUTCHER RESERVOIR □□

LLV PUMP STATION

WELL □6

WELL □□

WELL □□

WELL 3

WELL □

WELL

TWPS

WELL 9

WELL 6

WELL 8

WELL □3

WELL □

WELL □

DE MELLO WELL

THE FARM AT ALAMO CREEK

PROPOSED SPECIFIC IMPROVEMENTS WITHIN BRIGHTON LANDING AND ROBERTS' RANCH ARE CURRENTLY UNDER REVIEW□APPROVAL

NBR PLANT

LEGEND

- EXISTING WATER MAIN
- PUMP STATION
- MUNICIPAL WELL
- MAIN □ONE RESERVOIR
- PRO□ECTS TO MITIGATE DEFICIENCIES
- DEVELOPER FUNDED PRO□ECTS
- PRO□ECTS TO MEET BUILDOUT DEMAND

NOTE□

□□ SEE MOST CURRENT VERSION OF WATER MASTER PLAN FOR FURTHER INFORMATION ON PROPOSED WATER PRO□ECTS□

FIGURE 4

THE FARM AT ALAMO CREEK SB6□0
WATER SUPPLY ASSESSMENT REPORT

PROPOSED WATER PROJECT LOCATION MAP

NV5

N:\226217-0000008.12 THE FARM SB610-EIR SUPPORT\CADD\EXHIBITS\WSAR\FIG4.DWG CEH 9/25/2017

2.3 Summary of Existing and Planned Water Supply

The total water supply (allocation or safe yield) available to the City in 2015 from groundwater, surface water, and recycled water was approximately 34,173 ac-ft/yr. The actual water supplied to the City in 2015 was 13,205 ac-ft/yr. Table 10 is a summary of the respective supply sources as discussed in previous sections for the actual water supplied and the allocation or safe yield in 2015. The sources of water will remain the same for the City, however the allocations will increase over the years to meet the projected growth in the City. The total water supply (allocation or safe yield) available to the City in 2040 will be approximately 42,198 ac-ft/yr. Table 11 is a summary of the respective supply sources discussed in previous sections outlining the total water supply in year 2040.

TABLE 10
CITY OF VACAVILLE
TOTAL WATER SUPPLY IN YEAR 2015 [1]

Source of Supply	Total Right or Safe Yield (ac-ft/yr)	Total Actual Supply (ac-ft/yr)
Solano Project		
Vacaville Entitlement [a]	5,750	3,089
SID 1995 Agreement [b]	3,125	3,125
State Water Project		
Vacaville Entitlement [c]	8,978	1,769
Settlement Water [d]	9,320	0
Groundwater Pumping [e]	7,000	5,222
Total	**34,173**	**13,205**

[a] See Table 4
[b] See Table 5
[c] See Table 8
[d] See Table 9
[e] See Appendix B and Appendix C

TABLE 11
CITY OF VACAVILLE
TOTAL WATER SUPPLY IN YEAR 2040 [1]

Source of Supply	Total Right or Safe Yield (ac-ft/yr)
Solano Project	
Vacaville Entitlement [a]	5,750
SID 1995 Agreement [b]	10,050
State Water Project	
Vacaville Entitlement [c]	8,978
Settlement Water [d]	9,320
Groundwater Pumping [e]	8,100
Recycled Water [f]	0
Total	**42,198**

[a] See Table 4
[b] See Table 5
[c] See Table 8
[d] See Table 9
[e] See Appendix B and Appendix C
[f] Recycled water not considered a viable water supply source.

3.0 PROJECTED WATER DEMANDS

Presented in this section are land use summaries and projected water demands for the proposed Farm at Alamo Creek project. The water demand factors that serve as the basis for the demand projections are also described below.

