San Lorenzo Valley Water District

FINAL

San Lorenzo Valley Water District

NOVEMBER 2021

Water Master Plan

AKEL ENGINEERING GROUP, INC.

San Lorenzo Valley WATER DISTRICT

SAN LORENZO VALLEY WATER DISTRICT

2021

WATER MASTER PLAN

FINAL

October 2021

AKEL ENGINEERING GROUP, INC.

September 20, 2021

San Lorenzo Valley Water District
13060 Highway 9
Boulder Creek, CA 95006

Attention: Rick Rogers
District Manager

Subject: 2021 Water Master Plan

Dear Rick:

We are pleased to submit the final Water Master Plan Report for the San Lorenzo Valley Water District. This master plan is a standalone document, and documents the following:

- Existing distribution system facilities, acceptable hydraulic performance criteria, and projected water demands consistent with the Planning Area
- Development and calibration of the District's GIS-based hydraulic water model.
- Capacity evaluation of the existing water system with improvements to mitigate existing deficiencies and to accommodate future growth.
- Capital Improvement Program (CIP) with an opinion of probable construction costs and suggestions for cost allocations to meet AB 1600.

We extend our thanks to you, Rick Rogers, District Manager, and other District staff whose courtesy and cooperation were valuable components in completing this study.

Sincerely,

AKEL ENGINEERING GROUP, INC.

Tony Akel, P.E.
Principal

Enclosure: Report

San Lorenzo Valley
WATER DISTRICT

Acknowledgements

Board of Directors

Gail Mahood, President

Lois Henry, Vice President

Bob Fultz, Director

Mark Smolley, Director

Jayme Ackemann, Director

Management Personnel

Rick Rogers, District Manager

James Furtado, Director of Operations

Josh Wolff, Engineering Manager

Nate Gillespie, Water Treatment and System Supervisor

Joel Scianna, Assistant Engineer

Other District Engineering, Planning, and Operations Staff

Figures

Tables

EXECUTIVE SUMMARY

The purpose of this Water Master Plan is to determine the future water demands and supply requirements for San Lorenzo Valley Water District (District) and to identify the water facilities needed to produce, deliver, store, and transport this supply to its customers. The required facilities are based on the projected highest water usage day, when the District is fully developed.

This executive summary presents a brief background of the District's water distribution system, the planning area characteristics, the system performance and design criteria, the hydraulic model, and a capital improvement program. A hydraulic model of the District's existing water distribution system was created and used to evaluate the capacity adequacy of the existing distribution system and to recommend improvements to mitigate existing deficiencies, as well as to service future growth.

ES.1 STUDY OBJECTIVES

San Lorenzo Valley Water District recognizes the importance of planning, developing, and financing the District's water system infrastructure. In 1994, the County of Santa Cruz initiated the effort to develop a comprehensive, long-term General Plan for the orderly development of the community, while integrating the County's social, economic, and environmental goals. On May 24, 1994, the County Board of Supervisors adopted the County of Santa Cruz 1994 General Plan, a comprehensive update of the County's General Plan.

The District approved Akel Engineering Group Inc. to prepare this 2021 Water Master Plan in July of 2019. The 2021 WMP evaluates the District's water system and recommends capacity improvements necessary to service the needs of existing users and for servicing the future growth of the District. This 2021 WMP is intended to serve as a tool for planning and phasing the construction of future domestic water system infrastructure for the projected buildout of the San Lorenzo Valley Water District service area. The area and horizon for the master plan is stipulated in the County's General Plan. Should planning conditions change, and depending on their magnitude, adjustments to the master plan recommendations might be necessary.

This master plan included the following tasks:

- Summarizing the District's existing domestic water system facilities
- Documenting growth planning assumptions
- Developing the domestic water system performance criteria
- Projecting future domestic water demands

- Creating and calibrating a new hydraulic model using Geographic Information Systems (GIS) data
- Evaluating the domestic water facilities to meet existing and projected demand requirements and fire flows
- Recommending a capital improvement program (CIP) with an opinion of probable costs
- Performing a capacity allocation analysis for cost sharing purposes
- Developing a 2021 Water Master Plan report

ES.2 DWR GRANT FUNDING ACKNOWLEDGMENT FOR THE WATER MASTER PLAN

Funding for this study was provided, in part, from the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006, administered by State of California, Department of Water Resources through a grant awarded to the Regional Water Management Foundation.

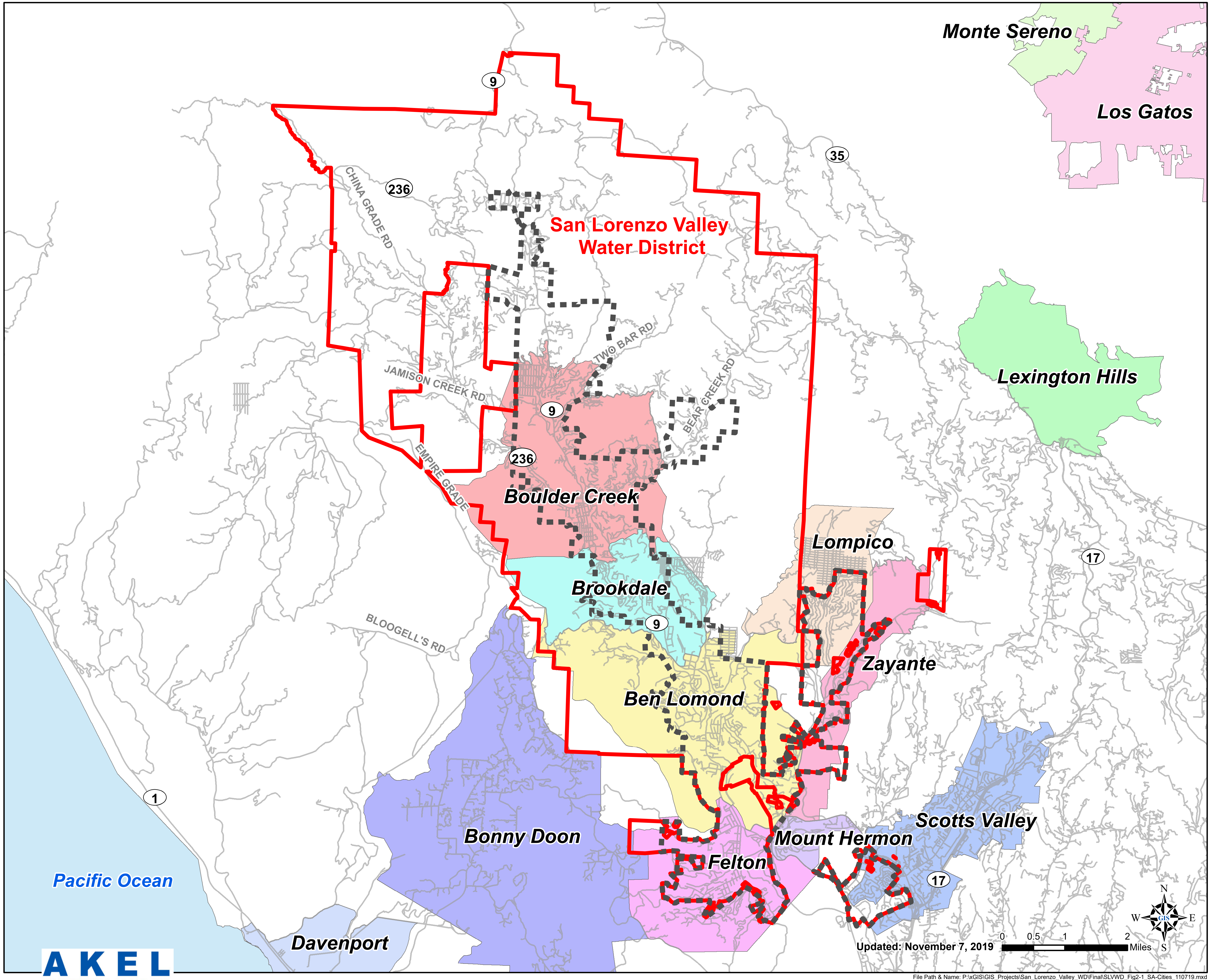
ES.3 STUDY AREA

The San Lorenzo Valley Water District service area is located in Santa Cruz County, approximately 19 miles southwest of San Jose, 28 miles west of Gilroy, and approximately 6 miles northwest of the City of Santa Cruz. California Highway 9 bisects the District's service area in the north-south direction. The District's service area limits currently encompass 17.9 square miles, with an approximate population of 23,000 residents.

The District's service area is generally bound to the north by the San Mateo County line, to the northeast by the Santa Cruz Mountain Range, to the southeast by Scotts Valley, and to the southwest by Empire Grade. There are several creeks flowing along the boundaries of the District's service area, including Fall Creek, Bull Creek, and Foreman Creek. The topography is generally mountainous, with increasing slopes in the northeast side of the district due to the Santa Cruz Mountain Range to the northeast. The unincorporated community of Scotts Valley is located to the northeast of the District's service area. **Figure ES.1** displays the planning area showing service area limits, the San Lorenzo Valley Water District's legal boundaries.

ES.4 SYSTEM PERFORMANCE AND DESIGN CRITERIA

This report documents the District's performance and design criteria that were used for evaluating the domestic water system. The system performance and design criteria are used to establish guidelines for determining future water demands, evaluating existing domestic water facilities, and for sizing future facilities. **Table ES.1** documents the system performance and design criteria for



Legend

- San Lorenzo Valley Water District
- Planning Area

Boundaries

- Ben Lomond
- Bonny Doon
- Boulder Creek
- Brookdale
- Davenport
- Felton
- Lexington Hills
- Lompico
- Los Gatos
- Monte Sereno
- Mount Hermon
- Scotts Valley
- Zayante
- Street Centerlines

Figure ES.1
SLVWD Service Area

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley Water District

Table ES.1 Design and System Performance Criteria
Water Master Plan
San Lorenzo Valley Water District

Design Parameter	Preliminary Criteria
DESIGN CRITERIA	
Demand Peaking Factors	
Maximum Day Demand	*1.5 x Average Day Demand*
Peak Hour Demand	*1.5 x Maximum Day Demand*
Supply Capacity Requirement	
Total Supply Requirement	Firm Supply Capacity = Maximum Day Demand
Storage Capacity Requirement	
Total Storage Requirement	Total Required Storage = Operational + Fire
Operational	**50%** of Maximum Day Demand
Fire Flow	Varies
Pump Stations Capacity Requirement[1]	
Booster Pump Stations	Firm Capacity to provide maximum day demand over 8 hours
Hydropneumatic Pump Stations	Firm Capacity = Peak Hour Demand
Transmission and Distribution Pipelines Capacity Requirements	
Maximum Velocity	
Maximum Day Demand + Fire Flow	**10** ft/s
Maximum Headloss	
Peak Hour Demand	**10** ft/k-ft
Minimum Pipeline Sizes	
New Pipelines	**8** inch
Pressure Reducing Valves Capacity Requirements	
Valve Size	Maximum Flow based on the greater of Peak Hour Demand and Maximum Day Demand + Fire Flow
PERFORMANCE CRITERIA	
Fire Flow Requirements	
Single Family Residential	**1,000 gpm** for **2 hours**
Multi-Family Residential	**1,500 gpm** for **2 hours**
Commercial/Institutional	**2,000 gpm** for **3 hours**
Distribution System Service Pressures	
Maximum Pressures	
At Service Connections	**80 psi**
In Pipelines	**130 psi**
Minimum Pressures	
Peak Hour Demand	**40 psi**
Maximum Day Demand + Fire Flow	**20 psi**

the domestic water system. This criterion was used in the capacity evaluation and for sizing recommended improvements.

ES.5 EXISTING WATER SYSTEM OVERVIEW

The District's domestic water system consists of 7 active groundwater wells, 2 water treatment plants, 55 storage tanks totaling 9.3 million gallons in storage, and over approximately 190 miles of distribution pipelines. The SLVWD service area ranges in elevation from approximately 200 ft MSL near Felton to as high as 1,400 ft MSL along the eastern flank of Ben Lomond Mountain. The water distribution system is comprised of 35 pressure zones.

The District's existing domestic water distribution system is shown in **Figure ES.2**, which displays the existing system by pipe size. This figure provides a general color coding for the distribution mains, as well as labeling the existing wells and the storage reservoir.

ES.6 EXISTING AND FUTURE DOMESTIC WATER DEMANDS

The District's existing average day domestic water demand was documented at 1.9 mgd. Accounting for losses in the system, the average daily production is 2.0 mgd. **Table ES.2** documents the future land use categories, and their corresponding domestic water demands. These demands were used in sizing the future infrastructure facilities, including transmission mains, storage reservoirs, and booster stations. Demands were also used for allocating and reserving capacities in the existing or proposed facilities.

ES.7 HYDRAULIC MODEL DEVELOPMENT

Hydraulic network analysis has become an effectively powerful tool in many aspects of water distribution planning, design, operation, management, emergency response planning, system reliability analysis, fire flow analysis, and water quality evaluations. The District's hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth. As part of this master plan, the hydraulic model was developed into a GIS-based hydraulic model in InfoWater by Innovyze. The model has an intuitive graphical interface and is directly integrated with ESRI's ArcGIS (GIS). The model was calibrated, and was used as an established benchmark in the capacity evaluation of the existing water distribution system.

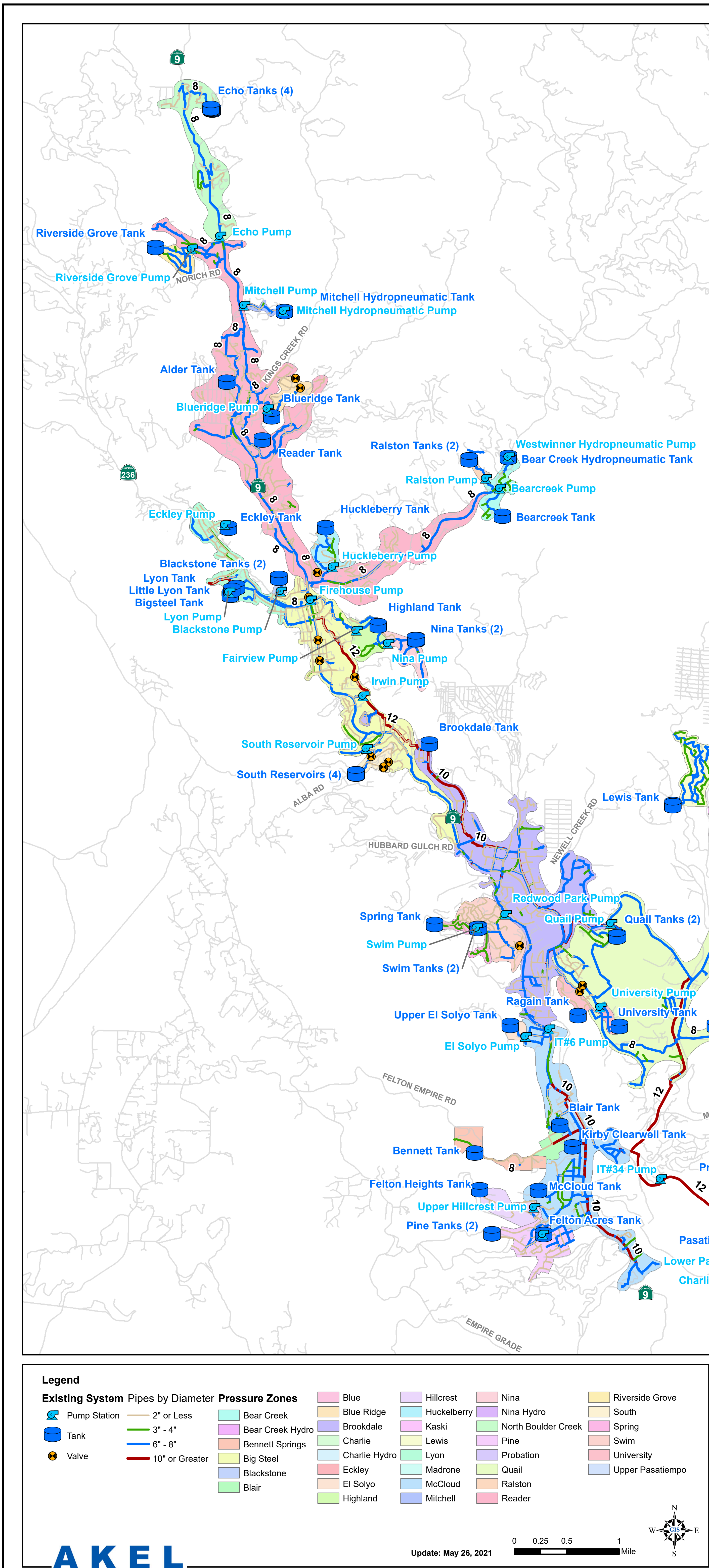


Figure ES.2
Existing System

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Table ES.2 Water Demand Unit Factor Analysis

Water Master Plan

San Lorenzo Valley Water District

Land Use Classification	Existing Development within Service Area (acres)	Existing Average Daily Water Demand Unit factors									
		Consumption[1]			Production[2]		Production at 100% Occupancy			Recommended Water Unit Factor	
		Unadjusted Water Unit Factors (gpd/acres)	Annual Consumption (gpd)	Annual Consumption (gpm)	Production Water Unit Factors (gpd/acres)	Production (gpd)	Vacancy Rate[3,4] (%)	Unit factor at 100% Occupancy (gpd/acres)	Production (gpd)	Recommended Factor (gpd/acres)	Balance Using Recommended Unit Factor (gpd)
Residential											
Rural Residential	3,190	162	515,669	358	219	698,248	3.4%	226	721,988	230	733,776
Single Family Residential	1,080	550	593,896	412	744	804,172	3.4%	770	831,514	770	831,758
Multi-Family Residential	190	685	129,965	90	928	175,981	3.4%	960	181,964	960	182,043
Subtotal - Residential	4,460	-	1,239,530	861	-	1,678,401					1,747,577
Non-Residential											
Commercial	103	507	52,029	36	687	70,450	2.9%	707	72,493	700	71,825
Hotel	44	526	22,980	16	712	31,116	0.0%	712	31,116	725	31,691
Institutional	173	118	20,534	14	160	27,805	2.9%	165	28,611	175	30,362
Public	51	593	30,296	21	803	41,023	0.0%	803	41,023	825	42,125
School	106	242	25,780	18	328	34,908	0.0%	328	34,908	350	37,234
Park	2	1,134	2,563	2	1,535	3,470	0.0%	1,535	3,470	1,550	3,504
Subtotal - Non-Residential	480	-	154,181	107	-	208,771					216,742
Other											
Vacant	108	0	0	0	-	0	0.0%	-	-	0	0
Other	1,047	0	0	0	-	0	0.0%	-	-	0	0
Subtotal - Other	1,155	-	0	0	-	0					0
Total											
	6,095	**-**	**1,393,711**	**968**		**1,887,172**					**1,964,319**

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11/2/2020

Notes:

1. Source: 2018 Billing Records provided by District staff August 20, 2019
2. Source: Production records provided by District staff September 5, 2019.
3. Residential vacanacy rates based on California Department of Finance Population Estimates for Scotts Valley.
4. Commercial and Institutional vacancy rates based on vacancy statistics for Retail Commercial as extracted from Santa Cruz County Office for Economic Development website.

ES.8 PRESSURE EVALUATION

The calibrated hydraulic model was used for evaluating the system pressures throughout the distribution system during peak hour demand, maximum day demands, and maximum day demands in conjunction with fire flows. Criteria for pressure and fire flows were also summarized in the System Performance and Design Criteria chapter. Since the hydraulic model was calibrated for extended period simulations, the analysis duration was established at 24 hours for analysis.

The hydraulic model indicates that the District's existing distribution system performed reasonably well during the pressure evaluation, with few exceptions noted in the Evaluation and Proposed Improvements chapter. However, due to a majority of the District's existing distribution system being comprised of small diameter mains, the hydraulic model indicates that a majority of the system's hydrants were unable to meet the pressure requirements under fire flow conditions.

ES.9 SUPPLY AND STORAGE EVALUATION

Existing and future supply requirements were identified for the District, which is required to be able to meet the maximum day demand of the existing system with firm groundwater well capacity. Based on the District's existing groundwater well firm capacity, the system experiences a minor deficiency in the Quail and Brookdale supply zones, and the District should consider the construction of an additional PRV be constructed from the Lyon portion of the North System to Big Steel Zone to convey surplus supply under maximum day demand conditions, and reduce supply requirements for Quail and Brookdale Zones.

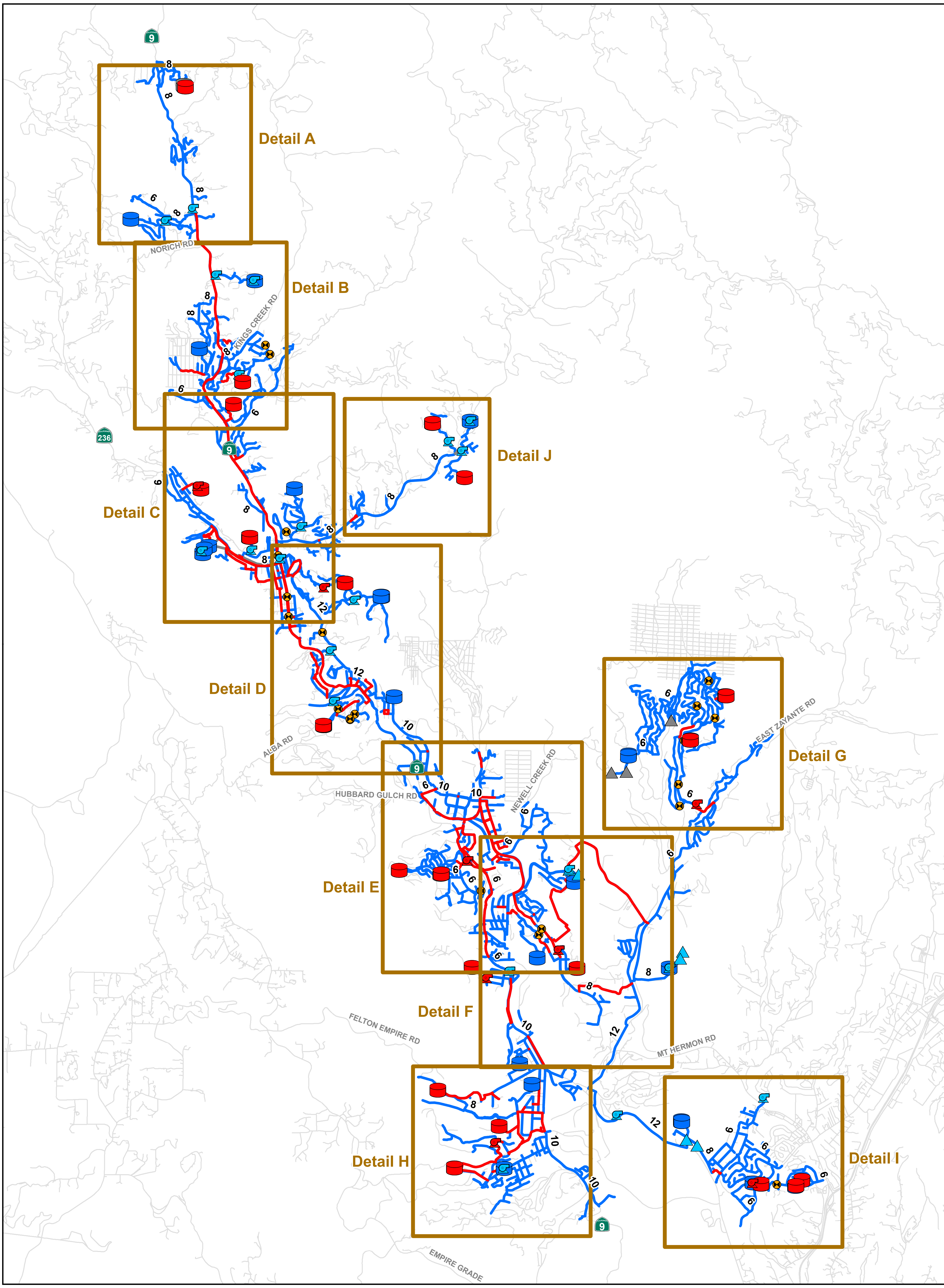
Existing storage requirements were identified for each existing pressure zone and included the operation, fire, and emergency storage components. The total District-wide required storage for existing domestic water demands is calculated at 7.7 MG.

Future storage requirements were identified based on the anticipated future growth, in each existing and future pressure zone, and will require an additional 3.2 MG of operational and fire protection storage capacity.

ES.10 CAPITAL IMPROVEMENT PROGRAM

The Capital Improvement Program costs for the projects identified in this master plan for mitigating existing system deficiencies and for serving anticipated future growth throughout the District are summarized on **Table ES.3** and are graphically represented on **Figure ES.3**.

The estimated construction costs include the baseline costs plus **30 percent** contingency allowance to account for unforeseen events and unknown field conditions. Capital improvement costs include the estimated construction costs plus **30 percent** project-related costs (engineering design, project administration, construction management and inspection, and legal costs). The



Legend

Recommended Improvements
- Pump Station
- Tank
- Pipelines

Existing System
- Pump Station
- Wells
- Wells (Inactive)
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines
- Abandoned Pipelines

Update: July 12, 2021

0 0.25 0.5 1 Mile

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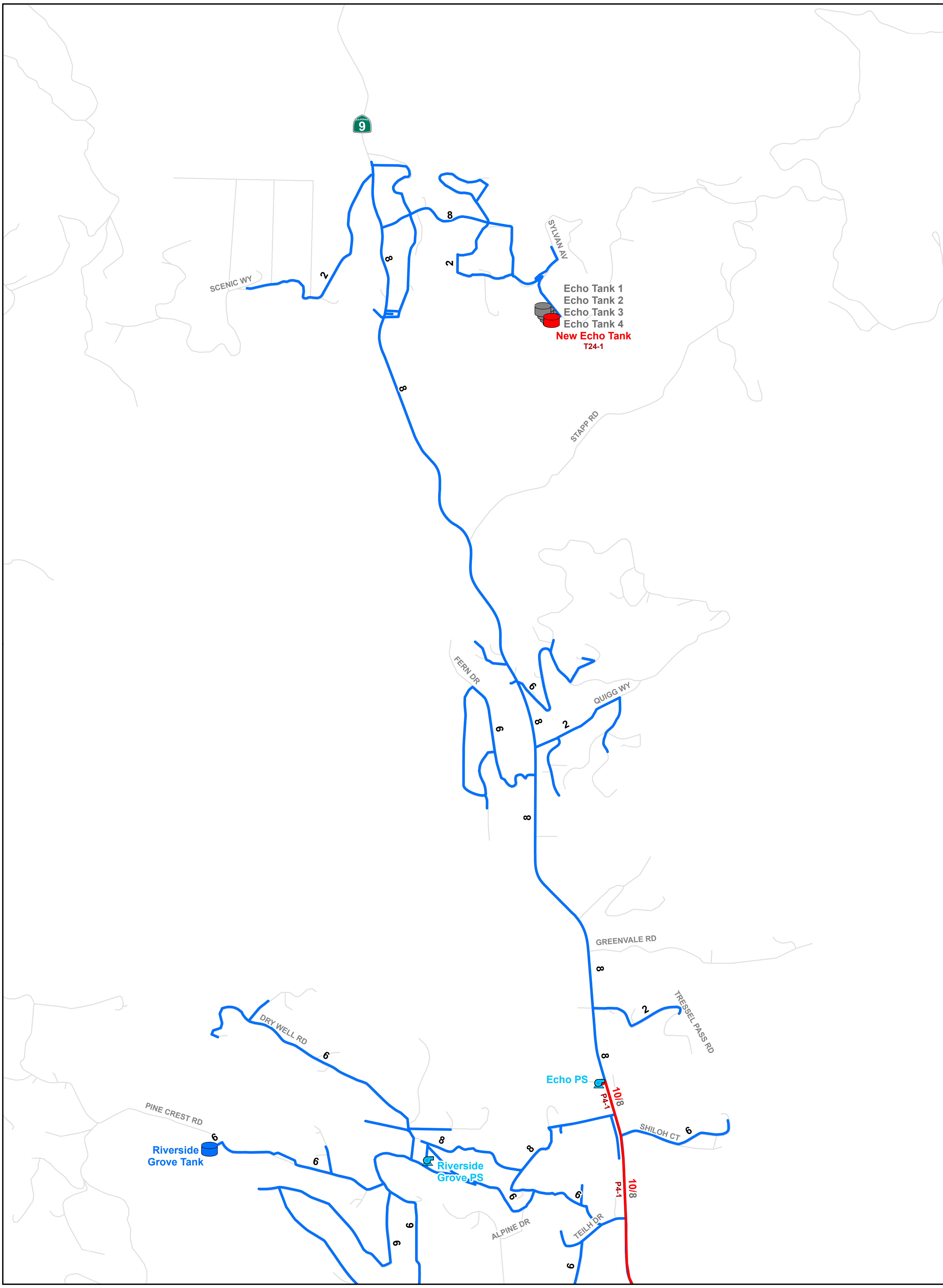
Figure ES.3 Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Existing Tank
Pipelines	Abandoned Tank
	Valve
	Existing Pipelines

Detail A
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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Update: September 10, 2021

0 250 500 1,000 Feet

N E S W

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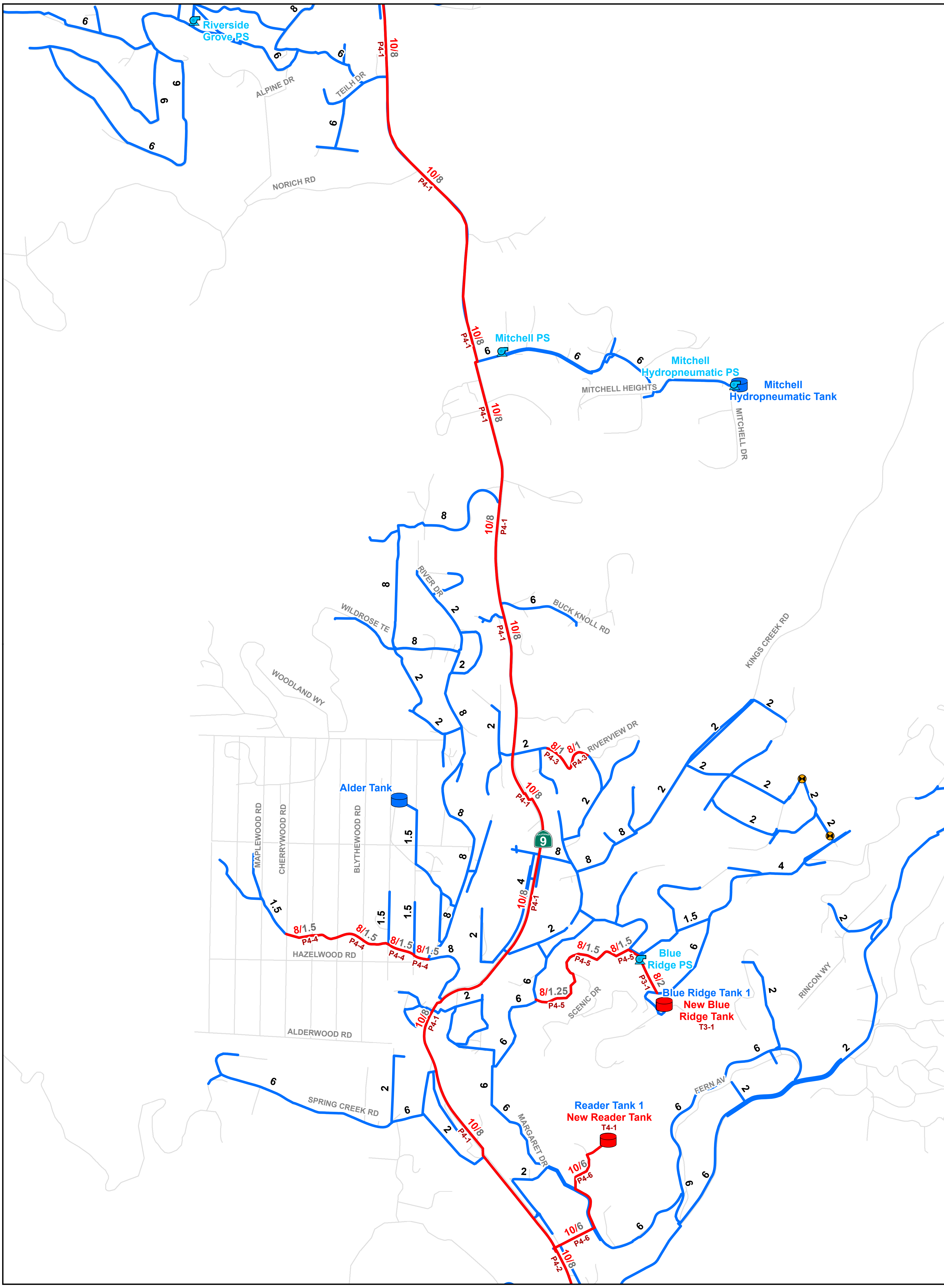

Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Tank
Pipelines	Valve
	Existing Pipelines

Update: September 10, 2021

0 250 500 1,000 Feet

N W E S

Detail B
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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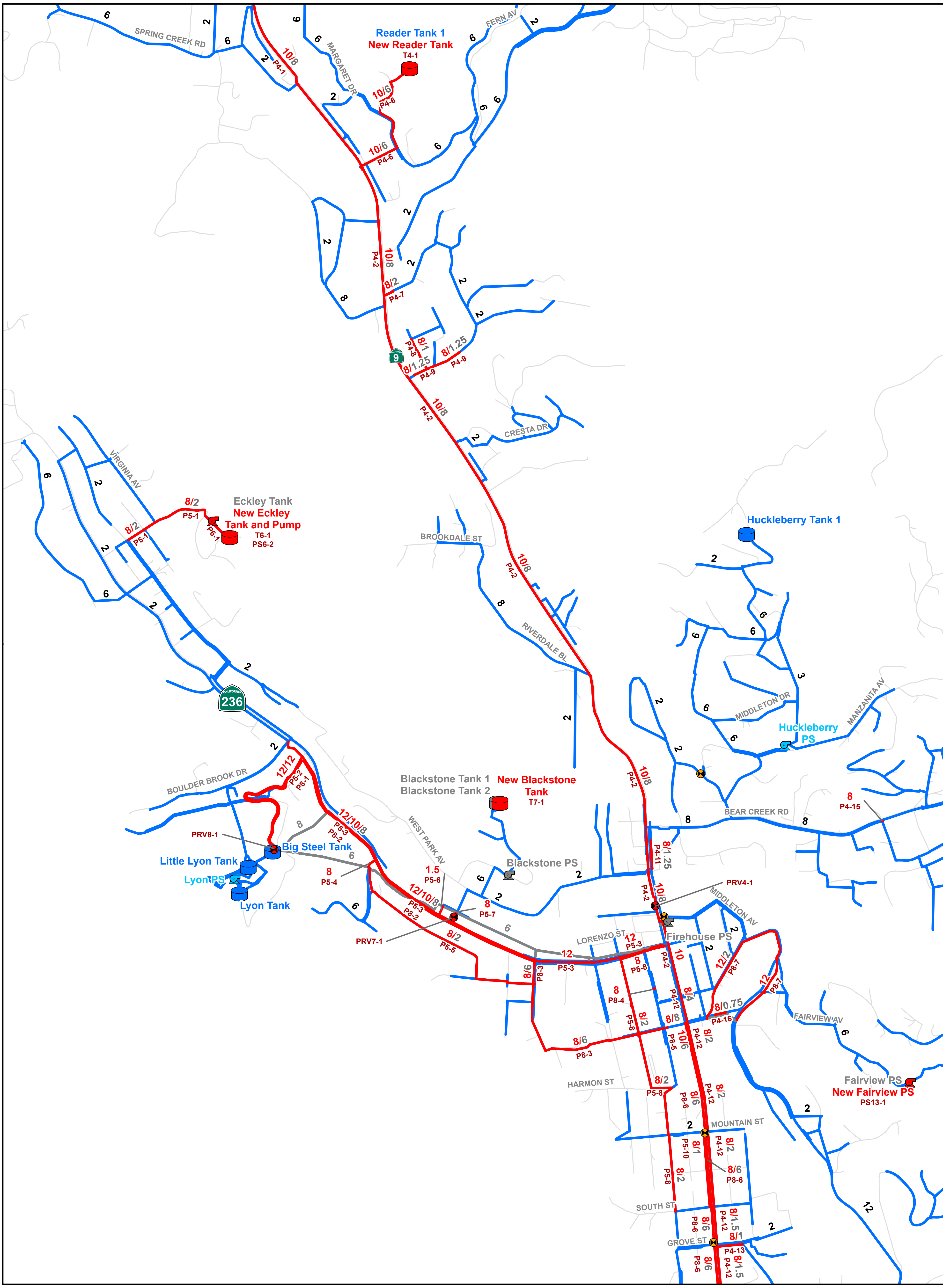

Legend

Recommended Improvements
- Pump Station
- Tank
- PRV
- Pipelines

Existing System
- Pump Station
- Abandoned Pump Station
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines
- Abandoned Pipelines

0 250 500 1,000 Feet

Update: September 10, 2021

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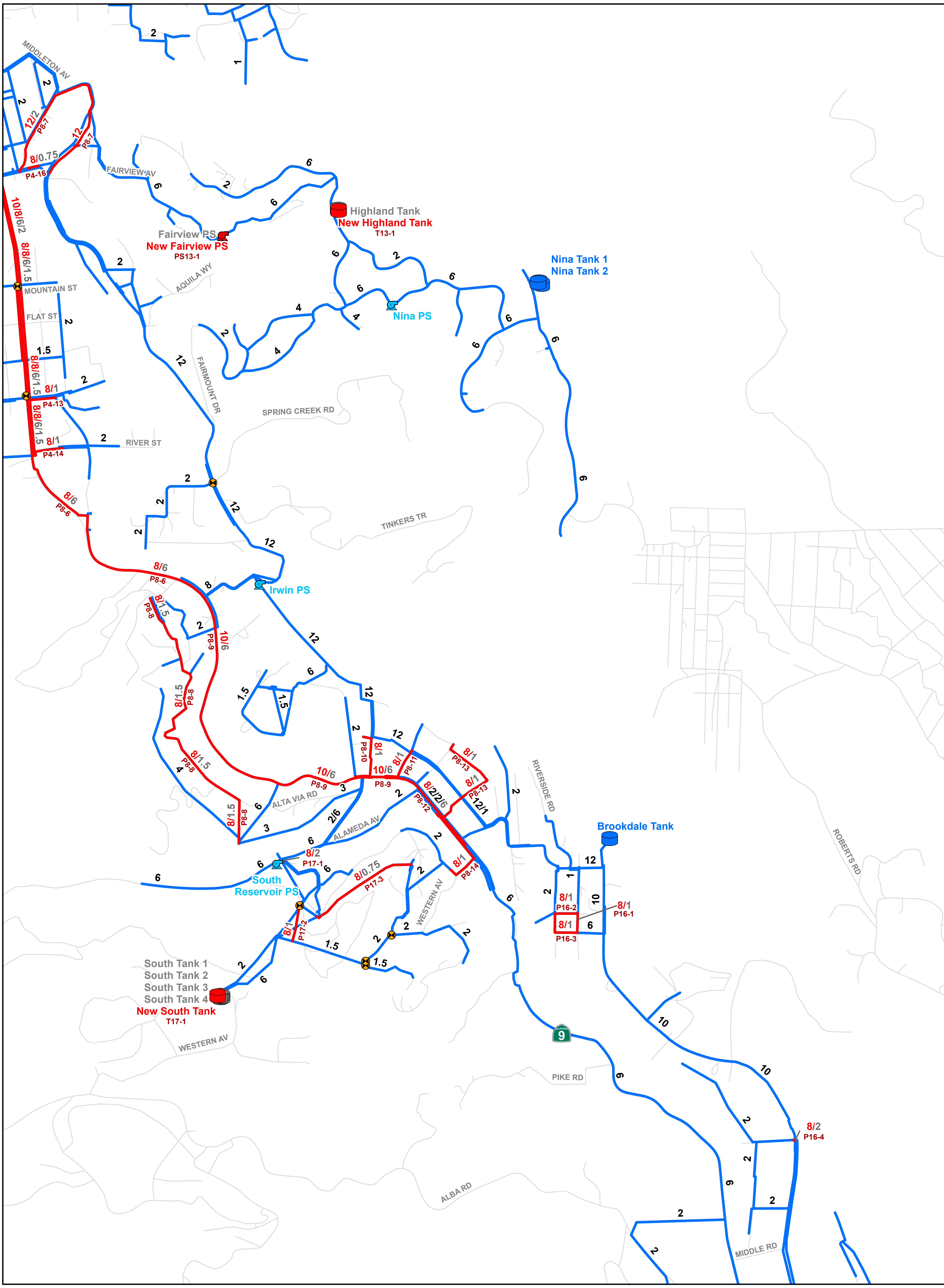
Detail C
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Existing Tank
Pipelines	Abandoned Tank
	Valve
	Existing Pipelines

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Update: September 10, 2021

0 250 500 1,000 Feet

N W E S

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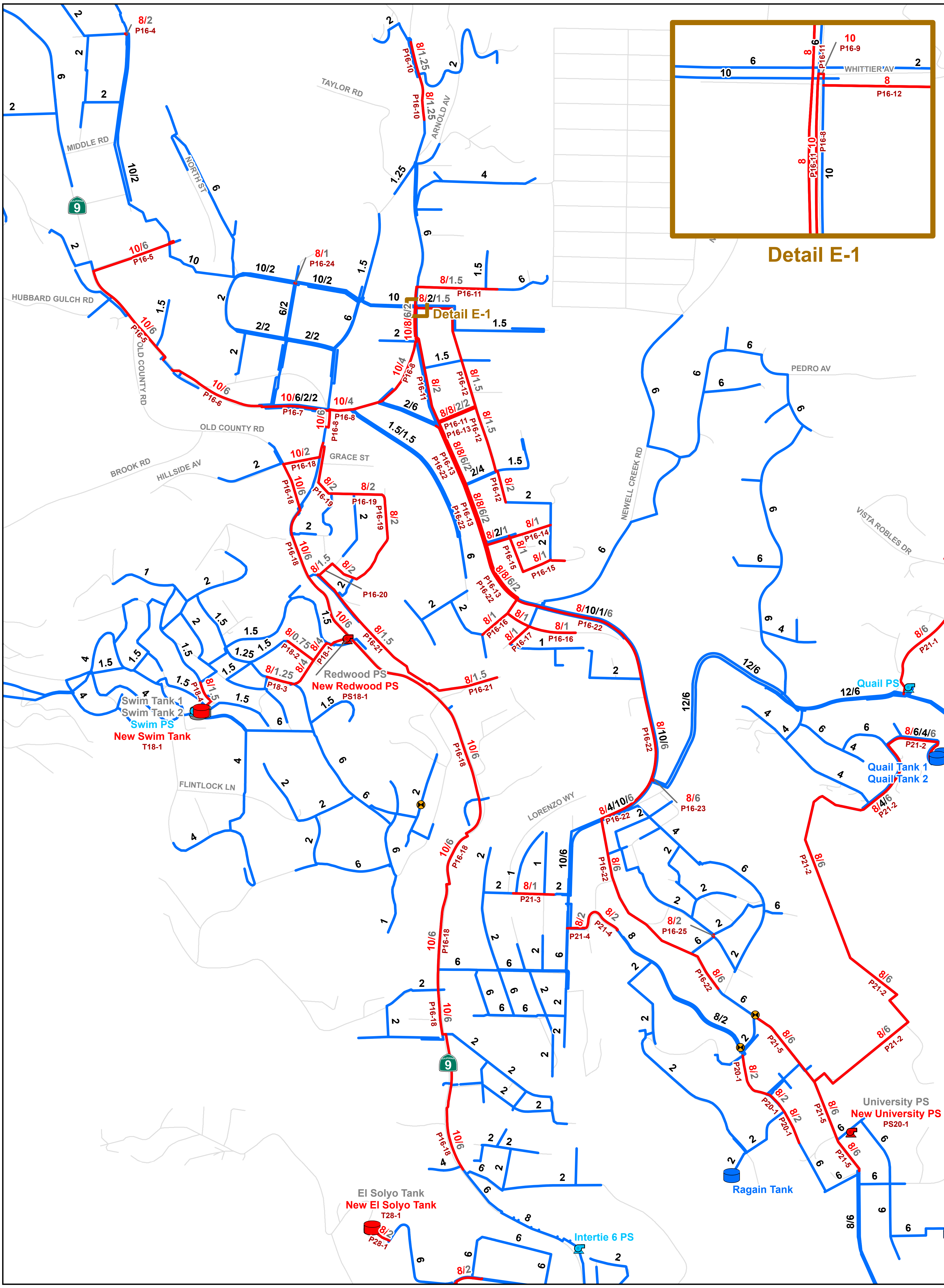
Detail D
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley
WATER DISTRICT



Legend

Recommended Improvements **Existing System**

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Existing Tank
Pipelines	Abandoned Tank
	Valve
	Existing Pipelines

Update: September 10, 2021

0 250 500 1,000 Feet

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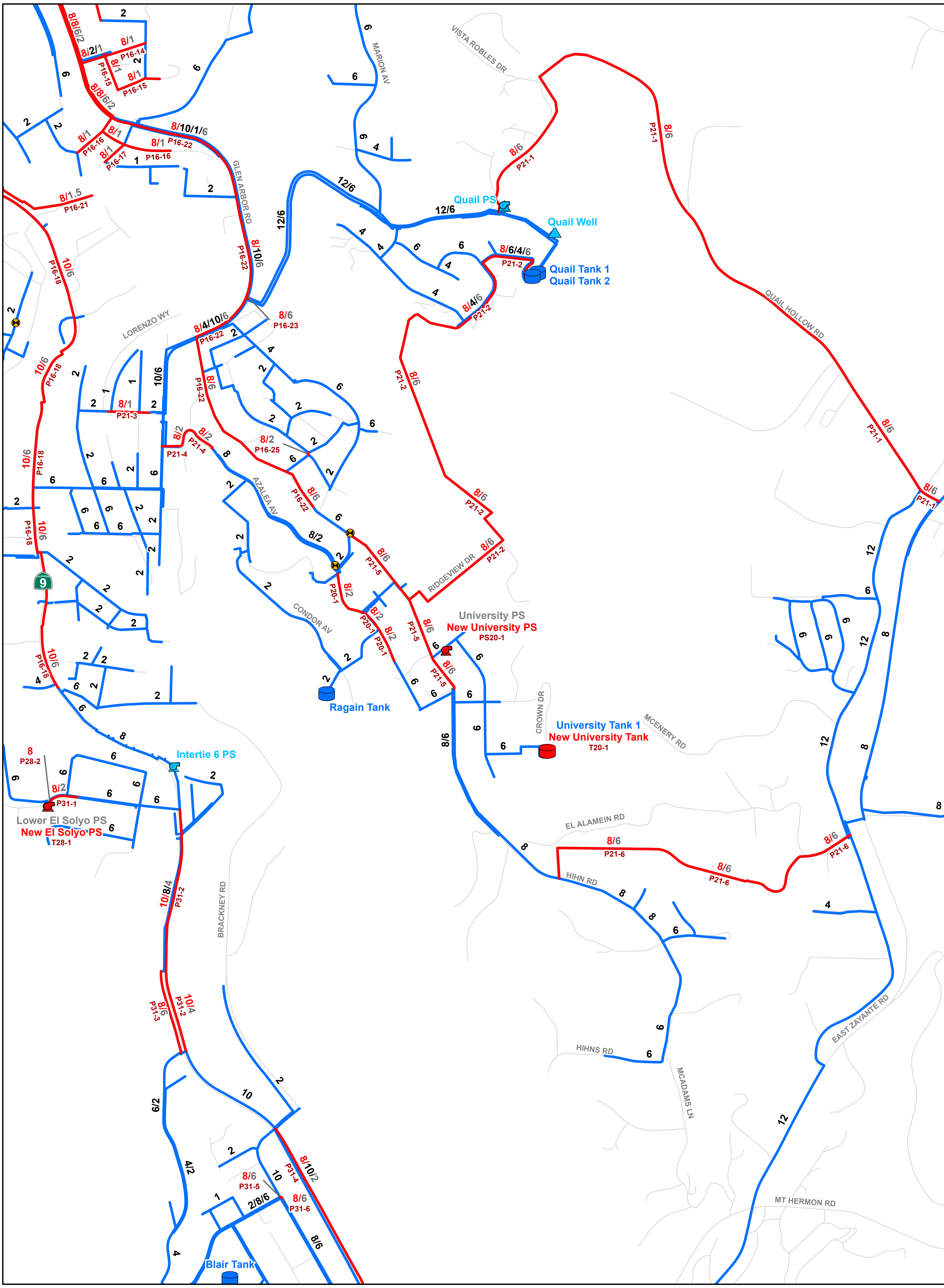
Detail E
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements
- Pump Station
- Tank
- Pipelines

Existing System
- Pump Station
- Wells
- Wells (Inactive)
- Tank
- Valve
- Existing Pipelines

N W E S

0 250 500 1,000 Feet

Update: September 10, 2021

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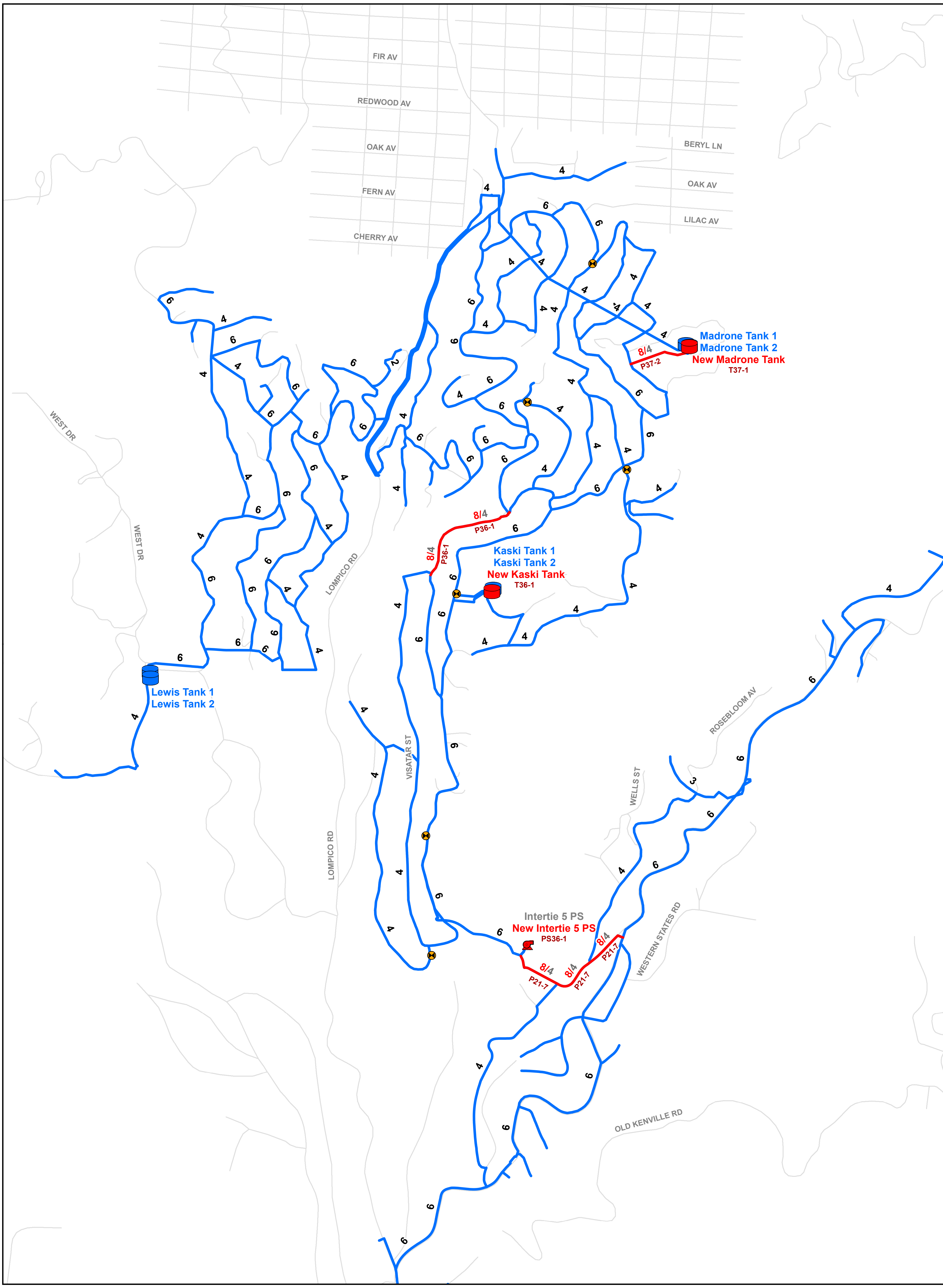
Detail F Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Wells
Pipelines	Existing Tank
	Abandoned Tank
	Valve
	Existing Pipelines

Update: September 10, 2021

0 250 500 1,000 Feet

N E S W

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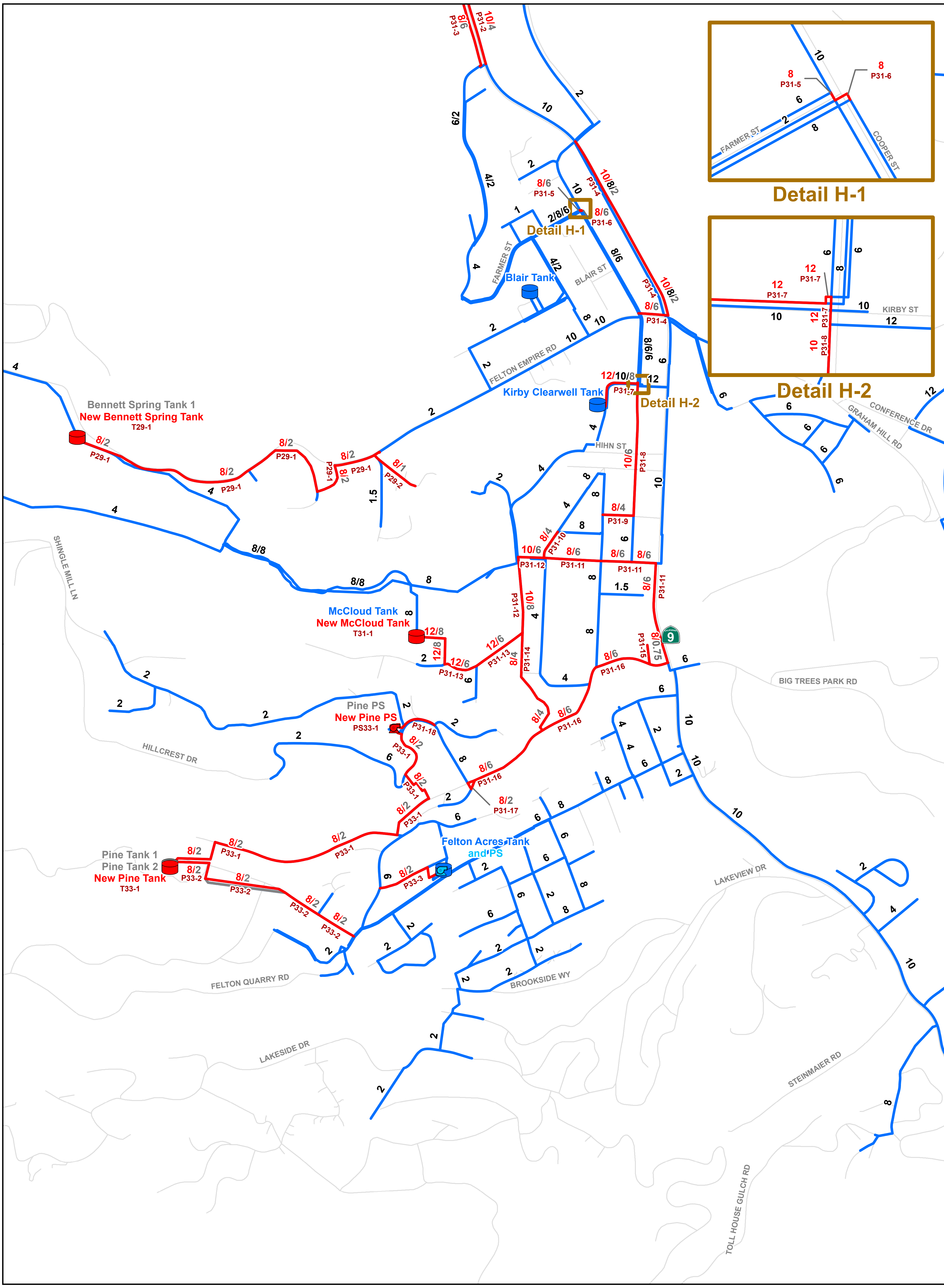
Detail G
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements
- Pump Station
- Tank
- Pipelines

Existing System
- Pump Station
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines
- Abandoned Pipelines

0 250 500 1,000 Feet

Update: September 10, 2021

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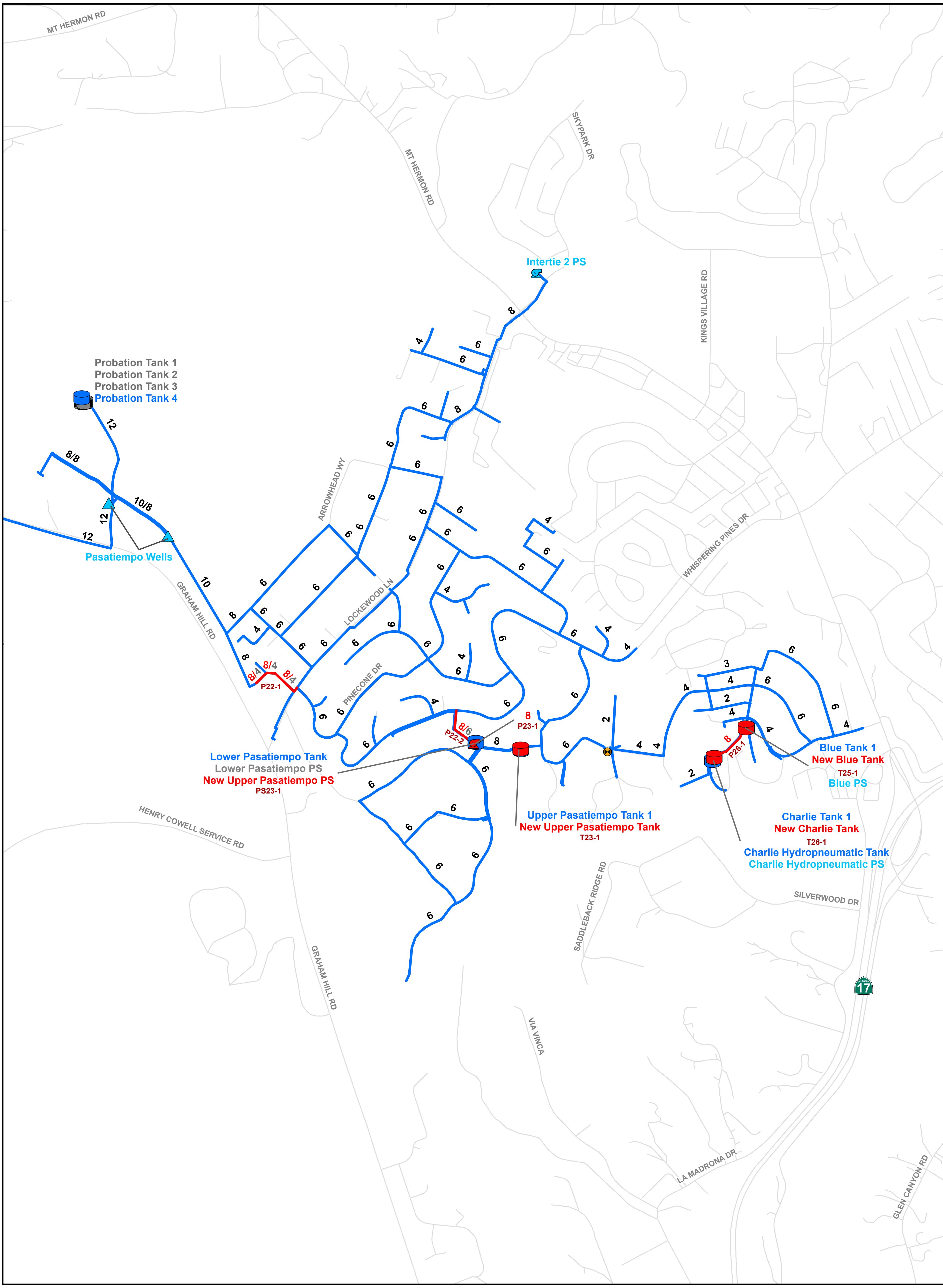
Detail H
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Existing Tank
Pipelines	Abandoned Tank
	Wells
	Wells (Inactive)
	Valve
	Existing Pipelines

AKEL ENGINEERING GROUP, INC.