3.1 Water Demand Factors

The City currently uses two sets of water demand factors (existing and growth) for planning and analysis of water supply and distribution systems. The existing demand factors are used to calculate the total existing water demand and the growth factors are applied to land use quantities designated in the City's land use database for development. Table 12 is a summary of the current water demand factors. These factors are from the *2016 Water System Master Plan, Revised Final Draft* (2016 Water Master Plan), dated August 2017 [6]. The difference between the two sets of demand factors (existing versus growth) includes a contingency to reflect uncertainties in projecting future land use. It also includes increases in the water demand for new development versus existing within a given land use category.

TABLE 12
SUMMARY OF WATER DEMAND FACTORS USED BY CITY OF VACAVILLE FOR MASTER PLANNING PURPOSES [6]

Land Use Description	Land Use Designation	Unit	Water Demand Factors, GPD/unit			
			Existing		Growth	
			Potable	Irrigation	Potable	Irrigation
Residential						
Residential Estates	RE	du	545	0	600	0
Residential High Density	RHD	du	210	0	230	0
Residential Urban High Density	RUHD	du	170	0	185	0
Residential Low Density	RLD	du	305	0	335	0
Residential Low Medium Density	RLMD	du	270	0	295	0
Residential Medium Density	RMD	du	240	0	265	0
Residential Rural	RR	du	680	0	750	0
Retired Single Family Residential	Ret SF	du	240	0	265	0
Retired Multiple Family Residential	Ret MF	du	240	0	265	0
Manufactured Homes	MH	du	210	0	230	0
Mixed Use – units	MX	du	0	0	0	0
Non-Residential						
Commercial Highway	CH	ac	3,800	360	4,180	430
Commercial Office	CO	ac	800	400	880	480
Medical Office	MO	ac	800	400	880	480
Commercial Service	CS	ac	1,120	320	1,230	385
Downtown	D	ac	3,120	80	3,430	95
Mixed Use – Area	MX	ac	800	320	880	385
Retail Service	RS	ac	800	320	880	385
Church	CH	ac	1,200	320	1,320	385
Hospital	HOS	ac	3,120	320	3,430	385
Industrial	IND	ac	960	320	1,055	385
Elementary School - Area	ESC	ac	0	720	0	865
Elementary School - Students	ESC	stu	20	0	20	0
High School - Area	HSC	ac	0	720	0	865
High School - Students	HSC	stu	30	0	35	0
College – Area	COL	ac	0	720	0	865
Public Park	PK	ac	0	1,040	0	1,250
Private Recreation	PR	ac	80	1,200	90	1,440
Public Low	PL	ac	0	0	0	0
Public Medium	PM	ac	800	320	880	385
Public High	PH	ac	800	320	880	385
Public Open Space	OS	ac	0	0	0	0
Miscellaneous	MISC	ac	0	0	0	0
Landscape Buffer	BUFF	ac	0	0	0	0
Agriculture	AG	ac	0	0	0	0
Hillside Agriculture	HIAG	ac	0	0	0	0

3.2 Projected Water Demands for The Farm at Alamo Creek

Table 13 includes the land use summary and resulting water demands for the proposed Farm at Alamo Creek development project. *The Farm at Alamo Creek Specific Plan* [7] presents the proposed land use and corresponding dwelling units or acreage by village. In addition to residential units of various densities and public parks, neighborhood commercial, public/institutional, agricultural buffer, and public open space land uses are planned for the Farm at Alamo Creek project. Figure 5 is a schematic representation of the proposed land uses within the Farm at Alamo Creek. This WSAR assumes that the Farm at Alamo Creek development project will be constructed by 2025.

3.3 Summary of Projected Water Demands

Table 14 includes projected water demands for the City and future development in five-year increments through the year 2040. The 2015 baseline City water demand is estimated using the 164 gallons per capita per day (gpcd) target for Year 2020 and the 2015 adjusted population of 89,267 (see Table 1) for a total demand of 16,465 ac-ft/yr or 14.7 million gallons per day (mgd). Water demands for the Year 2020 through 2040 were based on the demand projections presented in the 2015 UWMP Update and demand factors from the 2016 Water Master Plan [6]. These projections take into consideration the Year 2020 target per capita per day usage and applying that to the future population projections by the Association of Bay Area Governments.