Update: September 10, 2021

0 250 500 1,000 Feet

N W E S

Detail I Capital Improvement Project

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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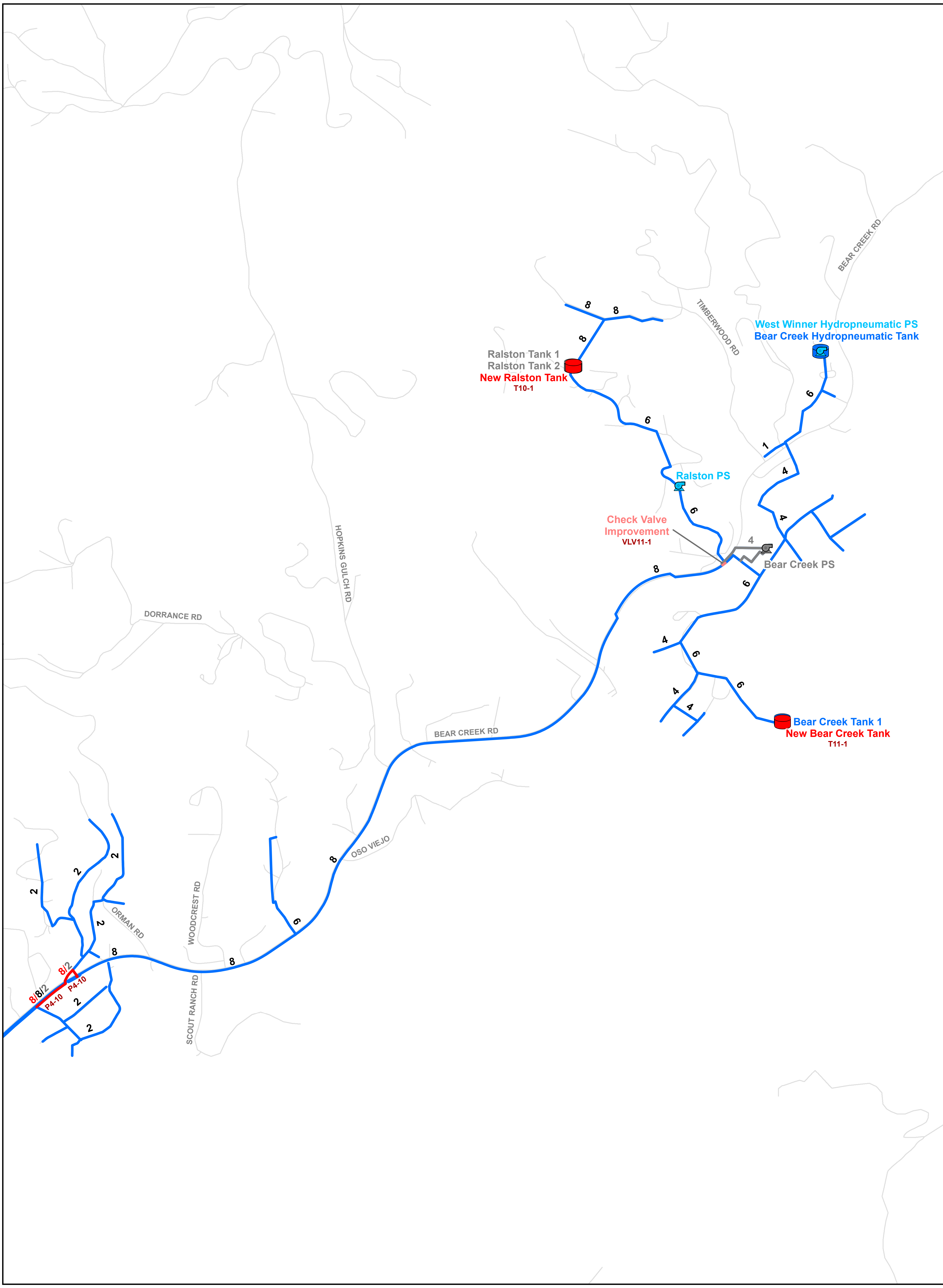

Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Abandoned Pump Station
Pipelines	Existing Tank
Check Valve Improvement	Abandoned Tank
	Valve
	Existing Pipelines
	Abandoned Pipelines

Update: September 10, 2021

0 250 500 1,000 Feet

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Detail J
Capital Improvement Project

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Table ES.3 Capital Improvement Program
Water Master Plan
San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Priority	Direct Service to Disadvantaged Communities (%)	Improvement Details: Existing Diameter (in)	Improvement Details: New/ Replace	Improvement Details: Diameter (in)	Improvement Details: Length (ft)	Infrastructure Costs: Unit Cost ($/unit)	Infrastructure Costs: Infr. Cost ($)	Baseline Construction Cost ($)	Estimated Construction Cost[1] ($)	Capital Improvement Cost[2] ($)	Construction Trigger	Suggested Cost Allocation: Existing Users	Suggested Cost Allocation: Future Users	Cost Sharing: Existing Users ($)	Cost Sharing: Future Users ($)
Pipeline Improvements																				
P3-1	Blue Ridge	Existing Deficiency	Grove Dr	From Blue Ridge PS to Blue Ridge Dr	1	0%	2	Replace	8	320	202	64,700	64,700	84,200	109,500	Existing Deficiency	100%	0%	109,500	0
P4-1	Reader	Fire Flow Reliability	Hwy 9	From Echo PS to approx. 700' se/o Douglas Ave	3	0%	4 / 6 / 8	Replace	10	13,100	217	2,840,100	2,840,100	3,692,200	4,799,900	As Funding is Available	100%	0%	4,799,900	0
P4-2	Reader	Existing Deficiency / Fire Flow Reliability	Hwy 9	From approx. 700' se/o Douglas Ave to approx. 250' s/o Big Basin Wy	1	9%	8	Replace	10	7,920	217	1,717,100	1,717,100	2,232,300	2,902,000	Existing Deficiency	100%	0%	2,902,000	0
P4-3	Reader	Capacity	Riverview Dr	From Old Country Hwy to approx. 520' e/o Old Country Hwy	3	0%	1	Replace	8	520	202	105,100	105,100	136,700	177,800	2 EDUs	94%	6%	167,400	10,400
P4-4	Reader	Existing Deficiency	Band Rd	From River Dr to approx. 450' w/o Baywood Rd	1	0%	1.5	Replace	8	1,300	202	262,700	262,700	341,600	444,100	Existing Deficiency	100%	0%	444,100	0
P4-5	Reader	Existing Deficiency	Scenic Dr / Blue Ridge Dr	From Hoot Owl Wy to Blue Ridge PS	1	0%	1.25 / 1.5 / 2	Replace	8	1,400	202	282,900	282,900	367,800	478,200	Existing Deficiency	100%	0%	478,200	0
P4-6	Reader	Existing Deficiency / Fire Flow Reliability	Dolores Dr / Douglas Ave	From Reader Reservoir to Hwy 9	1	22%	6	Replace	10	1,410	217	305,700	305,700	397,500	516,800	As Funding is Available	100%	0%	516,800	0
P4-7	Reader	Capacity	Brookside Dr	From Hwy 9 to approx 110' e/o Hwy 9	3	0%	2	Replace	8	110	202	22,300	22,300	29,000	37,700	8 EDUs	96%	4%	36,400	1,300
P4-8	Reader	Existing Deficiency	Orchard Dr	From approx. 330' n/o Juanita Rd to Juanita Rd	1	0%	1	Replace	8	330	202	66,700	66,700	86,800	112,900	Existing Deficiency	100%	0%	112,900	0
P4-9	Reader	Existing Deficiency	Juanita Rd	From approx. 150' w/o Orchard Dr to approx. 250' e/o Apple Ln	1	0%	1.25 / 2	Replace	8	500	202	101,100	101,100	131,500	171,000	Existing Deficiency	100%	0%	171,000	0
P4-10	Reader	Existing Deficiency	Hiawatha Rd	From Keller Dr to approx. 400' ne/o Keller Dr	1	100%	1 / 1.25 / 2	Replace	8	510	202	103,100	103,100	134,100	174,400	Existing Deficiency	100%	0%	174,400	0
P4-11	Reader	Capacity	Hwy 9	From approx. 150' s/o Bear Creek Rd to Park Ave	3	0%	1.25	Replace	8	270	202	54,600	54,600	71,000	92,300	4 EDUs	93%	7%	86,100	6,200
P4-12	Reader	Fire Flow Reliability	Central Ave	From approx. 250' s/o Big Basin Wy to River St	3	0%	1.5 / 2 / 4	Replace	8	3,200	202	646,500	646,500	840,500	1,092,700	As Funding is Available	100%	0%	1,092,700	0
P4-13	Reader	Existing Deficiency	Grove St	From Central Ave to Lorenzo Ave	1	0%	1	Replace	8	250	202	50,600	50,600	65,800	85,600	Existing Deficiency	100%	0%	85,600	0
P4-14	Reader	Existing Deficiency	River St	From Central Ave to approx. 250' w/o Lorenzo Ave	1	0%	1	Replace	8	320	202	64,700	64,700	84,200	109,500	Existing Deficiency	100%	0%	109,500	0
P4-15	Reader	Existing Deficiency	ROW	From Irene Ave to approx. 10' w/o Irene Ave	1	100%	1.5	Replace	8	10	202	2,100	2,100	2,800	3,700	Existing Deficiency	100%	0%	3,700	0
P4-16	Reader	Existing Deficiency	ROW	From Lomond St to approx. 110' e/o Lomond St	1	0%	0.75	Replace	8	110	202	22,300	22,300	29,000	37,700	Existing Deficiency	100%	0%	37,700	0
P5-1	Lyon	Existing Deficiency	Ridge Dr	From Park Ave to Eckley PS	1	0%	2	Replace	8	970	202	196,000	196,000	254,800	331,300	Existing Deficiency	100%	0%	331,300	0
P5-2	Lyon	Capacity	Redwood Dr / Madrone Dr	From Big Steel Reservoir site to Big Basin Wy	1	0%	-	New	12	1,570	233	365,300	365,300	474,900	617,400	As Funding is Available	100%	0%	617,400	0
P5-3	Lyon	Capacity	Big Basin Wy	From Boulder Brook Dr to Central Ave	1	0%	-	New	12	4,570	233	1,063,300	1,063,300	1,382,300	1,797,000	Construction of P5-2	100%	0%	1,797,000	0
P5-4	Lyon	Capacity	St Francis Dr	From Big Basin Wy to approx. 120' s/o Big Basin Wy	1	0%	-	New	8	120	202	24,300	24,300	31,600	41,100	Construction of P5-2	100%	0%	41,100	0
P5-5	Lyon	Existing Deficiency	St Francis Dr / Davidson Wy / Sunshine Ln	From approx. 100' s/o Big Basin Wy to Redwood Ave	1	0%	2 / 6	Replace	8	2,200	202	444,500	444,500	577,900	751,300	Existing Deficiency	100%	0%	751,300	0
P5-6	Lyon	Capacity	ROW	From Big Basin Wy to approx. 100' n/o Big Basin Wy	1	0%	-	New	8	100	202	20,300	20,300	26,400	34,400	Construction of P5-2	100%	0%	34,400	0
P5-7	Lyon	Capacity	ROW	From Big Basin Wy to approx. 110' n/o Big Basin Wy	1	0%	-	New	8	110	202	22,300	22,300	29,000	37,700	Construction of P5-2	100%	0%	37,700	0
P5-8	Lyon	Existing Deficiency	Big Basin Wy / Oak St / Boulder St	From Hwy 9 to South St	1	0%	2	Replace	8	3,120	202	630,400	630,400	819,600	1,065,500	Existing Deficiency	100%	0%	1,065,500	0
P5-9	Lyon	Existing Deficiency	South St	From Central Ave to approx. 30' w/o Central Ave	1	0%	1	Replace	10	30	217	6,600	6,600	8,600	11,200	Existing Deficiency	100%	0%	11,200	0
P5-10	Lyon	Existing Deficiency	Central Ave	From South St to Mountain St	1	0%	1	Replace	8	720	202	145,500	145,500	189,200	246,000	Existing Deficiency	100%	0%	246,000	0
P6-1	Eckley	Existing Deficiency	Ridge Dr	From Eckley PS to Eckley Reservoir	1	0%	2	Replace	8	240	202	48,500	48,500	63,100	82,100	Existing Deficiency	100%	0%	82,100	0
P8-1	Big Steel	Capacity	Redwood Dr / Madrone Dr / Big Basin Wy	From Big Steel Reservoir to approx. 600' se/o Redwood Dr	1	0%	-	New	12	2,120	233	493,300	493,300	641,300	833,700	As Funding is Available	100%	0%	833,700	0
P8-2	Big Steel	Fire Flow Reliability	Big Basin Wy	From approx. 600' se/o Redwood Dr to Redwood Ave	3	0%	8	Replace	10	2,480	217	537,700	537,700	699,100	908,900	As Funding is Available	100%	0%	908,900	0
P8-3	Big Steel	Fire Flow Reliability	Redwood Ave / Lomond St	From Big Basin Wy to Central Ave	3	0%	6	Replace	8	2,080	202	420,300	420,300	546,400	710,400	As Funding is Available	100%	0%	710,400	0
P8-4	Big Steel	Existing Deficiency	ROW	From Pine St to approx. 20' w/o Pine St	1	0%	1	Replace	8	20	202	4,100	4,100	5,400	7,100	Existing Deficiency	100%	0%	7,100	0
P8-5	Big Steel	Fire Flow Reliability	Central Ave	From Lomond St to approx. 420' s/o Lomond St	4	0%	6/ 8	Replace	10	420	217	91,100	91,100	118,500	154,100	As Funding is Available	100%	0%	154,100	0
P8-6	Big Steel	Fire Flow Reliability	Central Ave / Lorenzo Ave	From approx. 400' s/o Lomond St to Irwin Wy	3	0%	6	Replace	8	4,660	202	941,500	941,500	1,224,000	1,591,200	As Funding is Available	100%	0%	1,591,200	0

Table ES.3 Capital Improvement Program
Water Master Plan
San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Priority	Direct Service to Disadvantaged Communities (%)	Improvement Details				Infrastructure Costs		Baseline Construction Cost	Estimated Construction Cost[1]	Capital Improvement Cost[2]	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
											Unit Cost ($/unit)	Infr. Cost ($)	($)	($)	($)		Existing Users	Future Users	Existing Users ($)	Future Users ($)
P8-7	Big Steel	Capacity	Lomond St / Irwin Wy	From Railroad Ave to approx. 700' sw/o Maple Wy	1	0%	-	New	12	2,170	233	504,900	504,900	656,400	853,400	As Funding is Available	100%	0%	853,400	0
P8-8	Big Steel	Capacity	Monan Wy / Alta Via Dr	From Prospect Ave to approx. 450' s/o Alta Via Dr	3	0%	2	Replace	8	2,970	202	600,100	600,100	780,200	1,014,300	13 EDUs	93%	7%	944,400	69,900
P8-9	Big Steel	Fire Flow Reliability	Hwy 9	From Irwin Wy to Alameda Ave	3	0%	6	Replace	10	3,610	217	782,700	782,700	1,017,600	1,322,900	As Funding is Available	100%	0%	1,322,900	0
P8-10	Big Steel	Existing Deficiency	Reed St / ROW	From approx. 50' w/o Reed St to Pacific St	1	0%	1	Replace	8	610	202	123,300	123,300	160,300	208,400	Existing Deficiency	100%	0%	208,400	0
P8-11	Big Steel	Existing Deficiency	Cascade St / ROW	From Center St to approx. 100' w/o Cascade St	1	0%	1 / 2	Replace	8	420	202	84,900	84,900	110,400	143,600	Existing Deficiency	100%	0%	143,600	0
P8-12	Big Steel	Fire Flow Reliability	Hwy 9	From Alameda Ave to Larkspur St	4	0%	6	Replace	8	730	202	147,500	147,500	191,800	249,400	As Funding is Available	100%	0%	249,400	0
P8-13	Big Steel	Existing Deficiency	Berkeley Wy / ROW	From Alameda Ave to approx. 250' sw/o Center St	1	0%	1	Replace	8	1,070	202	216,200	216,200	281,100	365,500	Existing Deficiency	100%	0%	365,500	0
P8-14	Big Steel	Existing Deficiency	ROW / Western Ave / High St	From approx. 300' nw/o Larkspur Ave to approx. 100' nw/o Western Ave	1	0%	1 / 1.5	Replace	8	860	202	173,800	173,800	226,000	293,800	Existing Deficiency	100%	0%	293,800	0
P16-1	Brookdale	Existing Deficiency	Redwood St	From Hazel St to Fern St	1	0%	1	Replace	8	190	202	38,400	38,400	50,000	65,000	Existing Deficiency	100%	0%	65,000	0
P16-2	Brookdale	Existing Deficiency	Hazel St	From Redwood St to Riverside Rd	1	0%	1	Replace	8	220	202	44,500	44,500	57,900	75,300	Existing Deficiency	100%	0%	75,300	0
P16-3	Brookdale	Existing Deficiency	Riverside Rd / Fern St	From Hazel St to Redwood St	1	0%	1	Replace	8	390	202	78,800	78,800	102,500	133,300	Existing Deficiency	100%	0%	133,300	0
P16-4	Brookdale	Existing Deficiency	California Ave	From approx. 30' w/o Riverside Dr to Riverside Dr	1	0%	2	Replace	8	30	202	6,100	6,100	8,000	10,400	Existing Deficiency	100%	0%	10,400	0
P16-5	Brookdale	Fire Flow Reliability	Brown Gables Rd / Hwy 9	From approx. 800' e/o Hwy 9 to approx. 100' se/o Marshall Creek Ct	3	0%	6	Replace	10	1,980	217	429,300	429,300	558,100	725,600	As Funding is Available	100%	0%	725,600	0
P16-6	Brookdale	Fire Flow Reliability	Mill St	From Hwy 9 to approx. 100' w/o Main St	4	0%	6	Replace	10	950	217	206,000	206,000	267,800	348,200	As Funding is Available	100%	0%	348,200	0
P16-7	Brookdale	Fire Flow Reliability	Mill St	From approx. 100' w/o Main St to Oak St	3	0%	-	New	10	670	217	145,300	145,300	188,900	245,600	As Funding is Available	100%	0%	245,600	0
P16-8	Brookdale	Existing Deficiency / Fire Flow Reliability	Hwy 9 / Brookside Ave	From approx. 100' s/o Brookside Ave to Whittier Ave	1	0%	4 / 6	Replace	10	1,720	217	372,900	372,900	484,800	630,300	Existing Deficiency	100%	0%	630,300	0
P16-9	Brookdale	Fire Flow Reliability	Brookside Ave	From approx. 50' w/o Brookside Ave to Whittier Ave	3	0%	-	New	10	20	217	4,400	4,400	5,800	7,600	As Funding is Available	100%	0%	7,600	0
P16-10	Brookdale	Existing Deficiency	Love Creek Rd	From Roberts Rd to approx. 350' s/o Berts Rd	1	100%	1.25	Replace	8	760	202	153,600	153,600	199,700	259,700	Existing Deficiency	100%	0%	259,700	0
P16-11	Brookdale	Existing Deficiency	Kipling Ave / Live Oak Ave / Pine St	From Longfellow Ave to Manzanita Ave	1	100%	1.5 / 2	Replace	8	2,470	202	499,100	499,100	648,900	843,600	Existing Deficiency	100%	0%	843,600	0
P16-12	Brookdale	Existing Deficiency	Whittier Ave / Manzanita Ave	From Brookside Ave to approx. 300' s/o Locust St	1	100%	1.5 / 2	Replace	8	2,280	202	460,700	460,700	599,000	778,700	Existing Deficiency	100%	0%	778,700	0
P16-13	Brookdale	Existing Deficiency	Pine St / Glen Arbor Rd / Madrone Ave	From Manzanita Ave to Railroad Ave	1	100%	1 / 2	Replace	8	2,410	202	486,900	486,900	633,000	822,900	Existing Deficiency	100%	0%	822,900	0
P16-14	Brookdale	Existing Deficiency	Hillcrest Ave	From Hwy 9 to Manzanita Ave	3	100%	1	Replace	8	640	202	129,300	129,300	168,100	218,600	Existing Deficiency	100%	0%	218,600	0
P16-15	Brookdale	Existing Deficiency	Circle Dr / Urbana Ln	From Hillcrest Ave to approx. 50' e/o Manzanita Ave	1	100%	1	Replace	8	790	202	159,600	159,600	207,500	269,800	Existing Deficiency	100%	0%	269,800	0
P16-16	Brookdale	Existing Deficiency	Madrone Ave / Railroad Ave	From approx. 300' sw/o Railroad Ave to approx. 450' e/o Oak Ave	1	0%	1	Replace	8	1,000	202	202,100	202,100	262,800	341,700	Existing Deficiency	100%	0%	341,700	0
P16-17	Brookdale	Existing Deficiency	Oak Ave	From Railroad Ave to Riverside Park Dr	1	0%	1	Replace	8	250	202	50,600	50,600	65,800	85,600	Existing Deficiency	100%	0%	85,600	0
P16-18	Brookdale	Existing Deficiency / Fire Flow Reliability	Hwy 9	From approx. 100' n/o Hillside Ave to Glen Lomond Ln	1	0%	2 / 4 / 6	Replace	10	8,210	217	1,780,000	1,780,000	2,314,000	3,008,200	Existing Deficiency	100%	0%	3,008,200	0
P16-19	Brookdale	Existing Deficiency	Hwy 9 / Lorenzo Ave / Woodland Dr	From approx. 100' n/o Hillside Ave to Madrona Way	1	0%	2	Replace	8	2,200	202	444,500	444,500	577,900	751,300	Existing Deficiency	100%	0%	751,300	0
P16-20	Brookdale	Existing Deficiency	ROW	From Redwood Dr to Woodland Dr	1	0%	1.5	Replace	8	170	202	34,400	34,400	44,800	58,300	Existing Deficiency	100%	0%	58,300	0
P16-21	Brookdale	Existing Deficiency	Woodland Dr / ROW / Shadowbrook Rd	From Hwy 9 to approx. 650' e/o Hwy 9	1	0%	1.5 / 2	Replace	8	2,200	202	444,500	444,500	577,900	751,300	Existing Deficiency	100%	0%	751,300	0
P16-22	Brookdale	Fire Flow Reliability	Glen Arbor Rd / Hihn Rd	From Pine St to Eleana Dr	4	41%	6	Replace	8	7,070	202	1,428,400	1,428,400	1,857,000	2,414,100	As Funding is Available	100%	0%	2,414,100	0
P16-23	Brookdale	Fire Flow Reliability	ROW	From Glen Arbor Rd to approx. 40' e/o Glen Arbor Rd	4	0%	6	Replace	8	40	202	8,100	8,100	10,600	13,800	As Funding is Available	100%	0%	13,800	0
P16-24	Brookdale	Existing Deficiency	Sunnyside Ave	From approx. 20' w/o Main St to Main St	1	0%	1	Replace	8	20	202	4,100	4,100	5,400	7,100	Existing Deficiency	100%	0%	7,100	0
P16-25	Brookdale	Existing Deficiency	Larita Dr	From Archer Wy to approx. 40' se/o Archer Wy	1	0%	2	Replace	8	40	202	8,100	8,100	10,600	13,800	Existing Deficiency	100%	0%	13,800	0
P17-1	South	Existing Deficiency	Clear Creek Rd	From South PS to High St	1	0%	2	Replace	8	90	202	18,200	18,200	23,700	30,900	Existing Deficiency	100%	0%	30,900	0
P17-2	South	Existing Deficiency	Melwin	From Oak St to Logan Wy	1	0%	1	Replace	8	330	202	66,700	66,700	86,800	112,900	Existing Deficiency	100%	0%	112,900	0

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Water Master Plan
San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Priority	Direct Service to Disadvantaged Communities	Improvement Details				Infrastructure Costs		Baseline Construction Cost	Estimated Construction Cost[1]	Capital Improvement Cost[2]	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
											Unit Cost	Infr. Cost					Existing Users	Future Users	Existing Users	Future Users
						(%)					($/unit)	($)	($)	($)	($)				($)	($)
P17-3	South	Existing Deficiency	ROW	From Azalea Ave to Forest Wy	1	0%	0.75	Replace	8	1,070	202	216,200	216,200	281,100	365,500	Existing Deficiency	100%	0%	365,500	0
P18-1	Swim	Existing Deficiency	Greenfield St	From Redwood Park PS to Park Dr	1	0%	4	Replace	8	720	202	145,500	145,500	189,200	246,000	Existing Deficiency	100%	0%	246,000	0
P18-2	Swim	Existing Deficiency	Hillcrest Dr	From approx. 310' nw/o Greenfield St to Greenfield St	1	0%	0.75	Replace	8	310	202	62,700	62,700	81,600	106,100	Existing Deficiency	100%	0%	106,100	0
P18-3	Swim	Existing Deficiency	Scenic Wy	From approx. 250' nw/o Greenfield St to Greenfield St	1	0%	1.25	Replace	8	250	202	50,600	50,600	65,800	85,600	Existing Deficiency	100%	0%	85,600	0
P18-4	Swim	Existing Deficiency	Country Club Dr / Mountain View Dr	From approx. 250' n/o Mountain View Dr to Swim PS	1	0%	1.5 / 4	Replace	8	390	202	78,800	78,800	102,500	133,300	Existing Deficiency	100%	0%	133,300	0
P20-1	University	Existing Deficiency	Melin Ave	From Condor Ave to approx. 1,060' se/o Condor Ave	1	0%	2	Replace	8	1,060	202	214,200	214,200	278,500	362,100	Existing Deficiency	100%	0%	362,100	0
P21-1	Quail	Fire Flow Reliability	Quail Hollow Rd	From Cumora Ln to approx. 200' e/o Derick Ln	4	0%	6	Replace	8	7,740	202	1,563,700	1,563,700	2,032,900	2,642,800	As Funding is Available	100%	0%	2,642,800	0
P21-2	Quail	Fire Flow Reliability	Quail Ter / Webster Dr / Ridgeview Dr	From Quail Reservoirs to Hihn Rd	4	0%	6	Replace	8	5,730	202	1,157,600	1,157,600	1,504,900	1,956,400	As Funding is Available	100%	0%	1,956,400	0
P21-3	Quail	Existing Deficiency	Arden Ave	From Lorenzo Wy to approx. 150' w/o Glen Arbor Rd	1	0%	1	Replace	8	390	202	78,800	78,800	102,500	133,300	Existing Deficiency	100%	0%	133,300	0
P21-4	Quail	Existing Deficiency	Azalea Ave	From Glen Arbor Rd to approx. 300' e/o Cook Wy	1	0%	2	Replace	8	660	202	133,400	133,400	173,500	225,600	Existing Deficiency	100%	0%	225,600	0
P21-5	Quail	Fire Flow Reliability	Hihn Rd	From Condor Ave to approx. 150' s/o Stanford Dr	4	0%	6	Replace	8	1,800	202	363,700	363,700	472,900	614,800	As Funding is Available	100%	0%	614,800	0
P21-6	Quail	Fire Flow Reliability	Kim Wy / Bahr Dr / Moon Meadow Ln	From Hihn Rd to Zayante Rd	4	0%	6	Replace	8	3,420	202	691,000	691,000	898,300	1,167,800	As Funding is Available	100%	0%	1,167,800	0
P21-7	Quail	Capacity	Zayante Dr	From Intertie 5 PS to approx. 400' ne/o Rosebloom Ave	3	0%	4	Replace	8	1,310	202	264,700	264,700	344,200	447,500	Construction of PS-Z36	100%	0%	447,500	0
P22-1	Probation	Existing Deficiency	Casera Wy	From approx. 100' sw/o Caseta Ct to Lockwood Ln	1	0%	4 / 6	Replace	8	520	202	105,100	105,100	136,700	177,800	Existing Deficiency	100%	0%	177,800	0
P22-2	Probation	Capacity	Tank Rd	From Whispering Pines Dr to Lower Pasatiempo PS	2	0%	4 / 6	Replace	8	420	202	84,900	84,900	110,400	143,600	Construction of PS-Z23	100%	0%	143,600	0
P23-1	Upper Pasatiempo	Capacity	Tank Rd	Parallel lines from Lower Pasatiempo PS to approx. 20' se/o Lower Pasatiempo PS	3	0%	4	Replace	8	20	202	4,100	4,100	5,400	7,100	Construction of PS-Z23	100%	0%	7,100	0
P25-1	Blue	Existing Deficiency	ROW	From approx. 100' sw/o Miraflores Rd to Blue PS	1	0%	2	Replace	8	20	202	4,100	4,100	5,400	7,100	Existing Deficiency	100%	0%	7,100	0
P26-1	Charlie	Existing Deficiency	ROW	From Blue PS to Charlie Reservoir	1	0%	2	Replace	8	430	202	86,900	86,900	113,000	146,900	Existing Deficiency	100%	0%	146,900	0
P28-1	El Solyo	Existing Deficiency	El Solyo Heights Dr	From El Solyo Reservoir to approx. 210' se/o El Solyo Reservoir	1	0%	2	Replace	8	210	202	42,500	42,500	55,300	71,900	Existing Deficiency	100%	0%	71,900	0
P28-2	El Solyo	Existing Deficiency	ROW	From El Solyo Heights Dr to approx. 30' s/o El Solyo Heights Dr	1	0%	2	Replace	8	30	202	6,100	6,100	8,000	10,400	Existing Deficiency	100%	0%	10,400	0
P29-1	Bennett Spring	Existing Deficiency	Felton Empire Rd	From Bennett Spring Reservoir to Blair PRV	1	0%	2	Replace	8	3,520	202	711,200	711,200	924,600	1,202,000	Existing Deficiency	100%	0%	1,202,000	0
P29-2	Bennett Spring	Existing Deficiency	Ley Rd	From Felton Empire Rd to approx. 500' se/o Felton Empire Rd	1	0%	1 / 1.5	Replace	8	500	202	101,100	101,100	131,500	171,000	Existing Deficiency	100%	0%	171,000	0
P31-1	McCloud	Existing Deficiency	El Solyo Heights Dr	From approx. 100' e/o Hillview Dr to El Solyo PS	1	0%	2	Replace	8	370	202	74,800	74,800	97,300	126,500	Existing Deficiency	100%	0%	126,500	0
P31-2	McCloud	Fire Flow Reliability	Hwy 9	From El Solyo Heights Dr to Fall Creek Dr	3	0%	4 / 8	Replace	10	2,340	217	507,400	507,400	659,700	857,700	As Funding is Available	100%	0%	857,700	0
P31-3	McCloud	Existing Deficiency	Hwy 9	From approx. 300' n/o Fall Creek Dr to Fall Creek Dr	1	0%	6	Replace	8	820	202	165,700	165,700	215,500	280,200	Existing Deficiency	100%	0%	280,200	0
P31-4	McCloud	Fire Flow Reliability	Hwy 9 / Felton Empire Rd	From Clearview Pl to Gushee St	4	0%	2 / 6	Replace	8	2,170	202	438,400	438,400	570,000	741,000	As Funding is Available	100%	0%	741,000	0
P31-5	McCloud	Capacity	Cooper St	From approx. 10' nw/o Farmer St to Farmer St	3	0%	6	Replace	8	10	202	2,100	2,100	2,800	3,700	Construction of P31-6 and P31-7	100%	0%	3,700	0
P31-6	McCloud	Existing Deficiency	Farmer St	From approx. 20' sw/o Cooper St to Cooper St	1	0%	-	New	8	20	202	4,100	4,100	5,400	7,100	Existing Deficiency	100%	0%	7,100	0
P31-7	McCloud	Existing Deficiency	Wright St / Kirby St	From Kirby WTP to Gushee St	1	0%	6 / 8 / 10	Replace	12	560	233	130,300	130,300	169,400	220,300	Existing Deficiency	100%	0%	220,300	0
P31-8	McCloud	Capacity	Gushee St	From Kirby St to Russell Ave	2	0%	6	Replace	10	1,240	217	268,900	268,900	349,600	454,500	Construction of P31-6 and P31-7	100%	0%	454,500	0
P31-9	McCloud	Capacity	Russell Ave	From Valley Dr to Gushee St	2	0%	4	Replace	8	300	202	60,700	60,700	79,000	102,700	Construction of P31-6 and P31-7	100%	0%	102,700	0
P31-10	McCloud	Capacity	Plateau Ave	From Ada Ave to Laurel Dr	2	0%	2 / 4	Replace	8	290	202	58,600	58,600	76,200	99,100	Construction of P31-6 and P31-7	100%	0%	99,100	0
P31-11	McCloud	Capacity	Laurel Dr / Hwy 9	From Plateau Dr to Redwood Dr	2	0%	6	Replace	8	2,030	202	410,200	410,200	533,300	693,300	Construction of P31-6 and P31-7	100%	0%	693,300	0
P31-12	McCloud	Capacity	Laurel Dr / Hillside Dr	From Plateau Dr to Orchard Rd	2	0%	6 / 8	Replace	10	970	217	210,300	210,300	273,400	355,500	Construction of P31-6 and P31-7	100%	0%	355,500	0
P31-13	McCloud	Existing Deficiency	Orchard Rd	From McCloud Reservoir to Hillside Dr	1	0%	6 / 8	Replace	12	1,360	233	316,500	316,500	411,500	535,000	Existing Deficiency	100%	0%	535,000	0

Table ES.3 Capital Improvement Program
Water Master Plan
San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Priority	Direct Service to Disadvantaged Communities (%)	Improvement Details				Infrastructure Costs		Baseline Construction Cost ($)	Estimated Construction Cost[1] ($)	Capital Improvement Cost[2] ($)	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
											Unit Cost ($/unit)	Infr. Cost ($)					Existing Users	Future Users	Existing Users ($)	Future Users ($)
P31-14	McCloud	Capacity	Hillside Dr	From Orchard Rd to Redwood Dr	2	0%	4	Replace	8	1,060	202	214,200	214,200	278,500	362,100	Construction of P31-6 and P31-7	100%	0%	362,100	0
P31-15	McCloud	Existing Deficiency	ROW	From approx. 190' n/o Redwood Dr to Redwood Dr	1	0%	0.75	Replace	8	190	202	38,400	38,400	50,000	65,000	Existing Deficiency	100%	0%	65,000	0
P31-16	McCloud	Existing Deficiency	Redwood Dr	Hillcrest Dr to Hwy 9	1	0%	2 / 6	Replace	8	2,440	202	493,000	493,000	640,900	833,200	Existing Deficiency	100%	0%	833,200	0
P31-17	McCloud	Existing Deficiency	ROW / Oak Dr	From Redwood Dr to Redwood Dr	1	0%	2	Replace	8	160	202	32,400	32,400	42,200	54,900	Existing Deficiency	100%	0%	54,900	0
P31-18	McCloud	Existing Deficiency	Hillcrest Dr	From Skyline Dr to Upper Hillcrest PS	1	0%	2 / 6	Replace	8	520	202	105,100	105,100	136,700	177,800	Existing Deficiency	100%	0%	177,800	0
P33-1	Pine	Existing Deficiency	Hillcrest Dr / Pleasant Wy / Brookside Dr	From Upper Hillcrest PS to Pine Reservoir	1	0%	2	Replace	8	3,830	202	773,800	773,800	1,006,000	1,307,800	Existing Deficiency	100%	0%	1,307,800	0
P33-2	Pine	Existing Deficiency	Pine Dr	From Pine Reservoir to Redwood Dr	1	0%	2	Replace	8	2,090	202	422,300	422,300	549,000	713,700	Existing Deficiency	100%	0%	713,700	0
P33-3	Pine	Existing Deficiency	Madrona Dr	From Redwood Dr to Felton Acres PS	1	0%	2	Replace	8	720	202	145,500	145,500	189,200	246,000	Existing Deficiency	100%	0%	246,000	0
P36-1	Kaski	Existing Deficiency	Lake Blvd	From approx. 1,000' n/o Ocean View Ave to Madrone PS	1	0%	4	Replace	8	1,070	202	216,200	216,200	281,100	365,500	Existing Deficiency	100%	0%	365,500	0
P37-1	Madrone	Existing Deficiency	Lake Blvd	From Madrone PS to Lakeshore Blvd	1	0%	4	Replace	8	20	202	4,100	4,100	5,400	7,100	Existing Deficiency	100%	0%	7,100	0
P37-2	Madrone	Existing Deficiency	Whilaway Ave	From Madrone Ave to Madrone Reservoir	1	0%	4	Replace	8	550	202	111,200	111,200	144,600	188,000	Existing Deficiency	100%	0%	188,000	0
							Subtotal - Pipeline Improvements					**33,876,400**	**33,876,400**	**44,045,100**	**57,263,400**				**57,175,600**	**87,800**
Valve Improvements							Existing Capacity (MG)	New/Replace	Capacity (gpm)	Valve Size (in)										
PRV4-1	Reader	PRV	Hwy 9 & Lorenzo St		1	11%	-	New	2,403	8		32,000	32,000	41,600	54,100	As Funding is Available	100%	0%	54,100	0
PRV7-1	Blackstone	PRV	Big Basin Wy & Blackstone Dr		1	0%	-	New	1,005	6		32,000	32,000	41,600	54,100	As Funding is Available	100%	0%	54,100	0
PRV8-1	Big Steel	PRV	Existing Big Steel Tank Site		1	0%	-	New	2,071	8		32,000	32,000	41,600	54,100	As Funding is Available	100%	0%	54,100	0
VLV11-1	Bear Creek	Check Valve	Bear Creek Rd & Deerwood Dr		2	0%	-	New	2,023	8		32,000	32,000	41,600	54,100	As Funding is Available	100%	0%	54,100	0
							Subtotal - Valve Improvements					**128,000**	**128,000**	**166,400**	**216,400**				**216,400**	**0**
Booster Station Improvements							Existing Capacity (gpm)	New/Replace	Capacity (gpm)	No. of Pumps										
PS1-2	Riverside Grove	Booster Pump	Existing Riverside Grove Pump Station		2	0%	-	New	100	1	174	17,442	17,442	22,700	29,600	Existing Deficiency	100%	0%	29,600	0
PS6-2	Eckley	Booster Pump	Existing Eckley Pump Station		1	0%	-	New	15	1	176	2,634	2,634	3,500	4,600	Existing Deficiency	100%	0%	4,600	0
PS13-1	Highland	Booster Pump	Existing Fairview Pump Station		1	27%	50	Replace	220	2	205	45,130	45,130	58,700	76,400	Existing Deficiency	100%	0%	76,400	0
PS18-1	Swim	Booster Pump	Existing Redwood Park Pump Station		3	0%	180	Replace	240	2	205	49,135	49,135	63,900	83,100	Existing Deficiency	100%	0%	83,100	0
PS20-1	University	Booster Pump	Existing University Pump Station		3	0%	170	Replace	200	2	206	41,110	41,110	53,500	69,600	Existing Deficiency	100%	0%	69,600	0
PS23-1	Upper Pasatiempo	Booster Pump	Existing Upper Pasatiempo Pump Station		2	0%	150	Replace	440	2	201	88,296	88,296	114,800	149,300	Existing Deficiency	100%	0%	149,300	0
PS28-1	El Solyo	Booster Pump	Existing Lower El Solyo Pump Station		2	0%	60	Replace	300	2	204	61,051	61,051	79,400	103,300	Existing Deficiency	100%	0%	103,300	0
PS33-1	Pine	Booster Pump	Existing Hillcrest Pump Station		3	0%	120	Replace	400	2	201	80,591	80,591	104,800	136,300	Existing Deficiency	100%	0%	136,300	0
PS36-1	Kaski	Booster Pump	Existing Intertie 5 Pump Station		3	0%	140	Replace	400	2	201	80,591	80,591	104,800	136,300	Existing Deficiency	100%	0%	136,300	0
							Subtotal - Booster Station Improvements					**465,979**	**465,979**	**606,100**	**788,500**				**788,500**	**0**
Reservoir Improvements							Existing Capacity (gal)	New/Replace	Capacity (gal)											
T3-1	Blue Ridge	Storage Reservoir	Existing Blue Ridge Tank Site		1	0%	40,000	Replace	200,000			622,000	622,000	808,600	1,051,200	Existing Deficiency	100%	0%	1,051,200	0
T4-1	Reader	Storage Reservoir	Existing Reader Tank Site		3	11%	-	New	420,000			1,306,200	1,306,200	1,698,100	2,207,600	Existing Deficiency	100%	0%	2,207,600	0
T6-1	Eckley	Storage Reservoir	Existing Eckley Tank Site		2	0%	5,000	Replace	130,000			404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0
T7-1	Blackstone	Storage Reservoir	Existing Blackstone Tank Site		2	0%	24,000	Replace	130,000			404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0

Table ES.3 Capital Improvement Program
Water Master Plan
San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Priority	Direct Service to Disadvantaged Communities (%)	Improvement Details			Infrastructure Costs: Unit Cost ($/unit)	Infrastructure Costs: Infr. Cost ($)	Baseline Construction Cost ($)	Estimated Construction Cost[1] ($)	Capital Improvement Cost[2] ($)	Construction Trigger	Suggested Cost Allocation: Existing Users	Suggested Cost Allocation: Future Users	Cost Sharing: Existing Users ($)	Cost Sharing: Future Users ($)
T10-1	Ralston	Storage Reservoir	Existing Ralston Tank Site		2	0%	20,000	Replace	130,000		404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0
T11-1	Bear Creek	Storage Reservoir	Existing Bear Creek Tank Site		3	100%	-	New	310,000		964,100	964,100	1,253,400	1,629,500	Existing Deficiency	100%	0%	1,629,500	0
T13-1	Highland	Storage Reservoir	Existing Highland Tank Site		1	100%	60,000	Replace	130,000		404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0
T17-1	South	Storage Reservoir	Existing South Tank Site		2	0%	36,400	Replace	130,000		404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0
T18-1	Swim	Storage Reservoir	Existing Swim Tank Site		1	0%	19,600	Replace	210,000		653,100	653,100	849,100	1,103,900	Existing Deficiency	100%	0%	1,103,900	0
T19-1	Spring	Storage Reservoir	Existing Spring Tank Site		3	0%	-	New	60,000		186,600	186,600	242,600	315,400	Existing Deficiency	100%	0%	315,400	0
T20-1	University	Storage Reservoir	Existing University Tank Site		3	0%	-	New	80,000		248,800	248,800	323,500	420,600	Existing Deficiency	100%	0%	420,600	0
T23-1	Upper Pasatiempo	Storage Reservoir	Existing Upper Pasatiempo Tank Site		3	0%	-	New	50,000		155,500	155,500	202,200	262,900	Existing Deficiency	100%	0%	262,900	0
T24-1	North Boulder Creek	Storage Reservoir	Existing Echo Tank Site		1	0%	75,000	Replace	400,000		1,244,000	1,244,000	1,617,200	2,102,400	Existing Deficiency	100%	0%	2,102,400	0
T25-1	Blue	Storage Reservoir	Existing Blue Tank Site		3	0%	-	New	140,000		435,400	435,400	566,100	736,000	Existing Deficiency	100%	0%	736,000	0
T26-1	Charlie	Storage Reservoir	Existing Charlie Tank Site		3	0%	-	New	80,000		248,800	248,800	323,500	420,600	Existing Deficiency	100%	0%	420,600	0
T28-1	El Solyo	Storage Reservoir	Existing El Solyo Tank Site		2	0%	20,000	Replace	160,000		497,600	497,600	646,900	841,000	Existing Deficiency	100%	0%	841,000	0
T29-1	Bennett Spring	Storage Reservoir	Existing Bennett Spring Tank Site		1	0%	6,000	Replace	130,000		404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0
T31-1	McCloud	Storage Reservoir	Existing McCloud Tank Site		1	0%	-	New	40,000		124,400	124,400	161,800	210,400	Existing Deficiency	100%	0%	210,400	0
T33-1	Pine	Storage Reservoir	Existing Pine Tank Site		2	0%	18,500	Replace	230,000		715,300	715,300	929,900	1,208,900	Existing Deficiency	100%	0%	1,208,900	0
T36-1	Kaski	Storage Reservoir	Existing Kaski Tank Site		3	0%	-	New	50,000		155,500	155,500	202,200	262,900	Existing Deficiency	100%	0%	262,900	0
T37-1	Madrone	Storage Reservoir	Existing Madrone Tank Site		3	0%	-	New	30,000		93,300	93,300	121,300	157,700	Existing Deficiency	100%	0%	157,700	0
							Subtotal - Reservoir Improvements				**10,076,400**	**10,076,400**	**13,100,000**	**17,030,800**				**17,030,800**	**0**

Total Water System Improvement Costs

	Infr. Cost ($)	Baseline Construction Cost ($)	Estimated Construction Cost ($)	Capital Improvement Cost ($)	Cost Sharing: Existing Users ($)	Cost Sharing: Future Users ($)
Pipeline Improvements	**33,876,400**	**33,876,400**	**44,045,100**	**57,263,400**	**57,175,600**	**87,800**
Valve Improvements	**128,000**	**128,000**	**166,400**	**216,400**	**216,400**	**0**
Booster Station Improvements	**465,979**	**465,979**	**606,100**	**788,500**	**788,500**	**0**
Reservoir Improvements	**10,076,400**	**10,076,400**	**13,100,000**	**17,030,800**	**17,030,800**	**0**
Total - Improvement Cost	**44,546,779**	**44,546,779**	**57,917,600**	**75,299,100**	**75,211,300**	**87,800**

AKEL ENGINEERING GROUP, INC.

9/10/2021

Notes:
1. Baseline construction costs plus 30% to account for unforeseen events and unknown conditions.
2. Estimated construction costs plus 30% to cover other costs including: engineering design, project administration (developer and District staff), construction management and inspection, and legal costs.

costs in this Water System Master Plan were benchmarked using a 20-City national average Engineering News Record (ENR) Construction Cost Index (CCI) of 12,112, reflecting a date of June 2021. In total, the CIP includes approximately 30.7 miles of pipeline improvements, twenty-one new storage reservoirs, nine new booster stations, and four new valve stations, with a project cost totaling over $75 million dollars.

CHAPTER 1 - INTRODUCTION

This chapter provides a brief background of the District's domestic water system, the need for this master plan, and the objectives of the study. Abbreviations and definitions are also provided in this chapter.

1.1 BACKGROUND

The San Lorenzo Valley Water District (District) service area is located within the County of Santa Cruz, approximately 19 miles southwest of San Jose, and 28 miles west of Gilroy (**Figure 1.1**). The District provides potable water service to 23,000 residents, as well as numerous commercial, industrial, and institutional establishments. The District operates a domestic water distribution center that consists of 2 water treatment plants, 7 groundwater wells, 55 storage tanks equating to 9.3 million gallons in storage, and approximately 190 miles of distribution pipelines.

In 1994, the County of Santa Cruz initiated the effort to develop a comprehensive, long-term General Plan for the orderly development of the community, while integrating the County's social, economic, and environmental goals. On May 24, 1994, the County Board of Supervisors adopted the County of Santa Cruz 1994 General Plan, a comprehensive update of the County's General Plan.

In 2009, the District developed a Water Supply Master Plan (WSMP) that identified capacity deficiencies in the existing water system and recommended improvements to alleviate existing deficiencies and serve future developments in the Urban Growth Boundary. Recognizing the importance of planning, developments, and financing system facilities to provide reliable water service to existing customers and for servicing anticipated growth within the service area, the District initiated updating elements of the 2009 Water Supply Master Plan.

1.2 SCOPE OF WORK

The District approved Akel Engineering Group Inc. to prepare this 2021 Water Master Plan in July of 2019. The 2021 WMP evaluates the District's water system and recommends capacity improvements necessary to service the needs of existing users and for servicing the future growth of the District's service area. This 2021 WMP is intended to serve as a tool for planning and phasing the construction of future domestic water system infrastructure for the projected buildout of the District's service area. The area and horizon for the master plan is stipulated in the County's General Plan. Should planning conditions change, and depending on their magnitude, adjustments to the master plan recommendations might be necessary.

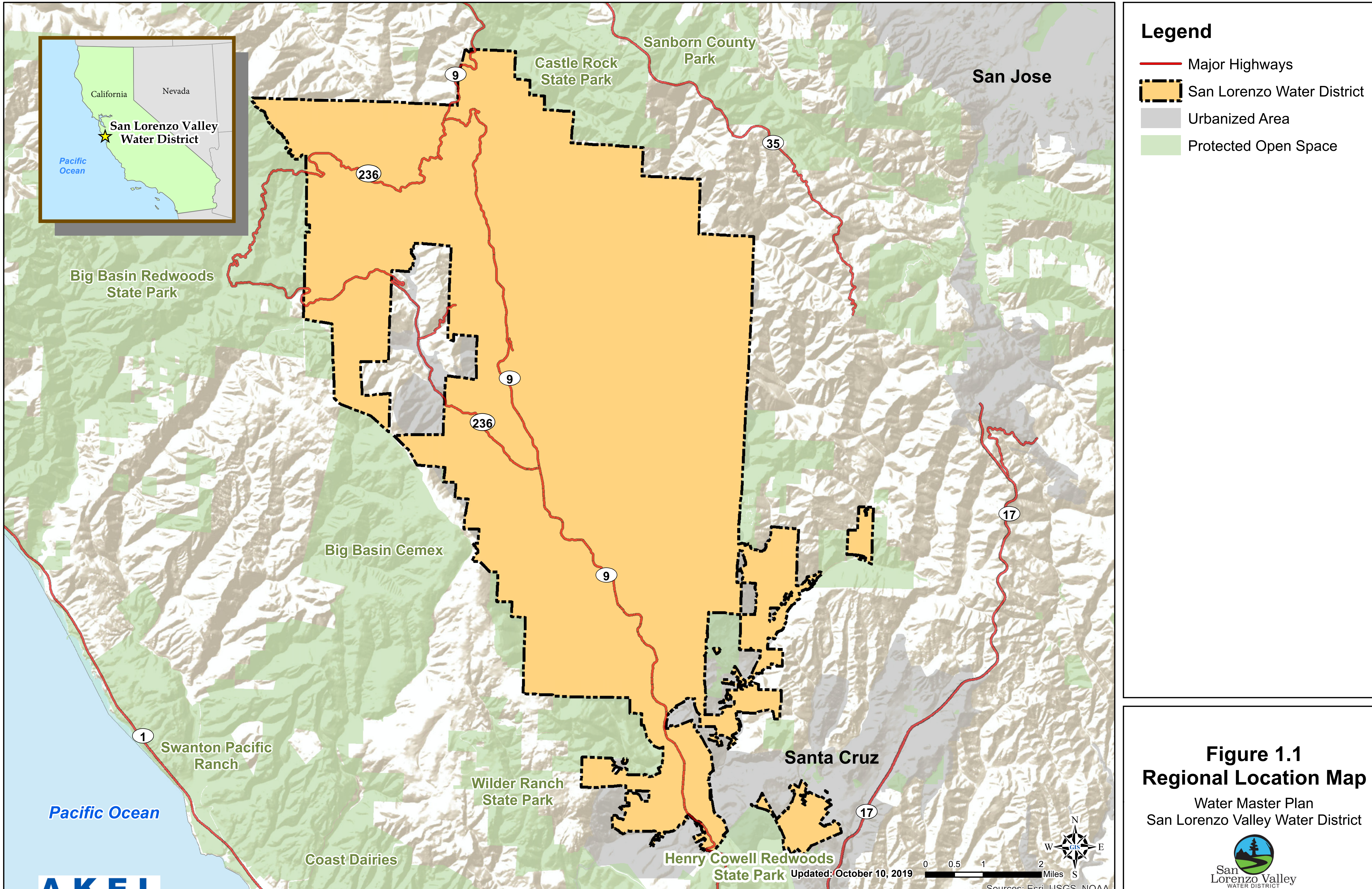


Figure 1.1
Regional Location Map
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

AKEL ENGINEERING GROUP, INC.

This master plan included the following tasks:

- Summarizing the District's existing domestic water system facilities
- Documenting growth planning assumptions and known future developments
- Updating the domestic water system performance criteria
- Projecting future domestic water demands
- Updating and calibrating a new hydraulic model using Geographic Information Systems (GIS) data
- Evaluating the domestic water facilities to meet existing and projected demand requirements and fire flows
- Evaluating the existing groundwater conditions
- Performing a capacity analysis for major distribution mains
- Performing a fire flow analysis
- Recommending a capital improvement program (CIP) with an opinion of probable costs
- Performing a capacity allocation analysis for cost sharing purposes
- Developing a 2021 Water Master Plan report

1.3 RELEVANT REPORTS

The District has completed several special studies intended to evaluate localized growth. These reports were referenced and used during this capacity analysis. The following lists relevant reports that were used in the completion of this master plan, as well as a brief description of each document:

- **San Lorenzo Valley Water District Water Supply Master Plan, May 2009 (2009 WSMP)**. This report provides a comprehensive description and assessment of the water supply of San Lorenzo Valley Water District. This includes a characterization of SLVWD's water supply sources, existing and planned water infrastructure, and water supply yield. This report intended to provide a reference for future District planning and projects.

- **San Lorenzo Valley Water District Urban Water Management Plan, December 2016 (2015 UWMP)**. The 2015 Urban Water Management Plan (UWMP) establishes a benchmark per capita water usage and targets in order to achieve higher levels of water conservation for the sustainability of water supply sources. This includes adopting an updated water shortage contingency plan, defining supply sources, addressing supply reliability, and projecting sustainable supply yields and future demands.

- **San Lorenzo Valley Water District Water Availability Assessment, January 2019 (2019 WAA)**. This report identifies options for increasing water supply reliability through use of available surface water and groundwater resources. This includes the development of alternatives for optimizing the use of current and potential water supply sources to improve water supply reliability and improve aquatic habitat within the San Lorenzo River watershed.

- **San Lorenzo Valley Water District Service Review and Sphere of Influence Study, July 2014 (2014 MSR)**. This study documented the service area and sphere of influence for San Lorenzo Valley Water District and Lompico County Water District. The study summarized aspects of the service area and SOI attributable to each district in order to consider amending them to allow for the dissolution of LCWD and annexation of the Lompico area to SLVWD.

1.4 REPORT ORGANIZATION

The water system master plan report contains the following chapters:

Chapter 1 - Introduction. This chapter provides a brief background of the District's domestic water system, the need for this master plan, and the objectives of the study. Abbreviations and definitions are also provided in this chapter.

Chapter 2 - Planning Areas Characteristics. This chapter presents a discussion of the planning area characteristics for this master plan and defines the land use classifications. The planning area is divided into several planning sub-areas, as established by the District's planning division.

Chapter 3 - System Performance and Design Criteria. This chapter presents the District's performance and design criteria, which was used in this analysis for identifying current system capacity deficiencies and for sizing proposed distribution mains, storage reservoirs, and wells.

Chapter 4 - Existing Domestic Water Facilities. This chapter provides a description of the District's existing domestic water system facilities including the existing wells, surface water diversions, distribution mains, storage reservoirs, booster pump stations, and pressure reducing valves.

Chapter 5 - Water Demands and Supply Characteristics. This chapter summarizes existing domestic water demands, characterizes daily water demand trends, and projects the future domestic water demands.

Chapter 6 - Hydraulic Model Development. This chapter describes the development and calibration of the District's domestic water distribution system hydraulic model. The hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth.

Chapter 7 - Evaluation and Proposed Improvements. This section presents a summary of the domestic water system evaluation and identifies improvements needed to mitigate existing deficiencies, as well as improvements needed to expand the system and service growth.

Chapter 8 – Risk Assessment. This chapter documents the methodology used to evaluate risk of failure to the domestic water system facilities and summarizes results. The chapter also presents recommended prioritization for addressing high risk facilities based on likelihood of failure and overall risk results.

Chapter 9 – Energy Reliability/Efficiency Analysis. This chapter documents the critical power needs for the water system facilities and recommends improvements to improve energy efficiency.

Chapter 10 - Capital Improvement Program. This chapter provides a summary of the recommended domestic water system improvements to mitigate existing capacity deficiencies and to accommodate anticipated future growth. The chapter also presents the cost criteria and methodologies for developing the capital improvement program. Finally, a capacity allocation analysis, usually used for cost sharing purposes, is also included.

1.5 ACKNOWLEDGEMENTS

Obtaining the necessary information to successfully complete the analysis presented in this report, and developing the long-term strategy for mitigating the existing system deficiencies and for accommodating future growth, was accomplished with the strong commitment and very active input from dedicated team members including:

- Rick Rogers, District Manager
- James Furtado, Director of Operations
- Josh Wolff, Engineering Manager
- Nate Gillespie, Water Treatment and System Supervisor
- Joel Scianna, Assistant Engineer

1.6 DWR GRANT FUNDING ACKNOWLEDGMENT FOR THE WATER MASTER PLAN

Funding for this study was provided, in part, from the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006, administered by State of California, Department of Water Resources through a grant awarded to the Regional Water Management Foundation.

1.7 UNIT CONVERSIONS AND ABBREVIATIONS

Engineering units were used in reporting flow rates and volumes pertaining to the design and operation of various components of the domestic water distribution system. Where it was necessary to report values in smaller or larger quantities, different sets of units were used to describe the same parameter. Values reported in one set of units can be converted to another set of units by applying a multiplication factor. A list of multiplication factors for units used in this report is shown on Table 1.1. Various abbreviations and acronyms were also used in this report to

Table 1.1 Unit Conversions
Water Master Plan
San Lorenzo Valley Water District

Volume Unit Calculations		
To Convert From:	**To:**	**Multiply by:**
acre feet	gallons	325,851
acre feet	cubic feet	43,560
acre feet	million gallons	0.3259
cubic feet	gallons	7.481
cubic feet	acre feet	2.296×10^{-5}
cubic feet	million gallons	7.481×10^{-6}
gallons	cubic feet	0.1337
gallons	acre feet	3.069×10^{-6}
gallons	million gallons	1,000,000
million gallons	gallons	1×10^{-6}
million gallons	cubic feet	133,672
million gallons	acre feet	3.069

Flow Rate Calculations		
To Convert From:	**To:**	**Multiply By:**
ac-ft/yr	mgd	8.93×10^{-4}
ac-ft/yr	cfs	1.381×10^{-3}
ac-ft/yr	gpm	0.621
ac-ft/yr	gpd	892.7
cfs	mgd	0.646
cfs	gpm	448.8
cfs	ac-ft/yr	724
cfs	gpd	646300
gpd	mgd	1×10^{-6}
gpd	cfs	1.547×10^{-6}
gpd	gpm	6.944×10^{-4}
gpd	ac-ft/yr	1.12×10^{-3}
gpm	mgd	1.44×10^{-3}
gpm	cfs	2.228×10^{-3}
gpm	ac-ft/yr	1.61
gpm	gpd	1,440
mgd	cfs	1.547
mgd	gpm	694.4
mgd	ac-ft/yr	1,120
mgd	gpd	1,000,000

represent relevant water system terminologies and engineering units. A list of abbreviations and acronyms is included in **Table 1.2**.

1.8 GEOGRAPHIC INFORMATION SYSTEMS

This master planning effort made extensive use of Geographic Information Systems (GIS) technology, for completing the following tasks:

- Develop the physical characteristics of the hydraulic model (pipes and junctions, wells, and storage reservoirs)
- Allocate existing water demands, as extracted from the water billing records, and based on each user's physical address.
- Calculate and allocating future water demands, based on future developments water use
- Extract ground elevations along the distribution mains from available contour maps
- Generate maps and exhibits used in this master plan

Table 1.2 Abbreviations and Acronyms

Water Master Plan
San Lorenzo Valley Water District

Abbreviation	Expansion	Abbreviation	Expansion
AACE International	Association for the Advancement of Cost Engineering	gpm	gallons per minute
AC	acre	hp	horsepower
ACP	Asbestos Cement Pipe	HGL	hydraulic grade line
ADD	average day demand	HWL	high water level
AF	Acre Feet	in	inch
Akel	Akel Engineering Group, Inc.	LF	linear feet
CCI	Construction Cost Index	MG	million gallons
CDPH	California Department of Public Health	MGD	million gallons per day
cfs	cubic feet per second	MMD	maximum month demand
CI	cast iron pipe	NFPA	National Fire Protection Association
CIB	Capital Improvement Budget	PDD	peak day demand
CIP	Capital Improvement Program	PHD	peak hour demand
DIP	Ductile Iron Pipe	PRV	pressure reducing valve
District	San Lorenzo Valley Water District	psi	pounds per square inch
DU	dwelling unit	ROW	Right of Way
EDU	equivalent dwelling unit	SCADA	Supervisory Control and Data Acquisition
ENR	Engineering News Record	SHGL	Static Hydraulic Gradient Line
EPA	Environmental Protection Agency	SS	Steady-State
EPS	Extended Period Simulation	SOI	Sphere of Influence
ft	feet	TBD	to be determined
fps	feet per second	ULL	Urban Limit Line
FY	Fiscal Year	UWMP	Urban Water Management Plan
GIS	Geographic Information Systems	WMP	Water Master Plan
gpd	gallons per day	WTP	Water Treatment Plant
gpdc	gallons per day per capita		

CHAPTER 2 - PLANNING AREA CHARACTERISTICS

This chapter presents a discussion of the planning area characteristics for this master plan and defines the land use classifications. The planning area is divided into several planning sub-areas, as established by the District's planning division.

2.1 STUDY AREA DESCRIPTION

The San Lorenzo Valley Water District service area is located in Santa Cruz County, approximately 19 miles southwest of San Jose, 28 miles west of Gilroy, and approximately 6 miles northwest of the City of Santa Cruz. California Highway 9 bisects the District's service area in the north-south direction. The District's service area limits currently encompass 17.9 square miles, with an approximate population of 23,000 residents.

The District's service area is generally bound to the north by the San Mateo County line, to the northeast by the Santa Cruz Mountain Range, to the southeast by Scotts Valley, and to the southwest by Empire Grade. There are several creeks flowing along the boundaries of the District's service area, including Fall Creek, Bull Creek, and Foreman Creek. The topography is generally mountainous, with increasing slopes in the northeast side of the district due to the Santa Cruz Mountain Range to the northeast. The unincorporated community of Scotts Valley is located to the northeast of the District's service area. **Figure 2.1** displays the planning area showing service area limits, the San Lorenzo Valley Water District's legal boundaries.

The District operates and maintains a domestic water system that covers the majority of the area within the service area limits. Currently, the water demands are provided from groundwater wells located throughout the service area, in addition to treatment plant production and surface water diversions.

2.2 WATER SERVICE AREA AND LAND USE

The District's water system services residential and non-residential lands primarily within the Service area limits, as summarized on **Table 2.1**. This service area includes:

- 6,095 net acres of developed lands inside the service area.
- 108 net acres of undeveloped lands inside the service area.

The existing land use statistics were based on information received from SLVWD staff and are shown on **Figure 2.2**. At the buildout of the Urban Growth Boundary, the District's water system is anticipated to service approximately 4,576 acres of residential land use and 1,519 acres of non-residential land use for a total water service area of 6,202 acres (**Table 2.1**). The land use designations utilized in this master plan are consistent with the Land Use Element of the County's General Plan, and as received from the District's planning division and shown on **Figure 2.3**.

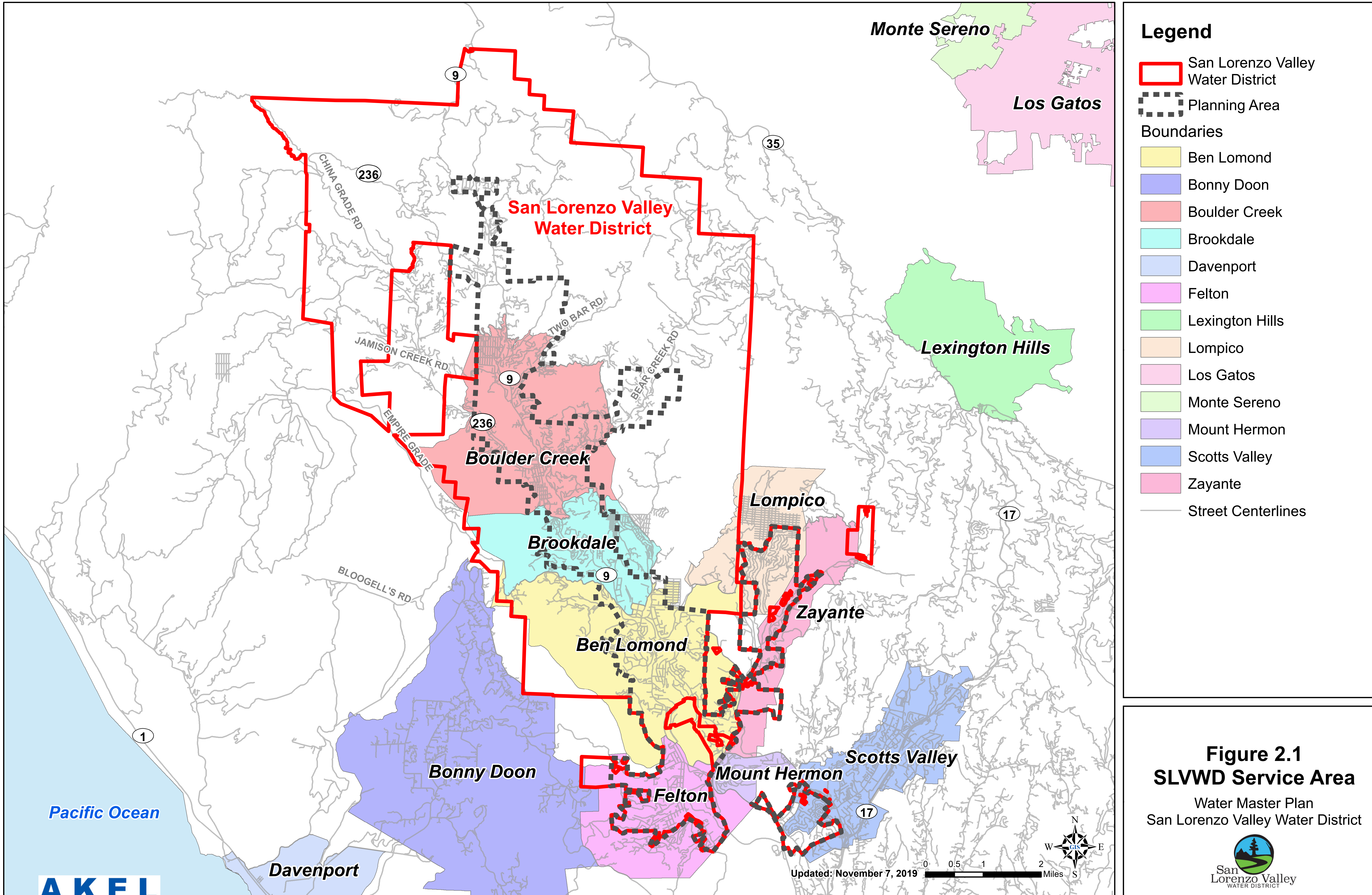
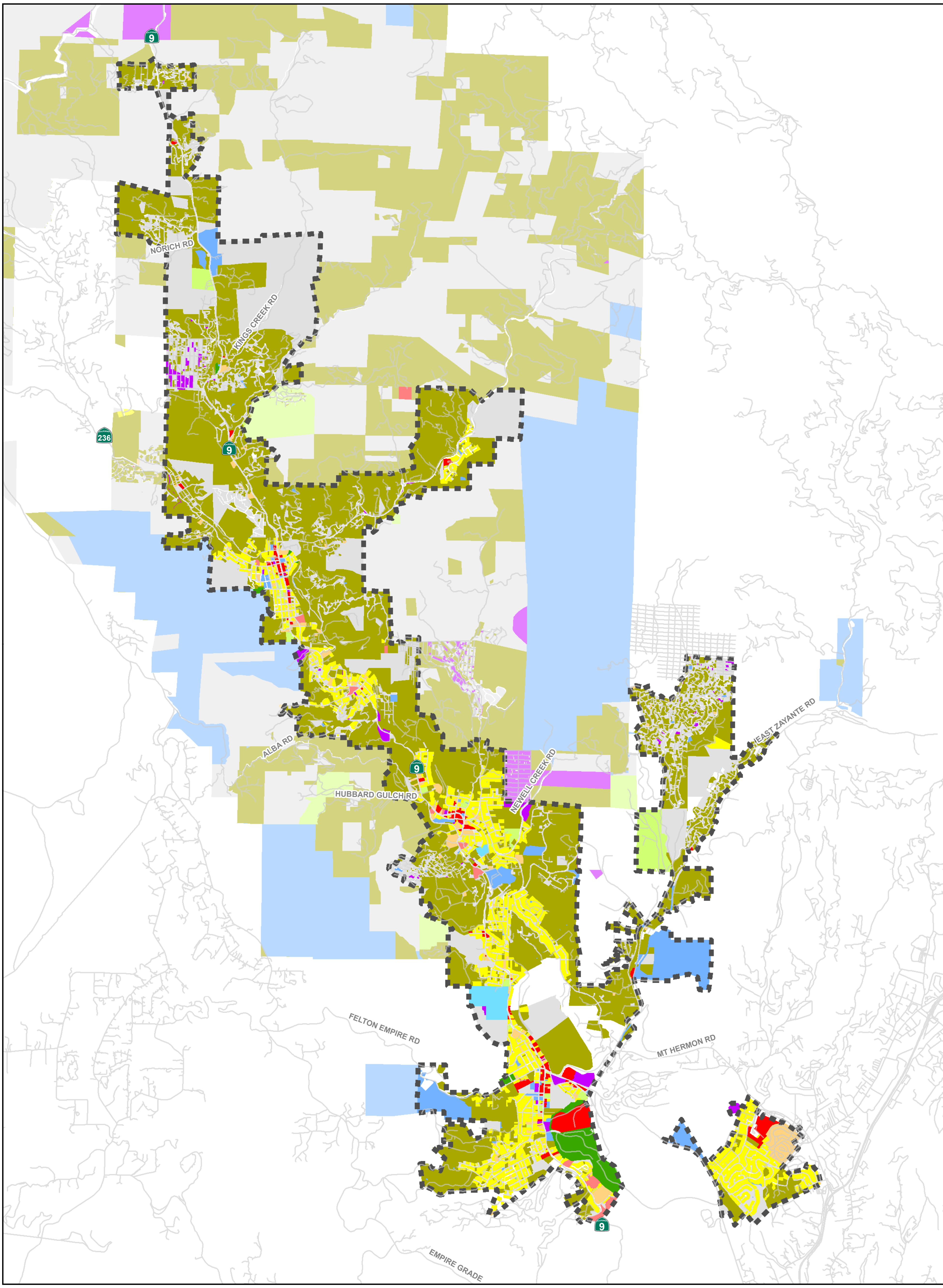


Figure 2.1
SLVWD Service Area

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley
WATER DISTRICT



Legend

Existing Land Use

- Rural Residential
- Single Family Residential
- Multi-Family Residential
- Commercial
- Hotel
- Institutional
- Public
- School
- Park
- Vacant
- Other
- Planning Area

N
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0 0.25 0.5 1 Mile

Update: February 18, 2020

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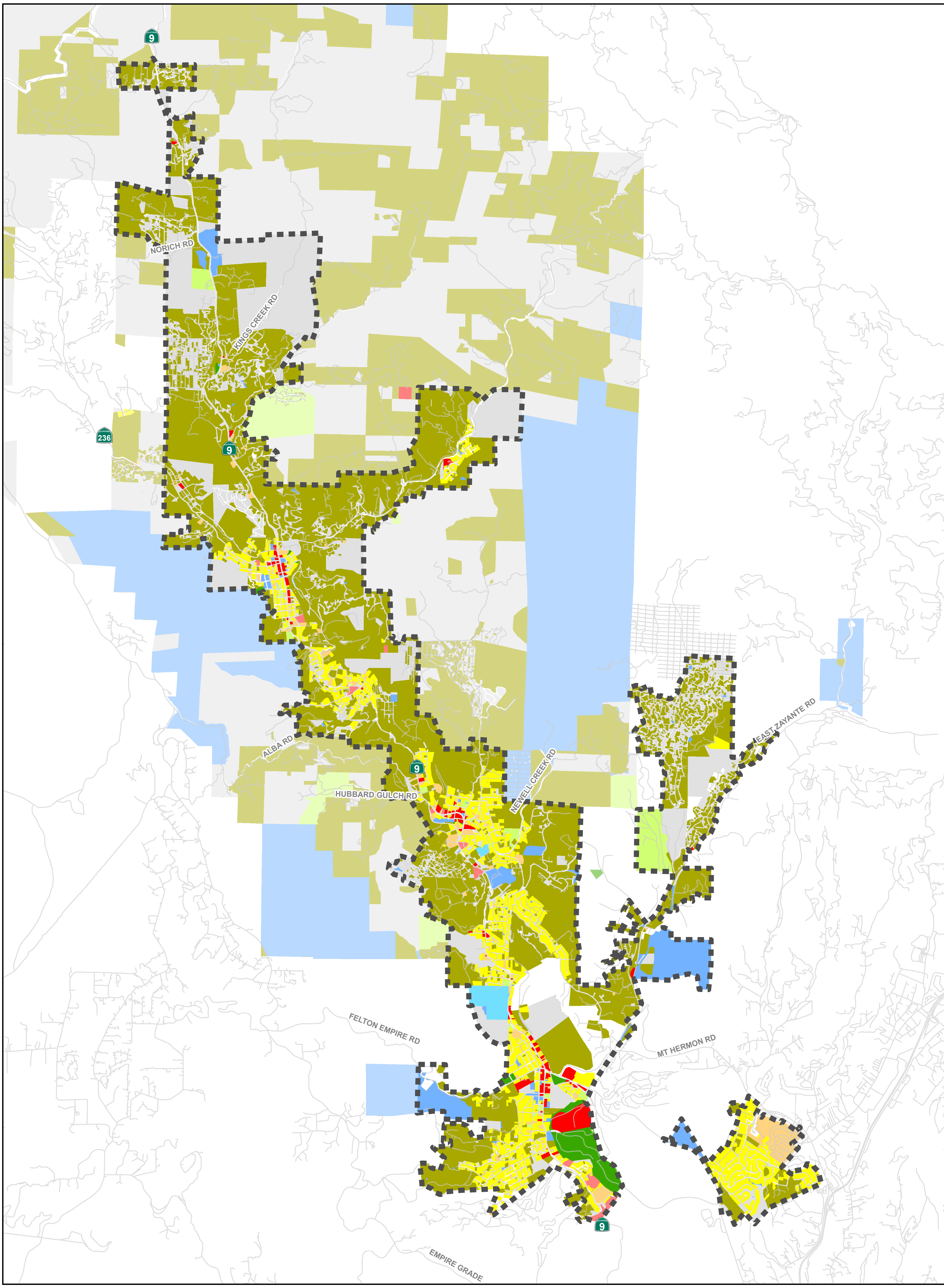
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig2-2_ExistingLU_021820.mxd

Figure 2.2
Existing Land Use

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Future Land Use

- Rural Residential
- Single Family Residential
- Multi-Family Residential
- Commercial
- Hotel
- Institutional
- Public
- School
- Park
- Vacant
- Other
- Planning Area

Update: February 18, 2020

0 0.25 0.5 1 Mile

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Figure 2.3
Future Land Use

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Table 2.1 Existing Service Area Land Use

Water Master Plan

San Lorenzo Valley Water District

Land Use Designation[1]	Service Area Land Use		
	Existing (acres)	Future (acres)	Total Buildout (acres)
Residential			
Rural Residential	3,190	74	3,265
Single Family Residential	1,080	23	1,103
Multi-Family Residential [2]	190	0	208
Subtotal - Residential	**4,460**	**97**	**4,576**
Non-Residential			
Commercial [2]	103	2	86
Hotel	44	0	44
Institutional	173	0	173
Public	51	2	53
School	106	0	106
Park	2	6	8
Subtotal - Non Residential	**480**	**11**	**472**
Other[3]			
Vacant	108	0	0
Other	1,047	0	1,047
Subtotal - Other	**1,155**	**0**	**1,047**
Total			
	6,095	108	6,202

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Notes:

1. Land use designations are consolidated land use types based on County of Santa Cruz parcel information.
2. Total buildout acreages include approximately 18.6 acres of existing commercial land use re-developed to become multi-family residential to accommodate the proposed Valley Gardens Development based on commen received from District staff on January 16, 2020.

2.3 HISTORICAL AND FUTURE GROWTH

San Lorenzo Valley is a growing community, with over 8% of the Santa Cruz County population residing within the District's service area limits. Records obtained from the 2015 UWMP and the 2014 MSR estimate the 2015 population at more than 23,000. From 2010 to present the District's service area has observed an average annual growth rate of approximately 0.24 percent.

The historical and projected population (**Table 2.2**) was extracted from the District's 2015 Urban Water Management Plan (UWMP), which utilized population estimates prepared by the Association of Monterey Bay Area Governments (AMBAG) 2014 Regional Growth Rate Forecast (RGF) Transportation Analysis Zone GIS data to determine an average annual growth rate of 0.5% from 2010 through 2035.

Though historical populations were used in understanding the domestic water consumption behaviors and trends, population forecasts are presented for informational purposes only. Estimates of future domestic water demands were not based on population, but rather on net acreage for residential and non-residential land uses. Future population and EDUs were used as a means for estimating the planning horizon of the water and phasing improvements.

Table 2.2 Historical and Projected Population

Water Master Plan
San Lorenzo Valley Water District

Year	North System[1]	South System (Manana Woods)[1,2]	Lompico[3]	Felton System[1]	District Totals: Population	District Totals: Average Annual Growth Rate (%)
Historical Population						
2010	15,693	2,763	1,137	3,193	22,786	-
2015	15,882	2,796	1,138	3,246	23,062	0.24%
Projected Population						
2020	16,342	3,498	1,138	3,360	24,338	1.11%
2025	16,553	3,510	1,142	3,414	24,619	0.23%
2030	16,947	3,531	1,151	3,515	25,144	0.43%
2035	17,248	3,548	1,158	3,592	25,546	0.32%

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Notes :

1. Data extracted from San Lorenzo Valley Water District 2015 Urban Water Management Plan.
2. South System (Manana Woods) projected population includes expected growth due to Valley Gardens development.
3. Historical population extracted from "2014 Service Review and Sphere of Influence Study for the Lompico County Water District and the San Lorenzo Valley Water District"
4. 2015 - 2035 population projected based on South System (Manana Woods) Annual Growth Rate.

CHAPTER 3 - SYSTEM PERFORMANCE AND DESIGN CRITERIA

This chapter presents the District's performance and design criteria, which was used in this analysis for identifying current system capacity deficiencies and for sizing proposed distribution mains, storage reservoirs, and wells.

3.1 HISTORICAL WATER USE TRENDS

The District's historical water production, for the period 2009-2019, are listed in **Table 3.1**. The District's production generally remained consistent from 2009 to 2013, with annual production slowly decreasing from 2013 to 2019.

The District saw a maximum annual production of 2.1 million gallon per day (mgd) in 2013 and a minimum of 1.57 mgd in 2015. Three years (2016-2018) of monthly production is documented on **Table 3.2**. The maximum month demand typically occurs during the months of July through September and the minimum month demand typically occurs during the months of January through March.

3.2 SEASONAL DEMANDS AND PEAKING FACTORS

Domestic water demands within municipal water systems vary with the time of day and month of the year. It is necessary to quantify this variability in demand so that the water distribution system can be evaluated and designed to provide reliable water service under these variable demand conditions.

Water use conditions that are of particular importance to water distribution systems include the average day demand (ADD), the maximum month demand (MMD), the maximum day demand (MDD), the peak hour demand (PHD), and the minimum month demand (MinMD).

The average day demand represents the annual water demand, divided by 365 days, since it is expressed in daily units. The minimum month demand typically represents the low month water demands (winter) and is used for simulating water quality analysis.

3.2.1 Maximum Month Demand

The maximum month demand (MMD) is the highest demand that occurs within a calendar month during a year. The District's MMD usually occurs in the summer months in either July or August. The MMD is used primarily in the evaluation of supply capabilities.

Historical monthly water production records, obtained for the period between 2009 and 2019 (**Table 3.1**), indicate that the maximum month to average month ratio ranges between 1.21 and

Table 3.1 Historical Annual Water Production (2009-2019)

Water Master Plan

San Lorenzo Valley Water District

Year	Annual Production [1]			Percent Change	Maximum Monthly Production [1]			Maximum Day Production		
	(MGY)	(mgd)	(gpm)	(%)	Maximum (mgd)	Month of Occur.	Max-to-Avg Ratio	Estimated Maximum [2,3] (MGD)	Max Day-to-Max Month Ratio	Max Day-to-Avg Day Ratio
2009	722	1.98	1,374	-	2.76	July	1.39	2.97	1.08	1.50
2010	704	1.93	1,340	-2%	2.74	July	1.42	2.89	1.06	1.50
2011	700	1.92	1,332	-1%	2.59	July	1.35	2.88	1.11	1.50
2012	729	2.00	1,388	4%	2.64	July	1.32	3.00	1.14	1.50
2013	767	2.10	1,459	5%	2.89	July	1.37	3.15	1.09	1.50
2014	625	1.71	1,189	-19%	2.11	July	1.23	2.57	1.22	1.50
2015	573	1.57	1,091	-8%	1.93	August	1.23	2.36	1.22	1.50
2016	591	1.62	1,125	3%	2.22	July	1.37	2.43	1.10	1.50
2017	694	1.90	1,320	17%	2.35	August	1.23	2.85	1.22	1.50
2018	689	1.89	1,311	-1%	2.29	August	1.21	2.83	1.24	1.50
2019	634	1.74	1,207	-8%	2.21	July	1.27	**2.36**	**1.07**	**1.36**
Historical Maximum Peaking Factors										
7-Year Maximum (2013-2019)	767	2.10	1,459		2.89		1.37	3.15	1.24	
5-Year Maximum (2015-2019)	694	1.90	1,320		2.35		1.37	2.85	1.24	
3-Year Maximum (2017-2019)	694	1.90	1,320		2.35		1.27	2.85	1.24	
Last Year's Maximum (2019)	634	1.74	1,207		2.21		1.27	2.36	1.07	
Recommended Peaking Factors										
							1.40			**1.50**

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Notes:

1. Source: Monthly production data received from District staff September 16, 2019.
2. Estimated Maximum Day Demand = 1.5 x Average Day Demand
3. Estimated Maximum Day Demand for 2019 was based on received 2019 SCADA. Data for Kirby WTP was unavailable, and was assumed based on monthly production records, which were used to proportionally match daily production data for Lyon WTP.

Table 3.2 Historical Monthly Water Production (2016-2018)

Water Master Plan

San Lorenzo Valley Water District

Month	2016 Monthly[1] Production (mgd)	2016 Monthly[1] Percent of Annual (%)	2016 Peaking Factor Month to Avg Factor	2017 Monthly[1] Production (mgd)	2017 Monthly[1] Percent of Annual (%)	2017 Peaking Factor Month to Avg Factor	2018 Monthly[1] Production (mgd)	2018 Monthly[1] Percent of Annual (%)	2018 Peaking Factor Month to Avg Factor
January	1.2	6%	0.72	1.2	5%	0.63	1.45	6%	0.77
February	1.3	7%	0.81	1.4	6%	0.72	1.60	7%	0.85
March	1.3	7%	0.83	1.6	7%	0.87	1.59	7%	0.84
April	1.4	7%	0.88	1.7	7%	0.88	1.65	7%	0.87
May	1.7	9%	1.05	2.1	9%	1.10	1.92	8%	1.02
June	2.1	11%	1.32	2.3	10%	1.24	2.24	10%	1.19
July	2.2	11%	**1.37**	2.3	10%	1.23	2.22	10%	1.18
August	2.1	11%	1.32	2.3	10%	1.24	2.29	10%	**1.21**
September	1.5	8%	0.94	2.4	11%	**1.27**	2.15	9%	1.14
October	1.6	8%	0.97	2.1	9%	1.08	1.90	8%	1.01
November	1.5	7%	0.90	1.6	7%	0.86	1.65	7%	0.88
December	1.4	7%	0.89	1.7	7%	0.88	1.98	9%	1.05
Total	**19.4**			**22.8**			**22.6**		
Average Value	**1.6**			**1.9**			**1.9**		
Maximum Value	**2.2**		**1.37**	**2.4**		**1.27**	**2.3**		**1.21**

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Notes:

1. Source: Production data received from District staff September 16, 2019.

1.42. Over the reviewed period, this ratio neither showed significant increasing or decreasing trends. Therefore, an MMD factor of 1.40 was deemed representative of District trends.

The following equation is recommended for estimating the maximum month demand, given the average day demand:

Maximum Month Demand = 1.40 x Average Day Demand

3.2.2 Maximum Day Demand

The maximum day demand (MDD) is the highest demand that occurs within a 24-hour day during a year. The District's MDD, which usually occurs during the summer months, is typically used for the evaluation and design of storage facilities, distribution mains, pump stations, and pressure reducing valves. The MDD, when combined with fire flows, is one of the highest demands that these facilities should be able to service while maintaining acceptable pressures within the system.

Daily production records were not available for the period between 2009 to 2018. California Water Board regulations recommend a maximum day demand to average day demand ratio of 1.5. As such, it was assumed that demands between 2009 to 2018 were approximately 1.5 times of average day demands for each year. Maximum day demand for 2019 was based on received 2019 SCADA data. It should be noted that daily production records for Kirby Water Treatment Plant were unavailable, and were assumed based on monthly production records, which were used to proportionally match daily production data for Lyon Water Treatment Plant. This resulted in an estimated maximum day demand of 2.36 MGD, and a ratio of 1.36.

Due to the limited daily production data, it was determined that a ratio of 1.5 (as recommended by California Water Board standards) would be used in this master plan. The following equation is then used to estimate the maximum day demand, given the average day demand:

Maximum Day Demand = 1.5 x Average Day Demand

3.2.3 Peak Hour Demand

The peak hour demand (PHD) is another high demand condition that is used in the evaluation and design of water distribution systems. The peak hour demand is the highest demand that occurs within a one-hour period during a year. The peak hour demand is considered to be the largest single measure of the maximum demand placed on the distribution system. The PHD is often compared to the MDD plus fire flow to determine the largest demand imposed on the system for the purpose of evaluating distribution mains.

An industry standard peak hour to maximum day ratio of 1.5 was applied to the maximum day demand to yield the peak hour demand ratio of 2.25. The peak hour demand can then be calculated using the average day demand and the following equation:

Peak Hour Demand = 2.25 x Average Day Demand

3.3 SUPPLY CRITERIA

In determining the adequacy of the domestic water supply facilities, the source must be large enough to meet the varying water demand conditions, as well as provide sufficient water during potential emergencies such as power outages and natural or created disasters.

Ideally, a water distribution system should be operated at a constant water supply rate with consistent supply from the water source. On the day of maximum demand, it is desirable to maintain a water supply rate equal to the maximum day rate. Water required for peak hour demands or for fire flows would come from storage.

The District currently uses a combination of groundwater wells and surface water treatment plants as a source of supply. The existing storage in the system is expected to supply water during peak period usage, while supply wells should be capable of meeting maximum day demand with the largest supply well out of service. Future system supply improvements should be designed to have a combined supply capacity capable of meeting the maximum day demand. Design criteria for water supply are documented on **Table 3.3**.

3.4 STORAGE CRITERIA

The intent of domestic water storage is to provide supply to meet the needs of existing water users and maintain service pressures in the event of emergency, such as a fire. The District's storage criteria consists of two main elements, operational storage and fire storage, as described below and documented in **Table 3.3**.

Operational Storage

Operational or equalization storage capacity is necessary to reduce the variations imposed on the supply system by daily demand fluctuations. Peak hour demands may require up to 1.5 times the amount of maximum day supply capacity. With storage in place, this increase in demand can be met by the operational storage rather than by increasing production from the supply sources.

Equalization storage also stabilizes system pressures for enhancing the service. Equalization storage requirements typically range from 25 percent to 50 percent of maximum day demand. The District criterion requires that 50 percent of the maximum day demand be reserved for operational storage.

Fire Storage

Fire storage is also needed to maintain acceptable service pressures within a pressure zone, in the event of a fire flow, which may occur during the maximum day demand. The recommended fire storage capacity varies by pressure zone and land use type, and is usually higher for commercial and institutional areas. Fire flow provisions for each pressure zone were calculated based on the governing (highest) land use type within a reservoir service area as follows:

Table 3.3 Design and System Performance Criteria
Water Master Plan
San Lorenzo Valley Water District

Design Parameter	Preliminary Criteria
DESIGN CRITERIA	
Demand Peaking Factors	
Maximum Day Demand	*1.5 x Average Day Demand*
Peak Hour Demand	*1.5 x Maximum Day Demand*
Supply Capacity Requirement	
Total Supply Requirement	Firm Supply Capacity = Maximum Day Demand
Storage Capacity Requirement	
Total Storage Requirement	Total Required Storage = Operational + Fire
Operational	**50%** of Maximum Day Demand
Fire Flow	Varies
Pump Stations Capacity Requirement[1]	
Booster Pump Stations	Firm Capacity to provide maximum day demand over 8 hours
Hydropneumatic Pump Stations	Firm Capacity = Peak Hour Demand
Transmission and Distribition Pipelines Capacity Requirements	
Maximum Velocity	
Maximum Day Demand + Fire Flow	**10** ft/s
Maximum Headloss	
Peak Hour Demand	**10** ft/k-ft
Minimum Pipeline Sizes	
New Pipelines	**8** inch
Pressure Reducing Valves Capacity Requirements	
Valve Size	Maximum Flow based on the greater of Peak Hour Demand and Maximum Day Demand + Fire Flow
PERFORMANCE CRITERIA	
Fire Flow Requirements	
Single Family Residential	**1,000 gpm** for **2 hours**
Multi-Family Residential	**1,500 gpm** for **2 hours**
Commercial/Institutional	**2,000 gpm** for **3 hours**
Distribution System Service Pressures	
Maximum Pressures	
At Service Connections	**80 psi**
In Pipelines	**130 psi**
Minimum Pressures	
Peak Hour Demand	**40 psi**
Maximum Day Demand + Fire Flow	**20 psi**

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- Single-Family Residential: 1,000 gpm for 2 hours = 0.12 MG
- Multi-Family Residential: 1,500 gpm for 2 hours = 0.18 MG
- Commercial/Institutional: 2,000 gpm for 3 hours = 0.36 MG

Table 3.4 documents the fire flow requirements by pressure zone. It should be noted that the fire flow requirements for each pressure zone were based on the highest fire flow requirement determined based on existing land use within each pressure zone.

Total Storage Requirement

The total storage is the summation of operational (equalization) and fire requirements as follows:

Qs = 50% MDD (equalization) + fire flow (varies)

where:

Qs is the Total Required Storage, in gallons

MDD is the Maximum Day Demand, in gallons

3.5 PRESSURE CRITERIA

Acceptable service pressures within distribution systems vary depending on District criteria and pressure zone topography. It is essential that the water pressure in a consumer's residence or place of business be maintained within an acceptable range. Low pressures below 30 psi can cause undesirable flow reductions when multiple faucets or water using appliances are used at once.

Excessively high pressures can cause faucets to leak and valve seats to wear out prematurely. Additionally, high service pressures can cause unnecessarily high flow rates, which can result in wasted water and high utility bills. The criteria for pressures in the domestic water system include the following:

- Maximum pressure, usually experienced during low demands and winter months
- Minimum pressure, usually experienced during peak hour demands and summer months
- Minimum pressure during maximum day demand plus fire flow

The American Water Works Association Manual on Computer Modeling and Water Distribution System (AWWA M-32) indicates that maximum pressures are usually in the range of 90-110 pounds per square inch (psi). In some communities, the maximum pressure may be limited to 80 psi to mitigate the impact on internal plumbing. In this case, the distribution system is usually sized for the higher pressures, and individual pressure-reducing valves are installed on service lines where the pressure may be exceeded.

Table 3.4 Fire Flow Requirements, by Zone

Water Master Plan

San Lorenzo Valley Water District

Pressure Zone	Fire Flow Requirements
North System	
Bear Creek	2,000 gpm for 3 hours
Bear Creek Hydro	-
Big Steel	2,000 gpm for 3 hours
Blackstone	1,000 gpm for 2 hours
Blue Ridge	1,500 gpm for 2 hours
Brookdale	2,000 gpm for 3 hours
Eckley	1,000 gpm for 2 hours
Highland	1,000 gpm for 2 hours
Huckleberry	1,000 gpm for 2 hours
Lyon	2,000 gpm for 3 hours
Mitchell	-
Nina	1,000 gpm for 2 hours
Nina Hydro	-
North Boulder Creek	2,000 gpm for 2 hours
Quail	2,000 gpm for 3 hours
Ralston	1,000 gpm for 2 hours
Reader	2,000 gpm for 3 hours
Riverside Grove	1,000 gpm for 2 hours
South	1,000 gpm for 2 hours
Spring	1,000 gpm for 2 hours
Swim	1,500 gpm for 2 hours
University	1,000 gpm for 2 hours
Lompico System	
Kaski	1,000 gpm for 2 hours
Lewis	1,500 gpm for 2 hours
Madrone	1,500 gpm for 2 hours

Table 3.4 Fire Flow Requirements, by Zone

Water Master Plan

San Lorenzo Valley Water District

Pressure Zone	Fire Flow Requirements
South System (Manana Woods)	
Blue	1,500 gpm for 2 hours
Charlie	1,000 gpm for 2 hours
Charlie Hydro	-
Probation	2,000 gpm for 3 hours
Upper Pasatiempo	1,000 gpm for 2 hours
Felton System	
Bennett Spring	1,000 gpm for 2 hours
Blair	1,000 gpm for 3 hours
El Solyo	1,000 gpm for 2 hours
McCloud	2,000 gpm for 3 hours
Pine	1,500 gpm for 2 hours

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The minimum acceptable pressure is usually in the range of 40-50 psi, which generally provides for sufficient pressures for second story fixtures. When backflow preventers are required, they may reduce the pressures by approximately 5-15 psi. The recommended minimum pressure during fire flows is 20 psi, as established by the National Fire Protection Association (NFPA).

The District's pressure criteria are summarized as follows (**Table 3.3**):

- **Maximum Pressure:**
  - In pipelines: 130 psi
  - At service connection: 80 psi
- **Minimum Pressure:**
  - Peak Hour Demand: 40 psi
  - Maximum Day Demand + Fire Flow: 20 psi

3.6 TRANSMISSION AND DISTRIBUTION MAIN CRITERIA

Transmission and distribution mains are usually designed to convey the maximum expected flow condition. In municipal water systems, this condition is usually the greater of either the peak hour demand or the maximum day demand plus fire flow. The hydrodynamics of pipe flow create two additional parameters that are taken into consideration when evaluating or sizing water mains: head loss and velocity.

Head loss is a loss of energy within pipes that is caused by the frictional effects of the inside surface of the pipe and friction within the moving fluid itself. Head loss creates a loss in pressure which is undesirable in water distribution systems. Head loss, by itself, is not an important factor as long as the pressure criterion has not been violated. However, high head loss may be an indicator that the pipe is nearing the limit of its carrying capacity and may not have sufficient capacity to perform under stringent conditions. The District criterion for maximum pipeline head loss is summarized as follows:

- Peak Hour Demand: 10 feet of per 1,000 feet of pipe.

Since high flow velocities can cause damage to pipes and lead to high head loss, it is desirable to keep the velocity below a predetermined limit. The criterion for maximum pipeline velocity under maximum day demand plus fire flow used in this master plan is 10 feet per second. This criterion also ensures that the head loss is kept below an acceptable limit, as the head loss in a pipe is a function of the flow velocity. The District criteria for maximum pipeline velocity is summarized as follows:

- Maximum Day Demand + Fire Flow: 10 feet per second

In addition to the capacity requirements described above, it is required that any newly installed transmission and distribution mains are at minimum 8-inches in diameter. Pipelines under 8-inches in diameter would result in significantly reduced capacity under head loss and velocity criteria, and would result in decreased system reliability under higher flow conditions.

3.7 UNIT FACTORS

Domestic water demand unit factors are coefficients commonly used in planning level analysis to estimate future average daily demands for areas with predetermined land uses. The unit factors are multiplied by the number of dwelling units or gross acreages for residential categories, and by the gross acreages for non-residential categories, to yield the average daily demand projections.

The total domestic water demand was calculated from consumption data. The demand was adjusted to balance with current production records, and to account for transmission main losses and vacancies in existing land uses. The demand unit factor was then calculated using the total water production and total number of residential and non-residential land use acreages.

This analysis generally indicates that existing single family residential, multiple family residential, public and park land uses have higher consumptive use factors than that of other land uses. The existing unit factor analysis is shown on **Table 3.5**. The water recommended water demand unit factors are summarized on **Table 3.6**.

Table 3.5 Water Demand Unit Factor Analysis

Water Master Plan

San Lorenzo Valley Water District

Land Use Classification	Existing Development within Service Area	Existing Average Daily Water Demand Unit factors									
		Consumption[1]			Production[2]		Production at 100% Occupancy			Recommended Water Unit Factor	
		Unadjusted Water Unit Factors	Annual Consumption		Production Water Unit Factors	Production	Vacancy Rate[3,4]	Unit factor at 100% Occupancy	Production	Recommended Factor	Balance Using Recommended Unit Factor
	(acres)	(gpd/acres)	(gpd)	(gpm)	(gpd/acres)	(gpd)	(%)	(gpd/acres)	(gpd)	(gpd/acres)	(gpd)
Residential											
Rural Residential	3,190	162	515,669	358	219	698,248	3.4%	226	721,988	230	733,776
Single Family Residential	1,080	550	593,896	412	744	804,172	3.4%	770	831,514	770	831,758
Multi-Family Residential	190	685	129,965	90	928	175,981	3.4%	960	181,964	960	182,043
Subtotal - Residential	4,460	-	1,239,530	861	-	1,678,401					1,747,577
Non-Residential											
Commercial	103	507	52,029	36	687	70,450	2.9%	707	72,493	700	71,825
Hotel	44	526	22,980	16	712	31,116	0.0%	712	31,116	725	31,691
Institutional	173	118	20,534	14	160	27,805	2.9%	165	28,611	175	30,362
Public	51	593	30,296	21	803	41,023	0.0%	803	41,023	825	42,125
School	106	242	25,780	18	328	34,908	0.0%	328	34,908	350	37,234
Park	2	1,134	2,563	2	1,535	3,470	0.0%	1,535	3,470	1,550	3,504
Subtotal - Non-Residential	480	-	154,181	107	-	208,771					216,742
Other											
Vacant	108	0	0	0	-	0	0.0%	-	-	0	0
Other	1,047	0	0	0	-	0	0.0%	-	-	0	0
Subtotal - Other	1,155	-	0	0	-	0					0
Total											
	6,095	**-**	**1,393,711**	**968**		**1,887,172**					**1,964,319**

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Notes:

1. Source: 2018 Billing Records provided by District staff August 20, 2019
2. Source: Production records provided by District staff September 5, 2019.
3. Residential vacanacy rates based on California Department of Finance Population Estimates for Scotts Valley.
4. Commercial and Institutional vacancy rates based on vacancy statistics for Retail Commercial as extracted from Santa Cruz County Office for Economic Development website.

Table 3.6 Recommended Water Unit Factors

Water Facilities Master Plan
West Valley Water District

Land Use Designation	Recommended Water Factor (gpd/ acre)	(gpm/acre)
Residential		
Rural Residential	230	0.16
Single Family Residential	770	0.53
Multi-Family Residential	960	0.67
Non-Residential		
Commercial	700	0.49
Hotel	725	0.50
Institutional	175	0.12
Public	825	0.57
School	350	0.24
Park	1,550	1.08

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CHAPTER 4 - EXISTING DOMESTIC WATER FACILITIES

This chapter provides a description of the District's existing domestic water system facilities including the existing wells, surface water diversions, distribution mains, storage reservoirs, booster pump stations, and pressure reducing valves.

4.1 EXISTING WATER SYSTEM OVERVIEW

The District's municipal water system consists of 7 active groundwater wells, 2 water treatment plants, 55 storage tanks totaling 9.3 million gallons in storage, and over approximately 190 miles of distribution pipelines. The SLVWD service area ranges in elevation from approximately 200 ft MSL near Felton to as high as 1,400 ft MSL along the eastern flank of Ben Lomond Mountain. The water distribution system is comprised of 35 pressure zones.

The District's existing domestic water distribution system is shown in **Figure 4.1**, which displays the existing system by pipe size. This figure provides a general color coding for the distribution mains based on diameter, as well as labels for the existing wells, booster stations, pressure reducing valves, and the storage reservoirs. The District is generally divided into four sub-areas: North System, Lompico System, Manana Woods System, and Felton System, which are briefly summarized in the following sections.