As summarized in Table 14, total average annual demand for the existing City, proposed growth and The Farm at Alamo Creek will reach 20,198 ac-ft/yr in the Year 2040. This value will be compared to available water supply in the subsequent report section. The Farm at Alamo Creek demand includes both potable and irrigation demands.

FIGURE 5

THE FARM AT ALAMO CREEK SB60
WATER SUPPLY ASSESSMENT REPORT

PROPOSED PROJECT
LAND USE MAP

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TABLE 13
THE FARM AT ALAMO CREEK PROJECT
LAND USE AND DEMAND SUMMARY AT YEAR 2025

					Demand Factors		Estimated Water Demand			
Area[a]	**Land Use [a]**	**Designation**	**Quantity[a] du**	**Quantity[a] ac**	**Potable gpd/du**	**Irrigation[b] gpd/ac**	**Potable gpd**	**Irrigation gpd**	**Total gpd**	**Annual ac-ft/yr**
1	Residential Low Density	RLD	48	10.8	335	0	16,080	0	16,080	18.0
2	Residential Low Medium Density	RLMD	51	8.0	295	0	15,045	0	15,045	16.9
3	Neighborhood Commercial[c]	RS	0	4.2	880	385	3,696	1,617	5,313	6.0
4	Residential Low Medium Density	RLMD	44	7.6	295	0	12,980	0	12,980	14.5
5	Residential Low Medium Density	RLMD	47	8.3	295	0	13,865	0	13,865	15.5
6	Residential Low Medium Density	RLMD	39	7.5	295	0	11,505	0	11,505	12.9
7	Residential Low Medium Density	RLMD	69	10.2	295	0	20,355	0	20,355	22.8
8	Residential Low Density	RLD	34	6.9	335	0	11,390	0	11,390	12.8
9	Residential Medium High Density[c]	RMD	40	2.8	265	0	10,600	0	10,600	11.9
10	Residential Medium High Density[c]	RMD	124	8.8	265	0	32,860	0	32,860	36.8
11	Public/Institutional[c]	PL	0	1.2	0	0	0	0	0	0
12	Neighborhood Commercial[c]	RS	0	3.2	880	385	2,816	1,232	4.048	4.5
13	Residential Medium High Density[c]	RMD	20	1.4	265	0	5,300	0	5,300	5.9
14	Public Park	PK	0	4.7	0	1,250	0	5,875	5,875	6.6
15	Public Park	PK	0	2.5	0	1,250	0	3,125	3,125	3.5
16	Open Space	OS	0	4.7	0	0	0	0	0	0
17	Public Park	PK	0	8.2	0	1,250	0	10,250	10,250	11.5
18	Public Park	PK	0	11.2	0	1,250	0	14,000	14,000	15.7
19	Open Space	OS	0	4.4	0	0	0	0	0	0
20	Public/Institutional[c]	PL	0	9.6	0	0	0	0	0	0
21	Public/Institutional[c]	PL	0	3.8	0	0	0	0	0	0
22	Public/Institutional[c]	PL	0	11.4	0	0	0	0	0	0
23	Public/Institutional[c]	PL	0	8.2	0	0	0	0	0	0
24	Residential Low Density	RLD	90	18.2	335	0	30,150	0	30,150	33.8
25	Residential Low Density	RLD	162	38.5	335	0	54,270	0	54,270	60.8
26	Agriculture Buffer	BUFF	0	4.3	0	0	0	0	0	0
Total Demand – The Farm at Alamo Creek			**768**	**210.6**			**240,912**	**36,099**	**277,011**	**310.3**

[a] Neighborhood numbers, land use, and quantities from The Farm at Alamo Creek Specific Plan [7].
[b] Domestic irrigation demand (for residential land uses) will be met with potable water, and therefore is included in potable demand factor.
[c] Demand factors for Public Low, Retail Service, and Residential Medium Density, were used for Public/Institutional, Neighborhood Commercial, and Residential Medium High Density land uses respectively.