4.1.1 North System

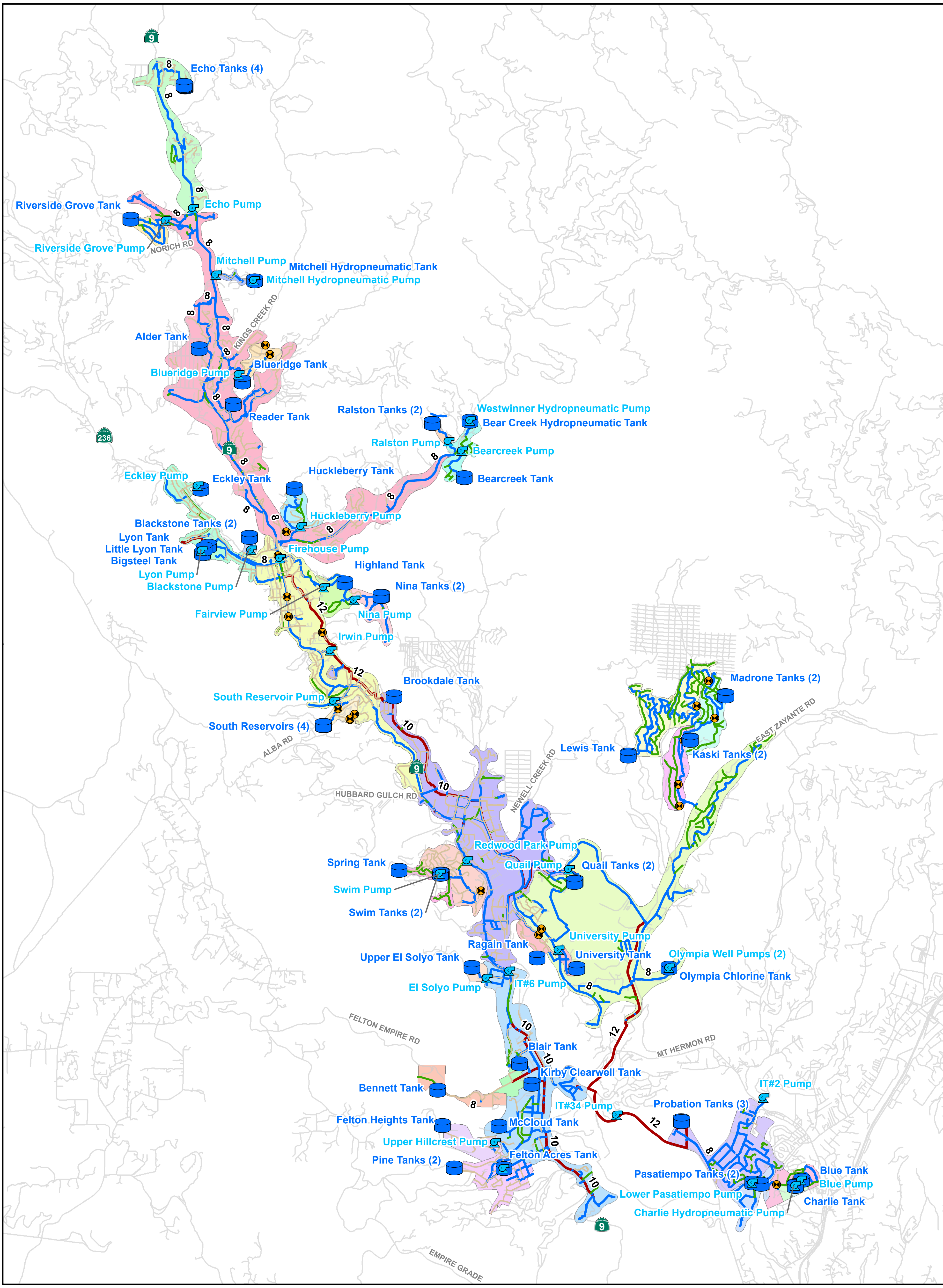
The North System encompasses the northern portion of the SLVWD service area, and is comprised of the pressure zones: Bear Creek, Bear Creek Hydro, Big Steel, Blackstone, Blue Ridge, Brookdale, Eckley, Highland, Huckleberry, Lyon, Mitchell, Nina, Nina Hydro, North Boulder Creek, Quail, Ralston, Reader, Riverside Grove, South, Spring, Swim, University. It provides domestic water service to the District's customers of Boulder Creek, Brookdale, and Ben Lomond. Supply for this system is provided by 4 groundwater wells and the Lyon Water Treatment Plant, in addition to water boosted from the Felton System.

4.1.2 Lompico System

The Lompico System provides domestic water service to the District's customers generally north of Lompico Road, which was previously serviced by the Lompico County Water District before merging with SLVWD in 2016. The Lompico System is comprised of the pressure zones: Kaski, Lewis, and Madrone. Supply for this system is boosted from the North System.

4.1.3 South System (Manana Woods)

The South System (Manana Woods) provides domestic water service to the District's customers generally east of Graham Hill Road. It is comprised of the pressure zones: Probation, Upper



Legend

Existing System
- Pump Station
- Tank
- Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Pressure Zones

Bear Creek	Blue	Hillcrest	Nina	Riverside Grove
Bear Creek Hydro	Blue Ridge	Huckelberry	Nina Hydro	South
Bennett Springs	Brookdale	Kaski	North Boulder Creek	Spring
Big Steel	Charlie	Lewis	Pine	Swim
Blackstone	Charlie Hydro	Lyon	Probation	University
Blair	Eckley	Madrone	Quail	Upper Pasatiempo
	El Solyo	McCloud	Ralston	
	Highland	Mitchell	Reader	

0 0.25 0.5 1 Mile

Update: May 26, 2021

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig4-1_ExistingSystem_052621.mxd

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Figure 4.1
Existing System

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Pasatiempo, Blue, Charlie, and Charlie Hydro. Supply for this system is provided by 3 groundwater wells and water boosted from the North System.

4.1.4 Felton System

The Felton System encompasses the southern portion of the SLVWD service area, and is comprised of the pressure zones: El Solyo, Bennett Spring, Blair, McCloud, and Pine. It provides domestic water service to the District's customers generally in the town of Felton. Supply for this system is provided by Kirby Water Treatment Plant, Bennett Spring Diversion and water boosted from the North System.

4.2 SOURCE OF SUPPLY

In order to meet existing domestic water demands, the District utilizes several sources of supply, including groundwater and surface water diversions. Production from stream diversions occurs whenever possible which allows groundwater to remain stored for use during dry periods. The following section provides a brief summary of these sources.

4.2.1 Groundwater Supply

The District's existing groundwater supply sources are summarized on **Table 4.1**; this includes 7 active and 4 inactive groundwater wells. As shown on **Table 4.1**; The total capacity of the District's active wells is approximately 1,675 gpm, or 2.4 MGD. SLVWD extraction wells operate regularly throughout the year, but especially in the dry season, beginning when stream diversions fall below the amount required to meet San Lorenzo Valley System water demand.

4.2.2 Treatment Facilities and Surface Water Diversions

The District has 7 surface water diversions, which are summarized on **Table 4.2**. The projected annual water supply in 2020 from the surface water diversions is 402.8 MG. Water treatment is needed to bring the surface water into production, excluding Bennett Spring Diversion.

Raw water diversions from Foreman Creek, Peavine Creek, Clear Creek, Sweetwater Creek are diverted to the Lyon Water Treatment Plant (Lyon WTP). Total production capacity for Lyon WTP was not available, but a peak operating capacity of 900 gpm has been assumed based on provided SCADA data, as shown on **Table 4.1**. Peak production is limited by various constraints associated with stormflow, conveyance, and treatment (e.g. high-flow bypass, turbidity, aeration, pipeline capacity), as well as generally lower water demand during wet periods.

Raw water diversions from Bull Creek, Fall Creek are diverted to the Kirby Water Treatment Plant (Kirby WTP), and supply the Felton System. The Kirby WTP has on operating capacity of 500 gpm. It should be noted that the surface water from Bennett Spring Diversion is designated by California Department of Drinking Water as a groundwater source, and thus does not require Water Treatment Plant filtration. The projected annual water supply for Bennett Spring Diversion is 33.2 MG in 2020, or approximately 60 gpm.

Table 4.1 Existing Supply Sources
Water Master Plan
San Lorenzo Valley Water District

Source Name	Discharge Pressure Zone	Pump Information [1,2]					
		Ground Elevation (ft)	Number of Pumps	Pumping Water Level (ft)	Flow (gpm)	Head (ft)	Horsepower (hp)
Water Treatment Plants							
Lyon WTP	Lyon	848	2	-	900*	377*	50*
Kirby WTP	McCloud	528	2	-	500	265	50
Manana Woods WTP (Inactive)	Blue	-	-	-	-	-	-
Groundwater Wells							
North System							
Olympia 2	Quail	542	1	292	360	210*	60
Olympia 3	Quail	528	1	279	150	200*	40
Quail 4A	Brookdale	598	1	237	280	335*	25
Quail 5A	Brookdale Or Quail	520	1	155	85	430*	25
South System (Manana Woods)							
Pasatiempo 5A	Probation	751	1	567	350	320*	75
Pasatiempo 7	Probation	734	1	535	100	344*	40
Pasatiempo 8	Probation	778	1	670	350	-	75
Pasatiempo 6 (Inactive)	Probation	-	-	-	-	-	-
Lompico System							
Lewis Well 1 (Inactive)	Lewis	-	-	-	-	-	-
Lewis Well 7 (Inactive)	Lewis	-	-	-	-	-	-
Well #6 (Inactive)	Lewis	-	-	-	-	-	-

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12/11/2020

Notes:

1. Pump information extracted from data provided by District staff September 16, 2019.
2. Pump information displayed with an asterisk was not provided and was assumed based on received SCADA records and the calibrated hydraulic model.

Table 4.2 Existing Surface Water Diversions

Water Master Plan

San Lorenzo Valley Water District

Designation No.	Watershed Area[1] (acres)	Points of Diversion[1]	Elevation[2] (ft)	Destination Pressure Zone	Projected Annual Supply[3] 2020 (MG)	2025 (MG)	2030 (MG)
North System							
Foreman Creek	710	**1**	928	Lyon	166.2	168.5	172.4
Peavine Creek		**1**	1,250	Lyon	41.1	41.7	42.7
Clear Creek	660	**3**	Diversion Point I - 1,358 Diversion Point II - 1,330 Diversion Point III - 1,330	Lyon	43.3	43.7	45.0
Sweetwater Creek		**1**	1,330	Lyon	28.7	29.3	30.0
Felton System							
Bennett Spring	225	**1**	914	Bennett Spring	33.2	33.9	34.9
Bull Creek	175	**2**		McCloud	28.4	29.0	29.7
Fall Creek	2,545	**1**		McCloud	61.9	62.9	64.8

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Notes:

1. Source: SLVWD 2015 Urban Water Management Plan Report
2. Source: SLVWD Distribution System drawing provided by District staff June 14, 2019.
3. Source: Projected annual supply based on historical averages as extracted from the SLVWD 2015 Urban Water Management Plan Report.

4.3 PRESSURE ZONES

The District's current water system serves elevations ranging from approximately 200 feet above sea level to more than 1,400 feet. To adequately provide water in this service area requires the creation of 35 pressure zones as described in Section 4.1 and shown in **Figure 4.1**. The District's main sources of supply are located in Lyon, Brookdale, Quail, McCloud, and Probation pressure zones.

4.4 WATER DISTRIBUTION PIPELINES

Supply is pumped directly into the District's distribution system via approximately 190 miles of pipeline with diameters ranging from pipelines 0.75-inches to 14-inches in diameter. A significant portion of the system is comprised of small diameter mains, with approximately 150 miles of pipeline having a diameter below 8-inches. An inventory of existing pipelines, extracted from the GIS-based hydraulic model and used in this analysis is included in **Table 4.3**. For each pipeline diameter, the inventory lists total pipeline length within the four different domestic water service areas.

4.5 STORAGE RESERVOIRS

Storage reservoirs are typically incorporated in the water system to provide water supply for operation during periods of high demand, for meeting fire flow requirements, and for other emergencies, as defined in the District's planning criteria. The District's existing storage reservoirs are summarized in **Table 4.4**, along with their volumes, construction year, material type, height, diameter, bottom elevations, high set points, design capacity and operating capacity. Based on information provided by the District, several of the existing tanks within the SLVWD system are aging wooden tanks. In addition, storage in multiple zones is provided by low-volume polyethylene storage tanks.

4.6 BOOSTER STATIONS

Water is conveyed from the lower supply pressure zones to the higher pressure zones via a series of booster pump stations. There is a total of 32 booster stations in the District, including 3 interties and 4 hydropneumatic pump stations. **Table 4.5** lists of their ground elevation, source and destination pressure zones, total pump capacities, and additional station information. Based on conversations with the District, Intertie 6 is capable of conveying flow from either Brookdale pressure zone to McCloud pressure zone, or from McCloud to Brookdale, depending on desired operation.

It should be noted that pump flow and head information was not available for multiple booster pumps in the system; hydraulic information for these pumps was assumed based on received SCADA data, as well as modeled operations in the calibrated hydraulic model.

Table 4.3 Existing Modeled Pipe Inventory

Water Master Plan

San Lorenzo Valley Water District

Pipe Size (in)	Total Pipe Length [1,2] (ft)	(miles)	Percent of Total System
North System			
0.75	2,819	0.5	0.4%
1	24,847	4.7	3.6%
1.25	4,357	0.8	0.6%
1.5	43,880	8.3	6.4%
2	210,356	39.8	30.8%
3	5,238	1.0	0.8%
4	56,672	10.7	8.3%
6	203,161	38.5	29.8%
8	81,203	15.4	11.9%
10	18,744	3.6	2.7%
12	30,719	5.8	4.5%
14	284	0.05	0.04%
Total	**682,280**	**129.2**	**100.0%**
Lompico System			
0.75	0	0.0	0.0%
1	0	0.0	0.0%
1.25	0	0.0	0.0%
1.5	0	0.0	0.0%
2	623	0.1	0.7%
3	0	0.0	0.0%
4	44,064	8.3	50.5%
6	42,529	8.1	48.8%
8	0	0.0	0.0%
10	0	0.0	0.0%
12	0	0.0	0.0%
14	0	0.0	0.0%
Total	**87,217**	**16.5**	**100.0%**

Table 4.3 Existing Modeled Pipe Inventory
Water Master Plan
San Lorenzo Valley Water District

Pipe Size	Total Pipe Length [1,2]		Percent of Total System
(in)	(ft)	(miles)	
South System (Manana Woods)			
0.75	0	0.0	0.0%
1	0	0.0	0.0%
1.25	0	0.0	0.0%
1.5	0	0.0	0.0%
2	3,703	0.7	5.6%
3	1,896	0.4	2.9%
4	11,466	2.2	17.3%
6	35,826	6.8	54.2%
8	6,593	1.2	10.0%
10	0	0.0	0.0%
12	6,654	1.3	10.1%
14	0	0.0	0.0%
Total	**66,139**	**12.5**	**100.0%**
Felton System			
0.75	183	0.0	0.1%
1	1,898	0.4	1.5%
1.25	0	0.0	0.0%
1.5	1,113	0.2	0.9%
2	48,934	9.3	37.5%
3	150	0.0	0.1%
4	12,283	2.3	9.4%
6	34,704	6.6	26.6%
8	17,328	3.3	13.3%
10	13,690	2.6	10.5%
12	288	0.1	0.2%
14	0	0.0	0.0%
Total	**130,571**	**24.7**	**100.0%**

Table 4.3 Existing Modeled Pipe Inventory

Water Master Plan

San Lorenzo Valley Water District

Pipe Size (in)	Total Pipe Length [1,2] (ft)	(miles)	Percent of Total System
System-Wide			
North System	682,280	129.2	70.6%
Lompico System	87,217	16.5	9.0%
South System (Manana Woods)	66,139	12.5	6.8%
Felton System	130,571	24.7	13.5%
Total	966,207	183.0	100.0%

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5/21/2021

Notes:

1. Source: In progress SLVWD Water System Hydraulic Model.
2. It should be noted that pipeline lengths shown do not include fire hydrant laterals.

Table 4.4 Existing Storage Reservoirs
Water Master Plan
San Lorenzo Valley Water District

Reservoir	Tank Information					Tank Dimensions[4]			Tank Volume	
	Pressure Zone	Date of Construction	Construction Type[1,2]	Bottom Elevation[2,3] (ft)	Hydro Zone Setting (psi)	Diameter (ft)	Height (ft)	High Set Point (ft)	Design Capacity[2] (gal)	Operating Capacity[5] (gal)
North System										
Bear Creek	Bear Creek Zone	1968	Steel	789	-	22	26.0	19.0	75,000	54,100
Bear Creek Hydro	Bear Creek Hydro Zone		Steel	-	50	-	-	-	-	-
Blackstone 1	Blackstone Zone	2020	Poly	794	-	12	12.0	8.0	12,000	6,800
Blackstone 2	Blackstone Zone	2020	Poly	794	-	12	12.0	8.0	12,000	6,800
Blue Ridge	Blue Ridge Zone		Wood	943	-	20	18.0	17.0	40,000	40,000
Brookdale	Brookdale Zone	1971	Steel	578	-	62	32.0	29.0	721,000	655,000
Eckley	Eckley Zone	2020	Poly	929	-	8	11.0	9.0	5,000	3,400
Highland	Highland Zone		Wood	946	-	26	16.0	15.5	60,000	61,600
Huckleberry	Huckleberry Zone	1992	Steel	1,025	-	30	24.0	22.0	125,000	116,400
Big Steel	Big Steel Zone	1941	Steel	739	-	72	46.0	33.5	1,400,000	1,020,400
Little Lyon	Lyon Zone	1991	Steel	867	-	40	24.0	24.0	250,000	225,700
Lyon	Lyon Zone	1990	Steel	849	-	120	36.0	35.3	3,000,000	2,986,700
Mitchell Hydro	Mitchell Hydro Zone	2018	-	-	50	-	-	-	-	-
Nina Hydro	Nina Hydro Zone		Steel	-	50	-	-	-	-	-
Nina 1	Nina Zone	2011	Steel	1,202	-	26	16.0	13.5	67,000	53,700
Nina 2	Nina Zone	2011	Steel	1,202	-	26	16.0	13.5	67,000	53,700
Echo 1	North Boulder Creek Zone		Wood	1,060	-	15	19.0	14.0	25,000	18,600
Echo 3	North Boulder Creek Zone		Wood	1,060	-	15	19.0	14.0	25,000	18,600
Echo 4	North Boulder Creek Zone		Wood	1,060	-	15	19.0	14.0	25,000	18,600
Quail 1	Quail Zone	1990	Steel	733	-	38.5	24.0	22.8	211,000	198,600
Quail 2	Quail Zone	1992	Steel	733	-	40	24.0	22.8	240,000	214,400
Ralston 1	Ralston Zone	2010	Poly	1,013	-	12	10.0	8.0	10,000	6,800
Ralston 2	Ralston Zone	2010	Poly	1,013	-	12	10.0	8.0	10,000	6,800
Alder	Reader Zone	1989	Poly	675	-	4	6.0	4.0	700	400
Reader	Reader Zone	1991	Steel	760	-	33	24.0	20.0	150,000	128,000
Riverside Grove	Riverside Grove Zone	1971	Steel	1,020	-	46	30.0	26.0	380,000	323,300

Table 4.4 Existing Storage Reservoirs

Water Master Plan

San Lorenzo Valley Water District

Reservoir	Tank Information					Tank Dimensions[4]			Tank Volume	
	Pressure Zone	Date of Construction	Construction Type[1,2]	Bottom Elevation[2,3]	Hydro Zone Setting	Diameter	Height	High Set Point	Design Capacity[2]	Operating Capacity[5]
				(ft)	(psi)	(ft)	(ft)	(ft)	(gal)	(gal)
South 1	South Zone		Poly	1,151	-	12	13.0	11.5	9,100	9,800
South 2	South Zone		Poly	1,151	-	12	13.0	11.5	9,100	9,800
South 3	South Zone		Poly	1,151	-	12	13.0	11.5	9,100	9,800
South 4	South Zone		Poly	1,151	-	12	13.0	11.5	9,100	9,800
Spring	Spring Zone	1980	Bolted Steel	995	-	26	16.0	14.2	65,000	56,500
Swim 1	Swim Zone		Wood	726	-	12	12.0	9.5	9,600	8,100
Swim 2	Swim Zone		Wood	748	-	12	12.0	9.5	10,000	8,100
Ragain	University Zone		Poly	732	-	4	6.0	6.0	14,000	600
University 1	University Zone		Concrete	828	-	36X26	12.0	9.0	50,800	63,100
Subtotal - North System Storage									**7,096,500**	**6,394,000**
Lompico System										
Kaski 1	Kaski Zone	2021	Bolted Steel	1,257	-	20	23.0	18.0	40,000	42,400
Kaski 2	Kaski Zone	2021	Bolted Steel	1,257	-	20	23.0	18.0	40,000	42,400
Lewis 1	Lewis Zone	2020	Bolted Steel	1,123	-	32	25.0	19.0	130,000	114,400
Lewis 2	Lewis Zone	2020	Bolted Steel	1,123		32	25.0	19.0	130,000	114,400
Madrone 1	Madrone Zone	2020	Bolted Steel	1,316	-	26	25.0	19.0	80,000	75,500
Madrone 2	Madrone Zone	2020	Bolted Steel	1,316	-	26	25.0	19.0	80,000	75,500
Subtotal - Lompico System Storage									**500,000**	**464,600**
South System (Manana Woods)										
Blue	Blue Zone	2019	Steel	732	-	26	16.0	14.0	65,000	55,700
Charlie	Charlie Zone	1988	Steel	825	-	23	15.0	14.0	45,000	43,600
Charlie Hydro	Charlie Hydro Zone		Steel	-	50	-	-	-	-	-
Lower Pasatiempo	Probation Zone		Concrete	832	-	57x27	15.0	8.8	100,000	100,800
Probation	Probation Zone	2019	Welded Steel	870	-	60	32.0	25.0	530,000	528,900
Upper Pasatiempo	Upper Pasatiempo Zone		Concrete	888	-	57x27	10.5	8.8	100,000	100,800
Subtotal - South System (Manana Woods) Storage									**840,000**	**829,800**

Table 4.4 Existing Storage Reservoirs

Water Master Plan

San Lorenzo Valley Water District

Reservoir	Pressure Zone	Tank Information: Date of Construction	Tank Information: Construction Type[1,2]	Tank Information: Bottom Elevation[2,3] (ft)	Tank Information: Hydro Zone Setting (psi)	Tank Dimensions[4]: Diameter (ft)	Tank Dimensions[4]: Height (ft)	Tank Dimensions[4]: High Set Point (ft)	Tank Volume: Design Capacity[2] (gal)	Tank Volume: Operating Capacity[5] (gal)
Felton System										
El Solyo	El Solyo Zone	2019	Poly	636	-	17.5	11.3	10.5	20,000	18,900
Bennett Spring	Bennett Spring Zone		Poly	799	-	11	8.0	6.0	6,000	4,300
Blair	Blair Zone	1968	Steel	497	-	47	20.0	20.0	255,000	259,600
Kirby Clearwell	McCloud Zone	1993	Steel	299	-	42	24.0	20.0	250,000	207,300
McCloud	McCloud Zone	1980	Steel	520	-	47	20.0	22.8	284,000	295,300
Felton Acres	Pine Zone	2018	Poly	475	-	5	5.0	5.0	500	800
Pine 1	Pine Zone	2017	Poly	637	-	12	11.0	10.5	9,000	8,900
Pine 2	Pine Zone	2017	Poly	637	-	12	11.0	10.5	9,000	8,900
Subtotal - Felton System Storage									**833,500**	**804,000**
Total System Storage									**9,270,000**	**8,492,400**

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9/1/2021

Notes:

1. Source: Department of Drinking Water 2019 Permit Application Engineering Report provided by District staff September 17, 2019.
2. Tank information extracted from data provided by District staff October 23, 2019.
3. Tank information extracted from data provided by District staff July 10, 2020.
4. Unless noted otherwise tank information extracted from inventory provided by District staff September 25, 2019.
5. Capacity calculated based on high set point.

Table 4.5 Existing Booster Pump Stations

Water Master Plan

San Lorenzo Valley Water District

Designation No.	Location	Elevation	Pressure Zones		Pump Information[1,2,3]				Operational Controls	
			Source	Destination	Number of Pumps	Individual Pump Flow	Pump Head	Individual HP	Pump Control [4]	High Set Point [5]
		(ft)				(gpm)	(ft)	(hp)	(ft)	(ft)
North System										
Bear Creek	Approx 850' SE/o Ralston Pump Station	548	Reader	Bear Creek	1	45	212	45	Bear Creek Tank	19.0
Blackstone	Blackstone Dr n/o State Highway 236	650	Big Steel	Blackstone	2	30	147	2	Blackstone Tank	8.0
Blue Ridge	Blueridge Dr e/o State Highway 9	682	Reader	Blue Ridge	2	42	265	7.5	Blue Ridge Tank	17.0
Echo	State Highway 9 n/o Tielh Rd	618	Reader	North Boulder Creek	2	150	449	20	Echo Tank	14.0
Eckley	Ridge Dr, approx 1250' E/o State Highway 236	774	Lyon	Eckley	1	15	85	2	Eckley Tank	9.0
Fairview	Fairview Av se/o Madrone Av	698	Reader	Highland	1	50	202	7.5	Highland Tank	15.5
Firehouse	Middleton Av, approx 75' E/o State Highway 9	490	Big Steel	Reader	2	500*	260	1 @ 40 1 @ 75 (not in use)	Reader Tank	20.0
Huckleberry	East Rd e/o Middleton Dr	608	Reader	Huckleberry	2	50	421	7.5	Huckleberry Tank	22.0
Intertie 3&4 (SLVWD South to North)	Summit Ave nw/o Graham Hill Rd	430	Quail	Probation	3	700	437	50	Probation Tank	9.0

Table 4.5 Existing Booster Pump Stations

Water Master Plan

San Lorenzo Valley Water District

Designation No.	Location	Elevation	Pressure Zones		Pump Information[1,2,3]				Operational Controls	
		(ft)	Source	Destination	Number of Pumps	Individual Pump Flow (gpm)	Pump Head (ft)	Individual HP (hp)	Pump Control [4] (ft)	High Set Point [5] (ft)
Irwin	Irwin Wy ne/o State Highway 9	436	Brookdale	Big Steel	2	400	321	20	Big Steel Tank	33.5
Mitchell	Mitchell Dr e/o State HWY 9	610	Reader	Mitchell	2	10*	10*	1	Mitchell Hydro Tank	-
Nina	Nina Dr e/o Fairmount Dr	947	Highland	Nina	2	75	259	15	Nina Tank	13.5
Nina Hydro	Nina Tanks	1,205	Nina	Nina Hydro	2	10*	100*	1.5	Nina Hydro Tank	-
Quail	Cumora Ln e/o Quail Hollow Rd	522	Brookdale	Quail	2	350	212	20	Quail Tank	22.8
Ralston	Ralston Ridge n/o Bear Creek Rd	702	Bear Creek	Ralston	2	30 - 50	305	3	Ralston Tank	8.0
Redwood Park	State Highway 9 ne/o Greenfield St	376	Brookdale	Swim	2	90	352	7.5	Swim Tank	9.5
Riverside Grove	Stewart St w/o Redwood Dr	680	Reader	Riverside Grove	1	100	342	15	Riverside Grove	26.0
South Reservoir	Clear Creek Rd w/o High St	560	Big Steel	South	2	30	624	5	South Tank	11.5

Table 4.5 Existing Booster Pump Stations

Water Master Plan
San Lorenzo Valley Water District

Designation No.	Location	Elevation	Pressure Zones		Pump Information[1,2,3]				Operational Controls	
		(ft)	Source	Destination	Number of Pumps	Individual Pump Flow (gpm)	Pump Head (ft)	Individual HP (hp)	Pump Control [4] (ft)	High Set Point [5] (ft)
Spring	Swim Tanks	750	Swim	Spring	2	45	241	5	Spring Tank	14.2
University	Stanford Dr w/o Harvard Dr	638	Quail	University	2	85	188	7.5	University Tank	9.0
West/Winner Hydro	Oak Knoll Ct n/o Greenview Dr	696	Bear Creek	Bear Creek Hydro	2	10*	50*		Bear Creek Hydro Tank	-
Lompico System										
Lompico (Intertie 5)	Zayante Dr w/o Rosebloom	612	Quail	Kaski	2	70	639	25	Kaski Tank	14.5
Madrone	Intersection of Lakeshore Dr and Lake Blvd	903	Kaski	Madrone	2	150	406	20	Madrone Tank	12.3
South System (Manana Woods)										
Blue	Blue Tank	741	Blue	Charlie	2	36	85	2	Charlie Tank	14.0
Charlie Hydro	Charlie Tank	828	Charlie	Charlie Hydro	2	30	15*	1 @ 2 1 @ 3	Charlie Hydro Tank	-
Intertie 2 (SLVWD South to Scotts Valley Water District)	Sky Park Dr n/o Mt Hermon Rd	515	Probation	Scotts Valley Water District	2	350	100*	30		

Table 4.5 Existing Booster Pump Stations

Water Master Plan

San Lorenzo Valley Water District

Designation No.	Location	Elevation (ft)	Pressure Zones: Source	Pressure Zones: Destination	Pump Information[1,2,3]: Number of Pumps	Individual Pump Flow (gpm)	Pump Head (ft)	Individual HP (hp)	Operational Controls: Pump Control[4] (ft)	High Set Point[5] (ft)
Lower Pasatiempo	Lower Pasatiempo Reservoir	830	Lower Pasatiempo	Upper Pasatiempo	2	75	84	5	Upper Pasatiempo Tank	8.8
Felton System										
Felton Acres	Pine Tank	478	Pine	Pine	2	10*	641	10	Pine Zone Pressure Switch	-
Lower El Solyo	El Solyo Heights Dr sw/o State Highway 9	424	McCloud	El Solyo	2	30*	226	7.5	El Solyo Zone Pressure Switch	10.5
Upper Hillcrest Booster	Hillcrest Dr nw/o Redwood Dr	439	McCloud	Pine	2*	60*	500*		Pine Tank Level	10.5
Intertie 6, SLVWD North to Felton	Highway 9 n/o Lazy Woods Dr	321	Brookdale	McCloud	2	350	196	30	McCloud Tank Level	22.8
Intertie 6, Felton to SLVWD North	Highway 9 n/o Lazy Woods Dr	321	McCloud	Brookdale	2	350	256	30	Brookdale Tank Level	31.0

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Notes:

1. Source: Well and Booster Station Inventory received from District staff September 16, 2019.
2. Source: Booster list received from District staff January 8, 2020.
3. Pump information displayed with an asterisk was not provided and was assumed based on the calibrated hydraulic model.
4. Source: Tank inventory received from District staff September 25, 2019.
5. Source: Tank Measurements received from District staff September 25, 2019.

4.7 PRESSURE REDUCING VALVES

Some pressure zones are served from higher pressure zones through pressure reducing valves (PRVs), which are summarized on **Table 4.6**. PRVs constructed at pressure zone intersections allow for the conveyance of water from higher pressure zones to the lower pressure zones in the District. Additionally, some PRVs provide a source of emergency supply to lower pressure zones in the case of booster station failure or other operational issues. The District currently operates 40 pressure reducing valves throughout its water system.

It should be noted that valve size and pressure settings were not available for multiple PRVs in the system; hydraulic information for these valves was assumed based on received SCADA data, as well as modeled operations in the calibrated hydraulic model.

Table 4.6 Existing Pressure Reducing Valves
Water Master Plan
San Lorenzo Valley Water District

PRV ID	Location [1]	Pressure Zone		Valve Information [2]			
		Upstream	Downstream	Size (in)	Elevation [3] (ft)	Setpoint (psi)	Construction Year
North System							
Big Steel 1	Intersection of Irwin Wy & Spring Creek Rd	Big Steel	PRV Zone	4	498	85	
Blue Ridge 1	Bar King Rd, S/o Alto Dr	Blue Ridge	PRV Zone	6*	781	80*	
Blue Ridge 2	Alto Dr, E/o Meadow Dr	Blue Ridge	PRV Zone	6*	696	80*	
Brookdale 1	NW intersection of Ardena Ave & Glen Arbor Rd	Brookdale	Quail	6*	361	120*	
Brookdale 2	SW intersection of Main St & Sunnyside Ave	Brookdale	PRV Zone	6	381	95	
Brookdale 3	Love Creek Rd, N/o Sunnyside Ave	Brookdale	PRV Zone	6*	346	80*	
Brookdale 4	North intersection of Hihn Rd & Condor Ave	Brookdale	Quail	4	534	100	
Lyon 1	NW intersection of State Highway 236 & Laurel St	Lyon	Big Steel	6*	503	120*	
Lyon 2	NW intersection of Grove St & State Highway 9	Lyon	Big Steel	6*	496	125*	
Lyon 3	SW intersection of State Highway 9 & Mountain St	Lyon	Big Steel	2*	510	120*	
Lyon 4	NW intersection of State Highway 9 & State Highway 236	Lyon	Reader	6*	493	126*	
Quail 1	NE intersection of Quail Hollow Rd and Cumora Ln	Quail	Brookdale	6	522	35	
Quail 2	East Zayante Rd, S/o Olympia Station Rd	Quail	Quail	6	342	180	
Quail 3	Caledonium Ave, N/o Tipping Wy	Brookdale	PRV Zone	2	331	75	
Reader 1	East intersection of Middleton Ave & State Highway 9	Reader	Big Steel	6*	486	80*	
Reader 2	Mayfair Rd, W/o Oak Rd	Reader	PRV Zone	6*	559	80*	
Reader 3	NW intersection of State Highway 9 & Haven Lane	Reader	PRV Zone	6*	484	80*	
South 1	Forest Wy, E/o Forest Ave	South	PRV Zone	6*	734	80*	
South 2	Forest Wy, W/o Western Ave	South	PRV Zone	6*	681	80*	
South 3	Forest Wy, E/o Forest Ave	South	PRV Zone	6*	724	80*	
South 4	Azalea Ave, N/o Oak St	South	PRV Zone	6*	613	80*	
South 5	Melwin Ave, W/o Azalea Ave	South	PRV Zone	6*	670	80*	
Swim 1	Center Wy, W/o Park Dr	Swim	PRV Zone	6*	555	80*	
University 1	NW intersection of Azalea Ave & Melin Ave	University	PRV Zone	2	531	95	

Table 4.6 Existing Pressure Reducing Valves
Water Master Plan
San Lorenzo Valley Water District

PRV ID	Location [1]	Pressure Zone		Valve Information [2]			
		Upstream	Downstream	Size (in)	Elevation [3] (ft)	Setpoint (psi)	Construction Year
Lompico System							
Kaski 1	Lakeview Ave, E/o Lake Blvd	Kaski	Madrone	4	1,108	55	
Kaski 2	Lake Blvd, E/o Visatar St	Kaski	PRV Zone	6*	899	120*	
Kaski 3	Lake Blvd, E/o Visatar St	PRV Zone	PRV Zone	6*	793	120*	
Kaski 4	Visatar St, N/o Lake Blvd	Kaski	PRV Zone	4	887	55*	
Kaski 5	South intersection of Lake Blvd & Visatar St	Kaski	PRV Zone	4	736	55	
Madrone 1	NE intersection of Volver Ave & Coleman Ave	Madrone	Lewis	4	878	55	
Madrone 2	East intersection of Bideawee Wy & Van Allen Rd	Madrone	Lewis	4	886	96*	
Madrone 3	SE intersection of Ocean View Ave & Gladys Ave	Madrone	PRV Zone	6	1,072	120	
Madrone 4	Lake Blvd, w/o Madrone Pump Station	Madrone	Lewis	6*	904	90*	
Manana Woods System							
Probation 1	Caliente Dr, N/o Estrella Dr	Probation	PRV Zone	4*	572	60*	
Probation 2	Locke Wy, E/o Lockewood Ln	Probation	PRV Zone	6*	523	60*	
Upper Pasatiempo 1	Blueberry Dr, S/o Whispering Pines Dr	Upper Pasatiempo	Probation	6	637	115	
Upper Pasatiempo 2	West intersection of Elena Ct & Canepa Dr	Upper Pasatiempo	Blue	6	661	62	
Felton System							
Bennett Spring 1	SE intersection of Felton Empire Rd & Jenny Wy	Bennett Spring	Blair	6*	501	80*	
El Solyo 1	SE intersection of El Solyo Heights Dr & Quail Glen	El Solyo	PRV Zone	2	427	52	
McCloud 1	Covered Bridge Rd, E/o Graham Hill Rd	McCloud	PRV Zone	4	258	70	

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Notes:
1. Source: Water system CAD files provided by District staff August 16, 2019.
2. Valve information displayed with an asterisk was not provided and was assumed based on the calibrated hydraulic model.
3. Source: Elevation contours information received from District staff August 20, 2019.

CHAPTER 5 – DOMESTIC WATER DEMANDS

This chapter summarizes existing domestic water demands and projects the future domestic water demands.

5.1 EXISTING DOMESTIC WATER DEMANDS

The existing water demands used for this master plan were based on the District's 2018 water billing consumption records as well as total annual production. The existing water demands in this analysis are adjusted to match the annual production records and account for system losses.

The existing demand distribution, by pressure zone, was obtained from the water billing records. Using GIS, each customer account was geocoded to its physical location within its existing pressure zone. The accounts were then sorted by pressure zone and the total demand in each zone was calculated.

The District's existing average day domestic water demand, as extracted from the water billing records, were lower than the total demands listed in the annual production records due to system losses that occurred between the water supply and customer service connections. The total domestic water demands were increased proportionally to 1.9 mgd to reflect the total 2018 production and account for transmission main losses. The existing domestic water demands, for each pressure zone, are summarized on **Table 5.1**.

5.2 FUTURE DOMESTIC WATER DEMANDS

Future demands were projected using the unit factors for residential and non-residential land uses and included the developments within the District's service area. **Table 5.2** organizes the future land use categories and their corresponding domestic water demands. It should be noted that the existing domestic water demands in **Table 5.2** were calculated using the recommended water unit factors, which take into account future water conservation practices, and are intended to represent the water use of the existing users at the buildout of the master plan horizon. The total average day domestic water demands from existing and future developments is calculated at 2.0 mgd.

These demands were used in sizing the future infrastructure facilities, including distribution mains, storage reservoirs, and booster stations. Demands were also used for allocating and reserving capacities in the existing or proposed facilities. **Table 5.1** summarizes the buildout water demand for each pressure zone.

5.4 MAXIMUM DAY AND PEAK HOUR DEMANDS

The maximum day and peak hour demands for the existing and future demands were calculated using the average day demands and District peaking factor criteria. The maximum day to average day ratio of 1.5, and peak hour to average day ratio of 2.25, were applied to the average day

Table 5.1 Demands by Pressure Zone

Water Master Plan

San Lorenzo Valley Water District

Pressure Zone	Demands by Pressure Zone			
	Existing [1]		Buildout [2]	
	Average Day Demands (gpd)	Maximum Day Demands [3] (gpd)	Average Day Demands (gdp)	Maximum Day Demands[3] (gdp)
North System				
Bear Creek	21,204	31,806	22,168	33,252
Bear Creek Hydro	115	173	115	173
Big Steel	85,479	128,218	94,113	141,169
Blackstone	4,951	7,426	5,144	7,716
Blue Ridge	13,413	20,120	13,992	20,988
Brookdale	369,922	554,883	389,377	584,066
Eckley	768	1,151	825	1,238
Highland	11,562	17,342	12,024	18,037
Huckleberry	10,333	15,500	10,758	16,136
Lyon	89,710	134,565	94,026	141,040
Mitchell	5,949	8,923	6,190	9,285
Nina	20,465	30,698	21,295	31,942
Nina Hydro	144	216	154	230
North Boulder Creek	26,193	39,290	27,350	41,025
Quail	140,811	211,217	153,841	230,762
Ralston	3,358	5,037	3,503	5,254
Reader	240,960	361,440	257,589	386,383
Riverside Grove	14,248	21,372	14,827	22,240
South	7,954	11,931	8,359	12,538
Spring	4,001	6,001	4,328	6,492
Swim	31,739	47,609	33,386	50,079
University	30,310	45,464	31,496	47,243
Subtotal	**1,133,589**	**1,700,383**	**1,204,858**	**1,807,286**

Table 5.1 Demands by Pressure Zone

Water Master Plan
San Lorenzo Valley Water District

Pressure Zone	Demands by Pressure Zone			
	Existing [1]		Buildout [2]	
	Average Day Demands (gpd)	Maximum Day Demands [3] (gpd)	Average Day Demands (gdp)	Maximum Day Demands[3] (gdp)
Lompico System				
Kaski	10,650	15,975	11,247	16,871
Lewis	37,669	56,503	40,132	60,199
Madrone	9,710	14,565	10,489	15,733
Subtotal	**58,028**	**87,043**	**61,869**	**92,803**
Manana Woods System				
Blue	27,623	41,435	28,693	43,040
Charlie	4,529	6,793	4,702	7,053
Charlie Hydro	902	1,353	940	1,411
Probation	263,939	395,909	276,292	414,438
Upper Pasatiempo	31,240	46,860	32,522	48,784
Subtotal	**328,233**	**492,350**	**343,151**	**514,727**
Felton System				
El Solyo	41,324	61,986	43,021	64,532
Bennett Spring	9,057	13,586	9,405	14,107
Blair	9,316	13,975	9,692	14,539
McCloud	250,142	375,213	280,064	420,096
Pine	57,482	86,222	59,824	89,737
Subtotal	**367,322**	**550,983**	**402,006**	**603,009**
System-Wide Demands				
	1,887,172	**2,830,758**	**2,011,883**	**3,017,825**

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Notes:

1. Average day demands based on 2018 production, where the demand distribution by pressure zone is based on 2018 water b
2. Future demands based on additional growth due to buildout of General Plan Land Use.
3. Maximum Day Demand = 1.5 x Average Day Demand

Table 5.2 Future Demands Analysis

Water Master Plan

San Lorenzo Valley Water District

Land Use Type	Developed Lands			To be Developed Lands			Total Development	
	Area (acre)	Unit Factor (gpd/acre)	Water Demand (gpd)	Area (acre)	Unit Factor (gpd/acre)	Water Demand (gpd)	Area (acre)	Water Demand (gpd)
Residential								
Rural Residential	3,190	230	733,776	74	230	17,087	3,265	750,864
Single Family Residential	1,080	770	831,758	23	770	17,513	1,103	849,270
Multi-Family Residential	190	960	182,043	0	960	0	190	182,043
Subtotal- Residential	**4,460**	**-**	**1,747,577**	**97**	**-**	**34,600**	**4,557**	**1,782,177**
Non-Residential								
Commercial	103	700	71,825	2	700	1,636	105	73,461
Hotel	44	725	31,691	0	725	0	44	31,691
Institutional	173	175	30,362	0	175	0	173	30,362
Public	51	825	42,125	2	825	1,873	53	43,997
School	106	350	37,234	0	350	0	106	37,234
Park	2	1,550	3,504	6	1,550	9,456	8	12,960
Subtotal-Non Residential	**480**	**-**	**216,742**	**11**	**-**	**12,965**	**490**	**229,706**
Other								
Vacant	108	0	0	0	0	0	0	0
Other	1,047	0	0	0	0	0	1,047	0
Subtotal- Other	**1,155**	**-**	**0**	**0**	**-**	**0**	**1,047**	**0**
Total								
	6,095		**1,964,319**	**108**		**47,564**	**6,095**	**2,011,883**

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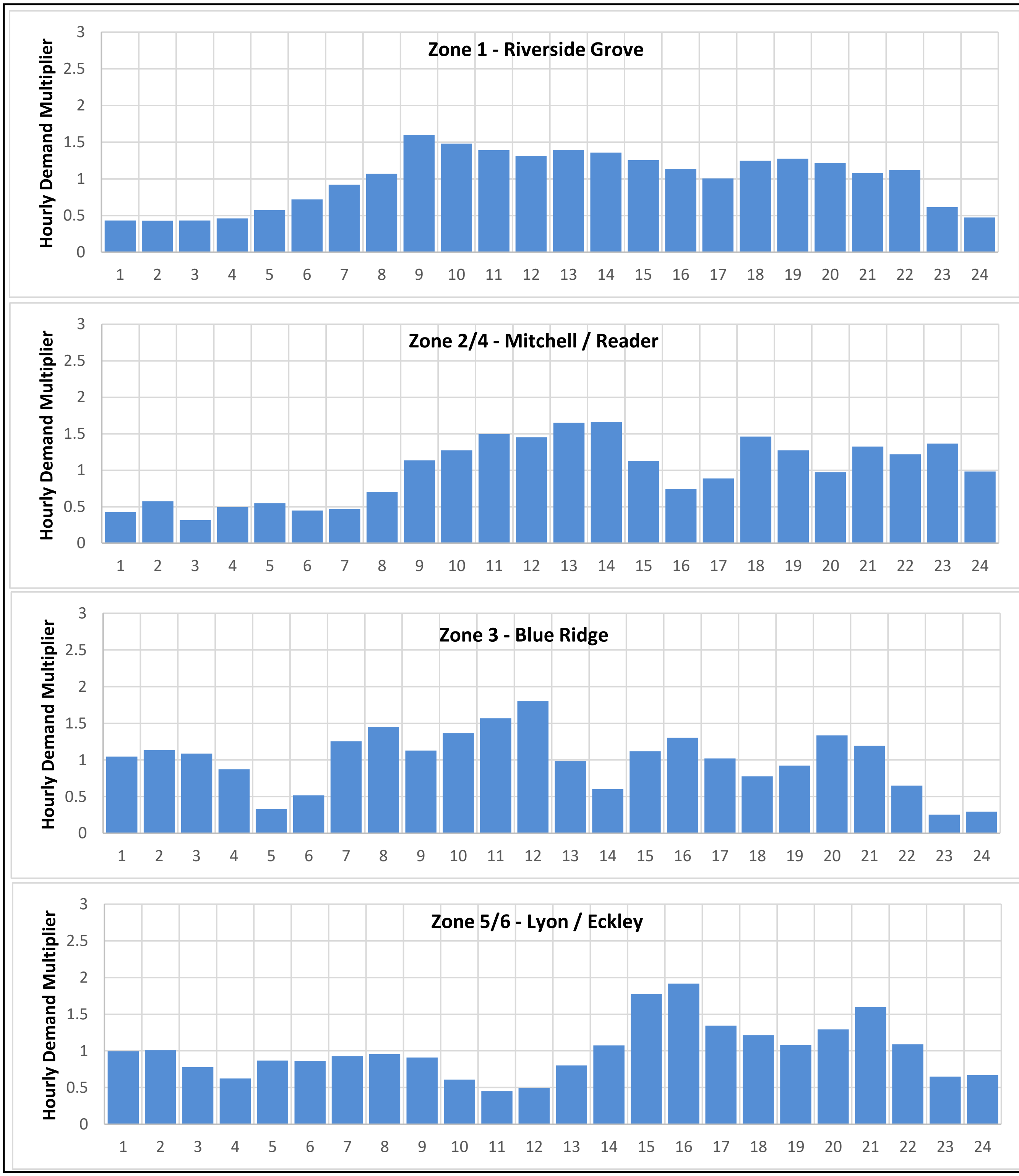
demands to obtain estimates of the higher demand conditions. The maximum day demand estimates for the buildout of the District's planning area are 3.0 mgd.

5.5 DIURNAL DEMAND PATTERNS

Water demands vary with the time of day and by account type according to the land use designation. These fluctuations were accounted for in the modeling effort and evaluation of the water distribution system. The diurnal demand patterns affect the water levels in storage reservoirs and amount of flow through distribution mains.

Using available SCADA data provided by District staff, unique diurnal curves were developed for the system pressure zones. These patterns were developed using a mass balance method for each pressure zone, using the pump station flow in, pump station flow out, and the change in storage volume to estimate the fluctuation in zone demand. Some pressure zones were consolidated during the development of the diurnals based on availability of facility data, resulting in 28 total diurnal patterns. As shown on **Figure 5.1**, the hourly demand multipliers by pressure zone range from a maximum of 3.4 in Blair Pressure Zone and a minimum of a 0.1 in Lewis Pressure Zone. The diurnal patterns were confirmed during the calibration effort of the District's hydraulic model and corresponding SCADA information.



Notes:

1. Diurnal patterns are based on flow observations between November 1, 2019 and January 4, 2020.

April 16, 2020

Figure 5.1

Pressure Zone Demand Diurnals

Water Master Plan

San Lorenzo Valley Water District

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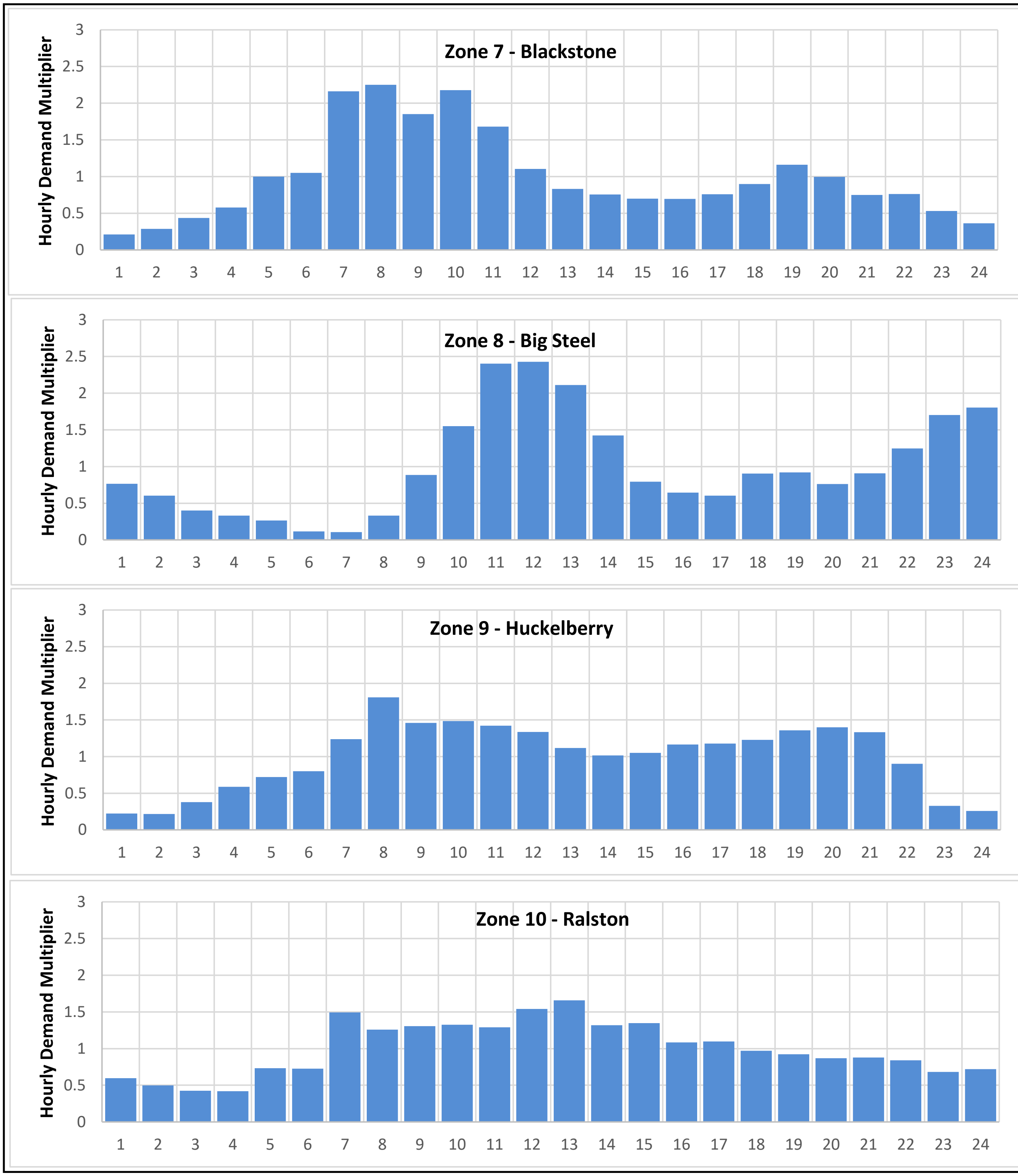

Notes:

1. Diurnal patterns are based on flow observations between November 1, 2019 and January 4, 2020.

April 16, 2020

Figure 5.1
Pressure Zone Demand Diurnals

Water Master Plan
San Lorenzo Valley Water District

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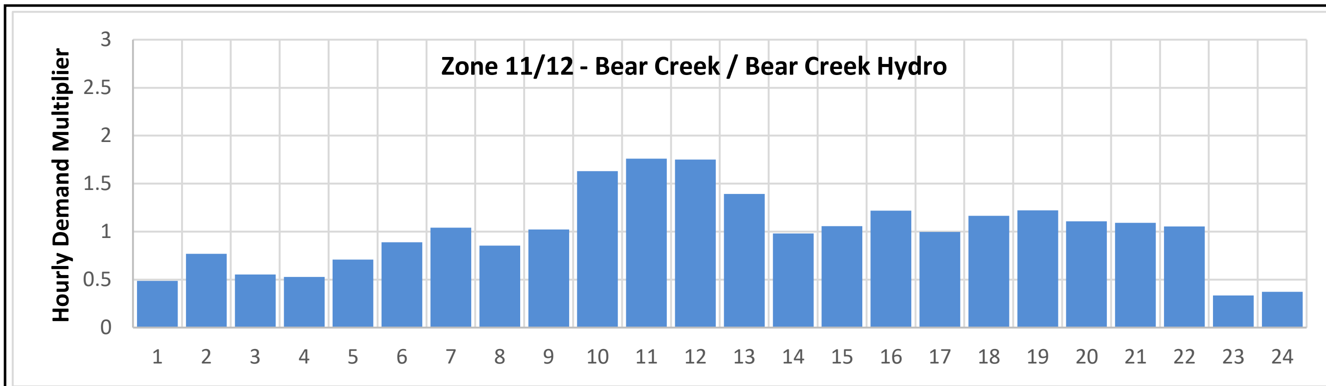

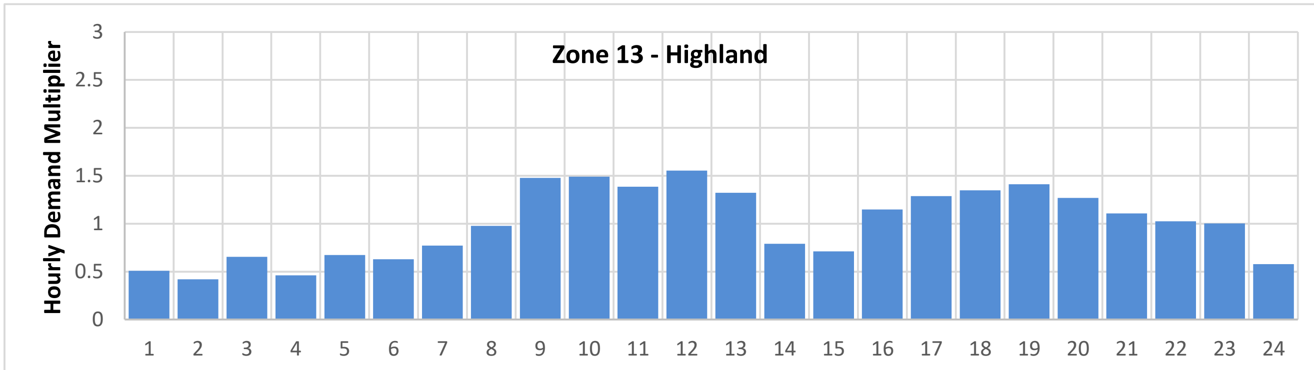

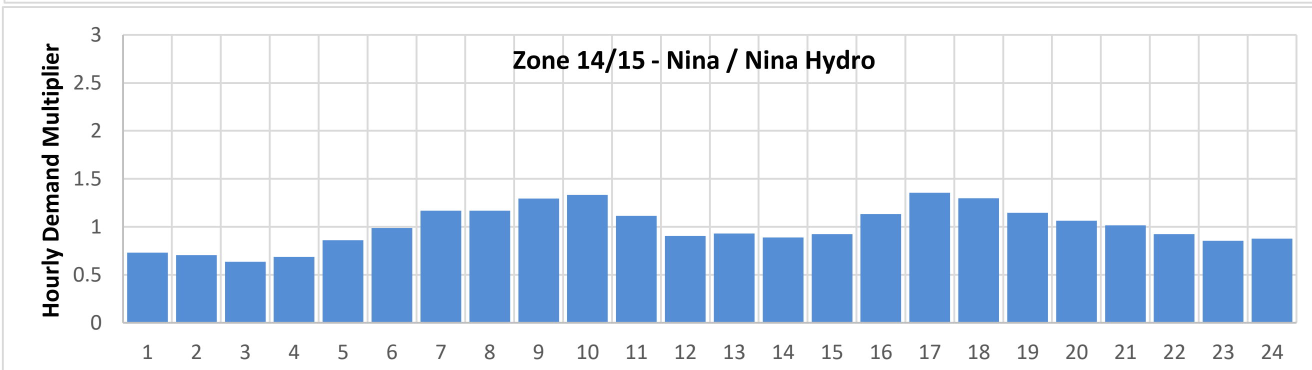

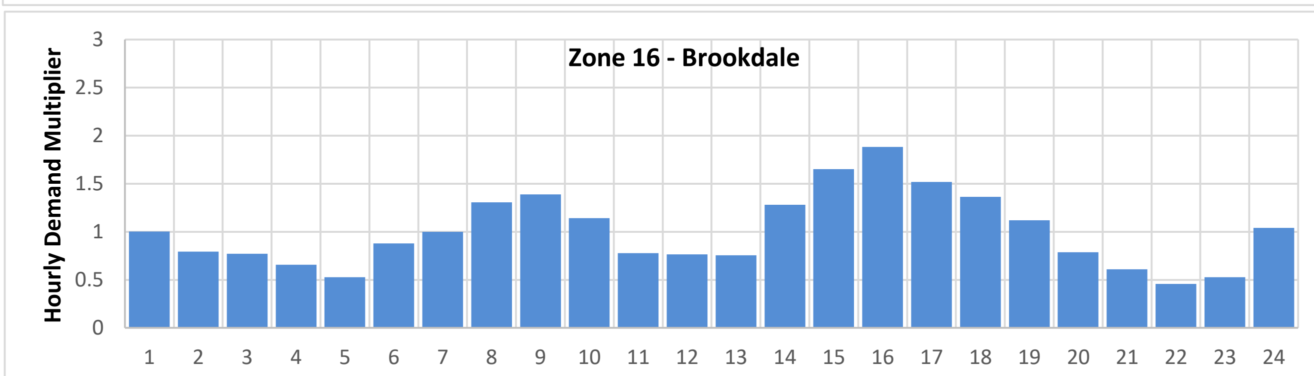

Notes:

1. Diurnal patterns are based on flow observations between November 1, 2019 and January 4, 2020.

April 16, 2020

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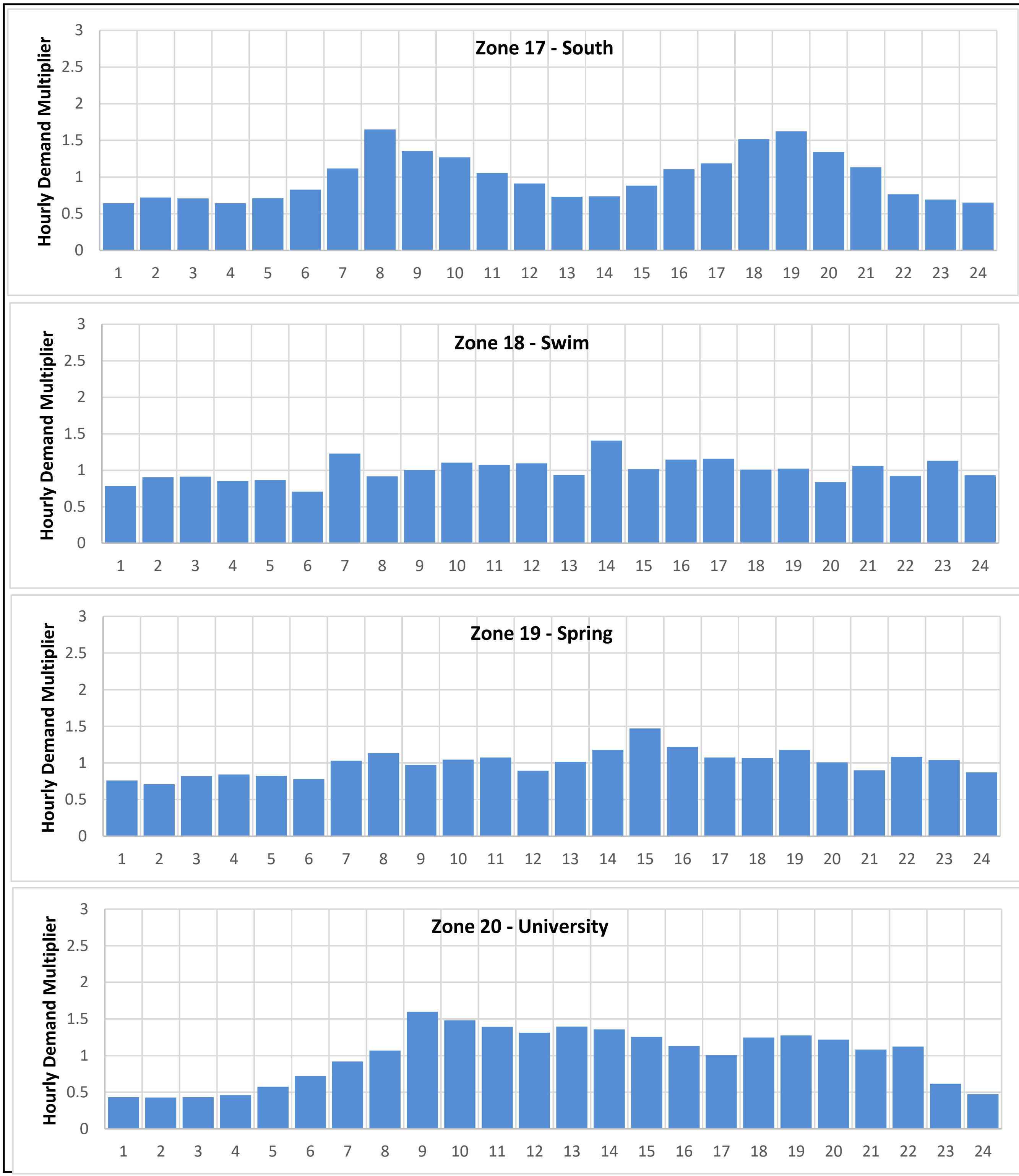
Figure 5.1
Pressure Zone Demand Diurnals

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Notes:

1. Diurnal patterns are based on flow observations between November 1, 2019 and January 4, 2020.

April 16, 2020

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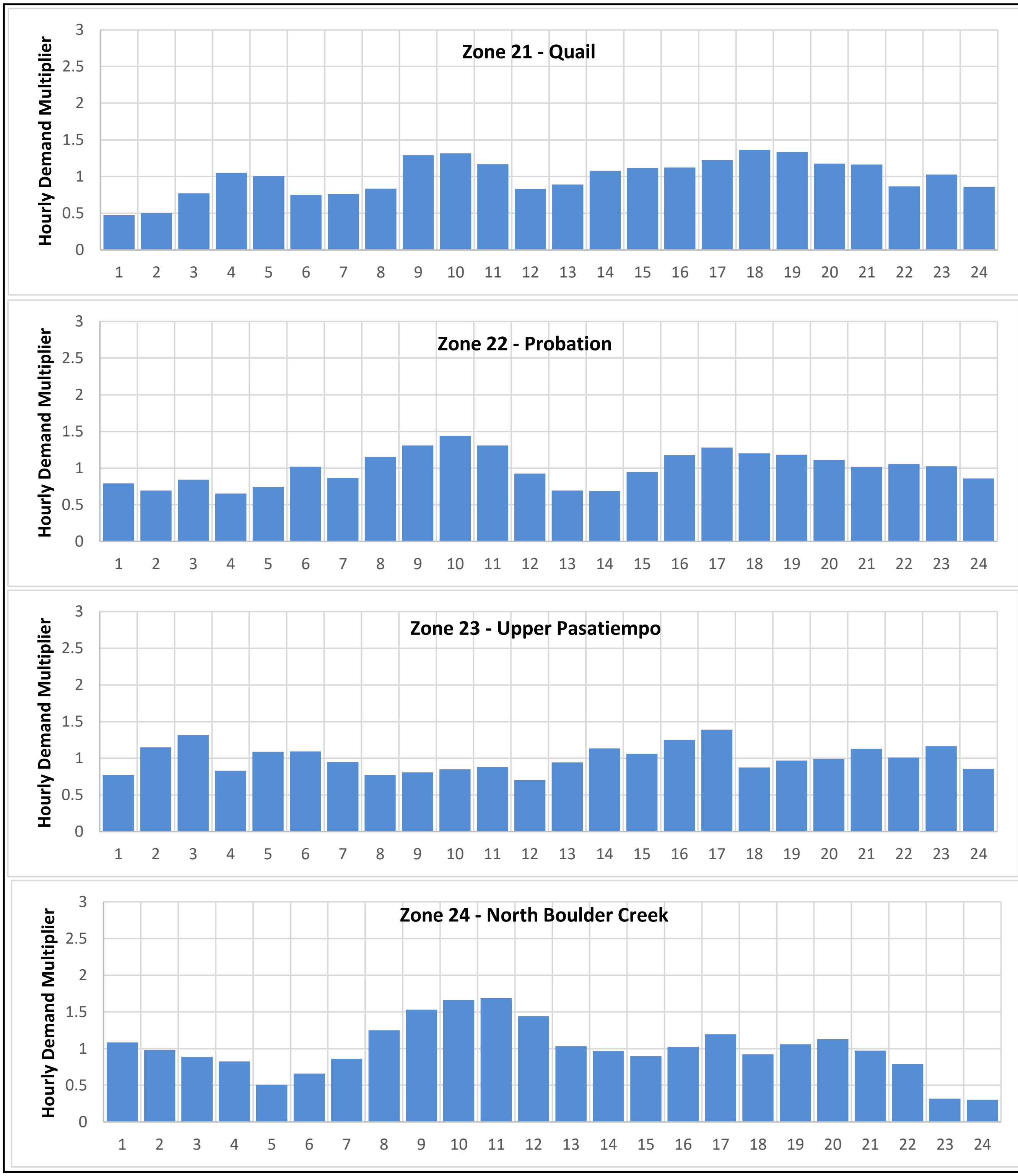
Figure 5.1
Pressure Zone Demand Diurnals

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley Water District



Notes:

1. Diurnal patterns are based on flow observations between November 1, 2019 and January 4, 2020.

April 16, 2020

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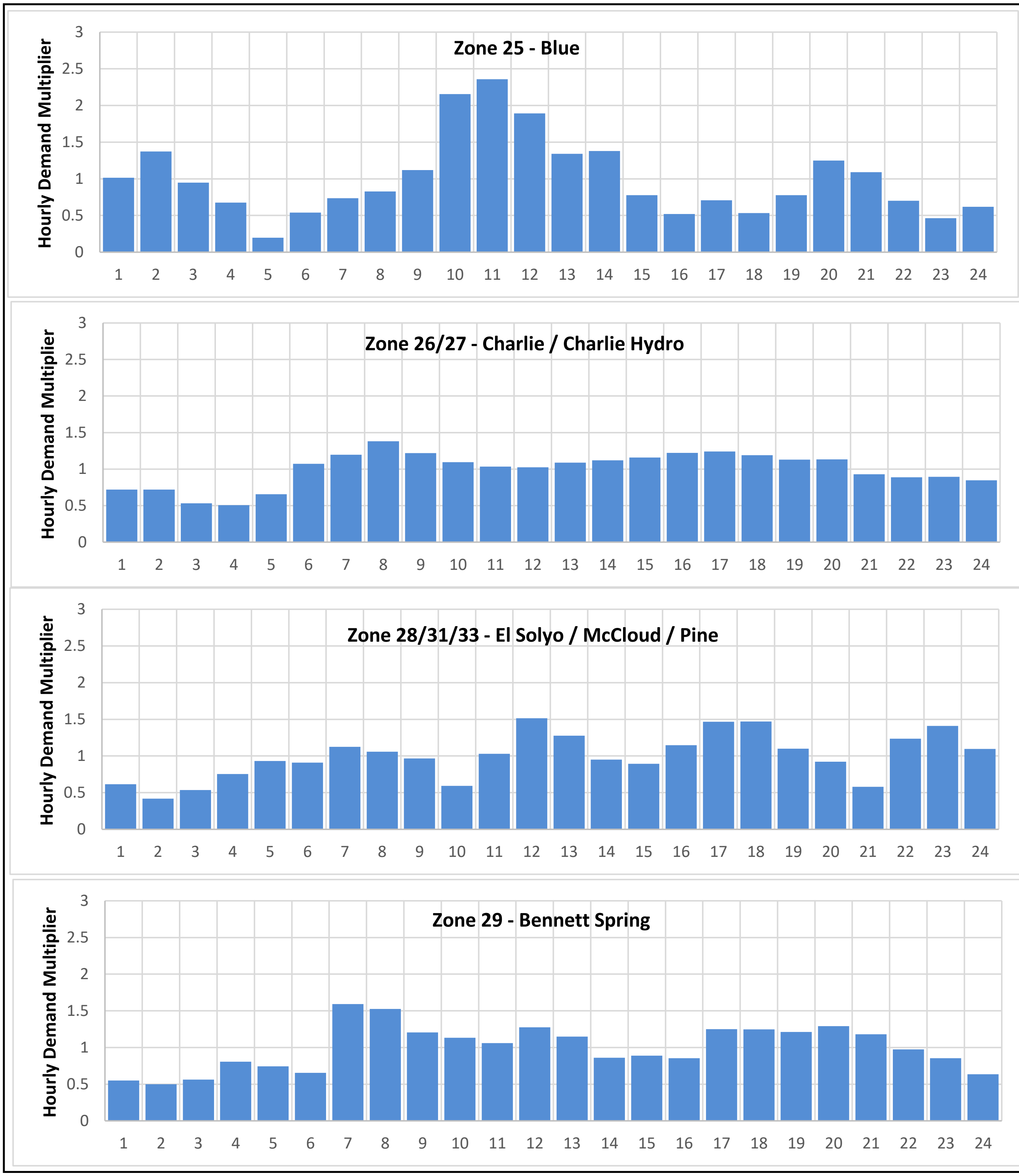
Figure 5.1
Pressure Zone Demand Diurnals
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Notes:

1. Diurnal patterns are based on flow observations between November 1, 2019 and January 4, 2020.

April 16, 2020

Figure 5.1
Pressure Zone Demand Diurnals

Water Master Plan
San Lorenzo Valley Water District

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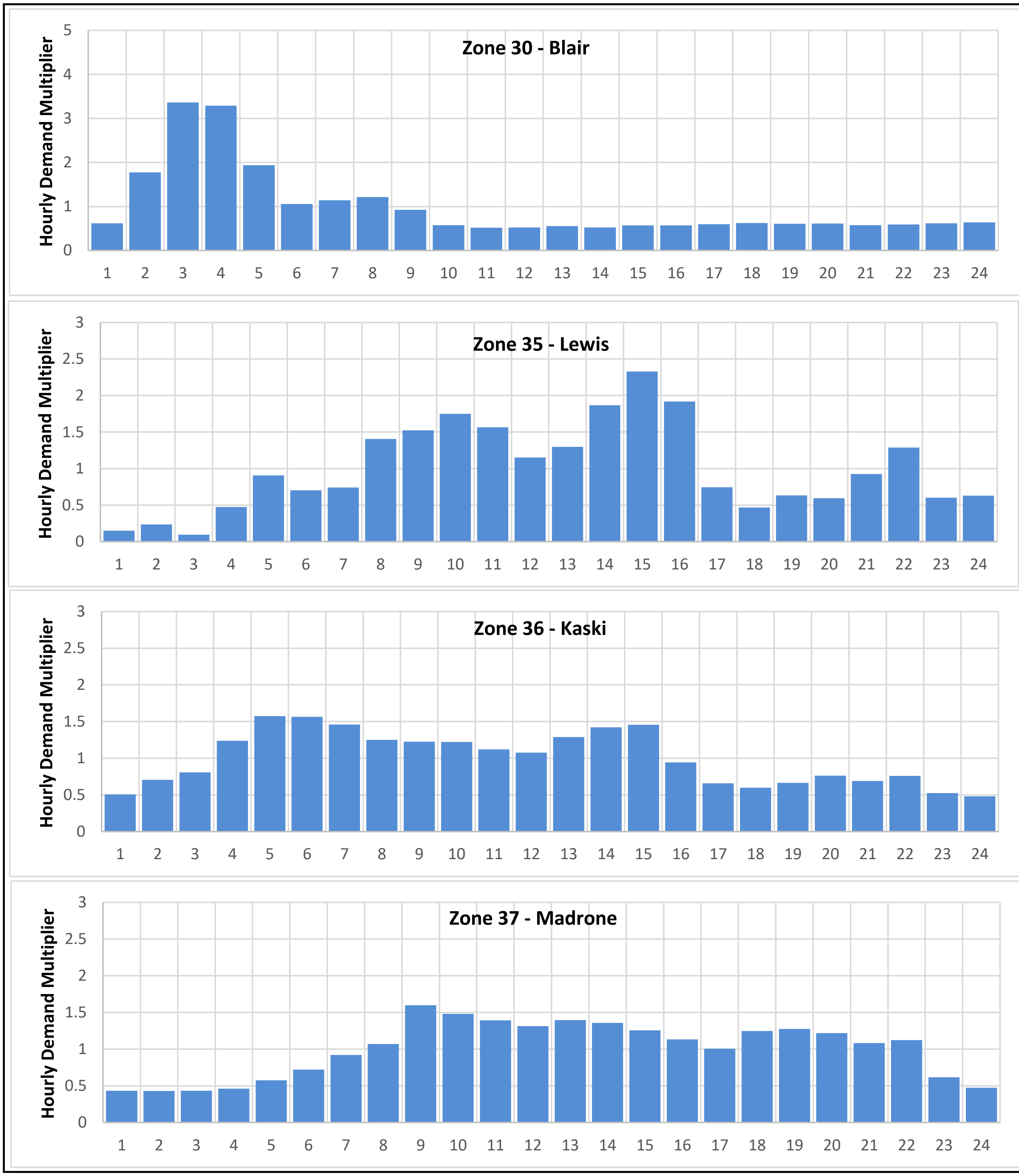

Notes:

1. Diurnal patterns are based on flow observations between November 1, 2019 and January 4, 2020.

April 16, 2020

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Figure 5.1
Pressure Zone Demand Diurnals

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

CHAPTER 6 - HYDRAULIC MODEL DEVELOPMENT

This chapter describes the development and calibration of the District's domestic water distribution system hydraulic model. The hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth.

6.1 OVERVIEW

Hydraulic network analysis has become an effectively powerful tool in many aspects of water distribution planning, design, operation, management, emergency response planning, system reliability analysis, fire flow analysis, and water quality evaluations. The District's hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth.

6.2 MODEL SELECTION

The District's hydraulic model combines information on the physical characteristics of the water system (pipelines, groundwater wells, and storage reservoir) and operational characteristics. The hydraulic model then performs calculations and solves series of equations to simulate flows in pipes and calculate pressures at nodes or junctions.

There are several network analysis software products released by different manufacturers, which can equally perform the hydraulic analysis satisfactorily. The selection of software depends on user preferences, the distribution system's unique requirements, and the costs for purchasing and maintaining the software.

As part of this master plan, the hydraulic model was developed into a GIS-based hydraulic model in InfoWater by Innovyze. The model has an intuitive graphical interface and is directly integrated with ESRI's ArcGIS (GIS).

6.3 HYDRAULIC MODEL DEVELOPMENT

The development of the hydraulic model included digitizing and quality control, developing pipe and node databases, and water demand allocation, as described in detail below.

6.3.1 Pipes and Nodes

Computer modeling requires the compilation of large numerical databases that enable data input into the model. Detailed physical aspects, such as pipe size, pipe elevation, and pipe lengths, contribute to the accuracy of the model.

Pipes and nodes represent the physical aspect of the system within the model. A node is a computer representation of a place where demand may be allocated into the hydraulic system, while a pipe represents the distribution and transmission aspect of the water demand. In addition, reservoir dimensions and capacities, and groundwater well capacity and design head, were also included in the hydraulic model.

6.3.2 Digitizing and Quality Control

The District's existing domestic water distribution system was digitized by extracting existing system information maintained by staff in GIS, and verified through reviews of received system schematics and facility inventories.

After reviewing the available data sources, the hydraulic model was developed from GIS and verified by District staff. Resolving discrepancies in data sources was accomplished by graphically identifying identified discrepancies and submitting it to engineering and public works staff for review and comments. District comments were incorporated in the verified model.

6.3.3 Demand Allocation

Demand allocation consists of assigning water demand values to the appropriate nodes in the model. The goal is to distribute the demands throughout the model to best represent actual system response.

As detailed in Chapter 5, existing demand distribution was obtained from received 2018 water billing records. Using customer meter locations, each customer account was geocoded and spatially joined within its existing pressure zone. The accounts were then sorted by pressure zone and the total demand in each zone was calculated.

Domestic water demands from each anticipated future development, as presented in a previous chapter, were also allocated to the model for the purpose of sizing the required future facilities. The demands from the District's Planning Area were allocated based on proposed land use and the land use acreages. As many of the areas were too large to be attributable to specific meter locations, demands were allocated evenly to the demand nodes within each area. Demands in the future demand allocation were comprised almost entirely of development of vacant lands throughout the planning area.

6.4 MODEL CALIBRATION

Calibration is intended to instill a level of confidence in the pressures and flows that are simulated. Calibration generally consists of comparing model predictions to field measured results and making necessary adjustments.

6.4.1 Calibration Plan and SCADA

A calibration plan was prepared for the newly developed hydraulic model, which consisted of identifying locations for installing temporary pressure loggers in the field. Each pressure logger was installed to monitor pressures for a period of one week. A total of 13 monitoring sites, installed throughout the distribution system, provided representative pressure readings for the major pressures zones in the water system. The calibration plan is shown on **Figure 6.1** and **Figure 6.2** and summarized on **Table 6.1**.

In addition, available SCADA for tanks, wells, treatment plants, and booster stations was collected throughout the water distribution system. District staff provided 15-minute pressure and flow data for groundwater wells and booster stations as well as 15-minute water level data for the District's storage reservoirs, for two different periods, from July 2019 to August 2019 and November 2019 to January 2020.

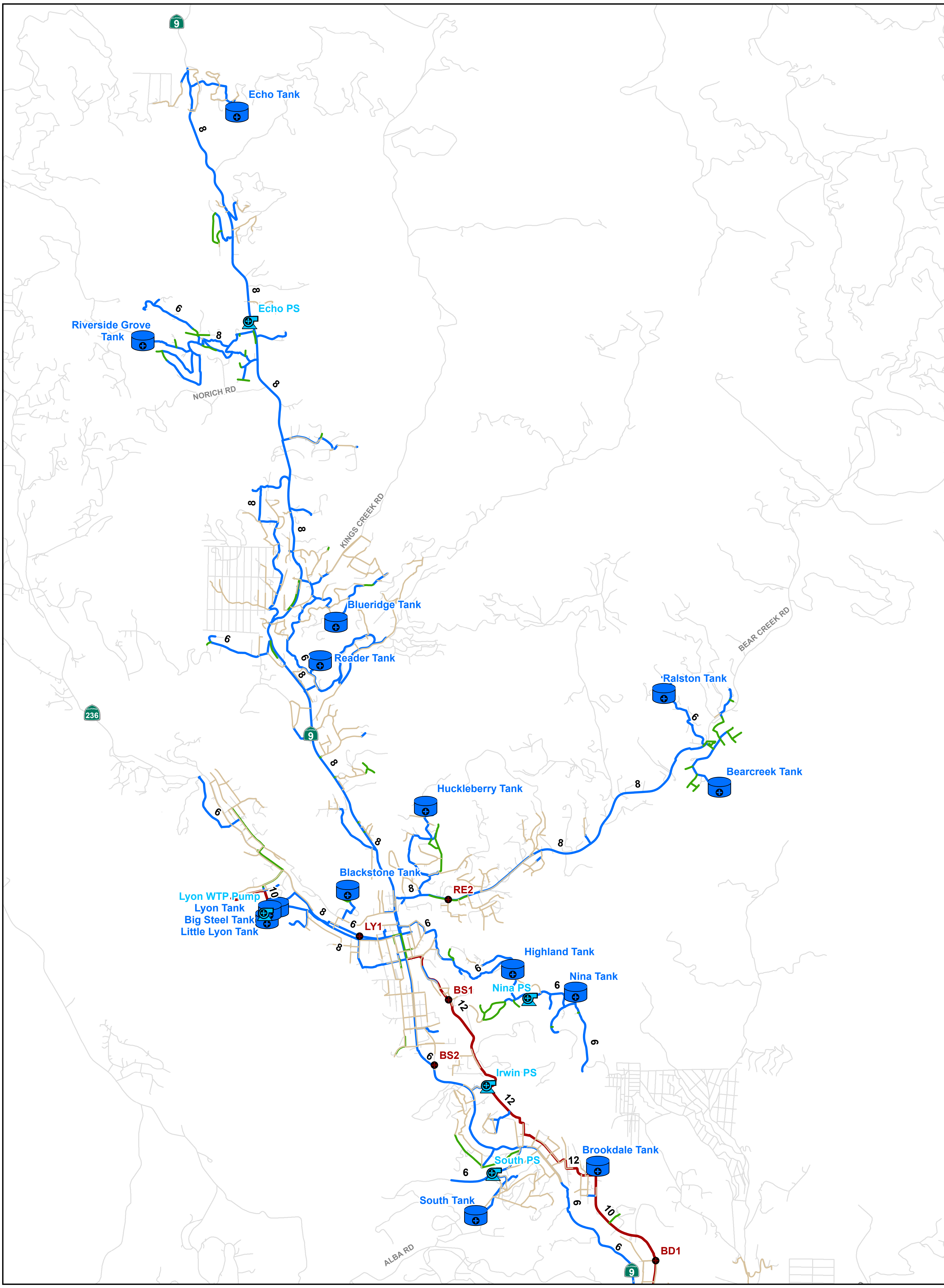
6.4.2 EPS Calibration

Calibration can be performed for steady state conditions or for extended period simulations (EPS). In steady state calibration, the model is compared to field monitoring results consisting of a single value, such as a single hydrant test. EPS calibration consists of comparing model predictions to diurnal operational changes in the water system.

The calibration process for the hydraulic model was extensive, and involved an iterative process which resulted with satisfactory comparisons between the field measurements and the hydraulic model predictions at each well site, the water tank and booster station. The calibration plan and results were graphically summarized for each site and included in **Appendix A**. Representative calibration graphs from Appendix A are shown on **Figure 6.3**.

6.4.3 Use of the Calibrated Model

The calibrated hydraulic model was used as an established benchmark in the capacity evaluation of the existing water distribution system. The model was also used to identify improvements necessary for mitigating existing system deficiencies and for accommodating future growth. This valuable investment will continue to prove its value to the District as future planning issues or other operational conditions surface. It is recommended that the model be maintained and updated with recent construction to preserve its integrity.



Legend

Calibration Tanks

Calibration Pumps

Calibration Pressure Loggers

Pipes by Diameter

2" or Less

3" - 4"

6" - 8"

10" or Greater

Streets

0 0.125 0.25 0.5 Mile

Update: April 6, 2020

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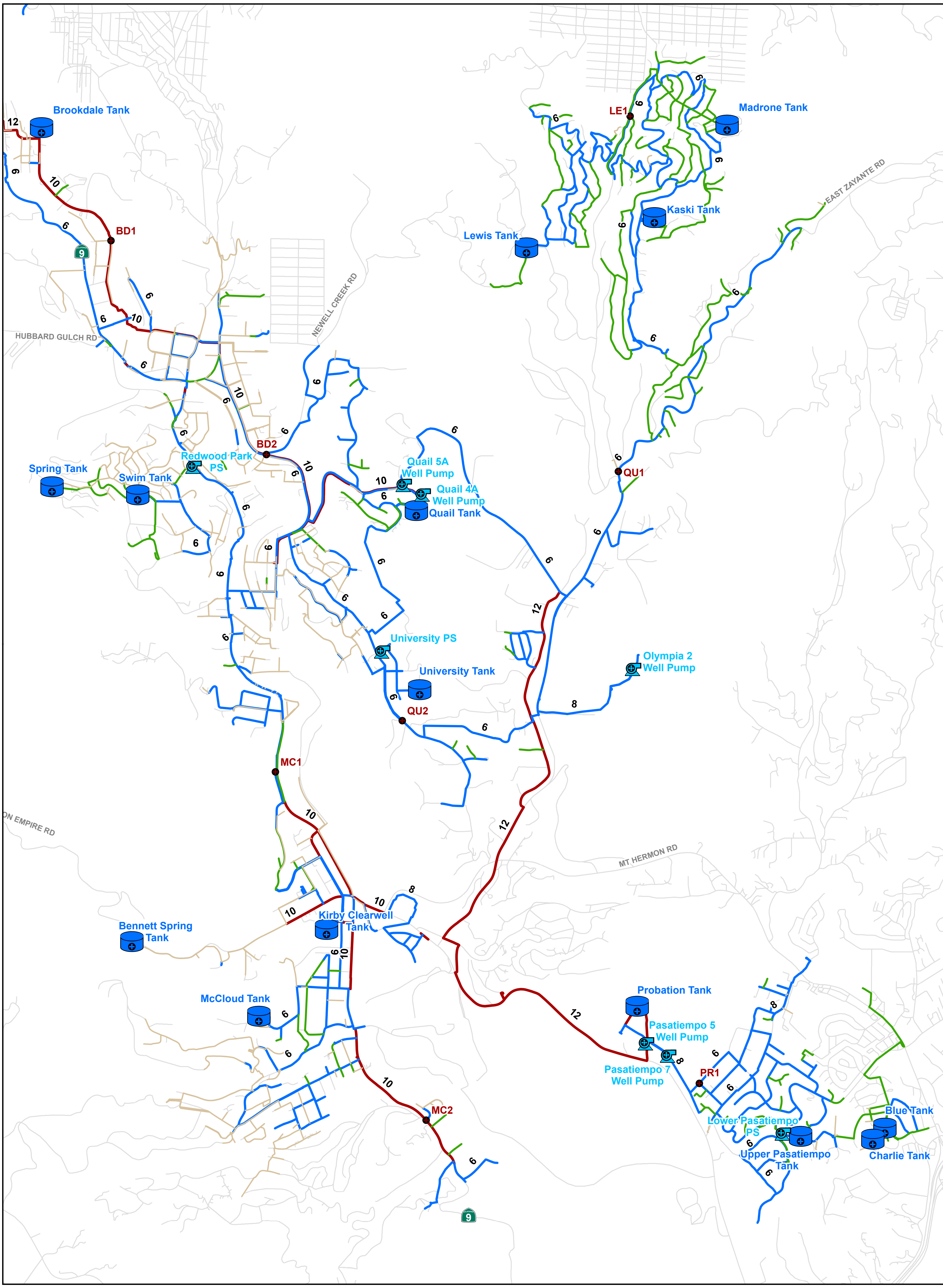
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig6-1_North_ModelCalibration_040620.mxd

Figure 6-1
Northern Hydraulic Model Calibration Program

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Calibration Tanks

Calibration Pumps

Calibration Pressure Loggers

Pipes by Diameter

- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater
- Streets

0 0.125 0.25 0.5 Mile

N S E W

Update: April 6, 2020

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File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig6-2_South_ModelCalibration_040620.mxd

Figure 6-2
Southern Hydraulic Model Calibration Program

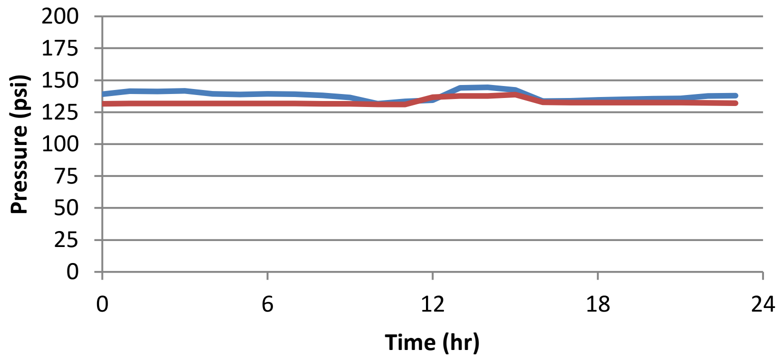
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Pressure Logger BS1

Zone 8 - Big Steel

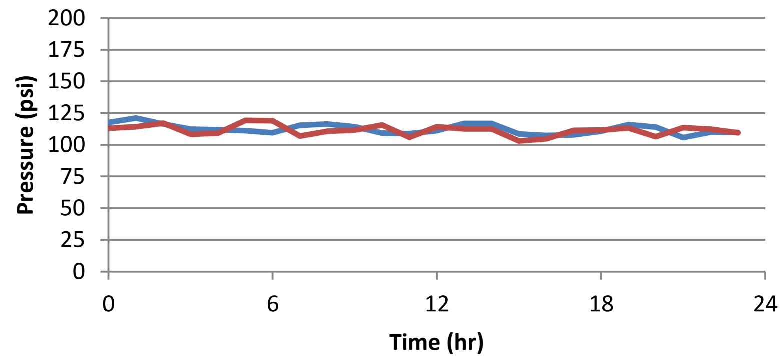
Irwin Wy and Redwood Wy



Pressure Logger MC2

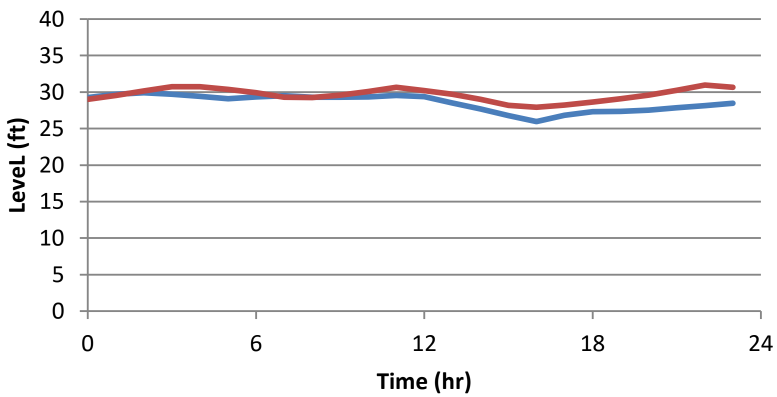
Zone 31 - McCloud

Hwy 9 and River Ln



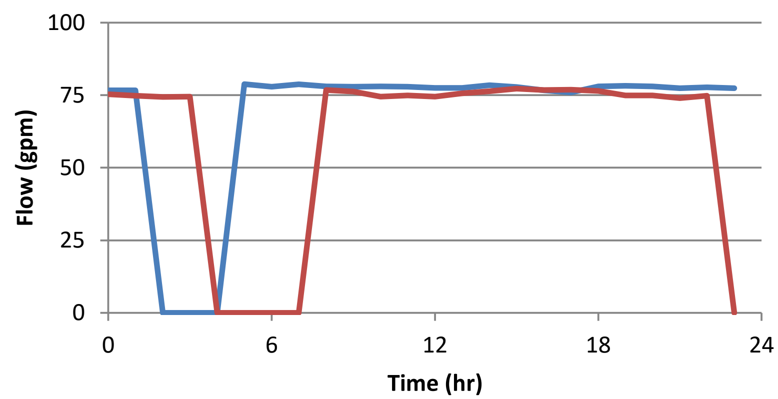
Brookdale

Zone 16 - Brookdale



Quail 5A Pump Station

Zone 16 - Brookdale



LEGEND

- Telemetry Data
- Model Data

April 14, 2021

Figure 6.3

Model Calibration

Water Master Plan

San Lorenzo Valley Water District

Table 6.1 Pressure Logger Summary

Water Master Plan

San Lorenzo Valley Water District

Pressure Logger Location	Pressure Zone	Pressure Logger Unit #	Nearest Road Intersection	Elevation (ft)	Distribution Pipe Diameter (in)	Start Date	End Date	Average SCADA Pressure[1] (psi)	Average Modeled Pressure (psi)
Week 1									
BS1 (permanent)	Big Steel	3	Irwin Wy & Redwood Wy	472	12	11/4/2019 10:00PM	11/12/2019 11:00AM	138.9	132.9
BS2	Big Steel	4	Lorenzo Ave & Hwy 9	456	6	11/4/2019 11:00AM	11/12/2019 12:00AM	148.5	139.7
RE1	Reader	1	Hwy 9 & Brookside Dr	510	8	11/5/2019 12:00AM	11/12/2019 10:00AM	122.2	116.8
RE2	Reader	Unknown	Bear Creek Rd & Monte Vista Ln	520	8	11/6/2019 3:00PM	11/12/2019 11:00AM	112.9	113.1
Week 2									
BS1 (permanent)	Big Steel	3	Irwin Wy & Redwood Wy	472	12	11/12/2019 3:00PM	11/19/2019 3:00PM	139.1	132.9
BS3	Big Steel	4	Big Basin Hwy & Redwood Ave	509	6	11/12/2019 3:00PM	11/19/2019 12:00AM	116.9	113.5
BD2	Brookdale	1	Glen Arbor Road & Newell Creek	346	10	11/12/2019 3:00PM	11/19/2019 2:00PM	117.5	112.8
Week 3									
BS1 (permanent)	Big Steel	3	Irwin Wy & Redwood Wy	472	12	11/19/2019 9:00PM	11/27/2019 10:00AM	139.6	132.9
UN1	University	1	Hihn Rd & driveway at El Alamein Road	640	6	11/19/2019 9:00PM	11/27/2019 9:00AM	80.3	84.9
BD1	Brookdale	4	Riverside Dr & California Dr	374	10	11/19/2019 4:00PM	11/27/2019 4:00AM	105.0	100.4
Week 4									
BS1 (permanent)	Big Steel	3	Irwin Wy & Redwood Wy	472	12	11/27/2019 12:00PM	12/4/2019 9:00AM	138.5	132.9
QU1	Quail	4	East Zayante Rd & Lompico Rd	406	6	11/27/2019 12:00PM	12/3/2019 3:00PM	157.5	150.2
MC2	McCloud	5	Hwy 9 & River Ln	286	10	11/27/2019 1:00PM	12/3/2019 2:00PM	113.6	110.7
PR1	Probation	1	Bob's Ln & Worth Ln	648	6	11/27/2019 1:00PM	12/3/2019 2:00PM	112.1	101.6
Week 5									
MC1	McCloud	4	Hwy 9 by SLV High School	323	10	12/4/2019 11:00AM	12/11/2019 11:00PM	92.6	95.4
Week 6									
LE1	Lewis	4	Lompico Rd & Creekwood Dr	623	6	12/16/2019 2:00PM	12/24/2019 2:00AM	246.06	210.7

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1/4/2021

Notes:

1. Data displayed does not account for erroneous data near beginning and end of pressure logging period.

CHAPTER 7 - EVALUATION AND PROPOSED IMPROVEMENTS

This section presents a summary of the domestic water system evaluation and identifies improvements needed to mitigate existing deficiencies, as well as improvements needed to expand the system and service growth.

7.1 OVERVIEW

The calibrated hydraulic model was used for evaluating the distribution system for capacity deficiencies during peak hour demand and during maximum day demands in conjunction with fire flows. Since the hydraulic model was calibrated for extended period simulations, the analysis duration was established at 24 hours for analysis.

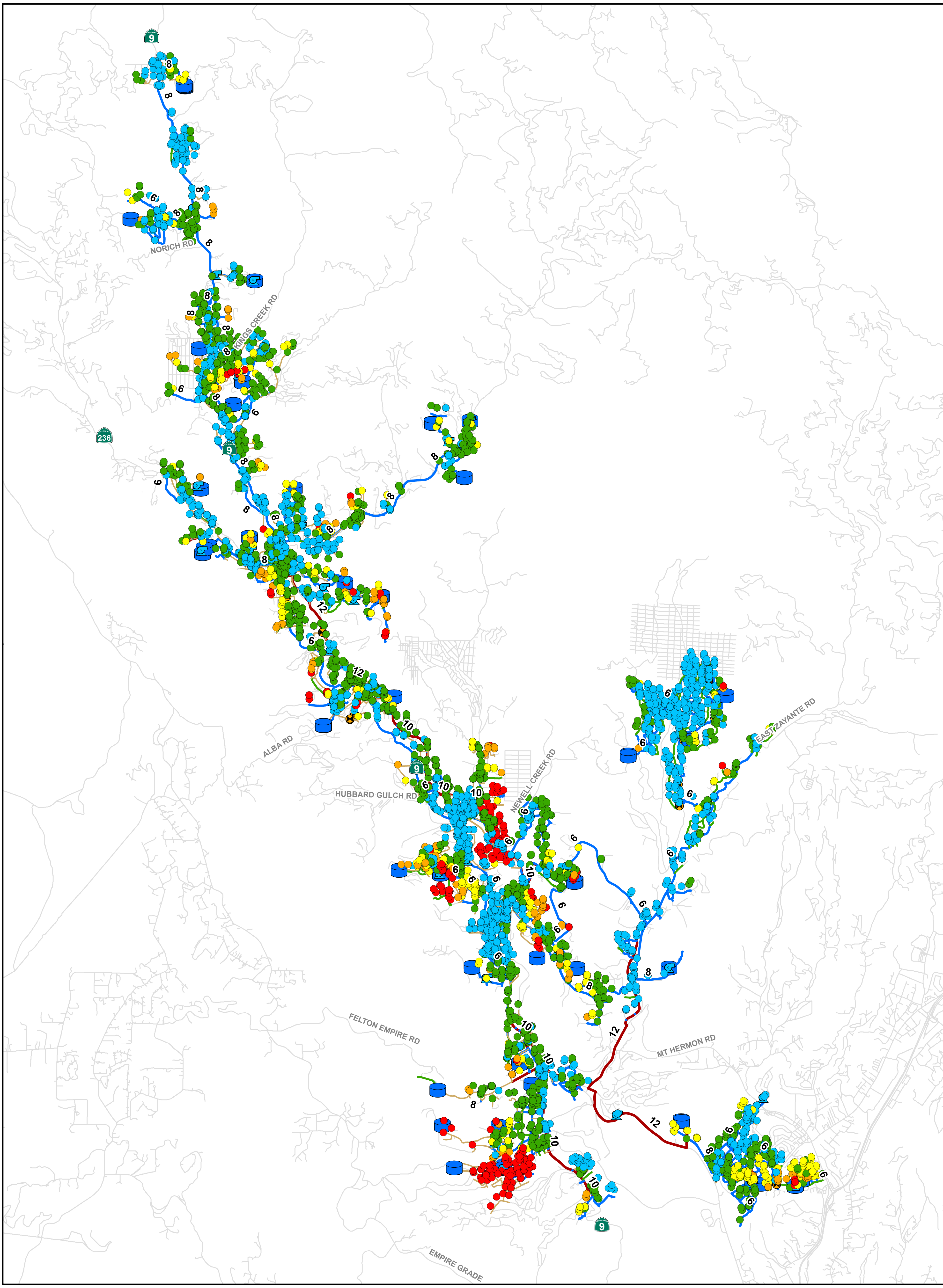
The criteria used for evaluating the capacity adequacy of the domestic water distribution system facilities (transmission mains, storage reservoirs, and booster stations) was discussed and summarized in the System Performance and Design Criteria chapter.

7.2 LOW PRESSURES ANALYSIS

The hydraulic model was used to determine if the existing domestic water distribution system meets the District's System Performance and Design Criteria for peak hour pressure. During the peak hour demand, the minimum pressure requirement is 40 psi. The hydraulic analysis indicated the District's existing system performed reasonably well during under peak hour operating conditions (**Figure 7.1**). However, there are several areas of the system, specifically in the Brookdale and Pine pressure zones, that experience pressures below 20 psi during peak hour demands. These pressure deficiencies are primarily caused by high levels of head loss through small diameter mains throughout the zones.

7.3 HIGH PRESSURE ANALYSIS

The hydraulic model was also used to identify areas in the District's existing domestic water distribution system that experience high pressure under maximum day demand conditions. The areas of high pressure are shown graphically on **Figure 7.2**. Areas of high pressure may be more susceptible to pipeline breaks and ruptures. The District's maximum desired pressure criterion is 80 psi at the service connection and 130 psi in pipelines. Due to the varying elevations throughout the system, a significant portion of the system experiences pressures in excess of 130 psi, especially in the Brookdale, Quail, Big Steel, North Boulder Creek Pressure Zones, and the zones in the Lompico System.



Legend

Minimum Pressure
- Greater than 100 psi
- 60 - 100 psi
- 40 - 60 psi
- 20 - 40 psi
- Less than 20 psi

Existing System
- Pump Station
- Tank
- Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Update: May 26, 2021

0 0.25 0.5 1 Mile

N W E S

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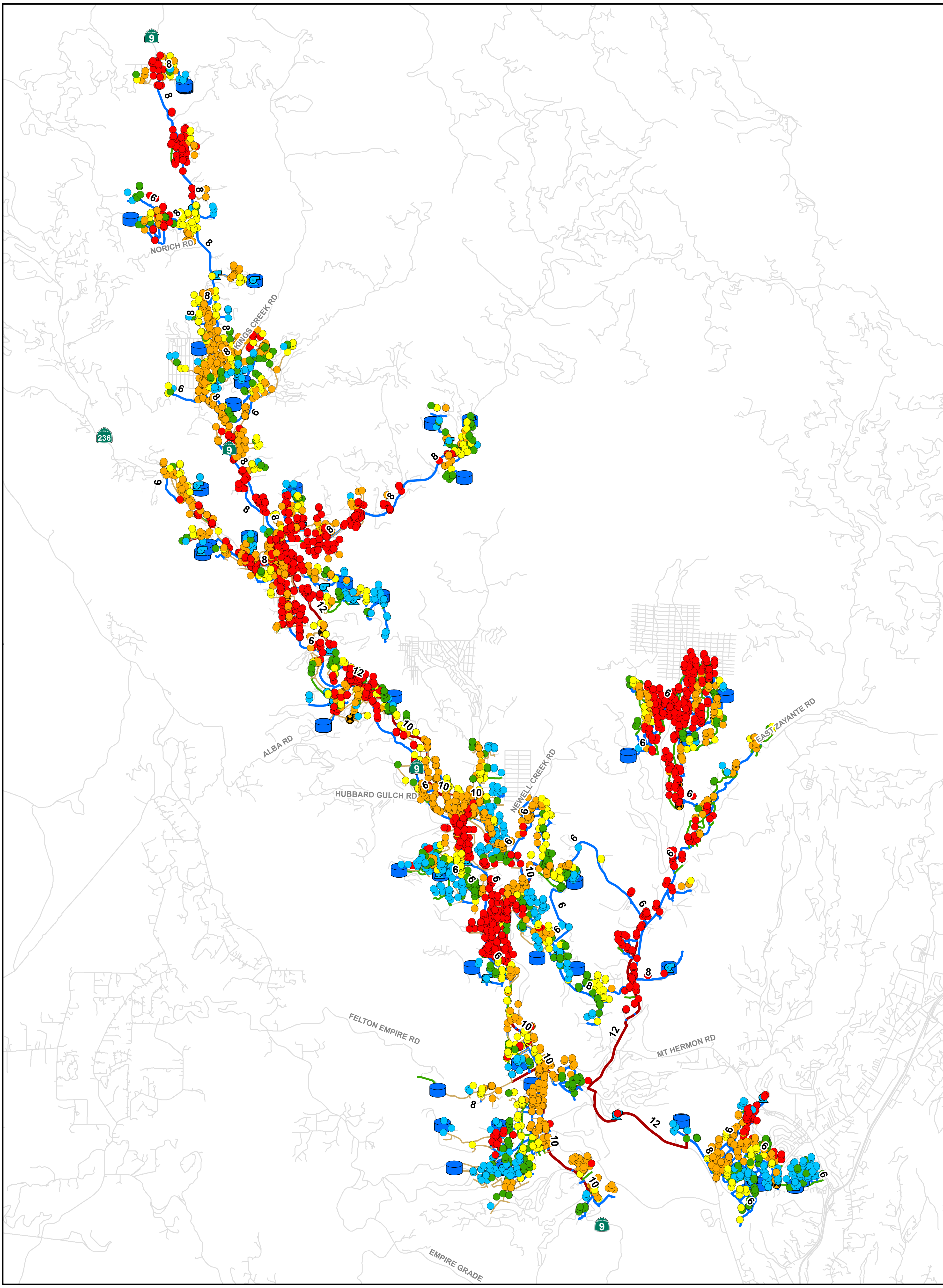
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-1_MinPressure_122820.mxd

Figure 7.1 Minimum System Pressures

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Maximum Pressure
- Less than 60 psi
- 60 - 80 psi
- 80 - 100 psi
- 100 - 130 psi
- Greater than 130 psi

Existing System
- Pump Station
- Tank
- Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

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Update: May 26, 2021

0 0.25 0.5 1 Mile

N W E S

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-2_MaxPressure_052621.mxd

Figure 7.2 Maximum System Pressures

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

7.4 FIRE FLOW ANALYSIS AND RECOMMENDED IMPROVEMENTS

The fire flow analysis consisted of using the maximum day demand in the hydraulic model and applying hypothetical fire flows. The magnitude and duration of each fire flow was based on the governing land use type within proximity to the fire location. The criterion for fire flows was also summarized in the System Performance and Design Criteria chapter.

Due to a majority of the District's existing distribution system being comprised of small diameter mains, the hydraulic model indicates that a majority of the system's hydrants were unable to meet the pressure requirements under fire flow conditions. The maximum instantaneous flow at the residual pressure criteria of 20 psi is summarized on **Figure 7.3.** It should be noted that these available fire flow values are based on system pressure, and do not take into account storage capacity. As discussed in Chapter 3, fire storage is needed to maintain acceptable service pressures within a pressure zone in the event of a fire flow. Multiple pressure zones did not have sufficient fire storage, and would therefore limit available fire flow as documented on **Figure 7.4**.

Improvements to mitigate specific fire flow deficiencies are discussed below and include a corresponding coded identifier, which is consistent with the capital improvements chapter. It should be noted that these improvements do not address every fire flow deficiency, and are recommended on the basis of being able to address numerous hydrant deficiencies, coinciding with capacity improvements, or improved major transmission mains. **Figure 7.5** displays all pipeline improvements necessary to address fire flow deficiencies.

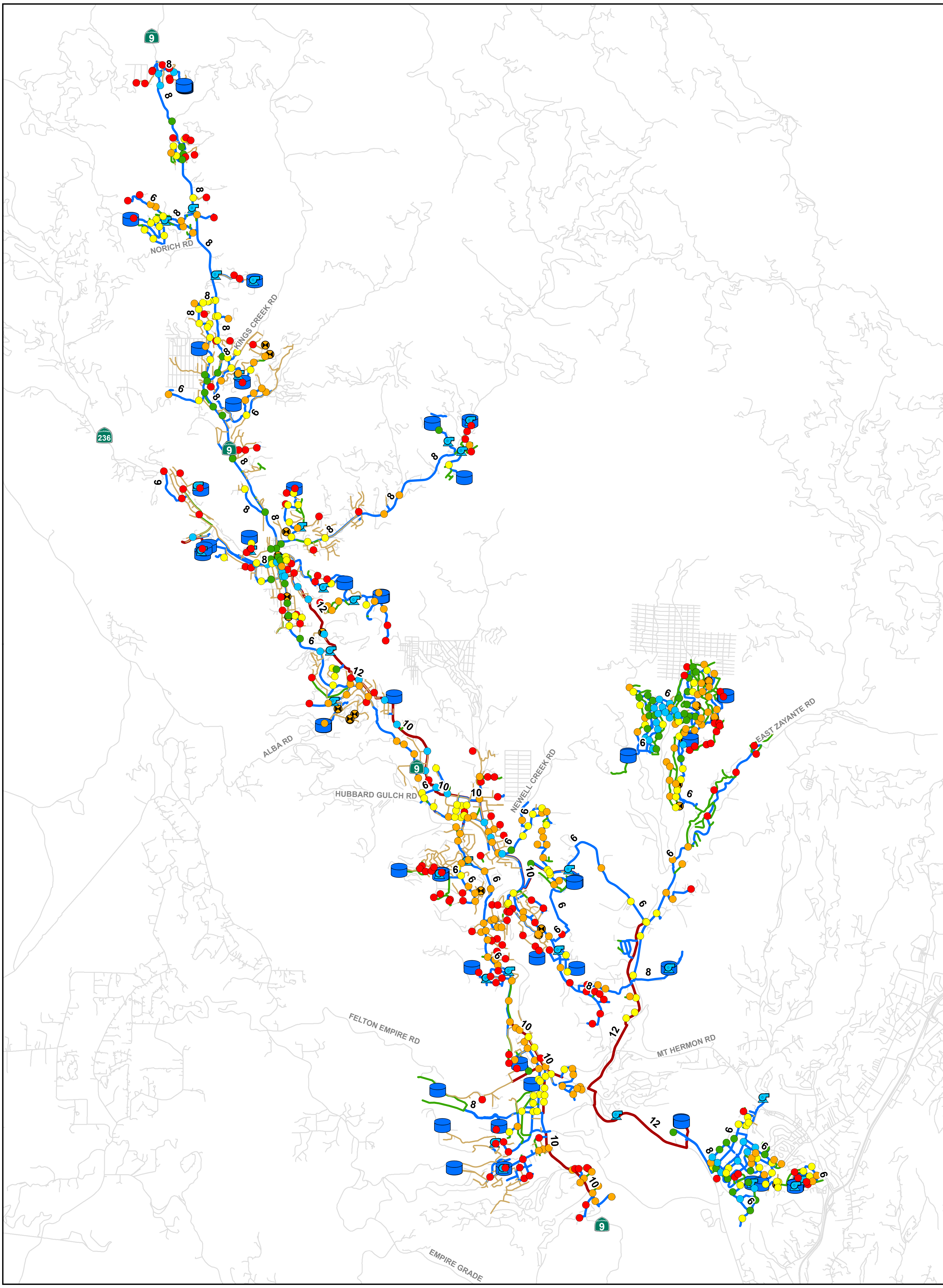
Reader Pressure Zone:

- **P4-1**: Replace approximately 13,100 feet of existing 4-inch, 6-inch, and 8-inch water main with new 10-inch water main along Highway 9 from the existing Echo pump station to approximately 700 feet southeast of Douglas Avenue.