TABLE 14
CITY OF VACAVILLE
SUMMARY OF NORMAL YEAR ANNUAL WATER DEMAND (AC-FT/YR)
IN FIVE YEAR INCREMENTS

Demand	2015	2020	2025	2030	2035	2040
City Base Year (2015)[a]	16,465	16,465	16,465	16,465	16,465	16,465
Future Growth in City [b]	0	520	1,162	1,772	2,634	3,423
Farm at Alamo Creek Project [c]	0	0	310	310	310	310
Total Demand	**16,465**	**16,985**	**17,937**	**18,547**	**19,409**	**20,198**

[a] Existing 2015 City demand based on Year 2020 gpcd target (164 gpcd) and Year 2015 adjusted population of 89,267 [1].
[b] Based on Year 2020 gpcd target (164 gpcd) and future population projections provided by ABAG [1].
[c] The Farm at Alamo Creek Project assumed complete development by Year 2025. See Table 13.

The City's existing (2016) and buildout water demands were recently estimated and included in the 2016 Water Master Plan as follows: Existing - 16,300 ac-ft/yr (or 14.55 mgd) and Buildout - 27,550 ac-ft/yr (or 24.60 mgd). These water demand estimates are based on existing and projected land use quantities and demand factors. The City Base Year (2015) demand (16,465 ac-ft/yr) as included in Table 14 is more conservative for this WSAR analysis. At this time, the City does not have projections of land use quantities for intermittent years to compare the future demands based on the Year 2020 target (164 gpcd) and the land use quantities and demand factors. However, based on the buildout demand of 27,550 ac-ft/yr, it is evident that buildout will occur after year 2040. For purposes of this WSAR the demand projections and assumptions used with the 2015 UWMP are adequate.

3.4 Water Shortage Contingency Planning

Under drought conditions, the City has an ability to reduce water demand. The primary mechanism for demand management is through public awareness and enforcement of water conservation ordinances. Specifically, the City's Urban Water Shortage Contingency Plan (UWSCP), see Appendix E. The UWSCP was revised in August 2014 and concluded with the adoption of the Drought Ordinance No. 1877 [8]. This ordinance establishes water conservations requirements and a water rate structure that addresses Normal, Drought, and Emergency Conditions. As drought or emergency conditions are declared by the City Council, additional rate tiers are added to the existing rate structure to promote conservation. A target water use amount is determined for all residential customers based on past usage patterns for commercial, industrial, and landscape customers. Customers using water above their target amount pay increasingly higher rates for that water.

The City is also committed to implementing water conservation programs. To achieve short term and long term conservation, the City has implemented, is planning to implement, or is studying Demand Management Measures (DMMs), as described in the *2015 Urban Water Management Plan Update* [1]. The DMMs are administered in conjunction with the five (5) Foundational Best Management Practices (BMPs) as outlined by the California Urban Water Conservation Council (CUWCC).

Since 2010, the City has maintained and implemented the DMMs. The implementation included proactive and responsive enforcement via the City's Code Compliance of the City's Municipal Code 13.20, Ordinance No. 1877, and Section 4 of the UWSCP.

In past drought years, demand management practices have been effective in reducing water demand. As shown in Table 15, during the 1991-1993 drought, the per capita demand was reduced from 195 gpd/person to 150 gpd/person, a reduction of at least 23 percent. Historically, the City has had the ability to lower demand by 10 percent during a single dry year and by 20 percent during multiple dry years.

TABLE 15
CITY OF VACAVILLE
CHANGE IN WATER PRODUCTION (DEMAND)
DURING DROUGHT YEARS (1990-1995)

Year	Adjusted Population [a]	Water Production		Per Capita Demand, gpd/person	Demand Change [b], %
		ac-ft/yr	mgd		
1990	64,148	13,991	12.5	195	0
1991	68,755	11,672	10.4	151	-23
1992	71,156	12,036	10.7	150	-23
1993	73,608	12,764	11.4	155	-21
1994	75,244	14,189	12.7	169	-13
1995	75,013	14,695	13.1	175	-10

[a] Adjusted population values are per the City of Vacaville 2015 Urban Water Management Plan Update [1] and have been updated to exclude the prison population that is served by SCWA.