- **P4-2**: Replace approximately 7,920 feet of existing 8-inch water main with new 10-inch water main along Highway 9 from approximately 700 feet southeast of Douglas Avenue to approximately 250 feet south of Big Basin Way. This improvement is also intended to address an existing deficiency.

- **P4-6**: Replace approximately 1,410 feet of existing 6-inch water main with new 10-inch water main along Dolores Drive and Douglas Avenue from Reader Reservoir to Highway 9. This improvement is also intended to address an existing deficiency.

- **P4-12**: Replace approximately 3,200 feet of existing 1.5-inch, 2-inch, and 4-inch water main with new 8-inch water main along Central Avenue from approximately 250 feet south of Big Basin Way to River Street.



Legend

Available Fire Flow

- Greater than 2,000 gpm
- 1,500 - 2,000 gpm
- 1,000 - 1,500 gpm
- 500 - 1,000 gpm
- Less than 500 gpm

Existing System

- Pump Station
- Tank
- Valve

Pipes by Diameter

- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Note:
Values shown reflect available fire flow as based on system pressures, and do not take into account storage capacity.

0 0.25 0.5 1 Mile

N W E S

Update: May 26, 2021

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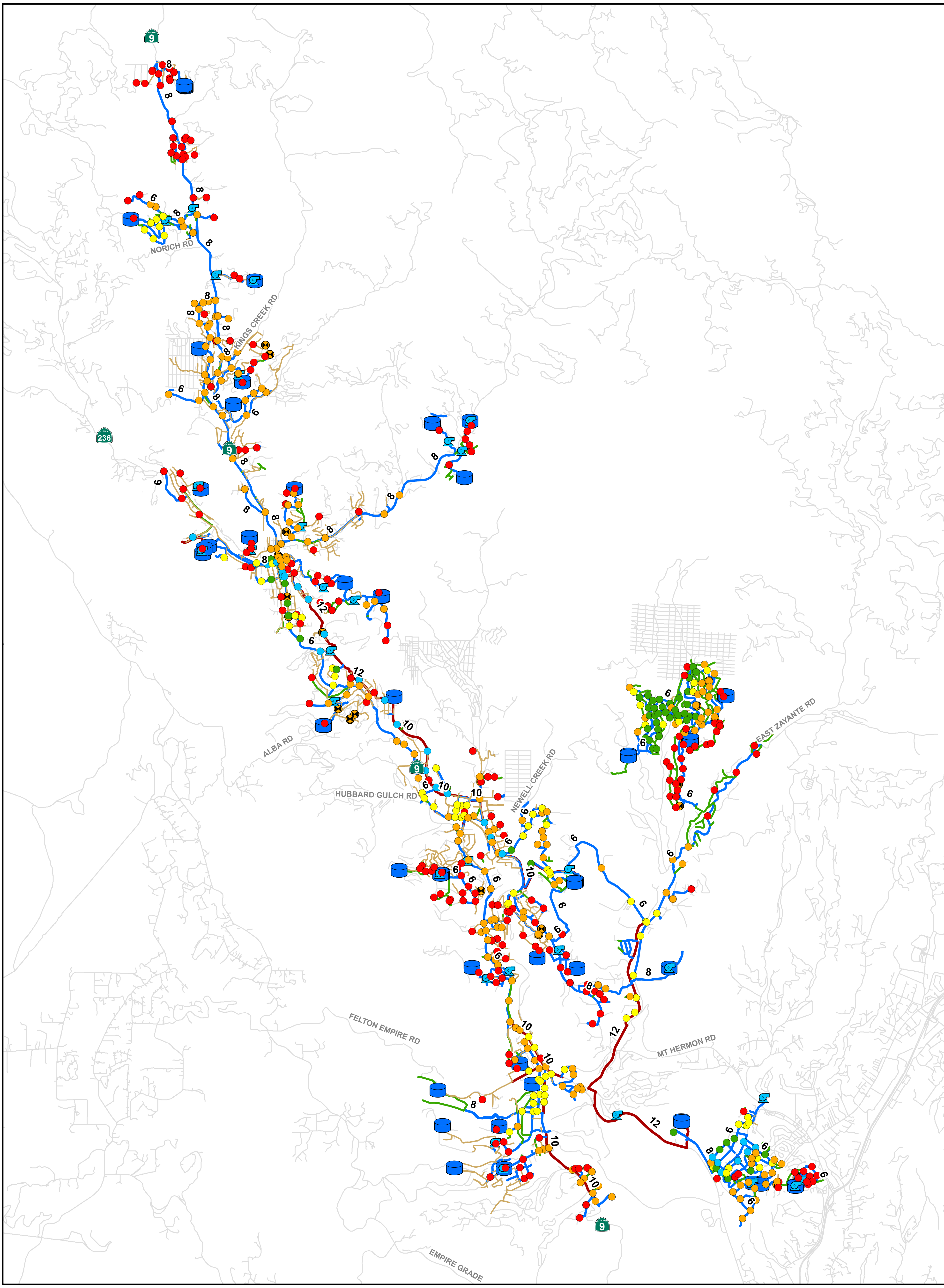
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-3_AvailFF_052621.mxd

Figure 7.3
Available Fire Flow Residual Pressure

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Available Fire Flow
- Greater than 2,000 gpm
- 1,500 - 2,000 gpm
- 1,000 - 1,500 gpm
- 500 - 1,000 gpm
- Less than 500 gpm

Existing System
- Pump Station
- Tank
- Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Note:
Values shown reflect available fire flow as based on available storage capacity for each pressure zone.

0 0.25 0.5 1 Mile

N E S W

Update: May 26, 2021

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-4_AvailFFStorage_052621.mxd

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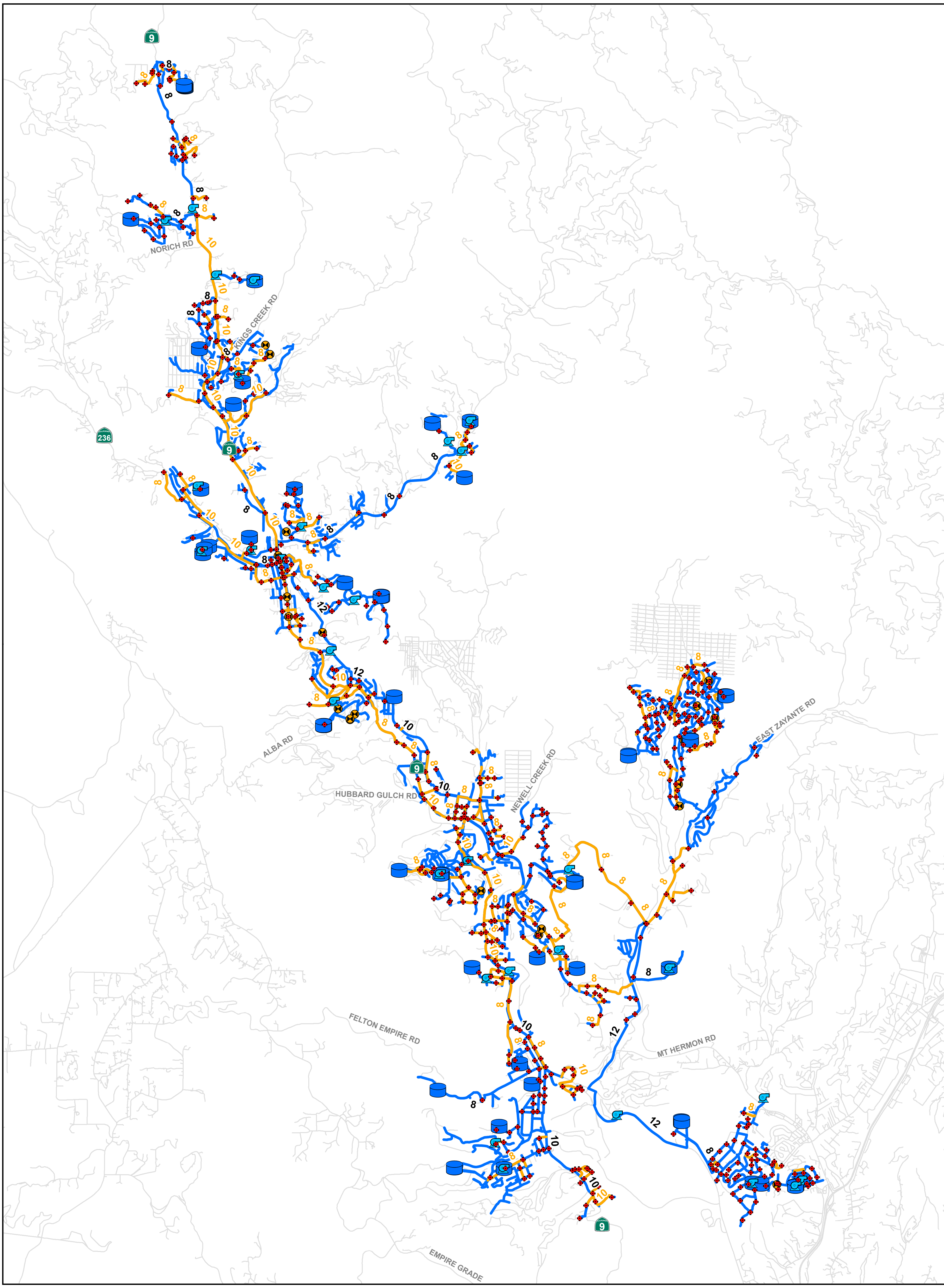
Figure 7.4
Available Fire Flow Storage Restriction

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Fire Flow Improvements

Existing System

Pump Station

Tank

Valve

Hydrants

Pipelines

Notes:
1. Improvements shown are recommended to mitigate fire flow deficiencies caused by pressure loss in pipelines.
2. Improvements shown are sized based off a minimum required pipe diameter of 8-inches and a velocity criteria of 10 fps during MDD + Fire Flow.

Update: June 1, 2021

0 0.25 0.5 1 Mile

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File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-5_FireFlowImp_060121.mxd

Figure 7.5
Fire Flow Improvements

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Big Steel Pressure Zone:

- **P8-2**: Replace approximately 2,480 feet of existing 8-inch water main with new 10-inch water main along Big Basin Way from approximately 600 southeast of Redwood Drive to Redwood Avenue.

- **P8-3**: Replace approximately 2,260 feet of existing 6-inch water main with new 8-inch water main along Redwood Avenue and Lomond Street from Big Basin Way to Central Avenue.

- **P8-5**: Replace approximately 420 feet of existing 6-inch and 8-inch water main with new 10-inch water main along Central Avenue from Lomond Street to approximately 400 feet south of Lomond Street.

- **P8-6**: Replace approximately 4,660 feet of existing 6-inch water main with new 8-inch water main along Central Avenue and Lorenzo Avenue from approximately 400 feet south of Lomond Street to Irwin.

- **P8-9**: Replace approximately 3,610 feet of existing 6-inch water main with new 10-inch water main along Highway 9 from Irwin Way to Alameda Avenue.

- **P8-12**: Replace approximately 730 feet of existing 6-inch water main with new 8-inch water main along Highway 9 from Alameda Avenue to Larkspur Street.

Brookdale Pressure Zone:

- **P16-5**: Replace approximately 1,980 feet of existing 6-inch water main with new 10-inch water main along Brown Gables Road and Highway 9 from approximately 800 feet east of Highway 9 to approximately 100 feet southeast of Marshall Creek.

- **P16-6**: Replace approximately 950 feet of existing 6-inch water main with new 10-inch water main along Mill Street from Highway 9 to approximately 100 feet west of Main Street.

- **P16-7**: Construct approximately 670 feet of new 10-inch water main along Mill Street from 100 feet west of Main Street to Oak Street.

- **P16-8**: Replace approximately 1,720 feet of existing 4-inch and 6-inch water main with new 10-inch water main along Highway 9 and Brookside Avenue from approximately 100 feet south of Brookside Avenue to Whittier Avenue. This improvement is also intended to address an existing deficiency.

- **P16-9**: Construct approximately 20 feet of new 10-inch water main along Brookside Avenue from approximately 50 feet west of Brookside Avenue to Whittier Avenue.

- **P16-18**: Replace approximately 8,210 feet of existing 2-inch. 4-inch, and 6-inch water main along Highway 9 with new 10-inch water main from approximately 100 feet north of Hillside Avenue to Glen Lomond Lane. This improvement is also intended to address an existing deficiency.

- **P16-22**: Replace approximately 7,070 feet of existing 6-inch water main with new 8-inch water main along Glen Arbor Road and Hihn Road from Pine Street to Eleana Drive.

- **P16-23**: Replace approximately 40 feet of existing 6-inch water main with new 8-inch water main within the right-of-way from Glen Arbor Road to approximately 40 feet east of Glen Arbor Road.

Quail Pressure Zone:

- **P21-1**: Replace approximately 7,740 feet of existing 6-inch water main with new 8-inch water main along Quail Hollow Road from Cumora Lane to approximately 200 feet east of Derick Lane.

- **P21-2**: Replace approximately 5,730 feet of existing 6-inch water main with new 8-inch water main along Quail Terrace, Webster Drive, and Ridgeview Drive from Quail Reservoirs to Hihn Road.

- **P21-5**: Replace approximately 1,800 feet of existing 6-inch water main with new 8-inch water main along Hihn Road from Condor Avenue to approximately 150 feet south of Stanford Drive.

- **P21-6**: Replace approximately 3,420 feet of existing 6-inch water main with new 8-inch water main along Kim Way, Bahr Drive, and Moon Meadow Lane from Hihn Road to Zayante Road.

McCloud Pressure Zone:

- **P31-2**: Replace approximately 2,340 feet of existing 4-inch and 8-inch water main with new 10-inch water main along Highway 9 from El Solyo Heights Drive to Fall Creek Drive.

- **P31-4**: Replace approximately 2,170 feet of existing 2-inch and 6-inch water main with new 8-inch water main along Highway 9 and Felton Empire Road from Clearview Place to Gushee Street.

7.5 WATER SUPPLY REQUIREMENTS AND IMPROVEMENT RECOMMENDATIONS

The District's existing domestic water system supply capacity is identified in this section. Additionally, this section identifies the additional supply capacity required to meet supply requirements, consistent with the District's System Performance and Design Criteria.

7.5.1 Existing Supply Requirements

Existing supply requirements were identified for the District and are summarized on **Table 7.1**. The District's existing water supply requirement is approximately 1,966 gpm, as based on existing land use and recommended water demand factors. This requirement must be supplied with the firm capacity of the District's supply sources. In this case, firm capacity assumes water treatment facilities will not be taken offline. Additionally, it was determined that the Quail and Brookdale portions of the North System faced the most critical supply constraints. Thus, firm capacity assumed groundwater well Olympia Well 2 would be taken offline in the following supply analysis.

7.5.2 System-Wide Water Supply Analysis

The system-wide water supply capacity analysis for existing and buildout conditions is summarized on **Table 7.1**, which includes the supply requirements and available supply volumes across the SLVWD water distribution system. The analysis was separated into four different supply areas based on supply zones and possible water conveyance. As documented on **Table 7.1**, the District's existing supply facilities are capable of meeting the existing and buildout supply requirement for the Lyon Zone portion of the North System, the South System (Manana Woods) and the Felton System. However, existing supply facilities in the Quail and Brookdale portion of the North System are not capable of meeting either existing or buildout supply requirements even with additional surplus capacity of 106 gpm from McCloud Pressure Zone being conveyed by the Intertie 6 pump station.

7.5.2.1 North System – Lyon Zone

The Lyon zone portion of the North System supplies water to Lyon and Eckley pressure zones, as well as a portion of Reader, South, Highland, Nina, Nina Hydro, Huckleberry, North Boulder Creek, Mitchell, Riverside Grove, Ralston, Bear Creek, Bear Creek Hydro pressure zones through a PRV.

The Lyon zone portion of the North System currently utilizes the Lyon WTP to meet existing supply requirements. As documented on **Table 7.1**, under existing and buildout conditions, this facility is anticipated to be sufficient to meet the system's supply requirements.

7.5.2.2 North System – Quail/Brookdale Zone

The Quail and Brookdale portion of the North System supplies water to Brookdale, Quail, University, Swim, Spring, Big Steel, Reader, South, Highland, Nina, Nina Hydro, Huckleberry, North Boulder Creek, Mitchell, Riverside Grove, Ralston, Bear Creek, and Bear Creek Hydro pressure zones from the North System as well as Kaski, Lewis, Madrone pressure zones from the Lompico System.

The Quail and Brookdale portions of the North System currently rely on groundwater wells and Intertie 6 from McCloud zone to meet existing supply requirements. The supply capacities required to meet demands for the Quail and Brookdale supply zones, as well as their dependent

Table 7.1 Buildout Supply Analysis
Water Master Plan
San Lorenzo Valley Water District

Supply Source	Pressure Zone	Supply Capacity Analysis								
		Total Supply Capacity (gpm)	Firm Supply Capacity [1] (gpm)	Existing Required Capacity [2,3] (gpm)	Existing Surplus/Deficiency (gpm)	Buildout Required Capacity [2] (gpm)	Buildout Surplus/ Deficiency (gpm)	Intertie Pumping Capacity [4] (gpm)	PRV Supply Capacity [5] (gpm)	Buildout Surplus/Deficiency (gpm)
North System - Lyon Zone										
Lyon WTP	Lyon	900								
Total		900	900	94	**806**	99	**801**	-	-412	**389**
North System - Quail/Brookdale Zone										
Quail Well 4A	Brookdale	280								
Quail Well 5A	Brookdale	85								
Olympia Well 2 [1]	Quail	*360*								
Olympia Well 3	Quail	*150*								
Total		875	515	1,148	**-633**	1,225	**-710**	106	412	**-192**
South System (Manana Woods)										
Pasatiempo Well 5A	Probation	350								
Pasatiempo Well 7	Probation	100								
Pasatiempo Well 8	Probation	350								
Total		800	800	342	**458**	365	**435**	-		**435**
Felton System										
Bennett Spring Diversion [6]	Bennett Spring	13								
Kirby WTP	McCloud	500								
Total		513	513	382	**131**	407	**106**	-106		**0**

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Notes:
1. Firm capacity is equal to total supply capacity needed to meet system maximum day demands less largest unit of most critical supply zone (Olympia 2). Firm capacity assumes water treatment facilities will not be taken offline.
2 Required supply capacity is equal to firm capacity needed to meet maximum day demand of supplying zone and any dependent zones.
3. Existing PRV from Lyon pressure zone to Reader pressure zone causes existing deficiency in Quail and Brookdale supply zones to be partially mitigated.
4. Interties in the SLVWD system may be used to mitigate supply deficiencies, as they are capable of conveying flow from areas of the system with surplus supply as documented below:
   - Intertie 6 can convey flow between Brookdale and McCloud pressure zones, and has a capacity of approximately 350 gpm. However, McCloud pressure zone only has surplus capacity to convey 156 gpm.
5. The planned construction of a PRV from Lyon zone to Reader zone will result in Reader zone demand and the demands of supply dependendent zones to be met by Lyon WTP instead of Quail and Brookdale supply zones.
6. Bennett Spring Diversion conveys some flow directly to the Felton System, and was therefore included in this supply analysis.

zones, are approximately 1,148 gpm under existing conditions and 1,225 gpm under buildout conditions. As documented on **Table 7.1**, the groundwater wells in the Quail and Brookdale supply zones are currently unable to meet demands with the firm supply capacity of Quail and Olympia groundwater wells. There is an existing pressure reducing valve from Lyon zone to Reader zone that provides supply to Reader zone and partially mitigates the existing deficiency. Intertie 6 is capable of partially reducing this deficiency, as it can convey approximately 106 gpm of surplus supply from McCloud zone, but additional supply will still be required.

It should be noted that there is a planned construction of a PRV from Lyon zone to Reader zone, as well as a planned construction of PRV from Lyon zone to Blackstone zone. As described above, this will cause Reader zone demands and the demands of supply dependent zones, as well as Blackstone zone demands, to be met by Lyon WTP instead of Quail and Brookdale groundwater wells. With this PRV constructed, Firehouse PS can be taken offline and either be abandoned or kept on standby for emergency supply, with Reader zone supplied solely by the new PRV.

As other supply zones within the system have surplus supply capacity, it is not recommended that additional groundwater wells be constructed. Instead, it is recommended that an additional PRV be constructed from the Lyon portion of the North System to Big Steel Zone to convey surplus supply under maximum day demand conditions, and reduce supply requirements for Quail and Brookdale Zones.

7.5.2.3 South System (Manana Woods)

The South System (Manana Woods) includes Probation, Upper Pasatiempo, Blue, Charlie and Charlie Hydro pressure zones.

The South System (Manana Woods) is currently supplied by groundwater wells. As documented on **Table 7.1**, under existing and buildout conditions, existing supply sources are anticipated to be sufficient to meet the system’s supply requirements.

7.5.2.4 Felton System

The Felton System includes McCloud, Bennett Spring, El Solyo, Blair, and Pine pressure zones.

The Felton System currently utilizes the Kirby WTP, as well as surface water from the Bennett Spring Diversion, to meet the supply requirements. As documented on **Table 7.1**, under existing and buildout conditions, this facility is anticipated to be sufficient to meet the system’s supply requirements.

7.6 WATER STORAGE REQUIREMENTS AND IMPROVEMENT RECOMMENDATIONS

The District’s existing domestic water system storage capacity is identified in this section. Additionally, this section identifies the existing and future storage requirements to meet the storage capacity and compares it with the existing storage facilities in each zone and makes recommendations for new storage facilities.

7.6.1 Existing Storage Requirements

Existing storage requirements were identified for each pressure zone and each water supply system, as summarized in **Table 7.2**. The table lists the existing domestic water demands and identifies the operational and fire storage for each pressure zone. This table also lists the total existing storage required for each water supply system and the overall system storage requirement, which is approximately 7,671,000 gallons (7.67 MG).

7.6.2 Future Storage Requirements

Future storage requirements were identified based on the buildout of the County's General Plan and summarized by pressure zone on **Table 7.2**. The table lists the future domestic water demands and identifies the operational and fire storage for each pressure zone. This table also lists the total buildout storage required for each water supply system and the overall system storage requirement, which is approximately 7,768,000 gallons (7.77 MG)

7.6.3 Recommended New Storage Facilities

The existing and future storage requirements, shown on **Table 7.2**, were compared with existing District storage facilities in each pressure zone in order to identify any deficits and recommend additional storage. The table lists existing storage facilities for each pressure zone, identifies existing storage capacity deficiencies, and identifies future storage capacity requirements to meet the needs from future growth.

Based on the storage analysis, many zones within the SLVWD water distribution system to not appear to have adequate storage to meet fire storage requirements, resulting in storage deficiencies in multiple zones across the system. Additional storage should be constructed to mitigate this deficiency and to avoid service disruptions in the event of fire.

The proposed storage reservoirs, summarized on **Table 7.3**, are described as follows:

- **T3-1**: Replace the existing Blue Ridge storage reservoir (40,000 gallons) with a new 200,000 gallon storage reservoir. This improvement is intended to replace the existing storage reservoir, which is an aging wood tank.
- **T4-1**: Construct a new 420,000 gallon storage reservoir at the existing Reader Tank Site.
- **T6-1**: Replace the existing Eckley storage reservoir (5,000 gallons) with a new 130,000 gallon storage reservoir. This improvement is intended to replace the existing storage reservoir, which is a low volume polyurethane tank.
- **T7-1**: Replace the existing Blackstone storage reservoirs (24,000 gallons) with a new 130,000 gallon storage reservoir. This improvement is intended to replace the existing storage reservoirs, which are low volume polyurethane tanks.

Table 7.2 Buildout Storage Capacity Analysis

Water Master Plan

San Lorenzo Valley Water District

Pressure Zone	Pressure Zone HGL	Demands				Storage Requirements [2]					Storage Balance					
		Existing		Buildout		Operational		Fire Protection	Total		Existing Storage Reservoirs	Balance for Existing Demands	Balance for Buildout Demands	Proposed New Storage Reservoirs	Total Storage	Balance for Proposed Storage
		Average Day Demand	Maximum Day Demand [1]	Average Day Demand	Maximum Day Demand [1]	Existing	Buildout		Existing	Buildout						
	(ft)	(MGD)	(MGD)	(MGD)	(MGD)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)
North System																
Bear Creek	789	21,331	31,997	22,291	33,437	15,998	16,718	360,000	376,000	377,000	75,000	-301,000	-302,000	310,000	385,000	8,000
Big Steel	739	85,526	128,290	94,147	141,221	64,145	70,610	360,000	425,000	431,000	1,400,000	975,000	969,000		1,400,000	969,000
Blackstone	794	4,954	7,430	5,146	7,718	3,715	3,859	120,000	124,000	124,000	24,000	-100,000	-100,000	130,000	130,000	6,000
Blue Ridge	943	13,421	20,131	13,997	20,995	10,066	10,498	180,000	191,000	191,000	40,000	-151,000	-151,000	200,000	200,000	9,000
Brookdale	578	370,128	555,192	389,520	584,280	277,596	292,140	360,000	638,000	653,000	721,000	83,000	68,000		721,000	68,000
Eckley	929	768	1,152	826	1,238	576	619	120,000	121,000	121,000	5,000	-116,000	-116,000	130,000	130,000	9,000
Highland	946	11,568	17,352	12,029	18,043	8,676	9,022	120,000	129,000	130,000	60,000	-69,000	-70,000	130,000	130,000	0
Huckleberry	1,025	10,339	15,509	10,762	16,142	7,754	8,071	120,000	128,000	129,000	125,000	-3,000	-4,000		125,000	-4,000
Lyon	849	89,760	134,640	94,061	141,091	67,320	70,546	360,000	428,000	431,000	3,250,000	2,822,000	2,819,000		3,250,000	2,819,000
Nina	1,202	20,621	30,931	21,456	32,184	15,466	16,092	120,000	136,000	137,000	134,000	-2,000	-3,000		134,000	-3,000
North Boulder Creek	1,060	26,208	39,312	27,360	41,040	19,656	20,520	360,000	380,000	381,000	75,000	-305,000	-306,000	400,000	400,000	19,000
Quail	733	140,890	211,334	153,898	230,846	105,667	115,423	360,000	466,000	476,000	451,000	-15,000	-25,000		451,000	-25,000
Ralston	1,013	3,360	5,040	3,504	5,256	2,520	2,628	120,000	123,000	123,000	20,000	-103,000	-103,000	130,000	130,000	7,000
Reader	760	247,046	370,570	263,875	395,813	185,285	197,906	360,000	546,000	558,000	150,700	-395,300	-407,300	420,000	570,700	12,700
Riverside Grove	1,020	14,256	21,384	14,832	22,248	10,692	11,124	120,000	131,000	132,000	380,000	249,000	248,000		380,000	248,000
South	1,151	7,958	11,938	8,362	12,542	5,969	6,271	120,000	126,000	127,000	36,400	-89,600	-90,600	130,000	130,000	3,000

Table 7.2 Buildout Storage Capacity Analysis

Water Master Plan

San Lorenzo Valley Water District

Pressure Zone	Pressure Zone HGL	Demands				Storage Requirements [2]					Storage Balance					
		Existing		Buildout		Operational		Fire Protection	Total							
		Average Day Demand	Maximum Day Demand [1]	Average Day Demand	Maximum Day Demand [1]	Existing	Buildout		Existing	Buildout	Existing Storage Reservoirs	Balance for Existing Demands	Balance for Buildout Demands	Proposed New Storage Reservoirs	Total Storage	Balance for Proposed Storage
	(ft)	(MGD)	(MGD)	(MGD)	(MGD)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)
Spring	995	4,003	6,005	4,330	6,494	3,002	3,247	120,000	124,000	124,000	65,000	-59,000	-59,000	60,000	125,000	1,000
Swim	748	31,757	47,635	33,398	50,098	23,818	25,049	180,000	204,000	206,000	19,600	-184,400	-186,400	210,000	210,000	4,000
University	828	30,326	45,490	31,507	47,261	22,745	23,630	120,000	143,000	144,000	64,800	-78,200	-79,200	80,000	144,800	800
Subtotal		1,134,221	1,701,331	1,205,299	1,807,949	850,666	903,974	4,080,000	4,939,000	4,995,000	7,096,500	2,157,500	2,101,500	2,330,000	9,146,500	4,151,500
Lompico System																
Kaski	1,262	10,656	15,984	11,251	16,877	7,992	8,438	120,000	128,000	129,000	80,000	-48,000	-49,000	50,000	130,000	1,000
Lewis	1,095	37,690	56,534	40,147	60,221	28,267	30,110	180,000	209,000	211,000	260,000	51,000	49,000		260,000	49,000
Madrone	1,288	9,715	14,573	10,493	15,739	7,286	7,870	180,000	188,000	188,000	160,000	-28,000	-28,000	30,000	190,000	2,000
Subtotal		58,061	87,091	61,891	92,837	43,546	46,418	480,000	525,000	528,000	500,000	-25,000	-28,000	80,000	580,000	52,000
Manana Woods System																
Blue	732	27,638	41,458	28,704	43,056	20,729	21,528	180,000	201,000	202,000	65,000	-136,000	-137,000	140,000	205,000	3,000
Charlie	825	5,434	8,150	5,645	8,467	4,075	4,234	120,000	125,000	125,000	45,000	-80,000	-80,000	80,000	125,000	0
Probation	873	264,086	396,130	276,394	414,590	198,065	207,295	360,000	559,000	568,000	630,000	71,000	62,000		630,000	62,000
Upper Pasatiempo	888	31,258	46,886	32,534	48,802	23,443	24,401	120,000	144,000	145,000	100,000	-44,000	-45,000	50,000	150,000	5,000
Subtotal		328,416	492,624	343,277	514,915	246,312	257,458	780,000	1,029,000	1,040,000	840,000	-189,000	-200,000	270,000	1,110,000	70,000
Felton System																
El Solyo	636	41,347	62,021	43,037	64,555	31,010	32,278	120,000	152,000	153,000	20,000	-132,000	-133,000	160,000	160,000	7,000
Bennett Spring	799	9,062	13,594	9,408	14,112	6,797	7,056	120,000	127,000	128,000	5,688	-121,312	-122,312	130,000	130,000	2,000

Table 7.2 Buildout Storage Capacity Analysis

Water Master Plan

San Lorenzo Valley Water District

Pressure Zone	Pressure Zone HGL	Demands				Storage Requirements [2]					Storage Balance					
		Existing		Buildout		Operational		Fire Protection	Total							
		Average Day Demand	Maximum Day Demand [1]	Average Day Demand	Maximum Day Demand [1]	Existing	Buildout		Existing	Buildout	Existing Storage Reservoirs	Balance for Existing Demands	Balance for Buildout Demands	Proposed New Storage Reservoirs	Total Storage	Balance for Proposed Storage
	(ft)	(MGD)	(MGD)	(MGD)	(MGD)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)
Blair	497	9,322	13,982	9,696	14,544	6,991	7,272	120,000	127,000	128,000	255,000	128,000	127,000		255,000	127,000
McCloud	520	250,282	375,422	280,166	420,250	187,711	210,125	360,000	548,000	571,000	534,000	-14,000	-37,000	40,000	574,000	3,000
Pine	637	57,514	86,270	59,846	89,770	43,135	44,885	180,000	224,000	225,000	18,500	-205,500	-206,500	230,000	230,000	5,000
Subtotal		367,526	551,290	402,154	603,230	275,645	301,615	900,000	1,178,000	1,205,000	833,188	-344,812	-371,812	560,000	1,349,000	144,000
Total		**1,888,224**	**2,832,336**	**2,012,621**	**3,018,931**	**1,416,168**	**1,509,466**	**6,240,000**	**7,671,000**	**7,768,000**	**9,269,688**	**1,598,688**	**1,501,688**	**3,240,000**	**12,185,500**	**4,417,500**

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Notes:

1. Maximum Day Demand = 1.5 x Average Day Demand
2. Storage Requirements are derived as follows:
   - •Operational = 50% of MDD
   - •Fire Protection = Maximum fire flow requirement for hydrants within the pressure zone

Table 7.3 Storage Reservoir Recommendations
Water Master Plan
San Lorenzo Valley Water District

Tank ID	Pressure Zone	New / Replace	Volume (MG)	Bottom Elevation (ft)
T3-1	Blue Ridge	Replace	**200,000**	943
T4-1	Reader	New	**420,000**	760
T6-1	Eckley	Replace	**130,000**	929
T7-1	Blackstone	Replace	**130,000**	794
T10-1	Ralston	Replace	**130,000**	1,013
T11-1	Bear Creek	New	**310,000**	789
T13-1	Highland	Replace	**130,000**	946
T17-1	South	Replace	**130,000**	1,151
T18-1	Swim	Replace	**210,000**	726
T19-1	Spring	New	**60,000**	995
T20-1	University	New	**80,000**	828
T23-1	Upper Pasatiempo	New	**50,000**	888
T24-1	North Boulder Creek	Replace	**400,000**	1,060
T25-1	Blue	New	**140,000**	732

Table 7.3 Storage Reservoir Recommendations

Water Master Plan

San Lorenzo Valley Water District

Tank ID	Pressure Zone	New / Replace	Volume (MG)	Bottom Elevation (ft)
T26-1	Charlie	New	**80,000**	825
T28-1	El Solyo	Replace	**160,000**	636
T29-1	Bennett Spring	Replace	**130,000**	799
T31-1	McCloud	New	**40,000**	520
T33-1	Pine	Replace	**230,000**	637
T36-1	Kaski	New	**50,000**	1,257
T37-1	Madrone	New	**30,000**	1,316
Total			**3,240,000**	

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- **T10-1**: Replace the existing Ralston storage reservoirs (20,000 gallons) with a new 130,000 gallon storage reservoir. This improvement is intended to replace the existing storage reservoirs, which are low volume polyurethane tanks.
- **T11-1**: Construct a new 310,000 gallon storage reservoir at the existing Bear Creek Tank Site.
- **T13-1**: Replace the existing Highland storage reservoir (60,000 gallons) with a new 130,000 gallon storage reservoir. This improvement is intended to replace the existing reservoir, which is an aging wood tank.
- **T17-1**: Replace the existing South storage reservoirs (36,400 gallons) with a new 130,000 gallon storage reservoir. This improvement is intended to replace the existing storage reservoirs, which are low volume polyurethane tanks.
- **T18-1**: Replace the existing Swim storage reservoirs (19,600 gallons) with a new 210,000 gallon storage reservoir. This improvement is intended to replace the existing storage reservoirs, which are aging wood tanks.
- **T19-1**: Construct a new 60,000 gallon storage reservoir at the existing Spring Tank Site.
- **T20-1**: Construct a new 80,000 gallon storage reservoir at the existing University Tank Site.
- **T23-1**: Construct a new 50,000 gallon storage reservoir at the existing Upper Pasatiempo Tank Site.
- **T24-1**: Replace the existing Echo storage reservoirs (75,000 gallons) with a new 400,000 gallon storage reservoir. This improvement is intended to replace the existing storage reservoirs, which are aging wood tanks.
- **T25-1**: Construct a new 140,000 gallon storage reservoir at the existing Blue Tank Site.
- **T26-1**: Construct a new 80,000 gallon storage reservoir at the existing Charlie Tank Site.
- **T28-1**: Replace the existing Lower El Solyo storage reservoir (20,000 gallon) with a new 160,000 gallon storage reservoir. This improvement is intended to replace the existing storage reservoir, which is a low volume polyurethane tank.
- **T29-1**: Replace the existing Bennett Spring storage reservoir (5,688 gallons) with a new 130,000 gallon storage reservoir. This improvement is intended to replace the existing storage reservoir, which is a low volume polyurethane tank.
- **T31-1**: Construct a new 40,000 gallon storage reservoir at the existing McCloud Tank Site.
- **T33-1**: Replace the existing Pine storage reservoirs (18,500 gallons) with a new 230,000 gallon storage reservoir. This improvement is intended to replace the existing storage reservoirs, which are low volume polyurethane tanks.
- **T36-1**: Construct a new 50,000 gallon storage reservoir at the existing Kaski Tank Site.
- **T37-1**: Construct a new 30,000 gallon storage reservoir at the existing Madrone Tank Site.

7.7 PUMP STATION CAPACITY ANALYSIS

The District's existing pump station capacity is identified in this section. Additionally, this section identifies the existing and future pump station capacity requirements and compares it with the existing pump station facilities in each zone and makes recommendations for new pump station facilities.

7.7.1 Existing Pump Station Capacity Requirements

Existing pump station requirements were identified for each existing pump station and are summarized on **Table 7.4**. The table lists the existing pump station capacities and identifies the required capacity, based on the District criteria. The existing pump station capacity analysis indicates several of the District's current pump stations do not maintain adequate capacity to meet existing requirements.

7.7.2 Future Pump Station Capacity Requirements

Future pump station requirements were identified for each existing pump station and are also summarized on **Table 7.4**. This table identifies the future pump station capacity requirements based on the buildout demands, and indicates several of the District's current pump stations do not have adequate capacity to meet future requirements.

7.7.3 Recommended Pump Station Improvements

The proposed pump stations, summarized on **Table 7.5**, are described as follows:

- **PS1-2:** Construct one additional 100 gpm pump at the existing Riverside Grove Pump Station site. This improvement is intended to serve as a standby pump, which will increase the total capacity to 200 gpm and create a firm capacity of 100 gpm.

- **PS6-2:** Construct one additional 15 gpm pump at the existing Eckley Pump Station Site. This improvement is intended to serve as a standby pump, which will increase the total capacity to 30 gpm and create a firm capacity of 15 gpm.

- **PS13-1:** Upgrade the existing Fairview Pump Station with larger capacity pumps, PS-Z13. This pump station will have two new 110 gpm pumps for a total pump station capacity of 220 gpm and a firm capacity of 110 gpm.

- **PS18-1:** Upgrade the existing Redwood Park Pump Station with larger capacity pumps, PS-Z18. This pump station will have two new 120 gpm pumps for a total pump station capacity of 240 gpm and a firm capacity of 120 gpm.

- **PS20-1:** Upgrade the existing University Pump Station with larger capacity pumps, PS-Z20. This pump station will have two new 100 gpm pumps for a total pump station capacity of 200 gpm and a firm capacity of 100 gpm.

Table 7.4 Booster Pump Station Analysis
Water Master Plan
San Lorenzo Valley Water District

Pump Station / PRV Connection	Pressure Zone: Source Zone	Pressure Zone: Destination Zone	Pressure Zone: Supply Dependent Zones	Pump Station Capacity: Total Capacity (gpm)	Pump Station Capacity: Firm Capacity[1] (gpm)	Required Existing Capacity[2,3]: Destination Zone (gpm)	Required Existing Capacity[2,3]: Supply Dependent Zones (gpm)	Required Existing Capacity[2,3]: Total (gpm)	Required Existing Capacity[2,3]: Surplus/ Deficiency (gpm)	Required Buildout Capacity[2,3]: Total (gpm)	Required Buildout Capacity[2,3]: Surplus/ Deficiency (gpm)
North System											
Bear Creek Zone											
Bear Creek PS	Reader	Bear Creek	Ralston, Bear Creek Hydro	45	0	66	11	77	-77	80	-80
Bear Creek Hydro Zone											
West/Winner Hydroneumatic Pumps	Bear Creek	Bear Creek Hydro	-	20	10	0.2	0	0.2	10	0.2	10
Big Steel Zone											
Irwin PS	Brookdale	Big Steel	South, Blackstone, Reader, Highland, Nina, Nina Hydro, Huckleberry, North Boulder Creek, Blue Ridge, Mitchell, Riverside Grove, Bear Creek, Bear Creek Hydro, Ralston	800	400	267	1,181	1,448	-1,048	915	-515
Blackstone Zone											
Blackstone PS	Big Steel	Blackstone	-	60	30	15	0	15	15	16	14
Blue Ridge Zone											
Blue Ridge PS	Reader	Blue Ridge	-	84	42	42	0	42	0	44	-2
Eckley Zone											
Eckley PS	Lyon	Eckley	-	15	0	2	0	2	-2	3	-3
Highland Zone											
Fairview PS	Reader	Highland	Nina, Nina Hydro	50	0	36	64	100	-100	104	-104
Huckleberry Zone											
Huckleberry PS	Reader	Huckleberry	-	100	50	32	0	32	18	34	16
Mitchell Hydro Zone											
Mitchell Hydroneumatic Pumps	Reader	Mitchell	-	20	10	9	0	9	1	10	0
Nina Zone											
Nina PS	Highland	Nina	Nina Hydro	150	75	64	0	64	11	67	8
Nina Hydro Zone											
Nina Hydroneumatic Pumps	Nina	Nina Hydro	-	20	10	0.2	0	0.2	10	0	10

Table 7.4 Booster Pump Station Analysis
Water Master Plan
San Lorenzo Valley Water District

Pump Station / PRV Connection	Pressure Zone: Source Zone	Pressure Zone: Destination Zone	Pressure Zone: Supply Dependent Zones	Pump Station Capacity: Total Capacity (gpm)	Pump Station Capacity: Firm Capacity[1] (gpm)	Required Existing Capacity[2,3]: Destination Zone (gpm)	Required Existing Capacity[2,3]: Supply Dependent Zones (gpm)	Required Existing Capacity[2,3]: Total (gpm)	Required Existing Capacity[2,3]: Surplus/ Deficiency (gpm)	Required Buildout Capacity[2,3]: Total (gpm)	Required Buildout Capacity[2,3]: Surplus/ Deficiency (gpm)
North Boulder Creek Zone											
Echo PS	Reader	North Boulder Creek	-	300	150	82	0	82	68	86	65
Ralston Zone											
Ralston PS	Bear Creek	Ralston	-	80	30	11	0	11	20	11	19
Reader Zone[4]											
Firehouse PS	Big Steel	Reader	Highland, Nina, Nina Hydro, Huckleberry, North Boulder Creek, Blue Ridge, Mitchell, Riverside Grove, Bear Creek, Bear Creek Hydro, Ralston	1,000	500	753	387	1,141	-641	1,209	-709
Riverside Grove Zone											
Riverside Grove PS	Reader	Riverside Grove	-	100	0	45	0	45	-45	46	-46
South Zone											
South Reservoir PS	Big Steel	South	-	60	30	25	0	25	5	26	4
Spring Zone											
Spring PS	Swim	Spring	-	90	45	13	0	13	32	14	31
Swim Zone											
Redwood Park PS	Brookdale	Swim	Spring	180	90	99	13	112	-22	118	-28
University Zone											
University PS	Quail	University	-	170	85	95	0	95	-10	98	-13
Lompico System											
Kaski Zone											
Lompico PS (Intertie 5)	Quail	Kaski	Madrone, Lewis	140	70	33	148	182	-112	186	-116
Madrone Zone											
Madrone PS	Kaski	Madrone	Lewis (PRV)	300	150	30	118	148	2	151	-1
Manana Woods System											
Charlie Zone											
Blue PS	Blue	Charlie	Charlie Hydro	72	36	14	1	16	20	16	20

Table 7.4 Booster Pump Station Analysis
Water Master Plan
San Lorenzo Valley Water District

Pump Station / PRV Connection	Pressure Zone			Pump Station Capacity		Pump Station Capacity Analysis					
						Required Existing Capacity [2,3]				Required Buildout Capacity [2,3]	
	Source Zone	Destination Zone	Supply Dependent Zones	Total Capacity (gpm)	Firm Capacity[1] (gpm)	Destination Zone (gpm)	Supply Dependent Zones (gpm)	Total (gpm)	Surplus/ Deficiency (gpm)	Total (gpm)	Surplus/ Deficiency (gpm)
Charlie Hydro Zone											
Charlie Hydroneumatic Pumps	Charlie	Charlie Hydro	-	60	30	1	0	1	29	1	29
Upper Pasatiempo Zone											
Lower Pasatiempo PS	Probation	Upper Pasatiempo	Blue (PRV), Charlie, Charlie Hydro	150	75	98	102	200	-125	204	-129
Felton System											
El Solyo Zone											
Lower El Solyo PS	McCloud	El Solyo	-	60	30	129	0	129	-99	134	-104
Pine Zone											
Upper Hillcrest PS	McCloud	Pine		120	60	180	0	180	-120	187	-127

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Notes:

1. Firm capacity for each pressure zone is defined as the sum of the total capacity of each pump station pumping into the pressure zone, with each pump station operating without their largest unit.
2. Pump stations to supply MDD of destination zone and all other supply dependent zones over 8 hours.
3. Hydroneumatic pump stations to supply PHD of hydroneumatic zone (MDD x 1.5).
4. It should be noted that a portion of Reader Zone demands are supplied via a PRV from Lyon Zone which mitigates this existing deficiency. The planned construction of a new transmission main and PRV from Lyon zone to Reader zone will result in the Firehouse PS either being abandoned or used for emergency supply only, with Reader zone supplied solely by the new PRV.

Table 7.5 Pump Stations Recommendations

Water Master Plan

San Lorenzo Valley Water District

Improvement ID	Pump Station	Source Pressure Zone	Destination Pressure Zone	Total Capacity (gpm)	Firm Capacity (gpm)	Number of Pumps	Pump Number	Pump Status	Design Capacity (gpm)	Recommendations
PS1-2	**Riverside Grove PS**	Reader	Riverside Grove	200	100	2	2	Standby	100	Construct additional pump at Riverside Grove Pump Station for reliability
PS6-2	**Eckley PS**	Lyon	Eckley	30	15	2	2	Standby	15	Construct additional pump at Eckley Pump Station for reliability
PS13-1	**Fairview PS**	Reader	Highland	220	110	2	1	Duty	110	Upgrade the existing Fairview Pump Station with larger capacity pumps
							2	Standby	110	
PS18-1	**Redwood Park PS**	Brookdale	Swim	240	120	2	1	Duty	120	Upgrade the existing Redwood Park Pump Station with larger capacity pumps
							2	Standby	120	
PS20-1	**University PS**	Quail	University	200	100	2	1	Duty	100	Upgrade the existing University Pump Station with larger capacity pumps
							2	Standby	100	
PS23-1	**Lower Pasatiempo PS**	Probation	Upper Pasatiempo	420	210	2	1	Duty	220	Upgrade the existing Lower Pasatiempo Pump Station with larger capacity pumps
							2	Standby	220	
PS28-1	**Lower El Solyo PS**	McCloud	El Solyo	300	150	2	1	Duty	150	Upgrade the existing Lower El Solyo Pump Station with larger capacity pumps
							2	Standby	150	
PS33-1	**Upper Hillcrest PS**	McCloud	Pine	400	200	2	1	Duty	200	Upgrade the existing Upper Hillcrest Pump Station with larger capacity pumps
							2	Standby	200	
PS36-1	**Lompico PS (Intertie 5)**	Quail	Kaski	400	200	2	1	Duty	200	Upgrade the existing Lompico Pump Station with larger capacity pumps
							2	Standby	200	

- **PS23-1:** Upgrade the existing Lower Pasatiempo Pump Station with larger capacity pumps, PS-Z23. This pump station will have two new 210 gpm pumps for a total pump station capacity of 420 gpm and a firm capacity of 210 gpm.

- **PS28-1:** Upgrade the existing Lower El Solyo Pump Station with larger capacity pumps, PS-Z28. This pump station will have two new 150 gpm pumps for a total pump station capacity of 300 gpm and a firm capacity of 150 gpm.

- **PS33-1:** Upgrade the existing Upper Hillcrest Pump Station with larger capacity pumps, PS-Z33. This pump station will have two new 200 gpm pumps for a total pump station capacity of 400 gpm and a firm capacity of 200 gpm.

- **PS36-1:** Upgrade the existing Lompico Pump Station (Intertie 5) with larger capacity pumps, PS-Z36. This pump station will have two new 200 gpm pumps for a total pump station capacity of 400 gpm and a firm capacity of 200 gpm.

The deficiencies identified for the Bear Creek, Irwin, and Firehouse pump stations are to be mitigated by the construction of new PRVs that are described in the Valve Improvement section.

7.8 RECOMMENDED VALVE IMPROVEMENTS

As mentioned in previous sections, the District has identified several existing pump station facilities that are proposed to be abandon, and are intended to be replaced with new valve facilities. This section identifies the proposed abandonments, and summarizes recommendations for new valve facilities. The proposed valves, summarized on **Table 7.6**, are described as follows:

- **PRV4-1:** Install a new pressure reducing valve from Lyon Zone near the intersection of Highway 9 and Lorenzo Street. This improvement is intended to provide supply to Reader Zone and dependent zones from Lyon Zone instead of Big Steel Zone. The Firehouse pump station can be abandoned but is recommended to stay online if condition permits to be used as an emergency supply backup for the North System. This valve improvement will also mitigate a portion of the deficiency at the Irwin Pump Station.

- **PRV7-1:** Abandon existing Blackstone pump station and install a new pressure reducing valve from Lyon Zone near the intersection of Big Basin Way and Blackstone Drive. This improvement is intended to provide energy savings by supplying Blackstone Zone through PRV instead of through pumping.

- **PRV8-1:** Install a new pressure reducing valve from Lyon Zone near the existing Big Steel tank site. This improvement is intended to provide supply to Big Steel Zone and dependent zones from Lyon Zone instead of Brookdale Zone. This valve improvement will mitigate a portion of the supply deficiency within Brookdale and Quail Zone.

- **VLV11-1**: Abandon existing Bear Creek pump station and install a new check valve from Reader Zone near the intersection of Bear Creek Road and Deerwood Drive. This

Table 7.6 Valve Recommendations

Water Master Plan

San Lorenzo Valley Water District

PRV ID	Location	Pressure Zone		Recommendations
		Upstream	Downstream	
PRV4-1	Hwy 9 & Lorenzo St	Lyon	Reader	Install new PRV from Lyon Zone.
PRV7-1	Big Basin Wy & Blackstone Dr	Lyon	Blackstone	Abandon Blackstone Pump Station and install new PRV from Lyon Zone.
PRV8-1	Existing Big Steel Tank Site	Lyon	Big Steel	Install new PRV from Lyon Zone.
VLV11-1	Bear Creek Rd & Deerwood Dr	Reader	Bear Creek	Abandon Bear Creek Pump Station and supply zone through check valve from Reader Zone.

- improvement is intended to provide energy savings by supplying Bear Creek Zone through a check valve instead of through pumping.

7.9 RECOMMENDED PIPELINE IMPROVEMENTS

The buildout of the County's General Plan includes development of vacant land within the extents of the existing domestic water distribution system. Distribution pipelines are recommended to serve future growth as well as increase the hydraulic reliability of the domestic water distribution system. Each pipeline improvement is assigned a uniquely coded identifier, which is intended to aid in defining the location of the improvement for mapping purposes. These identifiers reflect the pressure zone and sequence in the improvement schedule. The pipeline improvements are summarized on **Table 7.7** and shown graphically in **Figure 7.7** described in detail on the following pages.

7.9.1 Pipeline Improvements to Fix Existing Deficiencies

The hydraulic model was also used to identify areas in the District's existing domestic water distribution system that experience head loss under maximum day demand conditions which exceed the District's maximum desired head loss of 10 ft per thousand feet. The areas of existing pipeline deficiencies are shown graphically on **Figure 7.6**. Areas of high head loss may be more susceptible to pipeline breaks and ruptures. Improvements to mitigate existing pipeline deficiencies are discussed below with the corresponding coded identifier, which are consistent with the capital improvements chapter:

7.9.1.1 Blue Ridge Pressure Zone

This section documents pipeline improvements within the Blue Ridge Pressure Zone.

- **P3-1**: Replace approximately 320 feet of existing 2-inch main with new 8-in main along Grove Drive from Blue Ridge Pump Station to Blue Ridge Drive.

7.9.1.2 Reader Pressure Zone

This section documents pipeline improvements within the Reader Pressure Zone.

- **P4-2**: Replace approximately 7,920 feet of existing 8-inch water main with new 10-inch water main along Highway 9 from approximately 700 feet southeast of Douglas Ave to approximately 250 feet south of Big Basin Way.

- **P4-4**: Replace approximately 1,300 feet of existing 1.5-inch main with new 8-inch main along Band Road from River Drive to approximately 450 feet west of Baywood Road.

- **P4-5**: Replace approximately 1,400 feet of existing 1.25-inch, 1.5-inch, and 2-inch main with new 8-inch main along Scenic Drive and Blue Ridge Drive from Hoot Owl Way to the existing Blue Ridge Pump Station.