[b] Reduction in per capita demand as compared to 1990 demand.

Table 16 includes the change in per capita demand during the current drought from 2008 through 2015. In summary, the City has observed the per capita demand reduce from 201 gpd/person to 132 gpd/person, a reduction of approximately 34 percent. This confirms that historically, the City is capable of lowering the average day demand by 10 percent during a single dry year and by as much as 20 percent during multiple dry years.

TABLE 16
CITY OF VACAVILLE
CHANGE IN WATER PRODUCTION (DEMAND)
DURING DROUGHT YEARS (2008-2015)

Year	Adjusted Population [a]	Water Production		Per Capita Demand, gpd/person	Demand Change [b], %
		ac-ft/yr	mgd		
2008	85,911	19,344	17.3	201	0
2009	85,959	17,673	15.8	184	-8
2010	86,317	16,335	14.6	169	-16
2011	87,715	16,055	14.3	163	-19
2012	88,692	16,933	15.1	170	-15
2013	91,281	18,602	16.6	182	-9
2014	89,988	15,799	14.1	157	-22
2015	89,627	13,200	11.8	132	-34

[a] Adjusted population values are per the City of Vacaville 2015 Urban Water Management Plan Update [1] and have been updated to exclude the prison population that is served by SCWA.

[b] Reduction in per capita demand as compared to 2008 demand.

4.0 ANALYSIS OF WATER SUPPLY RELIABILITY

In this section, the City's groundwater and surface water supplies previously identified are analyzed. The sources are identified for their availability during normal, single, and multiple dry years as determined by the Department of Water Resources' Sacramento Valley Water Hydrologic Classifications. The three separate hydrologic conditions considered are described as follows:

Normal year: This is a year when average rainfall has been received. During a normal year, the water availability from some sources may be less than the allocated amount.

Single dry year: This is a solitary dry or critical dry year and may be the first year of a multiple year drought.

Multiple dry years: This is a series of three consecutive dry and/or critical dry years.

4.1 Groundwater

The following contains a description of the projected groundwater pumping during normal, single, and multiple dry years, as well as the estimated impact of future groundwater use.

A. Projected Amount to be Pumped

A groundwater source sufficiency report was prepared in 2011 and updated in May 2016 by Ludhorff and Scalmanini Consulting Engineers to describe the use and sufficiency of groundwater supplies beneath the City (see Appendix B and Appendix C). As part of the groundwater source sufficiency report, an analytical groundwater flow model was used to

provide a preliminary assessment of water level impacts from future increases in groundwater pumping by the City to meet future water demands.

The modeling effort included simulations of ten future pumping scenarios in which pumping would be increased and/or redistributed within the study area. The recommended maximum pumping is summarized in Table 17. The values presented in Table 17 include the following reliability percentages for groundwater: 100 percent reliability in normal years, 119 percent reliability in single dry years, and 120 percent reliability in multiple dry years. Details regarding the model simulations and suggested pumping practices are found in Appendix B and Appendix C.

TABLE 17
CITY OF VACAVILLE
PROJECTED GROUNDWATER PUMPING (AC-FT/YR)
DURING NORMAL, SINGLE DRY, AND MULTIPLE DRY YEARS [3]

Year	Normal Year	Single Dry Year	Multiple Dry Years
2020	7,000	8,320	8,320
2025	7,300	8,740	8,740
2030	7,700	9,160	9,160
2035	8,100	9,700	9,700
2040	8,100	9,700	9,700

B. Impact of Pumping

Groundwater pumping during periods of drought or dry years, has permanently impacted aquifers in areas of California, especially the Central Valley. Land subsidence is often a noticeable impact of unsustainable groundwater pumping. As noted in the groundwater supply sufficiency report, the City's goal is to maximize groundwater supply without causing significant impacts. The City's conjunctive water management program also helps groundwater levels recover, by allowing the City to reduce groundwater production in normal years and use other water sources (i.e. increase surface water utilization).

Increased pumping during dry years will cause groundwater levels to decrease but based on the results of the groundwater model discussed in the groundwater source sufficiency report, groundwater levels will return to normal levels once pumping decreases to normal year rates.

4.2 Surface Water

The following contains a description of the availability of the City's surface water sources during normal, single, and multiple dry years.

A. Solano Project (Vacaville Supply, SID Agreement)

The Solano Project has an annual water supply of 207,350 ac-ft/yr. As shown in Table 11, Vacaville is entitled to 15,800 ac-ft/yr (sum of Vacaville entitlement and SID agreement) of this annual yield in the year 2040. The Solano Project differs from other reservoir projects in

California because of the reservoir storage size relative to the watershed yield. This means it may take a relatively long time to deplete the reservoir, but, in turn, it takes a relatively long time to fill the reservoir. Because the size of the reservoir is a function of its yield, the long-term reliability for the Solano project is excellent.

Because of the high degree of reliability and historical records, the City anticipates the following reliabilities for normal, single dry, and multiple dry years from the Vacaville Entitlement and SID Agreement:

Vacaville Entitlement and SID Agreement

- Normal – 99 percent
- Single Dry Year – 98 percent
- Multiple Dry Years – 89 percent

Solano Project availability percentages for the City are derived using Sacramento Valley Water Year Hydrologic Classifications and historical records and are included in Appendix F, *SCWA Water Supply Reliability Technical Memorandum,* dated April 2016.

B. State Water Project (North Bay Aqueduct)

Supply from the NBA originates from the State Water Project and has a similar level of priority as all the other 28 contractors to the project. As a result, this source is subject to significant cutbacks during dry years. Specifically, the City anticipates the following reliabilities for normal, single dry, and multiple dry years from the Solano County Water Agency/Kern County Water Agency (KCWA Agreement) and Settlement Water:

Solano County Water Agency/KCWA Agreement

- Normal – 83 percent
- Single Dry Year – 22 percent
- Multiple Dry Years – 27 percent

Settlement Water

- Normal – 20 percent
- Single Dry Year – 0 percent
- Multiple Dry Years – 5 percent

4.3 Summary of Water Supply Availability

This section contains a determination of the water supply availability. As previously described, the amount of water entitled to the City is increasing until the maximum entitlement is reached by the year 2040. Furthermore, each source has a different availability under normal, single dry, and multiple dry years. Information on supply entitlement and availability is shown in Tables 18 through 22 for normal, single dry, and multiple dry years in five-year increments between 2020 and 2040. The water supply availability is summarized in Tables 23, 24, and 25.

TABLE 18
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2020

		Normal Year		Single Dry Year		Multiple Dry Years	
Sources of Supply	**Entitlement**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement	4,125	99	4,084	98	4,043	89	3,671
State Water Project							
Solano County Water Agency	8,978	83	7,452	22	1,975	5	2,424
Settlement Water	9,320	20	1,864	0	0	5	466
Groundwater [a]	7,000		7,000		8,320		8,320
Total	**35,173**		**26,092**		**19,973**		**19,999**

[a] Recommended maximum groundwater pumping.

TABLE 19
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2025

		Normal Year		Single Dry Year		Multiple Dry Years	
Sources of Supply	**Entitlement**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement	5,625	99	5,569	98	5,513	89	5,006
State Water Project							
Solano County Water Agency	8,978	83	7,452	22	1,975	27	2,424
Settlement Water	9,320	20	1,864	0	0	5	466
Groundwater [a]	7,300		7,300		8,740		8,740
Total	**36,973**		**27,877**		**21,863**		**21,754**

[a] Recommended maximum groundwater pumping.