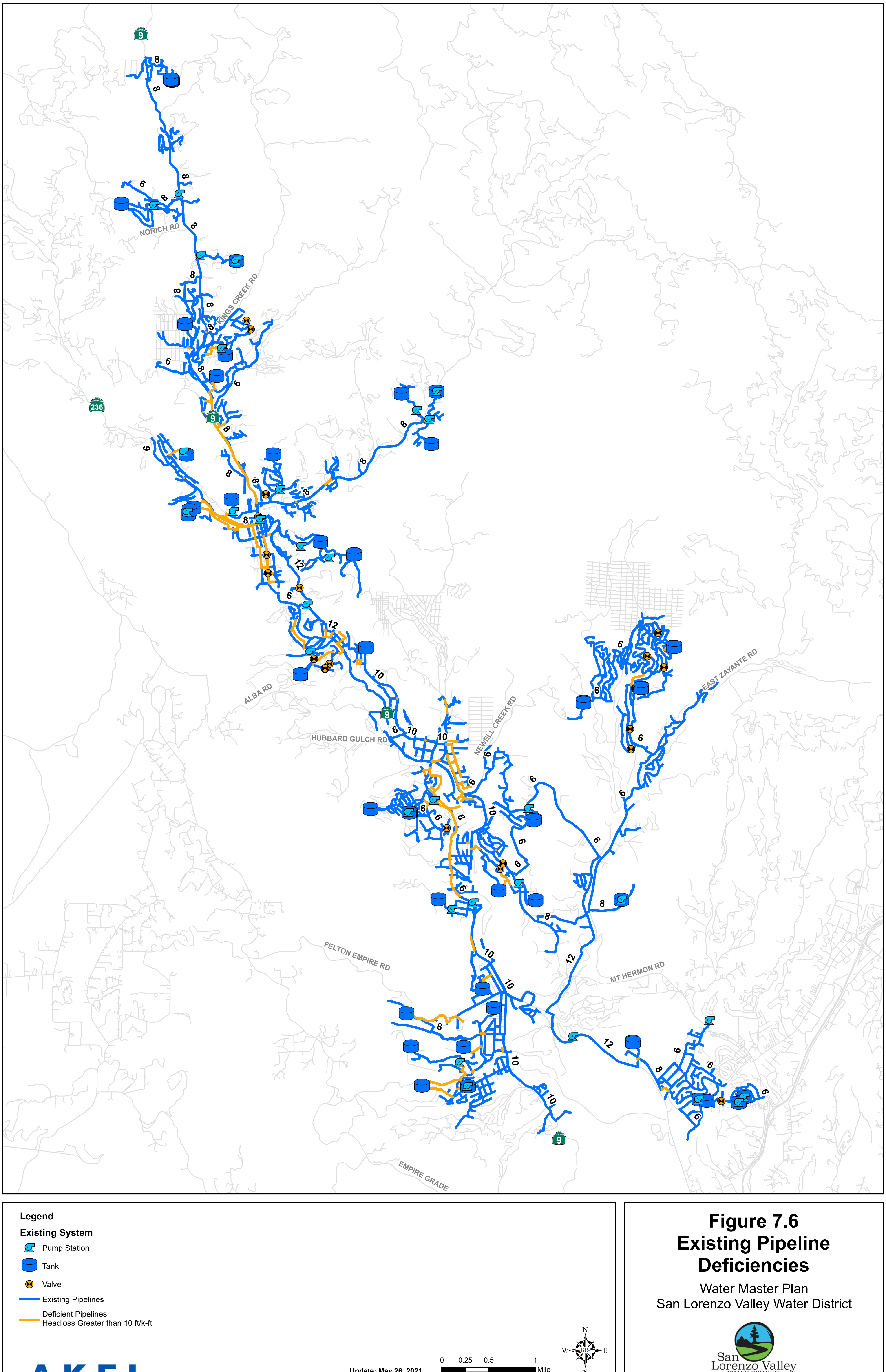

Figure 7.6
Existing Pipeline Deficiencies

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley
WATER DISTRICT

AKEL
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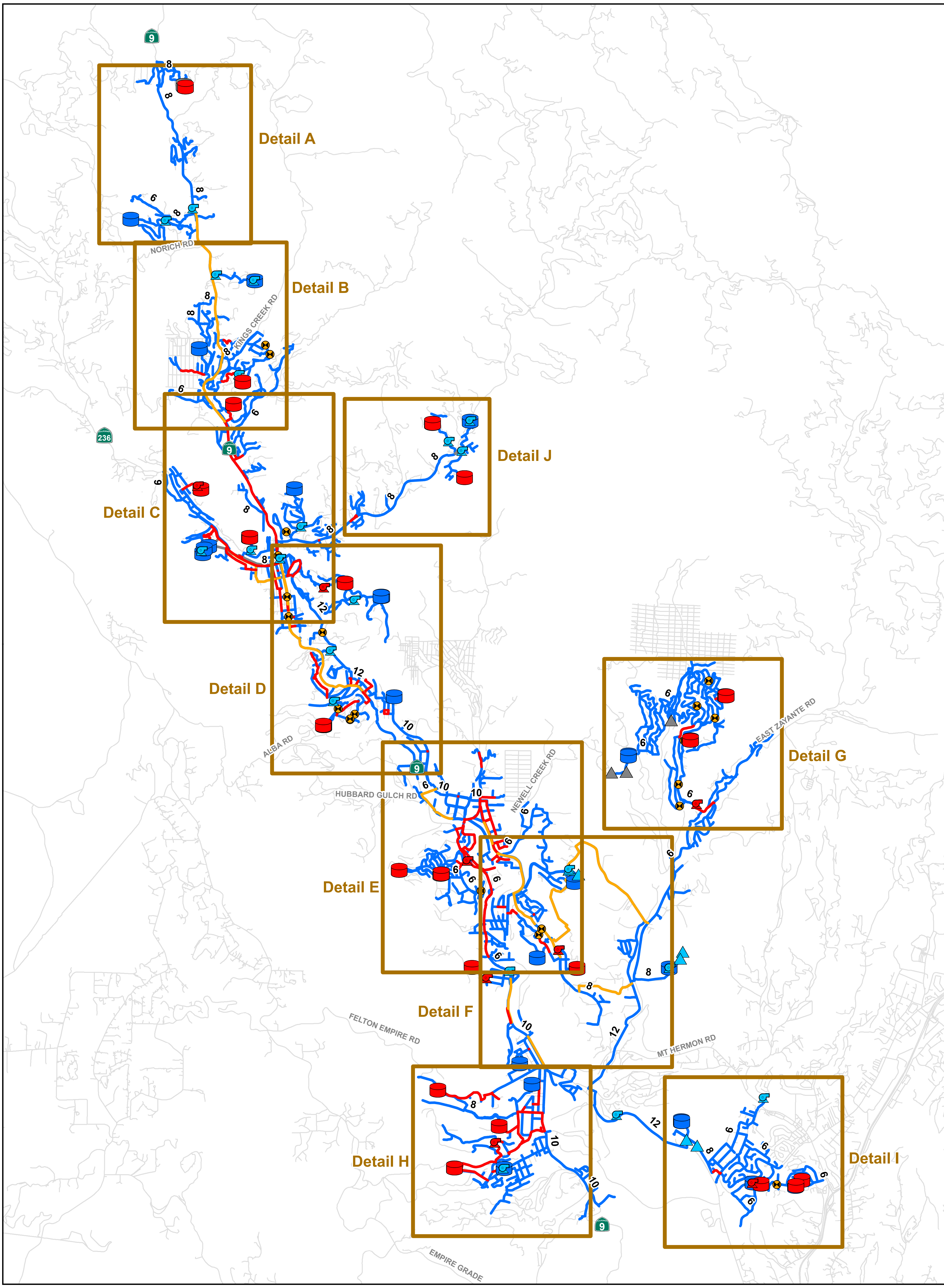

Legend

Recommended Improvements	Existing System	
Pump Station	Pump Station	Existing Pipelines
Tank	Wells	Abandoned Pipelines
CIP Improvements	Wells (Inactive)	
FF Reliability Improvements	Existing Tank	
	Abandoned Tank	
	Valve	

0 0.25 0.5 1 Mile

Update: September 10, 2021

Figure 7.7
Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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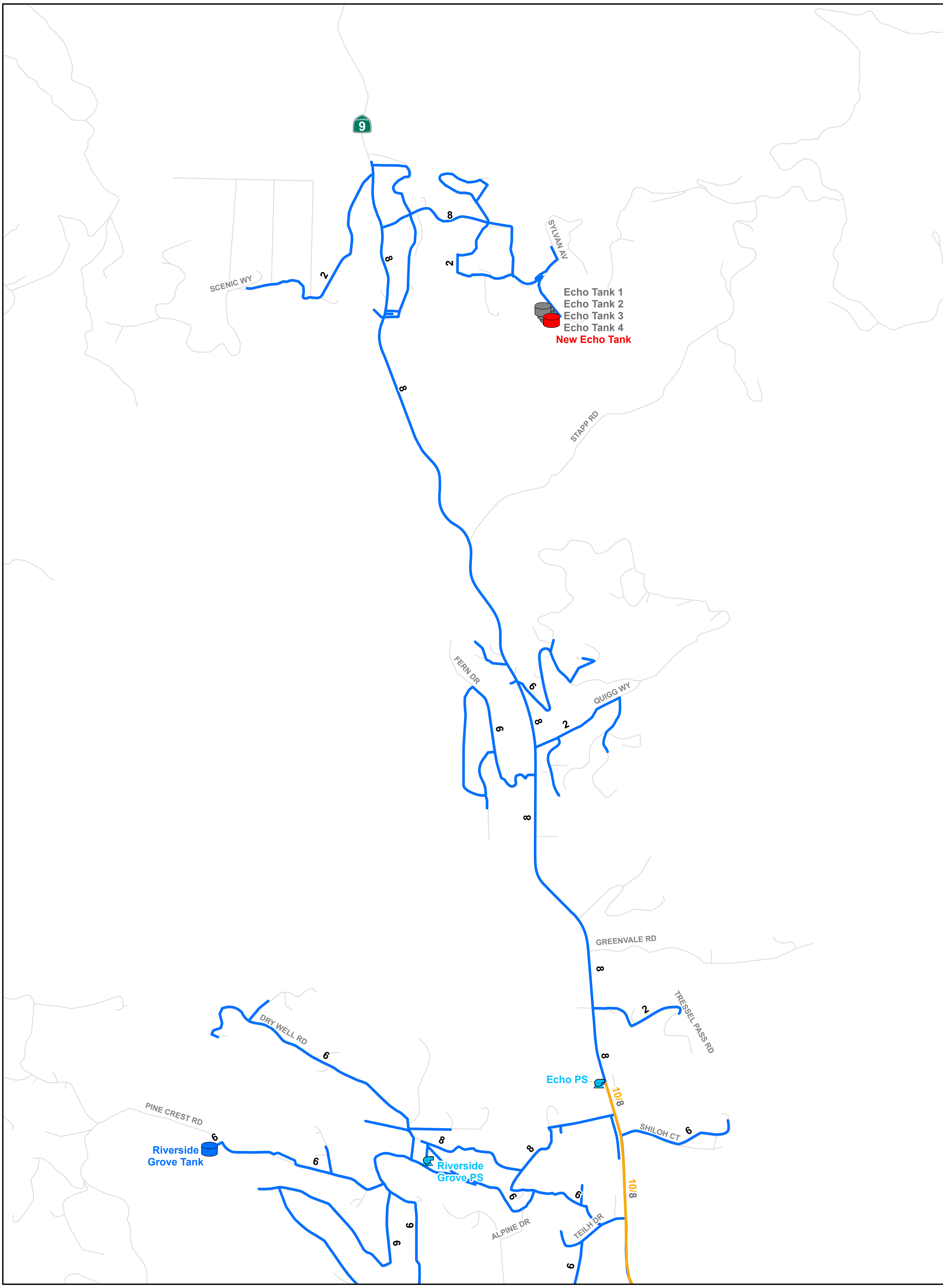
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-7_RecImp_091021.mxd



Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Existing Tank
CIP Improvements	Abandoned Tank
FF Reliability Improvements	Valve
	Existing Pipelines

Update: July 12, 2021

0 250 500 1,000 Feet

N E S W

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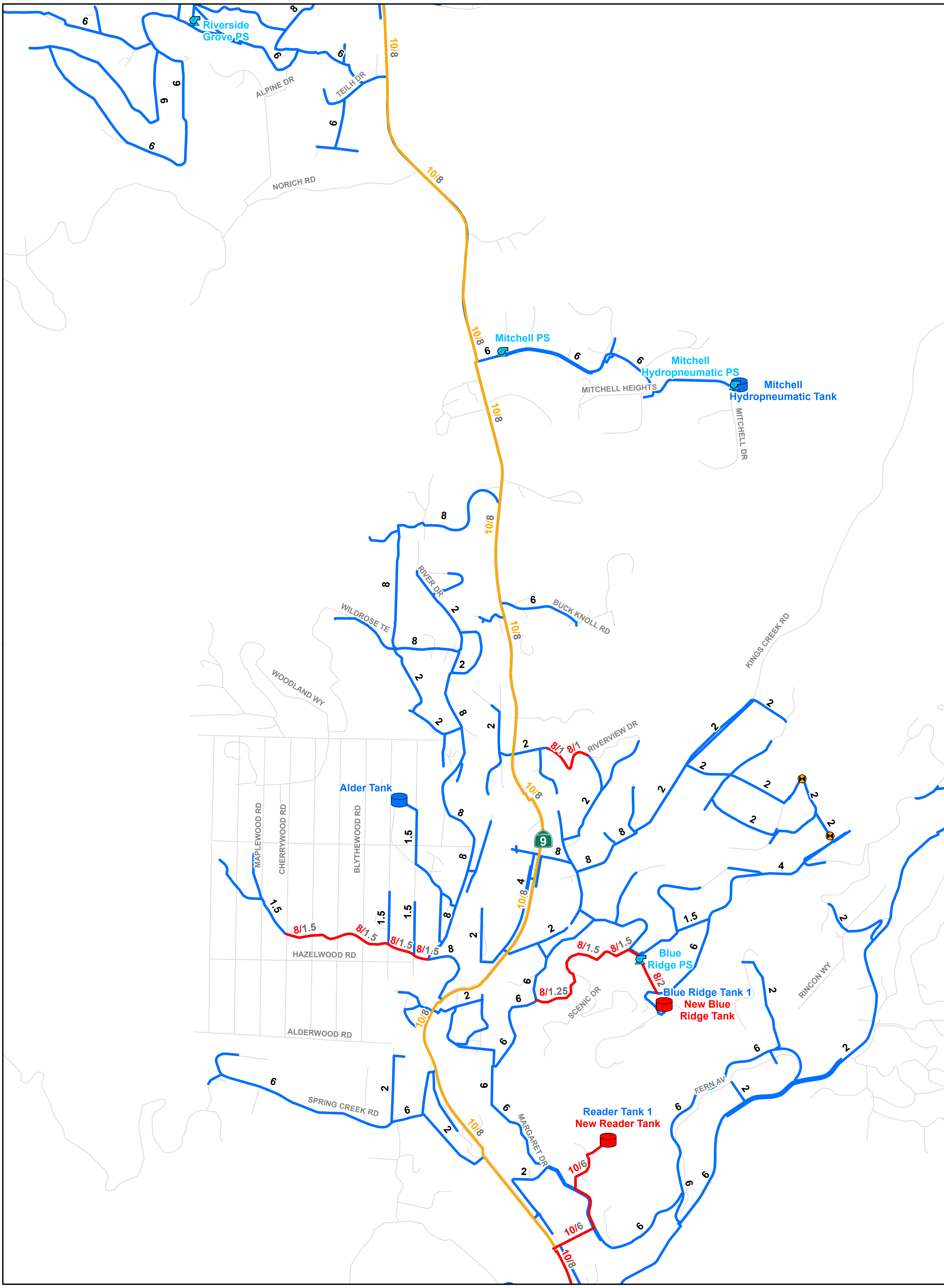
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-7_DetailA_RecImp_071221.mxd

Detail A Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements
- Pump Station
- Tank
- CIP Improvements
- FF Reliability Improvements

Existing System
- Pump Station
- Tank
- Valve
- Existing Pipelines

N W E S

0 250 500 1,000 Feet

Update: July 12, 2021

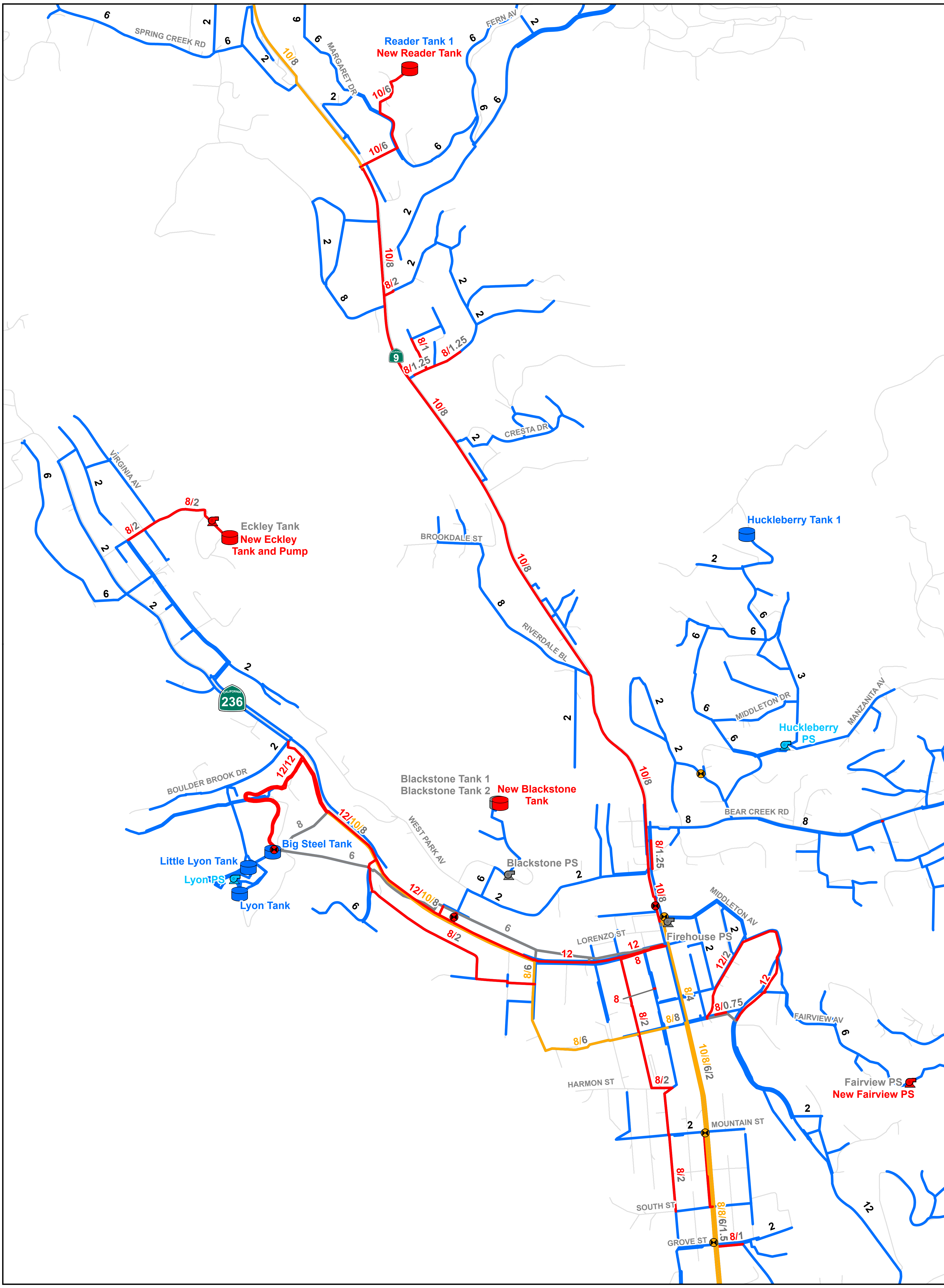
AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-7_DetailB_RecImp_071221.mxd

Detail B Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

- slvwd_recommendations_improvements_bigsteelprv_071921

Recommended Improvements

- Pump Station
- Tank
- PRV
- CIP Improvements
- FF Reliability Improvements

Existing System

- Pump Station
- Abandoned Pump Station
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines
- Abandoned Pipelines

0 250 500 1,000 Feet

N W E S

Update: July 12, 2021

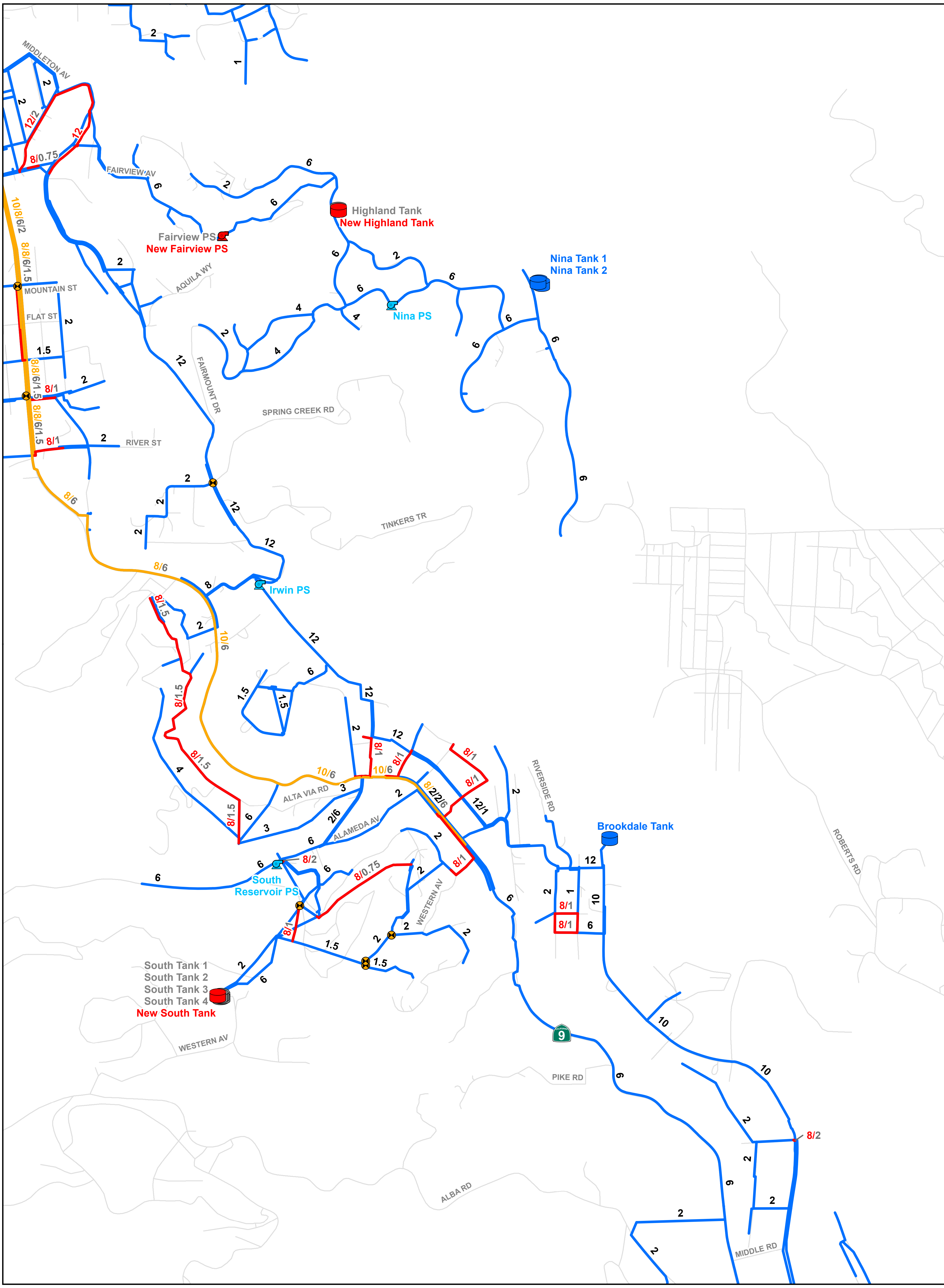
AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-7_DetailC_RecImp_071221.mxd

Detail C Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements

- Pump Station
- Tank
- CIP Improvements
- FF Reliability Improvements

Existing System

- Pump Station
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines

Update: July 12, 2021

0 250 500 1,000 Feet

N W E S

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-7_DetailD_RecImp_071221.mxd

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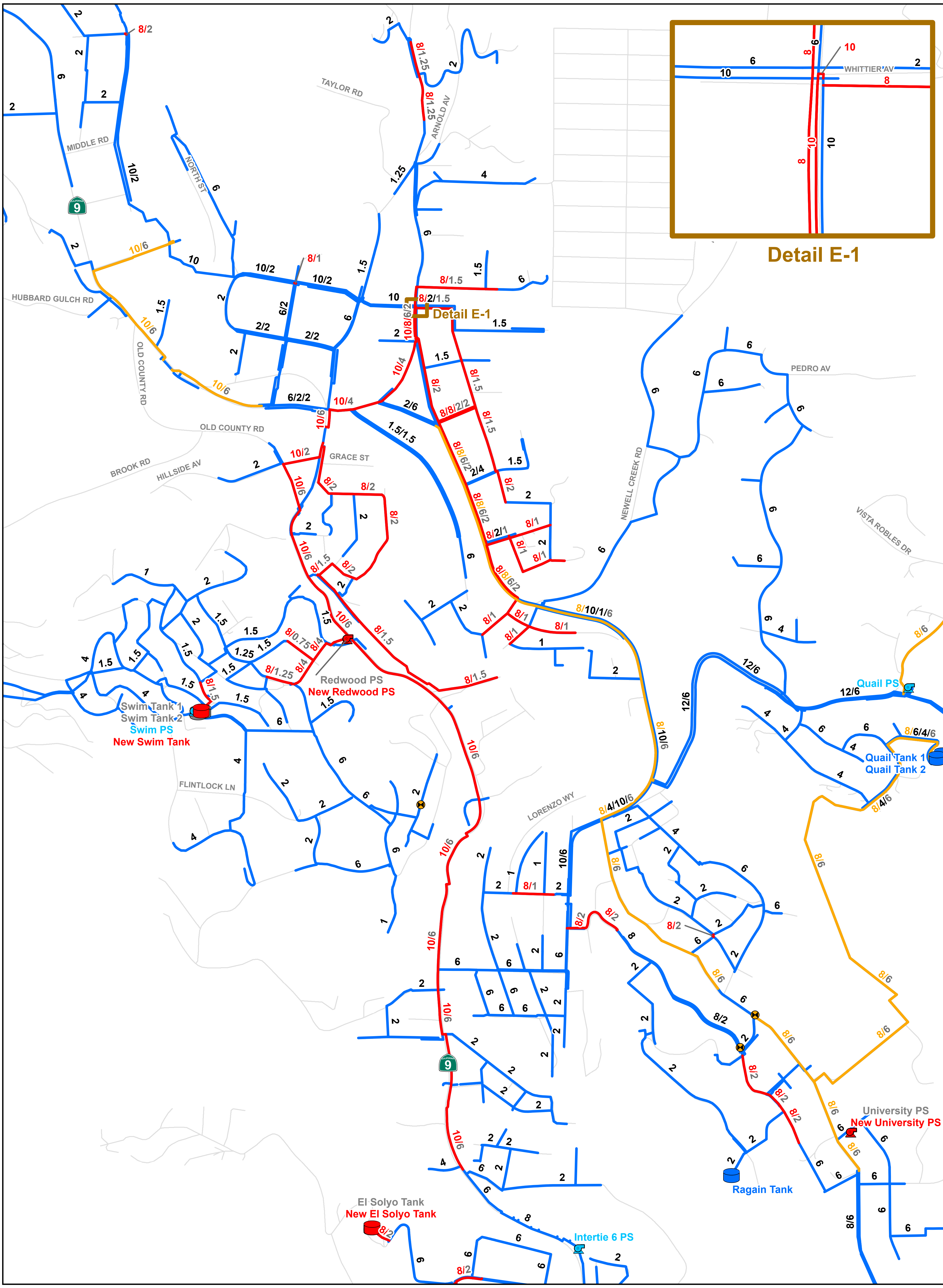
Detail D Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements
- Pump Station
- Tank
- CIP Improvements
- FF Reliability Improvements

Existing System
- Pump Station
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines

Update: July 12, 2021

0 250 500 1,000 Feet

N W E S

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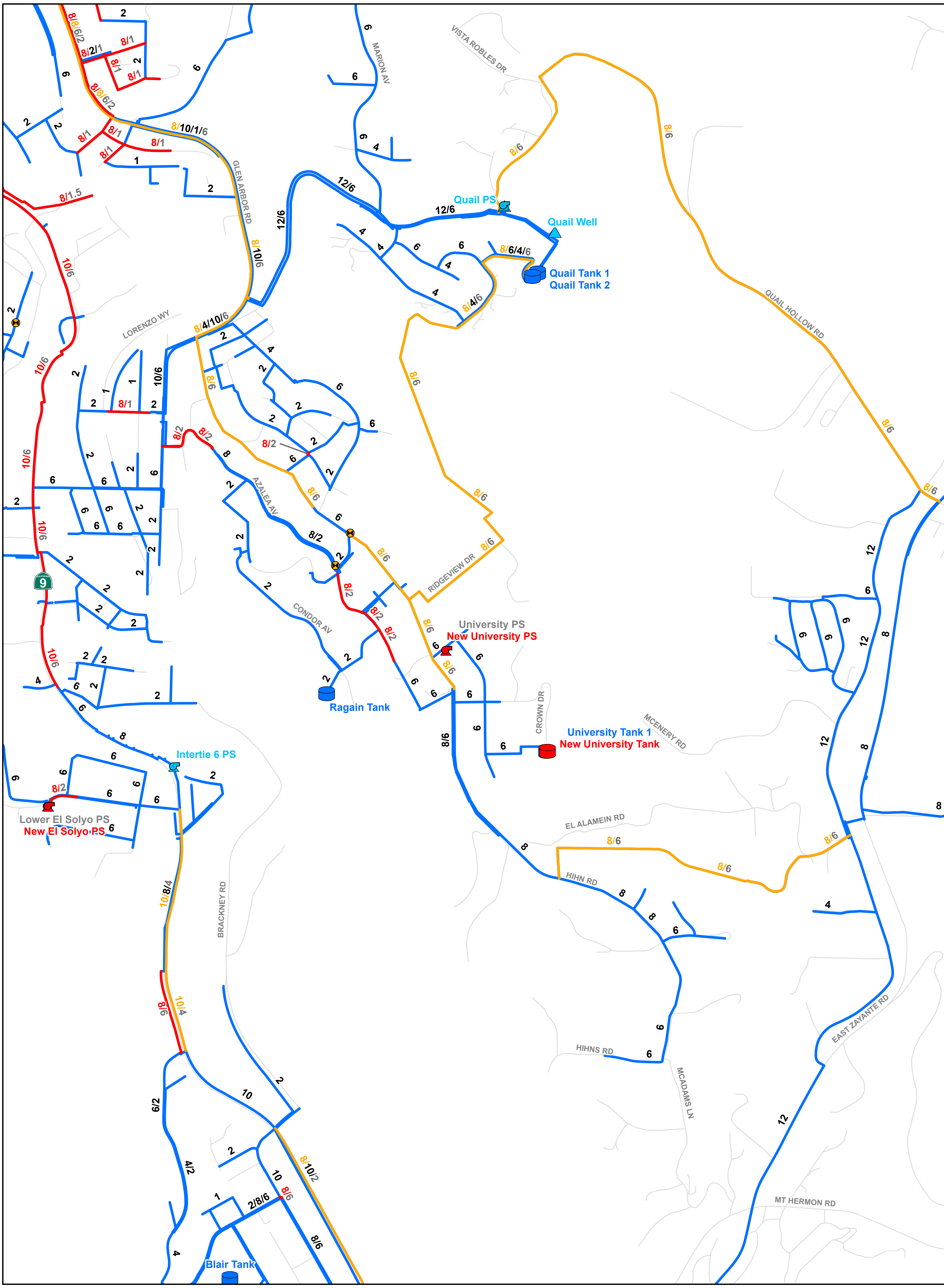
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-7_DetailE_RecImp_071221.mxd

Detail E Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements
- Pump Station
- Tank
- CIP Improvements
- FF Reliability Improvements

Existing System
- Pump Station
- Wells
- Wells (Inactive)
- Tank
- Valve
- Existing Pipelines

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Update: July 12, 2021

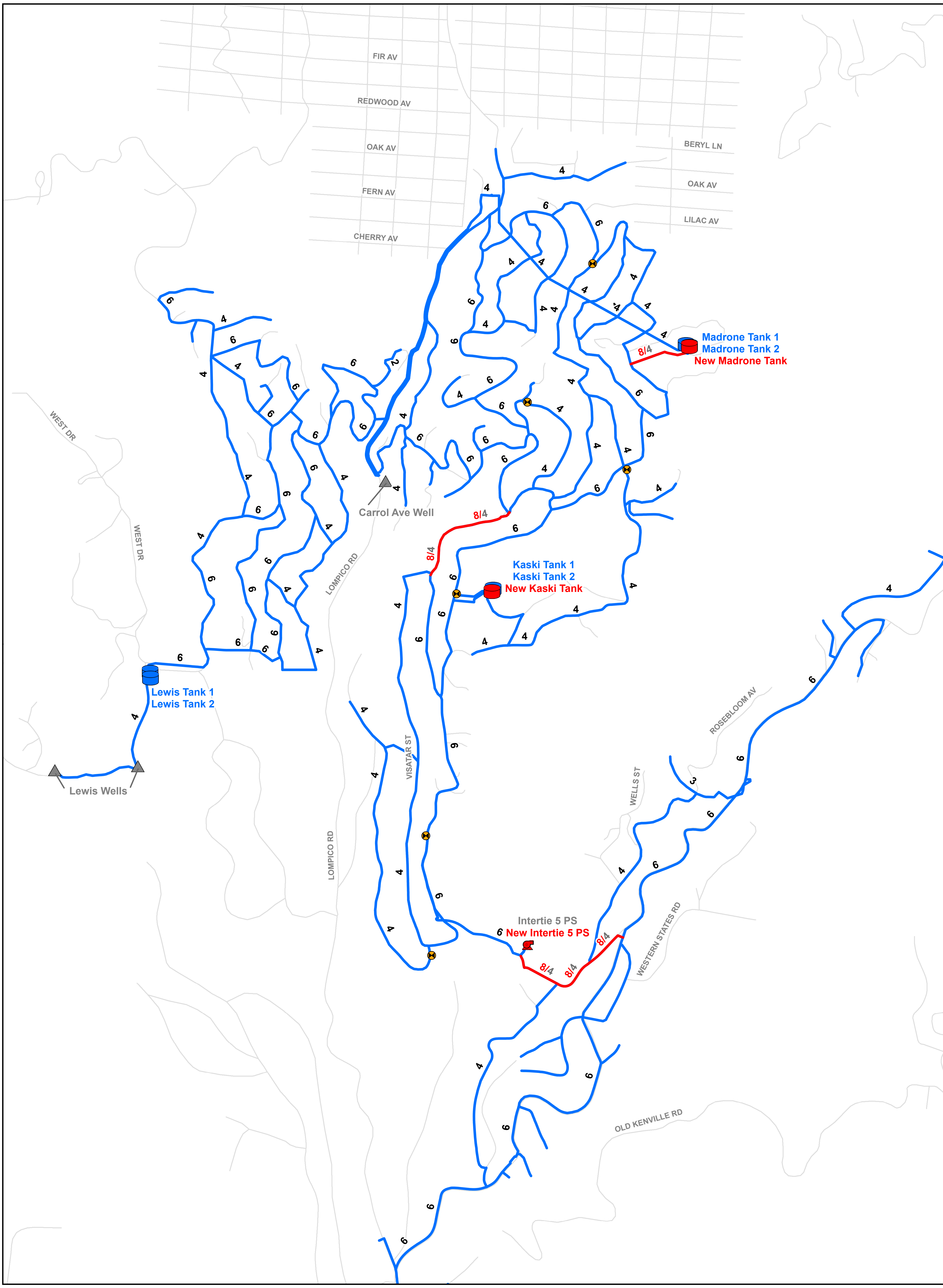
0 250 500 1,000 Feet

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-7_DetailF_RecImp_071321.mxd

Detail F Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements
- Pump Station
- Tank
- CIP Improvements
- FF Reliability Improvements

Existing System
- Pump Station
- Wells
- Wells (Inactive)
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines

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Update: September 10, 2021

0 250 500 1,000 Feet

N E S W

Detail G Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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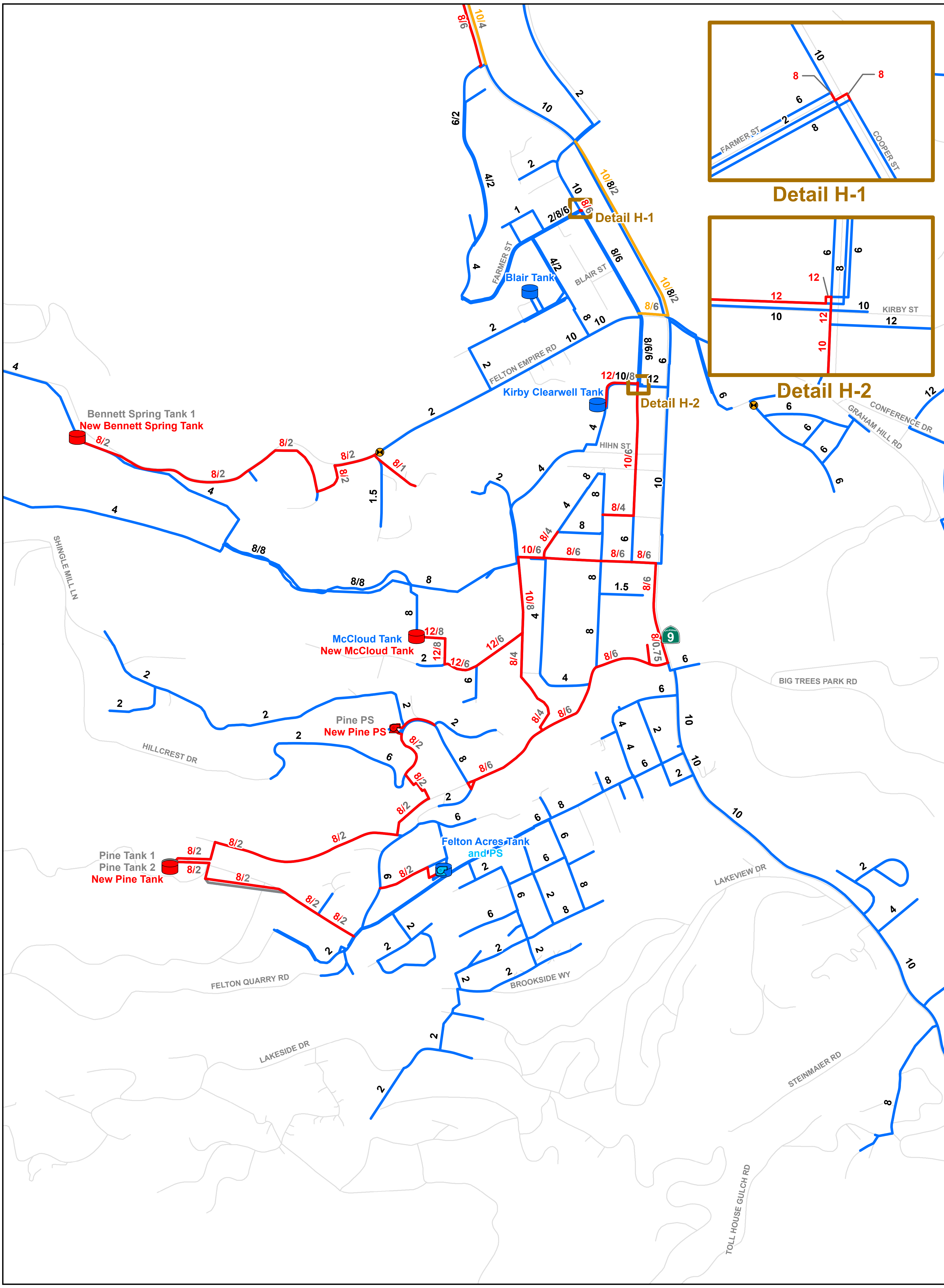

Legend

Recommended Improvements
- Pump Station
- Tank
- CIP Improvements
- FF Reliability Improvements

Existing System
- Pump Station
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines
- Abandoned Pipelines

0 250 500 1,000 Feet

Update: September 10, 2021

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-7_DetailH_RecImp_091021.mxd

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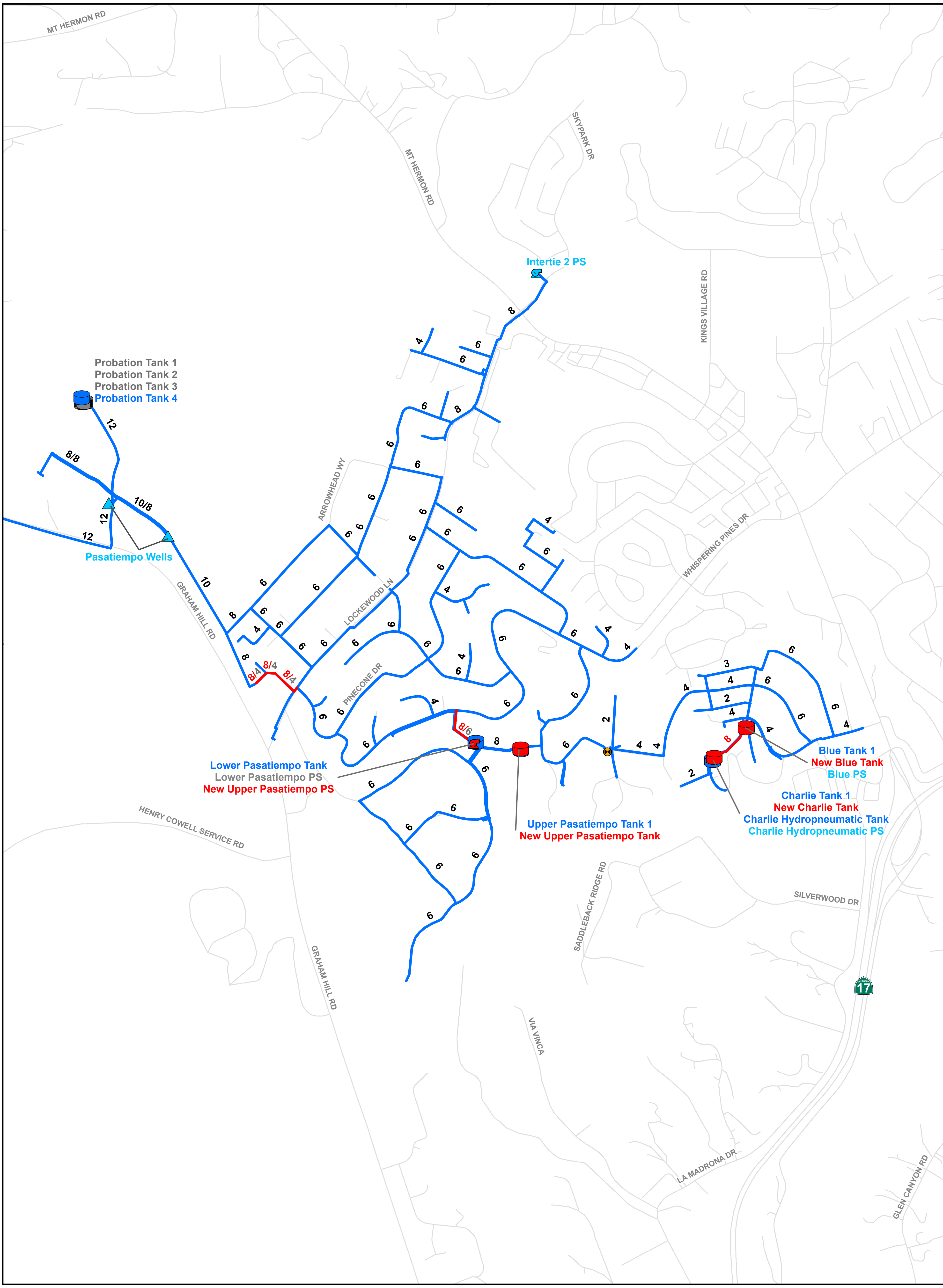
Detail H Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District



Legend

Recommended Improvements
- Pump Station
- Tank
- CIP Improvements
- FF Reliability Improvements

Existing System
- Pump Station
- Existing Tank
- Abandoned Tank
- Wells
- Wells (Inactive)
- Valve
- Existing Pipelines

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Update: July 13, 2021

0 250 500 1,000 Feet

N W E S

Detail I Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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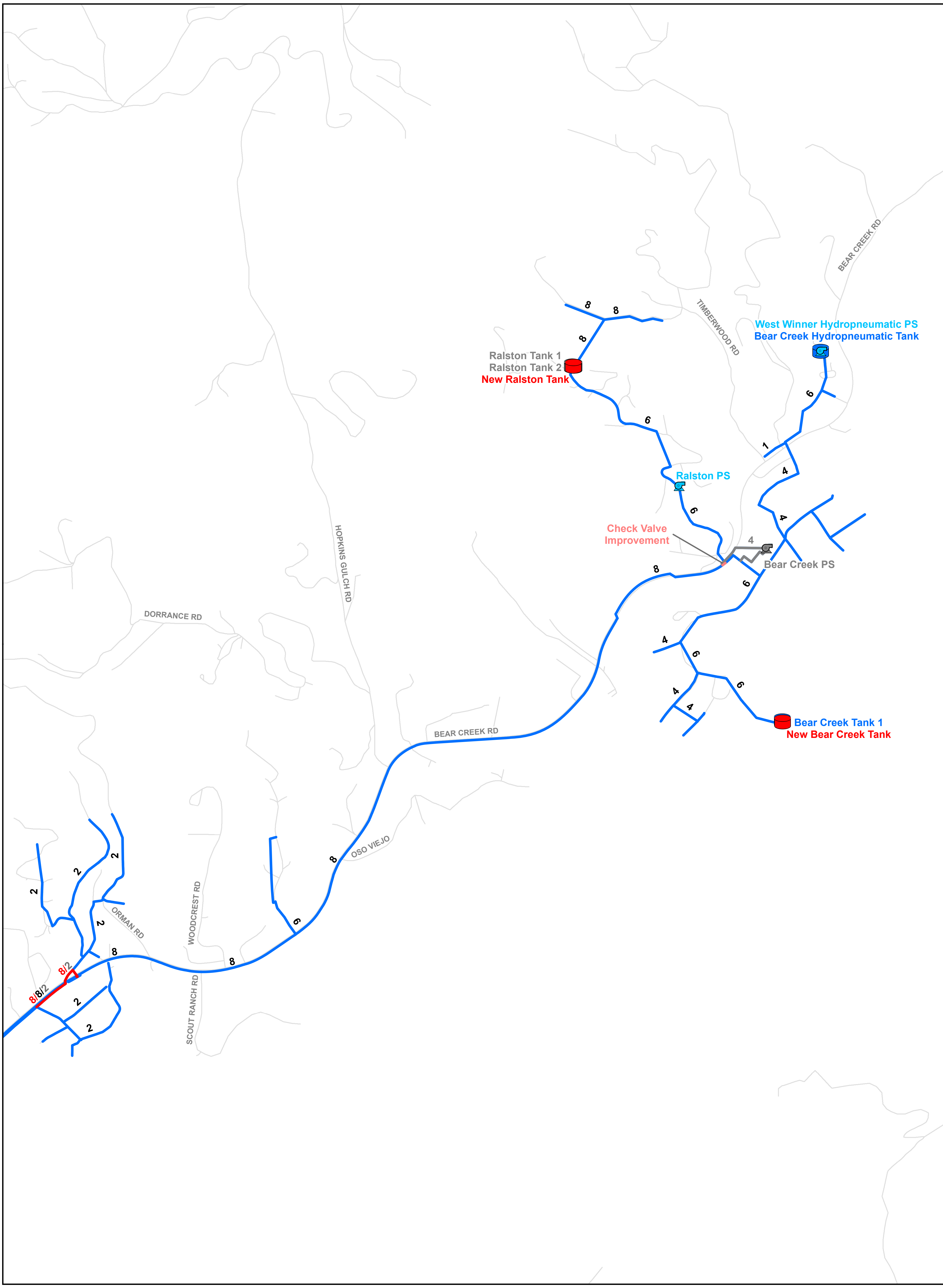

Legend

Recommended Improvements
- Pump Station
- Tank
- CIP Improvements
- FF Reliability Improvements
- Check Valve Improvement

Existing System
- Pump Station
- Abandoned Pump Station
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines
- Abandoned Pipelines

0 250 500 1,000 Feet

Update: July 12, 2021

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File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig7-7_DetailJ_RecImp_071221.mxd

Detail J Recommended Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Table 7.7 Schedule of Improvements

Water Master Plan

San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Improvement Details			
Pipeline Improvements					Existing Diameter (in)	New/ Replace	Diameter (in)	Length (ft)
P3-1	Blue Ridge	Existing Deficiency	Grove Dr	From Blue Ridge PS to Blue Ridge Dr	2	Replace	8	320
P4-1	Reader	Fire Flow Reliability	Hwy 9	From Echo PS to approx. 700' se/o Douglas Ave	4 / 6 / 8	Replace	10	13,100
P4-2	Reader	Existing Deficiency / Fire Flow Reliability	Hwy 9	From approx. 700' se/o Douglas Ave to approx. 250' s/o Big Basin Wy	8	Replace	10	7,920
P4-3	Reader	Capacity	Riverview Dr	From Old Country Hwy to approx. 520' e/o Old Country Hwy	1	Replace	8	520
P4-4	Reader	Existing Deficiency	Band Rd	From River Dr to approx. 450' w/o Baywood Rd	1.5	Replace	8	1,300
P4-5	Reader	Existing Deficiency	Scenic Dr / Blue Ridge Dr	From Hoot Owl Wy to Blue Ridge PS	1.25 / 1.5 / 2	Replace	8	1,400
P4-6	Reader	Existing Deficiency / Fire Flow Reliability	Dolores Dr / Douglas Ave	From Reader Reservoir to Hwy 9	6	Replace	10	1,410
P4-7	Reader	Capacity	Brookside Dr	From Hwy 9 to approx 110' e/o Hwy 9	2	Replace	8	110
P4-8	Reader	Existing Deficiency	Orchard Dr	From approx. 330' n/o Juanita Rd to Juanita Rd	1	Replace	8	330
P4-9	Reader	Existing Deficiency	Juanita Rd	From approx. 150' w/o Orchard Dr to approx. 250' e/o Apple Ln	1.25 / 2	Replace	8	500
P4-10	Reader	Existing Deficiency	Hiawatha Rd	From Keller Dr to approx. 400' ne/o Keller Dr	1 / 1.25 / 2	Replace	8	510
P4-11	Reader	Capacity	Hwy 9	From approx. 150' s/o Bear Creek Rd to Park Ave	1.25	Replace	8	270
P4-12	Reader	Fire Flow Reliability	Central Ave	From approx. 250' s/o Big Basin Wy to River St	1.5 / 2 / 4	Replace	8	3,200
P4-13	Reader	Existing Deficiency	Grove St	From Central Ave to Lorenzo Ave	1	Replace	8	250
P4-14	Reader	Existing Deficiency	River St	From Central Ave to approx. 250' w/o Lorenzo Ave	1	Replace	8	320
P4-15	Reader	Existing Deficiency	ROW	From Irene Ave to approx. 10' w/o Irene Ave	1.5	Replace	8	10
P4-16	Reader	Existing Deficiency	ROW	From Lomond St to approx. 110' e/o Lomond St	0.75	Replace	8	110
P5-1	Lyon	Existing Deficiency	Ridge Dr	From Park Ave to Eckley PS	2	Replace	8	970
P5-2	Lyon	Capacity	Redwood Dr / Madrone Dr	From Big Steel Reservoir site to Big Basin Wy	-	New	12	1,570
P5-3	Lyon	Capacity	Big Basin Wy	From Boulder Brook Dr to Central Ave	-	New	12	4,570
P5-4	Lyon	Capacity	St Francis Dr	From Big Basin Wy to approx. 120' s/o Big Basin Wy	-	New	8	120
P5-5	Lyon	Existing Deficiency	St Francis Dr / Davidson Wy / Sunshine Ln	From approx. 100' s/o Big Basin Wy to Redwood Ave	2 / 6	Replace	8	2,200
P5-6	Lyon	Capacity	ROW	From Big Basin Wy to approx. 100' n/o Big Basin Wy	-	New	8	100
P5-7	Lyon	Capacity	ROW	From Big Basin Wy to approx. 110' n/o Big Basin Wy	-	New	8	110
P5-8	Lyon	Existing Deficiency	Big Basin Wy / Oak St / Boulder St	From Hwy 9 to South St	2	Replace	8	3,120
P5-9	Lyon	Existing Deficiency	South St	From Central Ave to approx. 30' w/o Central Ave	1	Replace	10	30
P5-10	Lyon	Existing Deficiency	Central Ave	From South St to Mountain St	1	Replace	8	720
P6-1	Eckley	Existing Deficiency	Ridge Dr	From Eckley PS to Eckley Reservoir	2	Replace	8	240
P8-1	Big Steel	Capacity	Redwood Dr / Madrone Dr / Big Basin Wy	From Big Steel Reservoir to approx. 600' se/o Redwood Dr	-	New	12	2,120
P8-2	Big Steel	Fire Flow Reliability	Big Basin Wy	From approx. 600' se/o Redwood Dr to Redwood Ave	8	Replace	10	2,480
P8-3	Big Steel	Fire Flow Reliability	Redwood Ave / Lomond St	From Big Basin Wy to Central Ave	6	Replace	8	2,080
P8-4	Big Steel	Existing Deficiency	ROW	From Pine St to approx. 20' w/o Pine St	1	Replace	8	20
P8-5	Big Steel	Fire Flow Reliability	Central Ave	From Lomond St to approx. 420' s/o Lomond St	6/ 8	Replace	10	420