TABLE 20
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2030

		Normal Year		Single Dry Year		Multiple Dry Year	
Sources of Supply	**Entitlement**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement	7,125	99	7,054	98	6,983	89	6,341
State Water Project							
Solano County Water Agency	8,978	83	7,452	22	1,975	27	2,424
Settlement Water	9,320	20	1,864	0	0	5	466
Groundwater [a]	7,700		7,700		9,160		9,160
Total	**38,873**		**29,762**		**23,753**		**23,509**

[a] Recommended maximum groundwater pumping.

TABLE 21
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2035

		Normal Year		Single Dry Year		Multiple Dry Year	
Sources of Supply	**Entitlement**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement	8,625	99	8,539	98	8,453	89	7,676
State Water Project							
Solano County Water Agency	8,978	83	7,452	22	1,975	27	2,424
Settlement Water	9,320	20	1,864	0	0	5	466
Groundwater [a]	8,100		8,100		9,700		9,700
Total	**40,773**		**31,647**		**25,763**		**25,384**

[a] Recommended maximum groundwater pumping.

TABLE 22
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2040

		Normal Year		Single Dry Year		Multiple Dry Year	
Sources of Supply	**Entitlement**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**
Solano Project							
Vacaville Entitlement	5,750	99	5,693	98	5,635	89	5,118
SID Agreement	10,050	99	9,950	98	9,849	89	8,945
State Water Project							
Solano County Water Agency	8,978	83	7,452	22	1,975	27	2,424
Settlement Water	9,320	20	1,864	0	0	5	466
Groundwater [a]	8,100		8,100		9,700		9,700
Total	**42,198**		**33,058**		**27,159**		**26,652**

[a] Recommended maximum groundwater pumping.

TABLE 23
CITY OF VACAVILLE
WATER SUPPLY DURING NORMAL YEAR (AC-FT/YR)

	Year				
Sources of Supply	**2020**	**2025**	**2030**	**2035**	**2040**
Solano Project					
Vacaville Entitlement	5,693	5,693	5,693	5,693	5,693
SID Agreement	4,084	5,569	7,054	8,539	9,950
State Water Project					
Solano County Water Agency	7,452	7,452	7,452	7,452	7,452
Settlement Water	1,864	1,864	1,864	1,864	1,864
Groundwater	7,000	7,300	7,700	8,100	8,100
Total	**26,092**	**27,877**	**29,762**	**31,647**	**33,058**

TABLE 24
CITY OF VACAVILLE
WATER SUPPLY DURING SINGLE DRY YEAR (AC-FT/YR)

	Year				
Sources of Supply	**2020**	**2025**	**2030**	**2035**	**2040**
Solano Project					
Vacaville Entitlement	5,635	5,635	5,635	5,635	5,635
SID Agreement	4,043	5,513	6,983	8,453	9,849
State Water Project					
Solano County Water Agency	1,975	1,975	1,975	1,975	1,975
Settlement Water	0	0	0	0	0
Groundwater	8,320	8,740	9,160	9,700	9,700
Total	**19,973**	**21,863**	**23,753**	**25,763**	**27,159**

TABLE 25
CITY OF VACAVILLE
WATER SUPPLY DURING MULTIPLE DRY YEAR (AC-FT/YR)

	Year				
Sources of Supply	**2020**	**2025**	**2030**	**2035**	**2040**
Solano Project					
Vacaville Entitlement	5,118	5,118	5,118	5,118	5,118
SID Agreement	3,671	5,006	6,341	7,676	8,945
State Water Project					
Solano County Water Agency	2,424	2,424	2,424	2,424	2,424
Settlement Water	466	466	466	466	466
Groundwater	8,320	8,740	9,160	9,700	9,700
Total	**19,999**	**21,754**	**23,509**	**25,384**	**26,652**

5.0 COMPARISON AND DETERMINATION OF SUFFICIENT SUPPLY

This section compares projected water demand as estimate in Table 14 to available water supply during normal, single, and multiple dry years summarize in Section 4. Table 26 is a summary of the total projected water demand compared to the available water supply. In summary, Vacaville has sufficient water to meet its customers' needs through 2040, including the proposed Farm at Alamo Creek project. This is based on continued application of the water conservation ordinance and on-going conjunctive use of water supply sources.

Groundwater and surface water supplies are projected to meet or exceed projected water demands even during extended drought conditions. This was demonstrated during a previous drought that lasted for seven years. In view of this demonstrated reliability of the City's conjunctive water supply strategy, future water supply will be adequate to offset future water demands during normal, single, and multiple dry years.

TABLE 26
CITY OF VACAVILLE
SUMMARY OF PROJECTED WATER DEMAND VERSUS AVAILABLE SUPPLY DURING NORMAL, SINGLE DRY, AND MULTIPLE DRY YEARS (AC-FT/YR)

Year	Normal Year		Single Dry Year		Multiple Dry Year	
	Projected Demand[a]	Available Supply	Projected Demand	Available Supply[b]	Projected Demand	Available Supply[b]
2020	16,985	26,092	16,985	19,973	16,985	19,999
2025 [c]	17,937	27,877	17,937	21,863	17,937	21,754
2030	18,547	29,762	18,547	23,753	18,547	23,509
2035	19,409	31,647	19,409	25,763	19,409	25,384
2040	20,198	33,058	20,198	27,159	20,198	26,652

[a] From Table 14.
[b] Water supply for single dry or multiple dry year is more than 35% reduction from the normal year which constitutes a Stage 1 Drought, 20% voluntary reduction, therefore the demand values for Single Dry and Multiple Dry Year are the same as a Normal Year.
[c] The Farm at Alamo Project assumed complete development by Year 2025.

6.0 REFERENCES

[1] City of Vacaville, *2015 Urban Water Management Plan Update*, July 2016.

[2] City of Vacaville, *Connection and Development Fees*, January 2016.

[3] Luhdorff and Scalmanini, Consulting Engineers, *Groundwater Source Sufficiency Technical Memorandum, May 2016*.

[4] Luhdorff and Scalmanini, Consulting Engineers, *Conceptualization of the Aquifer System for the City of Vacaville*, March 2003.

[5] *Second Amendment to Master Water Agreement Between Solano Irrigation District and City of Vacaville*, Approved June 8, 2010.

[6] NV5, *2016 Water Master Plan, Revised Final Draft*, August 2017.

[7] PEI and SWA, *The Farm at Alamo Creek Specific Plan*, June 2017.

[8] City of Vacaville Ordinance 1877, *Ordinance of the City Council of the City of Vacaville, Rescinding Ordinance No. 1431 and Amending Chapter 13.20 of the Vacaville Municipal Code Relating to Water Conservation in Normal, Drought, and Emergency Conditions*, adopted December 1, 2014.

APPENDIX A

CITY COUNCIL RESOLUTION NO. _____ ADOPTING THE FARM AT ALAMO CREEK WSAR

(to be added once available.)

APPENDIX B

2011 GROUNDWATER MANAGEMENT PLAN UPDATE

APPENDIX C

GROUNDWATER SOURCE SUFFICIENCY TECHNICAL MEMORANDUM, MAY 2016

APPENDIX D

CITY OF VACAVILLE
WATER SUPPLY CONTRACTS

APPENDIX E

2014 URBAN WATER SHORTAGE CONTINGENCY PLAN

APPENDIX F

SCWA WATER SUPPLY RELIABILITY TECHNICAL MEMORANDUM

APPENDIX G

SUPPLEMENTAL ANALYSIS FOR SETTLEMENT WATER IN SUPPORT OF THE CITY OF VACAVILLE SB610 WATER SUPPLY ASSESSMENT

APPENDIX H

ORDINANCE No. 1891 ADOPTING STATE MODEL WATER EFFICIENT LANDSCAPE ORDINANCE DIVISION 14.27