Table 7.7 Schedule of Improvements

Water Master Plan
San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Improvement Details			
P17-1	South	Existing Deficiency	Clear Creek Rd	From South PS to High St	2	Replace	8	90
P17-2	South	Existing Deficiency	Melwin	From Oak St to Logan Wy	1	Replace	8	330
P17-3	South	Existing Deficiency	ROW	From Azalea Ave to Forest Wy	0.75	Replace	8	1,070
P18-1	Swim	Existing Deficiency	Greenfield St	From Redwood Park PS to Park Dr	4	Replace	8	720
P18-2	Swim	Existing Deficiency	Hillcrest Dr	From approx. 310' nw/o Greenfield St to Greenfield St	0.75	Replace	8	310
P18-3	Swim	Existing Deficiency	Scenic Wy	From approx. 250' nw/o Greenfield St to Greenfield St	1.25	Replace	8	250
P18-4	Swim	Existing Deficiency	Country Club Dr / Mountain View Dr	From approx. 250' n/o Mountain View Dr to Swim PS	1.5 / 4	Replace	8	390
P20-1	University	Existing Deficiency	Melin Ave	From Condor Ave to approx. 1,060' se/o Condor Ave	2	Replace	8	1,060
P21-1	Quail	Fire Flow Reliability	Quail Hollow Rd	From Cumora Ln to approx. 200' e/o Derick Ln	6	Replace	8	7,740
P21-2	Quail	Fire Flow Reliability	Quail Ter / Webster Dr / Ridgeview Dr	From Quail Reservoirs to Hihn Rd	6	Replace	8	5,730
P21-3	Quail	Existing Deficiency	Arden Ave	From Lorenzo Wy to approx. 150' w/o Glen Arbor Rd	1	Replace	8	390
P21-4	Quail	Existing Deficiency	Azalea Ave	From Glen Arbor Rd to approx. 300' e/o Cook Wy	2	Replace	8	660
P21-5	Quail	Fire Flow Reliability	Hihn Rd	From Condor Ave to approx. 150' s/o Stanford Dr	6	Replace	8	1,800
P21-6	Quail	Fire Flow Reliability	Kim Wy / Bahr Dr / Moon Meadow Ln	From Hihn Rd to Zayante Rd	6	Replace	8	3,420
P21-7	Quail	Capacity	Zayante Dr	From Intertie 5 PS to approx. 400' ne/o Rosebloom Ave	4	Replace	8	1,310
P22-1	Probation	Existing Deficiency	Casera Wy	From approx. 100' sw/o Caseta Ct to Lockwood Ln	4 / 6	Replace	8	520
P22-2	Probation	Capacity	Tank Rd	From Whispering Pines Dr to Lower Pasatiempo PS	4 / 6	Replace	8	420
P23-1	Upper Pasatiempo	Capacity	Tank Rd	Parallel lines from Lower Pasatiempo PS to approx. 20' se/o Lower Pasatiempo PS	4	Replace	8	20
P25-1	Blue	Existing Deficiency	ROW	From approx. 100' sw/o Miraflores Rd to Blue PS	2	Replace	8	20
P26-1	Charlie	Existing Deficiency	ROW	From Blue PS to Charlie Reservoir	2	Replace	8	430
P28-1	El Solyo	Existing Deficiency	El Solyo Heights Dr	From El Solyo Reservoir to approx. 210' se/o El Solyo Reservoir	2	Replace	8	210
P28-2	El Solyo	Existing Deficiency	ROW	From El Solyo Heights Dr to approx. 30' s/o El Solyo Heights Dr	2	Replace	8	30
P29-1	Bennett Spring	Existing Deficiency	Felton Empire Rd	From Bennett Spring Reservoir to Blair PRV	2	Replace	8	3,520
P29-2	Bennett Spring	Existing Deficiency	Ley Rd	From Felton Empire Rd to approx. 500' se/o Felton Empire Rd	1 / 1.5	Replace	8	500
P31-1	McCloud	Existing Deficiency	El Solyo Heights Dr	From approx. 100' e/o Hillview Dr to El Solyo PS	2	Replace	8	370
P31-2	McCloud	Fire Flow Reliability	Hwy 9	From El Solyo Heights Dr to Fall Creek Dr	4 / 8	Replace	10	2,340
P31-3	McCloud	Existing Deficiency	Hwy 9	From approx. 300' n/o Fall Creek Dr to Fall Creek Dr	6	Replace	8	820
P31-4	McCloud	Fire Flow Reliability	Hwy 9 / Felton Empire Rd	From Clearview Pl to Gushee St	2 / 6	Replace	8	2,170
P31-5	McCloud	Capacity	Cooper St	From approx. 10' nw/o Farmer St to Farmer St	6	Replace	8	10
P31-6	McCloud	Existing Deficiency	Farmer St	From approx. 20' sw/o Cooper St to Cooper St	-	New	8	20
P31-7	McCloud	Existing Deficiency	Wright St / Kirby St	From Kirby WTP to Gushee St	6 / 8 / 10	Replace	12	560
P31-8	McCloud	Capacity	Gushee St	From Kirby St to Russell Ave	6	Replace	10	1,240
P31-9	McCloud	Capacity	Russell Ave	From Valley Dr to Gushee St	4	Replace	8	300
P31-10	McCloud	Capacity	Plateau Ave	From Ada Ave to Laurel Dr	2 / 4	Replace	8	290

Table 7.7 Schedule of Improvements

Water Master Plan

San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Improvement Details			
P31-11	McCloud	Capacity	Laurel Dr / Hwy 9	From Plateau Dr to Redwood Dr	6	Replace	8	2,030
P31-12	McCloud	Capacity	Laurel Dr / Hillside Dr	From Plateau Dr to Orchard Rd	6 / 8	Replace	10	970
P31-13	McCloud	Existing Deficiency	Orchard Rd	From McCloud Reservoir to Hillside Dr	6 / 8	Replace	12	1,360
P31-14	McCloud	Capacity	Hillside Dr	From Orchard Rd to Redwood Dr	4	Replace	8	1,060
P31-15	McCloud	Existing Deficiency	ROW	From approx. 190' n/o Redwood Dr to Redwood Dr	0.75	Replace	8	190
P31-16	McCloud	Existing Deficiency	Redwood Dr	Hillcrest Dr to Hwy 9	2 / 6	Replace	8	2,440
P31-17	McCloud	Existing Deficiency	ROW / Oak Dr	From Redwood Dr to Redwood Dr	2	Replace	8	160
P31-18	McCloud	Existing Deficiency	Hillcrest Dr	From Skyline Dr to Upper Hillcrest PS	2 / 6	Replace	8	520
P33-1	Pine	Existing Deficiency	Hillcrest Dr / Pleasant Wy / Brookside Dr	From Upper Hillcrest PS to Pine Reservoir	2	Replace	8	3,830
P33-2	Pine	Existing Deficiency	Pine Dr	From Pine Reservoir to Redwood Dr	2	Replace	8	2,090
P33-3	Pine	Existing Deficiency	Madrona Dr	From Redwood Dr to Felton Acres PS	2	Replace	8	720
P36-1	Kaski	Existing Deficiency	Lake Blvd	From approx. 1,000' n/o Ocean View Ave to Madrone PS	4	Replace	8	1,070
P37-1	Madrone	Existing Deficiency	Lake Blvd	From Madrone PS to Lakeshore Blvd	4	Replace	8	20
P37-2	Madrone	Existing Deficiency	Whilaway Ave	From Madrone Ave to Madrone Reservoir	4	Replace	8	550
Valve Improvements					**Existing Capacity** (MG)	**New/Replace**	**Capacity** (gpm)	**Valve Size** (in)
PRV4-1	Reader	PRV	Hwy 9 & Lorenzo St		-	New	2,403	8
PRV7-1	Blackstone	PRV	Big Basin Wy & Blackstone Dr		-	New	1,005	6
PRV8-1	Big Steel	PRV	Existing Big Steel Tank Site		-	New	2,071	8
VLV11-1	Bear Creek	Check Valve	Bear Creek Rd & Deerwood Dr		-	New	2,023	8
Booster Station Improvements					**Existing Capacity** (gpm)	**New/Replace**	**Capacity** (gpm)	**No. of Pumps**
PS1-2	Riverside Grove	Booster Pump	Existing Riverside Grove Pump Station		-	New	100	1
PS6-2	Eckley	Booster Pump	Existing Eckley Pump Station		-	New	15	1
PS13-1	Highland	Booster Pump	Existing Fairview Pump Station		50	Replace	220	2
PS18-1	Swim	Booster Pump	Existing Redwood Park Pump Station		180	Replace	240	2
PS20-1	University	Booster Pump	Existing University Pump Station		170	Replace	200	2
PS23-1	Upper Pasatiempo	Booster Pump	Existing Upper Pasatiempo Pump Station		150	Replace	440	2
PS28-1	El Solyo	Booster Pump	Existing Lower El Solyo Pump Station		60	Replace	300	2
PS33-1	Pine	Booster Pump	Existing Hillcrest Pump Station		120	Replace	400	2
PS36-1	Kaski	Booster Pump	Existing Intertie 5 Pump Station		140	Replace	400	2
Reservoir Improvements					**Existing Capacity** (gal)	**New/Replace**	**Capacity** (gal)	
T3-1	Blue Ridge	Storage Reservoir	Existing Blue Ridge Tank Site		40,000	Replace	200,000	
T4-1	Reader	Storage Reservoir	Existing Reader Tank Site		-	New	420,000	

Table 7.7 Schedule of Improvements

Water Master Plan

San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Improvement Details		
T6-1	Eckley	Storage Reservoir	Existing Eckley Tank Site		5,000	Replace	130,000
T7-1	Blackstone	Storage Reservoir	Existing Blackstone Tank Site		24,000	Replace	130,000
T10-1	Ralston	Storage Reservoir	Existing Ralston Tank Site		20,000	Replace	130,000
T11-1	Bear Creek	Storage Reservoir	Existing Bear Creek Tank Site		-	New	310,000
T13-1	Highland	Storage Reservoir	Existing Highland Tank Site		60,000	Replace	130,000
T17-1	South	Storage Reservoir	Existing South Tank Site		36,400	Replace	130,000
T18-1	Swim	Storage Reservoir	Existing Swim Tank Site		19,600	Replace	210,000
T19-1	Spring	Storage Reservoir	Existing Spring Tank Site		-	New	60,000
T20-1	University	Storage Reservoir	Existing University Tank Site		-	New	80,000
T23-1	Upper Pasatiempo	Storage Reservoir	Existing Upper Pasatiempo Tank Site		-	New	50,000
T24-1	North Boulder Creek	Storage Reservoir	Existing Echo Tank Site		75,000	Replace	400,000
T25-1	Blue	Storage Reservoir	Existing Blue Tank Site		-	New	140,000
T26-1	Charlie	Storage Reservoir	Existing Charlie Tank Site		-	New	80,000
T28-1	El Solyo	Storage Reservoir	Existing El Solyo Tank Site		20,000	Replace	160,000
T29-1	Bennett Spring	Storage Reservoir	Existing Bennett Spring Tank Site		6,000	Replace	130,000
T31-1	McCloud	Storage Reservoir	Existing McCloud Tank Site		-	New	40,000
T33-1	Pine	Storage Reservoir	Existing Pine Tank Site		18,500	Replace	230,000
T36-1	Kaski	Storage Reservoir	Existing Kaski Tank Site		-	New	50,000
T37-1	Madrone	Storage Reservoir	Existing Madrone Tank Site		-	New	30,000

- **P4-6**: Replace approximately 1,410 feet of existing 6-inch water main with new 10-inch water main along Dolores Drive and Douglas Avenue from Reader Reservoir to Highway 9.
- **P4-8**: Replace approximately 330 feet of existing 1-inch main with new 8-inch main along Orchard Road from approximately 330 feet north of Juanita Road to Juanita Road.
- **P4-9**: Replace approximately 500 feet of existing 1.25-inch and 2-inch main with new 8-inch main along Juanita Road from approximately 150 feet west of Orchard Drive to approximately 250 feet east of Apple Lane.
- **P4-10**: Replace approximately 510 feet of existing 1-inch, 1.25-inch, and 2-inch main with new 8-inch main along Hiawatha Road from Keller Drive to approximately 400 feet northeast of Keller Drive.
- **P4-13**: Replace approximately 250 feet of existing 1-inch main with new 8-inch main along Grove Street from Central Avenue to Lorenzo Avenue.
- **P4-14**: Replace approximately 320 feet of existing 1-inch main with new 8-inch main along River Street from Central Avenue to approximately 250 feet west of Lorenzo Avenue.
- **P4-15**: Replace approximately 10 feet of existing 1.5-inch main with new 8-inch main within the right-of-way from Irene Avenue to approximately 10 feet west of Irene Avenue.
- **P4-16**: Replace approximately 110 feet of existing 0.75-main with new 8-inch main within the right-of-way from Lomond Street to approximately 110 feet east of Lomond Street.

7.9.1.3 Lyon Pressure Zone

This section documents pipeline improvements within the Lyon Pressure Zone.

- **P5-1**: Replace approximately 970 feet of existing 2-inch main with new 8-inch main along Ridge Drive from Park Avenue to the existing Eckley Pump Station.
- **P5-5**: Replace approximately 2,200 feet of existing 2-inch and 6-inch main with new 8-inch main along St. Francis Drive, Davidson Way, and Sunshine Lane from approximately 100 feet south of Big Basin Way to Redwood Avenue.
- **P5-8**: Replace approximately 3,120 feet of existing 2-inch main with new 8-inch main along Big Basin Way, Oak Street, and Boulder Street from Highway 9 to South Street.
- **P5-9**: Replace approximately 30 feet of existing 1-inch main with new 10-inch main along South Street from Central Avenue to approximately 30 feet west of Central Avenue.
- **P5-10**: Replace approximately 720 feet of existing 1-inch main with new 10-inch main along Central Avenue from South Street to Mountain Street.

7.9.1.4 Eckley Pressure Zone

This section documents main improvements within the Eckley Pressure Zone.

- **P6-1**: Replace approximately 240 feet of existing 2-inch main with new 8-inch main along Ridge Drive from the existing Eckley Pump Station to the existing Eckley Reservoir.

7.9.1.5 Big Steel Pressure Zone

This section documents pipeline improvements within the Big Steel Pressure Zone.

- **P8-4**: Replace approximately 20 feet of existing 1-inch main with new 8-inch main within the right-of-way from Pine Street to approximately 20 feet west of Pine Street.
- **P8-10**: Replace approximately 610 feet of existing 1-inch main with new 8-inch main along Reed Street and within the right-of-way from approximately 50 feet west of Reed Street to Pacific Street.
- **P8-11**: Replace approximately 420 feet of existing 1-inch and 2-inch main with new 8-inch main along Cascade Street and within the right-of-way from Center Street to approximately 100 feet west of Cascade Street.
- **P8-13**: Replace approximately 1,070 feet of existing 1-inch main with new 8-inch main along Berkeley Way and within the right-of-way from Alameda Avenue to approximately 250 feet southwest of Center Street.
- **P8-14**: Replace approximately 860 feet of existing 1-inch and 1.5-inch main along Western Avenue, High Street, and within the right-of-way from approximately 300 feet northwest of Larkspur Avenue to approximately 100 feet northwest of Western Avenue.

7.9.1.6 Brookdale Pressure Zone

This section documents pipeline improvements within the Brookdale Pressure Zone.

- **P16-1**: Replace approximately 190 feet of existing 1-inch main with new 8-inch main along Redwood Street from Hazel Street to Fern Street.
- **P16-2**: Replace approximately 220 feet of existing 1-inch main with new 8-inch main along Hazel Street from Redwood Street to Riverside Road.
- **P16-3**: Replace approximately 390 feet of existing 1-inch main with new 8-inch main along Riverside Road and Fern Street from Hazel Street to Redwood Street.
- **P16-4**: Replace approximately 30 feet of existing 2-inch main with new 8-inch main along California Avenue from approximately 30 feet west of Riverside Drive to Riverside Drive.

- **P16-8**: Replace approximately 1,720 feet of existing 4-inch and 6-inch water main with new 10-inch water main along Highway 9 and Brookside Avenue from approximately 100 feet south of Brookside Avenue to Whittier Avenue.
- **P16-10**: Replace approximately 760 feet of existing 1.25-inch main with new 8-inch main along Love Creek Road from Roberts Road to approximately 350 feet south of Berts Road.
- **P16-11**: Replace approximately 2,470 feet of existing 1.5-inch and 2-inch main with new 8-inch main along Kipling Avenue, Live Oak Avenue, and Pine Street from Longfellow Avenue to Manzanita Avenue.
- **P16-12**: Replace approximately 2,280 feet of existing 1.5-inch and 2-inch main with new 8-inch main along Whittier Avenue and Manzanita Avenue from Brookside Avenue to approximately 300 feet south of Locust Street.
- **P16-13**: Replace approximately 2,410 feet of existing 1-inch and 2-inch main with new 8-inch main along Pine Street, Glen Arbor Road, and Madrone Avenue from Manzanita Avenue to Railroad Avenue.
- **P16-14**: Replace approximately 640 feet of existing 1-inch main with new 8-inch main along Hillcrest Avenue from Highway 9 to Manzanita Avenue.
- **P16-15**: Replace approximately 790 feet of existing 1-inch main with new 8-inch main along Circle Drive and Urbana Lane from Hillcrest Avenue to approximately 50 feet east of Manzanita Avenue.
- **P16-16**: Replace approximately 1,000 feet of existing 1-inch main with new 8-inch main along Madrone Avenue and Railroad Avenue from approximately 300 feet southwest of Railroad Avenue to approximately 450 east of Oak Avenue.
- **P16-17**: Replace approximately 250 feet of existing 1-inch main with new 8-inch main along Oak Avenue from Railroad Avenue to Riverside Park Drive.
- **P16-18**: Replace approximately 8,210 feet of existing 2-inch. 4-inch, and 6-inch water main along Highway 9 with new 10-inch water main from approximately 100 feet north of Hillside Avenue to Glen Lomond Lane.
- **P16-19**: Replace approximately 2,200 feet of existing 2-inch main with new 8-inch main along Highway 9, Lorenzo Avenue, and Woodland Drive from approximately 100 feet north of Hillside Avenue to Madrona Way.
- **P16-20**: Replace approximately 170 feet of existing 1.5-inch main with new 8-inch main within the right-of-way from Redwood Drive to Woodland Drive.

- **P16-21**: Replace approximately 2,200 feet of existing 1.5-inch and 2-inch main with new 8-inch main along Woodland Drive, Shadowbrook Road, and within the right-of-way from Highway 9 to approximately 650 feet east of Highway 9.
- **P16-24**: Replace approximately 20 feet of existing 1-inch main with new 8-inch main along Sunnyside Avenue from approximately 20 feet west of Main Street to Main Street.
- **P16-25**: Replace approximately 40 feet of existing 2-inch main with new 8-inch main along Larita Drive from Archer Way to approximately 40 feet southeast of Archer Way.

7.9.1.7 South Pressure Zone

This section documents pipeline improvements within the South Pressure Zone.

- **P17-1**: Replace approximately 90 feet of existing 2-inch main from South Pump Station to High Street along Clear Creek Road with 8-inch main.
- **P17-2**: Replace approximately 330 feet of existing 1-inch main from Oak Street to Logan Way along Melwin with 8-inch main.
- **P17-3**: Replace approximately 1,070 feet of 0.75-inch main from Azalea Avenue to Forest Way along ROW with 8-inch main.

7.9.1.8 Swim Pressure Zone

This section documents pipeline improvements within the Swim Pressure Zone.

- **P18-1**: Replace approximately 720 feet of 4-inch main with new 8-inch main along Greenfield Street from Redwood Park Pump Station to Park Drive.
- **P18-2**: Replace approximately 310 feet of 0.75-inch main with new 8-inch main along Hillcrest Drive from approximately 310 feet northwest of Greenfield Street to Greenfield Street.
- **P18-3**: Replace approximately 250 feet of 1.25-inch main with new 8-inch main along Scenic Way from approximately 250 feet northeast of Greenfield Street to Greenfield Street.
- **P18-4**: Replace approximately 390 feet of 1.5-inch and 4-inch main with new 8-inch main along Country Club Drive and Mountain View Drive from approximately 250 feet north of Mountain View Drive to the existing Swim Pump Station.

7.9.1.9 University Pressure Zone

This section documents pipeline improvements within the University Pressure Zone.

- **P20-1**: Replace approximately 1,060 feet of existing 2-inch main with new 8-inch main along Melin Avenue from Condor Avenue to approximately 1,060 feet southeast of Condor Avenue.

7.9.1.10 Quail Pressure Zone

This section documents pipeline improvements within the Quail Pressure Zone.

- **P21-3**: Replace approximately 390 feet of existing 1-inch main with new 8-inch main along Arden Avenue from Lorenzo Way to approximately 150 feet west of Glen Arbor Road.

- **P21-4**: Replace approximately 660 feet of existing 2-inch main with new 8-inch main along Azalea Avenue from Glen Arbor Road to approximately 300 feet east of Cook Way.

7.9.1.11 Probation Pressure Zone

This section documents pipeline improvements within the Probation Pressure Zone.

- **P22-1**: Replace approximately 520 feet of existing 4-inch and 6-inch main with new 8-inch main along Casera Way from approximately 100 feet southwest of Caseta Court to Lockwood Lane.

7.9.1.12 Blue Pressure Zone

This section documents pipeline improvements within the Blue Pressure Zone.

- **P25-1**: Replace approximately 20 feet of existing 2-inch main with new 8-inch main within the right-of-way from approximately 100 feet southwest of Miraflores Road to the existing Blue Pump Station.

7.9.1.13 Charlie Pressure Zone

This section documents pipeline improvements within the Charlie Pressure Zone.

- **P26-1**: Replace approximately 430 feet of existing 2-inch main with new 8-inch main within the right-of-way from the existing Blue Pump Station to the existing Charlie Reservoir.

7.9.1.14 El Solyo Pressure Zone

This section documents pipeline improvements within the El Solyo Pressure Zone.

- **P28-1**: Replace approximately 210 feet of existing 2-inch main with new 8-inch main along El Solyo Heights Drive from El Solyo Reservoir to approximately 210 feet southeast of El Solyo Reservoir.

- **P28-2**: Replace approximately 30 feet of existing 2-inch main with new 8-inch main within the right-of-way from El Solyo Heights Drive to approximately 30 feet south of El Solyo Heights Drive.

7.9.1.15 Bennett Spring Pressure Zone

This section documents pipeline improvements within the Bennett Spring Pressure Zone.

- **P29-1**: Replace approximately 3,520 feet of existing 2-inch main with new 8-inch main along Felton Empire Road from the existing Bennett Spring Reservoir to the Blair Pressure Reduce Valve.
- **P29-2**: Replace approximately 500 feet of existing 1-inch and 1.5-inch main with new 8-inch main along Ley Road from Felton Empire Road to approximately 500 feet southeast of Felton Empire Road.

7.9.1.16 McCloud Pressure Zone

This section documents pipeline improvements within the McCloud Pressure Zone.

- **P31-1**: Replace approximately 370 feet of existing 2-inch main with new 8-inch main along El Solyo Heights Drive from approximately 100 feet east of Hillview Drive to the existing El Solyo Pump Station.
- **P31-3**: Replace approximately 820 feet of existing 6-inch main with new 8-inch main along Highway 9 from approximately 300 feet north of Fall Creek Drive to Fall Creek Drive.
- **P31-6**: Construct approximately 20 feet of new 8-inch main along Farmer Street from approximately 20 feet southwest of Cooper Street to Cooper Street.
- **P31-7**: Replace approximately 560 feet of existing 6-inch, 8-inch, and 10-inch main with new 12-inch main along Wright Street and Kirby Street from Kirby Water Treatment Plant to Gushee Street.
- **P31-13**: Replace approximately 1,360 feet of existing 6-inch and 8-inch main with new 12-inch main along Orchard Road from the existing McCloud Reservoir to Hillside Drive.
- **P31-15**: Replace approximately 190 feet of existing 0.75-inch main with new 8-inch main within the right-of-way from approximately 190 feet north of Redwood Drive to Redwood Drive.
- **P31-16**: Replace approximately 2,440 feet of existing 2/6-inch main with new 8-inch main along Redwood Drive from Hillcrest Drive to Highway 9.
- **P31-17**: Replace approximately 160 feet of existing 2-inch main with new 8-inch main within the right-of-way from Redwood Drive to Redwood Drive.
- **P31-18**: Replace approximately 520 feet of existing 2-inch and 6-inch main with new 8-inch main along Hillcrest Drive from Skyline Drive to Upper Hillcrest Pump Station.

7.9.1.17 Pine Pressure Zone

This section documents pipeline improvements within the Pine Pressure Zone.

- **P33-1**: Replace approximately 3,830 feet of existing 2-inch main with new 8-inch main along Hillcrest Drive, Pleasant Way, and Brookside Drive from the existing Upper Hillcrest Pump Station to the existing Pine Reservoir.
- **P33-2**: Replace approximately 2,090 feet of existing 2-inch main with new 8-inch main along Pine Drive from the existing Pine Reservoir to Redwood Drive.
- **P33-3**: Replace approximately 720 feet of existing 2-inch main with new 8-inch main along Madrona Drive from Redwood Drive to Felton Acres Pump Station.

7.9.1.18 Kaski Pressure Zone

This section documents pipeline improvements within the Kaski Pressure Zone.

- **P36-1**: Replace approximately 1,070 feet of existing 4-inch main with new 8-inch main along Lake Boulevard from approximately 1,000 feet north of Ocean View Avenue to the existing Madrone Pump Station.

7.9.1.19 Madrone Pressure Zone

This section documents pipeline improvements within the Madrone Pressure Zone.

- **P37-1**: Replace approximately 20 feet of existing 4-inch main with new 8-inch main along Lake Boulevard from the existing Madrone Pump Station to Lakeshore Boulevard.
- **P37-2**: Replace approximately 550 feet of existing 4-inch main with new 8-inch main along Whilaway Avenue from Madrone Avenue to the existing Madrone Reservoir.

7.9.2 Pipeline Improvements to Increase Distribution Capacity

Additional demands from future growth or changes to flow condition as a result of the construction of other improvements can lead to deficiencies in pipelines. Improvements to increase pipeline capacities are discussed below with the corresponding coded identifier, which is also consistent with the capital improvements chapter:

7.9.2.1 Reader Pressure Zone

This section documents pipeline improvements within the Reader Pressure Zone.

- **P4-3**: Replace approximately 520 feet of existing 1-inch main with new 8-inch main along Riverview Drive from Old Country Highway to approximately 5200 feet east of Old Country Highway.

- **P4-7**: Replace approximately 110 feet of existing 2-inch main with new 8-inch main along Brookside Drive from Highway 9 to approximately 110 feet east of Highway 9.

- **P4-11**: Replace approximately 320 feet of existing 1.25-inch main with new 8-inch main along Central Avenue from approximately 50 feet south of Middleton Avenue to approximately 50 feet north of Lorenzo Street.

7.9.2.2 Lyon Pressure Zone

This section documents pipeline improvements within the Lyon Pressure Zone.

- **P5-2**: Construct approximately 1,570 feet of new 12-inch main along Redwood Drive and Madrone Drive from the existing Big Steel Reservoir site to Big Basin Way.

- **P5-3**: Construct approximately 4,570 feet of new 12-inch main along Big Basin Way from Boulder Brook Drive to Central Avenue.

- **P5-4**: Construct approximately 120 feet of new 8-inch main along St Francis Drive from Big Basin Way to approximately 120 feet south of Big Basin Way.

- **P5-6**: Construct approximately 100 feet of new 1.5-inch main within the right-of-way from Big Basin Way to approximately 100 feet north of Big Basin Way.

- **P5-7**: Construct approximately 110 feet of new 8-inch main within the right-of-way from Big Basin Way to approximately 110 feet north of Big Basin Way.

7.9.2.3 Big Steel Pressure Zone

This section documents pipeline improvements within the Big Steel Pressure Zone.

- **P8-1**: Construct approximately 2,120 feet of new 12-inch main along Redwood Drive, Madrone Drive, and Big Basin Way from the existing Big Steel Reservoir to approximately 600 feet southeast of Redwood Drive.

- **P8-7**: Construct approximately 2,170 feet of new 12-inch main along Lomond Street and Irwin Way from Railroad Avenue to approximately 700 southwest of Maple Way.

- **P8-8**: Replace approximately 2,970 feet of existing 2-inch main with new 8-inch main along Monan Way and Alta Via Drive from Prospect Avenue to approximately 450 feet south of Alta Via Drive.

7.9.2.4 Brookdale Pressure Zone

This section documents pipeline improvements within the Brookdale Pressure Zone.

- **P16-7**: Construct approximately 670 feet of new 10-inch main along Mill Street from approximately 100 feet west of Main Street to Oak Street.

- **P16-9**: Construct approximately 20 feet of new 10-inch main along Brookside Avenue from approximately 50 feet west of Brookside Avenue to Whittier Avenue.

7.9.2.5 Swim Pressure Zone

This section documents pipeline improvements within the Swim Pressure Zone.

- **P18-2**: Replace approximately 290 feet of 1.25-inch main with new 8-inch main along Greenbank Drive from Scenic Way to Hillcrest Drive.

7.9.2.6 Quail Pressure Zone

This section documents pipeline improvements within the Quail Pressure Zone.

- **P21-7**: Replace approximately 1,310 feet of existing 4-inch main with new 8-inch main along Zayante Drive from the existing Intertie 5 Pump Station to approximately 400 feet northeast of Rosebloom Avenue.

7.9.2.7 Probation Pressure Zone

This section documents pipeline improvements within the Probation Pressure Zone.

- **P22-2**: Replace approximately 1,710 feet of existing 8-inch main with new 10-inch main within the right-of-way from approximately 450 feet north of Graham Hill Road to Fox Court.

- **P22-3**: Replace approximately 390 feet of existing 6-inch main with new 8-inch main along Bobs Lane from Quarry Worth Lane to Sugar Pine Road.

- **P22-5**: Replace approximately 420 feet of existing 4-inch and 6-inch main with new 10-inch main along Tank Road from Whispering Pines Drive to the existing Lower Pasatiempo Pump Station.

7.9.2.8 Upper Pasatiempo Pressure Zone

This section documents pipeline improvements within the Upper Pasatiempo Pressure Zone.

- **P23-1**: Replace approximately 20 feet of existing 4-inch main with 8-inch main along Tank Road from the existing Lower Pasatiempo Pump Station to approximately 20 feet southeast of the existing Lower Pasatiempo Pump Station.

7.9.2.9 McCloud Pressure Zone

This section documents pipeline improvements within the McCloud Pressure Zone.

- **P31-5**: Replace approximately 10 feet of existing 6-inch main with new 8-inch main along Cooper Street from approximately 10 feet northwest of Farmer Street to Farmer Street.

- **P31-8**: Replace approximately 1,240 feet of existing 6-inch main with new 10-inch main along Gushee Street from Kirby Street to Russell Avenue.
- **P31-9**: Replace approximately 300 feet of existing 4-inch main with new 8-inch main along Russel Avenue from Valley Drive to Gushee Street.
- **P31-10**: Replace approximately 290 feet of existing 2-inch and 4-inch main with new 8-inch main along Plateau Avenue from Ada Avenue to Laurel Drive.
- **P31-11**: Replace approximately 2,030 feet of existing 6-inch main with new 8-inch main along Laurel Drive and Highway 9 from Plateau Drive to Redwood Drive.
- **P31-12**: Replace approximately 970 feet of existing 6-inch and 8-inch main with new 10-inch main along Laurel Drive and Hillside Drive from Plateau Drive to Orchard Road.
- **P31-14**: Replace approximately 1,060 feet of existing 4-inch main with new 8-inch main along Hillside Drive from Orchard Road to Redwood Drive.

CHAPTER 9 – ENERGY RELIABILITY & EFFICIENCY ANALYSIS

This section documents the energy reliability of the existing water distribution system facilities within the San Lorenzo Valley Water District service area. This section identifies critical power needs and evaluates potential energy savings.

9.1 CRITICAL POWER NEEDS

The District maintains 2 water treatment plants, 7 wells, 27 booster stations, and 6 interties to supply the water system and transfer water between service areas. Many of these booster stations serve smaller pressure zones and if a power failure were to occur, only a small portion of the system would be impacted. The most critical facilities for the District include the sources of supply (water treatment plants and wells). If supply sources are without power the system may not be able to maintain adequate pressures in the distribution system for the duration of the power failure event.

Other critical facilities include interties and large pump stations that can transfer water between service areas. If a power failure were to occur in one service area, these interties/booster stations can transfer water to the impacted service area to maintain adequate level of service while the issue is being resolved. The critical facilities or critical power needs are documented on **Table 9.1**. These facilities are vital for maintaining the level of service and are recommended to have a back-up power source in the event of a power failure.

9.2 POTENTIAL ENERGY SAVINGS

Large pump stations, wells, and water treatment plants have the largest energy costs as documented on **Table 9.2**. These are also many of the critical facilities in the distribution system since they supply water or transfer water to large service areas in the system.

The hydraulic grade at the Lyon Water Treatment Plant provides an opportunity to supply the lower gradient pressure zones of Reader, Big Steel, and other supply dependent zones. Supplying these zones from Lyon WTP will reduce the pumping requirements at the Irwin and Firehouse booster station. The supply analysis performed in the system evaluation chapter indicates the Lyon Water Treatment Plant maintains enough surplus capacity to supply the Reader and Big Steel Pressure Zones.

There is also a potential to eliminate the Bear Creek and Blackstone booster station and add a PRV and check valve to supply these zones and further reduce pumping costs.

9.3 RECOMMENDED ENERGY EFFICIENCY IMPROVEMENTS

The recommended energy efficiency improvements are documented on **Table 9.3** and summarized as follows;

Table 9.1 Critical Power Needs

Water Master Plan

San Lorenzo Valley Water District

	Pressure Zone	Capacity (gpm)
Supply		
Water Treatment Plants		
Lyon WTP	Lyon	900
Kirby WTP	McCloud	500
Wells		
Olympia 2	*Quail*	*360*
Olympia 3	*Quail*	*150*
Quail 4A	Brookdale	280
Quail 5A	Brookdale Or Quail	85
Pasatiempo 5A	Probation	350
Pasatiempo 7	Probation	100
Interties		
Intertie 6	Brookdale/ McCloud	2 @ 350
Intertie 5	Quail/Kaski	2 @ 70
Intertie 3&4	Probation/ Quail	3 @ 700
Boosters		
Irwin	Brookdale to Big Steel	2 @ 400
Firehouse	Big Steel to Reader	2 @ 500
Quail	Brookdale to Quail	2 @ 350

Table 9.2 Historical Pump Energy Costs

Water Master Plan

San Lorenzo Valley Water District

Facility ID	2013 ($)	2014 ($)	2015 ($)	2016 ($)	2017 ($)	2018 ($)	2019 ($)	5 year Average ($)	3 year Average ($)
Olympia Wells	67,196	91,136	57,397	40,337	46,378	9,995	12,664	33,354	23,012
Quail Pump Station	12,462	14,937	13,727	20,939	27,149	9,108	9,067	15,998	15,108
Quail 4A	13,178	14,665	18,108	15,330	15,125	4,318	1,830	10,942	7,091
Firehouse Pump Station	4,974	4,938	5,314	14,481	17,571	5,370	6,888	9,925	9,943
Kirby WTP	0	11,147	12,910	0	0	1,167	14,688	9,588	7,927
Intertie 5	0	506	1,139	11,504	18,683	6,514	8,297	9,227	11,164
Pasatiempo 7	10,746	16,024	14,337	12,302	5,694	2,790	6,108	8,246	4,864
Irwin Pump Station	19,926	26,715	21,375	7,794	2,639	648	418	6,575	1,235
Echo Pump Station	2,682	3,680	3,324	4,062	5,963	2,278	2,887	3,703	3,709
Intertie 3/4	0	0	0	0	0	0	3,315	3,315	3,315
Pasatiempo 5	0	0	0	0	0	0	3,243	3,243	3,243
Redwood Park Pump Station	2,025	3,364	3,180	3,492	3,627	1,120	2,183	2,720	2,310
Fireview Pump Station	2,486	3,346	3,282	3,208	3,760	1,036	986	2,455	1,927
Felton Acres Pump Station	0	0	0	0	0	0	2,233	2,233	2,233
Nina Pump Station	2,075	2,810	2,811	2,795	3,259	871	877	2,123	1,669
South Pump Station	2,334	2,558	2,615	2,784	2,937	842	1,194	2,074	1,658
Spring Pump Station	1,027	1,832	1,777	2,292	2,251	809	2,330	1,892	1,797
Madrone Pump Station	0	0	0	1,749	3,451	1,101	797	1,774	1,783
Blueridge Pump Station	1,479	2,914	1,769	2,191	2,306	792	1,244	1,660	1,447
Riverside Grove Pump Station	1,226	1,638	1,528	1,913	2,009	653	779	1,376	1,147
Huckleberry Pump Station	1,205	1,552	1,331	1,446	1,670	437	570	1,091	892
University Pump Station	889	1,107	1,067	1,339	1,572	544	629	1,030	915
El Soylo Pump Staiton	0	0	0	0	0	0	629	629	629
Ralston Pump Station	329	573	842	584	617	197	180	484	331
Eckley Pump Station	207	403	432	452	451	161	259	351	290
Blackstone Pump Station	309	440	393	371	387	127	134	282	216
Intertie 6 Pump Station	0	0	0	0	0	0	229	229	229
Westwinner Pump Station	192	254	232	214	207	64	94	162	122
Upperhill Crest Pump Station	0	0	0	0	0	0	24	24	24

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Notes:

1. Energy costs per PG&E workbooks received from SLVWD staff

Table 9.3 Potential Energy Efficency Improvements

Water Master Plan

San Lorenzo Valley Water District

Improvement ID	Improvement	Pressure Zone		Energy Impacts
		Source	Destination	
PRV-Z4-1	Pressure reducing valve	Lyon	Reader	Reduces pumping requirements at the Irwin and Firehouse pump stations and utilizes a supply with a higher HGL.
PRV-Z7-1	Pressure reducing valve	Lyon	Blackstone	Eliminates the Blacktone Pump Station
PRV-Z8-1	Pressure reducing valve	Lyon	Big Steel	Reduces pumping requirements at the Irwin and Firehouse pump stations and utilizes a supply with a higher HGL.
VLV-Z11-1	Check Valve	Reader	Bear Creek	Reduces/Eliminates pumping requirements at the Bear Creek Pump Station

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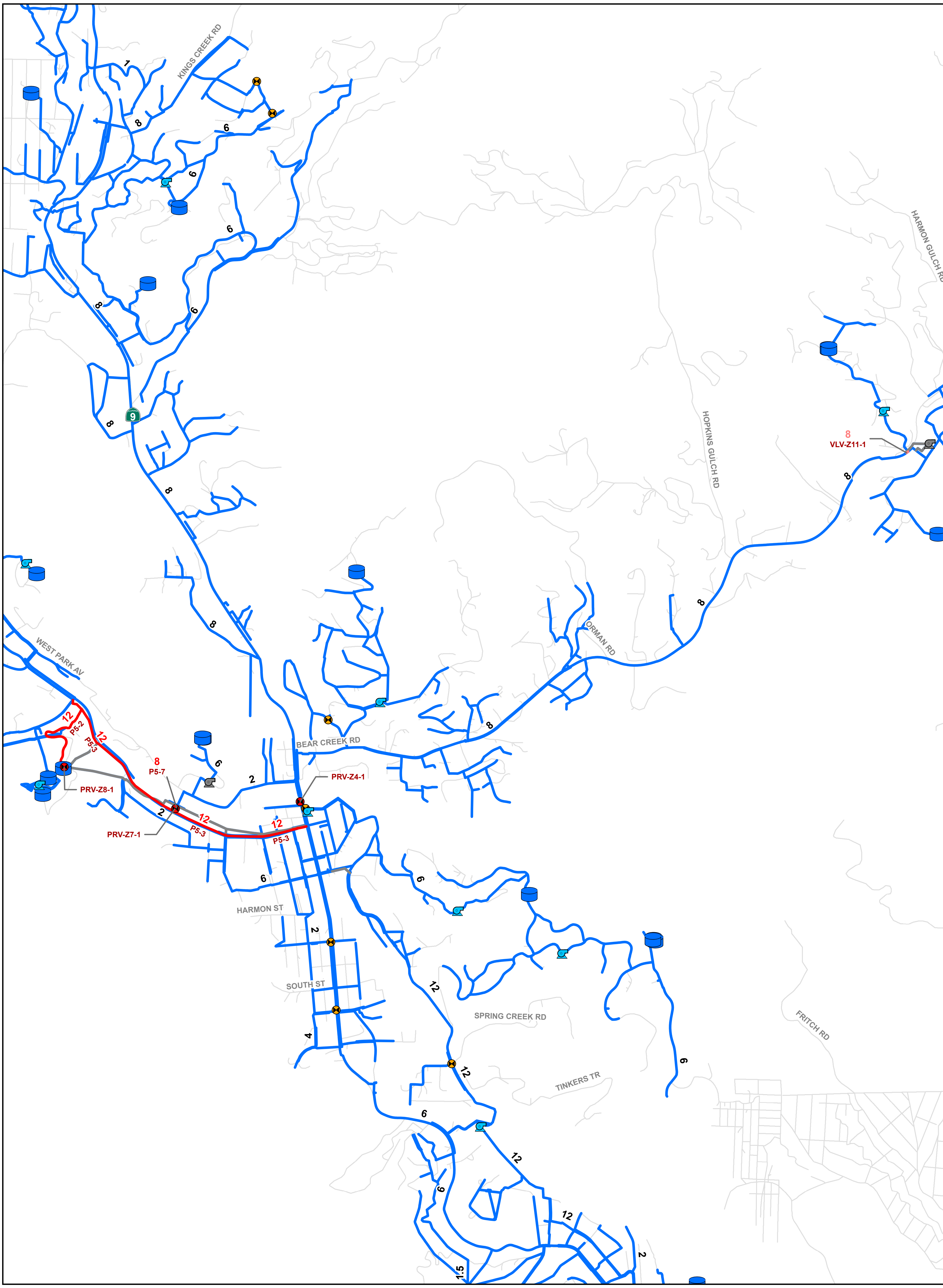
Notes:

1. The existing Lyon tranmission main is undersized and should be upsized before these improvments are implemented

- Construct a pressure reducing station from Lyon to Reader Pressure Zone at Highway 9 and Lorenzo Street.
- Construct a pressure reducing station from Lyon to Big Steel Pressure Zone at the Big Steel Tank site
- Construct a pressure reducing station from Lyon to Blackstone Pressure Zone at Big Basin Way and Blackstone Drive
- Construct a check valve from Reader to Bear Creek Pressure Zone at Bear Creek Road and Deerwood Drive.

Please note the existing Lyon transmission main is undersized and should be upsized before these improvements are implemented (Pipeline Improvements P5-2 and P5-3). Additionally, an additional improvement would need to be constructed to connect the Blackstone Zone to the upsized Lyon transmission main (Pipeline Improvement P5-7). The recommended energy efficiency improvements are identified on **Figure 9.1** and include the transmission main improvements required.



Legend

Recommended Improvements
- Pump Station
- Tank
- PRV
- Pipelines
- Check Valve Improvement

Existing System
- Pump Station
- Abandoned Pump Station
- Wells
- Wells (Inactive)
- Tank
- Valve
- Existing Pipelines
- Abandoned Pipelines

Update: July 19, 2021

0 500 1,000 2,000 Feet

N S E W

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File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig9-1_EnergyEff_071921.mxd

Figure 9.1
Recommended Energy Efficiency Improvements

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

CHAPTER 8 – RISK ASSESSMENT

This section documents the risk assessment of the existing water distribution system within the San Lorenzo Valley Water District service area. The following sections include discussion of the data reviewed to perform the analysis, the risk assessment criteria used to evaluate the risk of each water distribution facilities, the result of the risk assessment, and recommended improvements.

8.1 OVERVIEW

The purpose of this evaluation is to identify facilities in the water distribution system with the largest risk based on its likelihood of failure and consequence of failure. This risk will be used to provide near-term improvement recommendations so the system can maintain levels of service desired by the District and expected by the customers. This evaluation will aid District staff in justifying capital improvement budgets and help change from a reactive repair strategy to a proactive renewal and replacement strategy by identifying high risk pipelines.

This chapter documents the methodology used to identify risk and prioritize distribution system pipeline, storage tanks, booster pump stations, and valve improvement recommendations.

8.2 AVAILABLE DATA

The following data was used as a basis for the risk assessment. The review included system maps, asset data inventory, and pipeline maintenance records.

- **Hydraulic Model**: This Master Plan entailed the development of a water system hydraulic model that combines information on the physical characteristics of the system (pipelines, wells, booster stations, tanks, pressure reduce valves) as well as operational characteristics (how they operate). The model was developed from the District’s pipeline GIS which includes the pipeline spatial location, diameters, materials, and construction year, where available. The hydraulic model was also used to extract pipeline flows and maximum pressures.

- **System Maps**: This included pipeline connections and alignments based on SLVWD’s existing water system GIS, which was most recently updated in 2021 as part of a model update process.

- **Asset Data Inventory**: This included age, diameter, capacity, and material. Pipeline age was available for more than 90% of pipes.

- **Maintenance History**: This included documentation of maintenance records and staff rating for assets received from SLVWD Staff.

- **Geographic Information**: This included geographic information and aerial imaging used to determine general plan land use, critical facilities, road types and fire hazard ratings.

8.3 METHODOLOGY

Risk assessment and analysis is at the heart of asset management planning, and is one of the primary tools used for identifying and prioritizing renewal projects with the highest urgency. The results of this process guide optimized decision on financial planning, and are used for choosing where the limited available public funds are more wisely spent.

The risk assessment incorporated information about the water system extracted from hydraulic model as well as user-defined risk assessment criteria to perform a risk analysis for each asset included in the analysis. The results of this analysis can be used to prioritize capital projects throughout the District, focusing on the areas of highest risk first and developing an improvement plan for the near-term recommendations.

Risk analysis consists of assessing the probability (or likelihood) of an asset falling, and more importantly linking it to a consequence if such failure was to occur. This analysis allows the agency to identify existing and future risks that potentially impact the level of customer service and the associated costs. Thus, the risk, also known as the business risk exposure (BRE), is calculated by multiplied the probability or likelihood of failure (LOF) by the consequence of failure (COF).

Risk (BRE) = Likelihood of Failure (LOF) x Consequence of Failure (COF)

The likelihood (or probability) of failure analysis allows a prediction of failure timing for a particular asset. Did the asset fail to meet the level of service? Has capacity become inadequate? How is the structural condition? Is the lifecycle cost efficient? A numerical LOF score is assigned to each asset based on this assessment.

The consequence of failure analysis assesses the impact of such failure on the residential or agricultural environment, and the resulting anticipated economic loss.

Criterion Type: The various criteria can be categorized differently based on the information evaluated. Some of the various criteria types included in this risk assessment are briefly summarized on the following page.

- Proximity to specific locations or infrastructure elements (critical facilities such as schools or hospitals, active service connections, critical pumping facilities, railroads, major roads or freeways)
- Hydraulic results (asset flows, velocities, maximum pressure, available fire flow)

- Maintenance record (year of installation, historical leak repair information, problematic materials)
- Asset material and age

Criterion Score: Each criterion assigns a score, typically between one and five, to an asset based on a scale specific to each criterion. A score of one indicates that a given criterion will minimally contribute to the total consequence or likelihood of failure for a specific asset, while a score of five indicates a criterion will maximally contribute to the asset's total score.

Criterion Weight: Each criterion includes a weight that determines how much contribution it makes to the total COF or LOF scores. A higher weight means the score for an asset from a particular criterion will contribute more to total COF or LOF score than a criterion with a lower weight.

The criteria type, score, and weight for both the COF and LOF calculations was established in coordination with District staff before being incorporated into the risk assessment analysis.

A total of 5 categories were used to assign numerical scores to each likelihood of failure and consequence of failure category. The five rating categories include: Extreme, High, Moderate, Low, and Very Low, as documented on Table 8.1. High scores are associated with the Extreme and High rating categories and represent at risk assets that require immediate attention. Low scores are associate with the Very Low or Low rating categories and may represent new or low risk assets.

Table 8.1 Rating and Scores

Risk Rating	Score
Extreme	**5**
High	**4**
Moderate	**3**
Low	**2**
Very Low	**1**

8.4 RISK ASSESSMENT CRITERIA

This section documents the risk assessment criteria for each asset type in the District's water distribution system. The criteria used for evaluating the risk for each asset are divided into two categories: Consequence of Failure (COF) and Likelihood of Failure (LOF).

Consequence of Failure: The COF criteria are intended to qualitatively identify the consequences of the failure of pipelines within the system and are used in the calculation of the COF score; the measure or proxy, scale, and weights vary for each criterion. These criteria, as well as the scores and weights, were reviewed and approved by SLVWD staff before incorporation into risk assessment.

Likelihood of Failure: The LOF criteria are intended to qualitatively identify the likelihood of the failure of pipelines within the system and are used in the calculation of the total LOF score; the type, score values, and weights vary for each criterion. These criteria, as well as the scores and weights, were reviewed and approved by SLVWD staff before incorporation into the risk assessment.

8.4.1 Pipeline Risk Criteria

This section documents the risk assessment criteria for existing distribution pipelines.

8.4.1.1 Pipeline Consequence of Failure Criteria

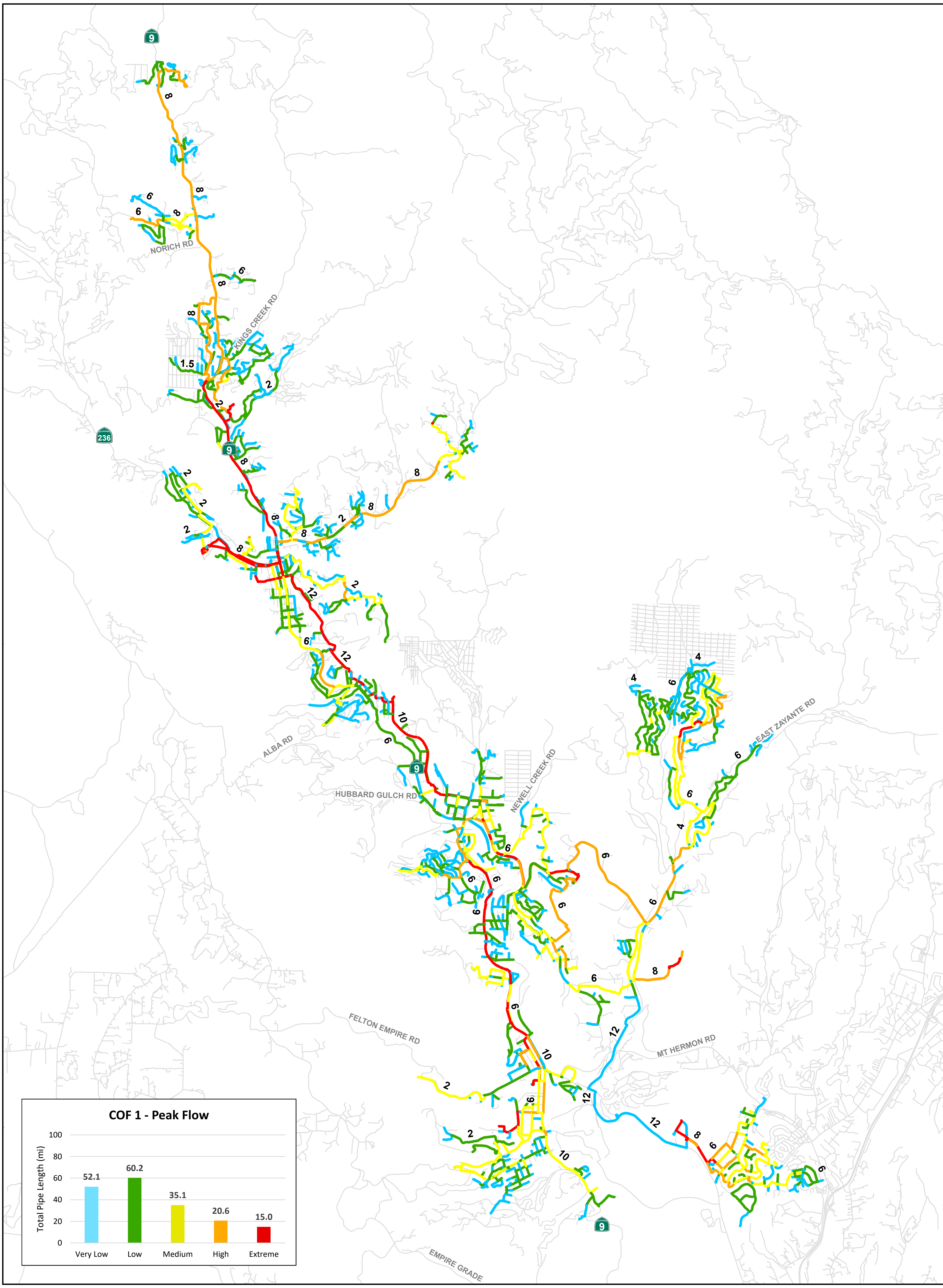
The specific score values and weights for pipeline consequence of failure criteria are documented below, and summarized on **Table 8.2**.

- **Peak Flow (40%)**: This criterion assesses the consequence of failure of pipelines based on the maximum flow conveyed in the pipes, based on results from the existing distribution system hydraulic model. Scores range from a value of 1 for pipelines that convey less than 2.5 gpm of flow to a value of 5 for pipelines with flows greater than or equal to 250 gpm. The peak flows in modeled pipes were extracted from the hydraulic model and are documented on **Figure 8.1**.

- **Critical Transmission Mains (25%)**: This criterion identifies pipelines that are non-redundant transmission mains. Failures in non-redundant transmission mains will have a greater level of service interruption. Scores range from a value of 5 for critical transmission mains to a value of 1 for the other mains. Critical transmission mains were identified and are documented on **Figure 8.2**.

- **Critical Facilities (20%)**: This criterion characterizes the consequence of pipelines in close proximity of critical facilities, which were assumed to include schools, child care facilities, medical facilities, and skilled nursing facilities. Scores range from a value of 1 for pipelines not in proximity to a critical facility to a value of 5 for pipelines within 150 feet of critical facilities. Failures adjacent to schools and specific facilities may require greater levels of maintenance, and more critical response. The existing pipelines in proximity to critical facilities were identified and are documented on **Figure 8.3**.

- **Road Type (10%)**: This criterion identifies pipelines that cross highway or are within arterial roads. Water main breaks in high traffic areas can be costlier to repair and can involve multiple jurisdictions. The road types were determined by using GIS road shapefiles from the County's databases. Scores range from a value of 5 for pipelines crossing highway roads, a value of 4 for pipelines crossing arterial roads and a value of 1



Legend

Consequence Score

Roads

Very Low (< 2.5 gpm)
(52.1 Miles, 28.5%)

Low (2.5 - 25 gpm)
(60.2 Miles, 32.9%)

Moderate (25 - 100 gpm)
(35.1 Miles, 19.2%)

High (100 - 250 gpm)
(20.6 Miles, 11.3%)

Extreme (250 gpm or More)
(15.0 Miles, 8.2%)

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Update: May 21, 2021

0 0.25 0.5 1 Mile

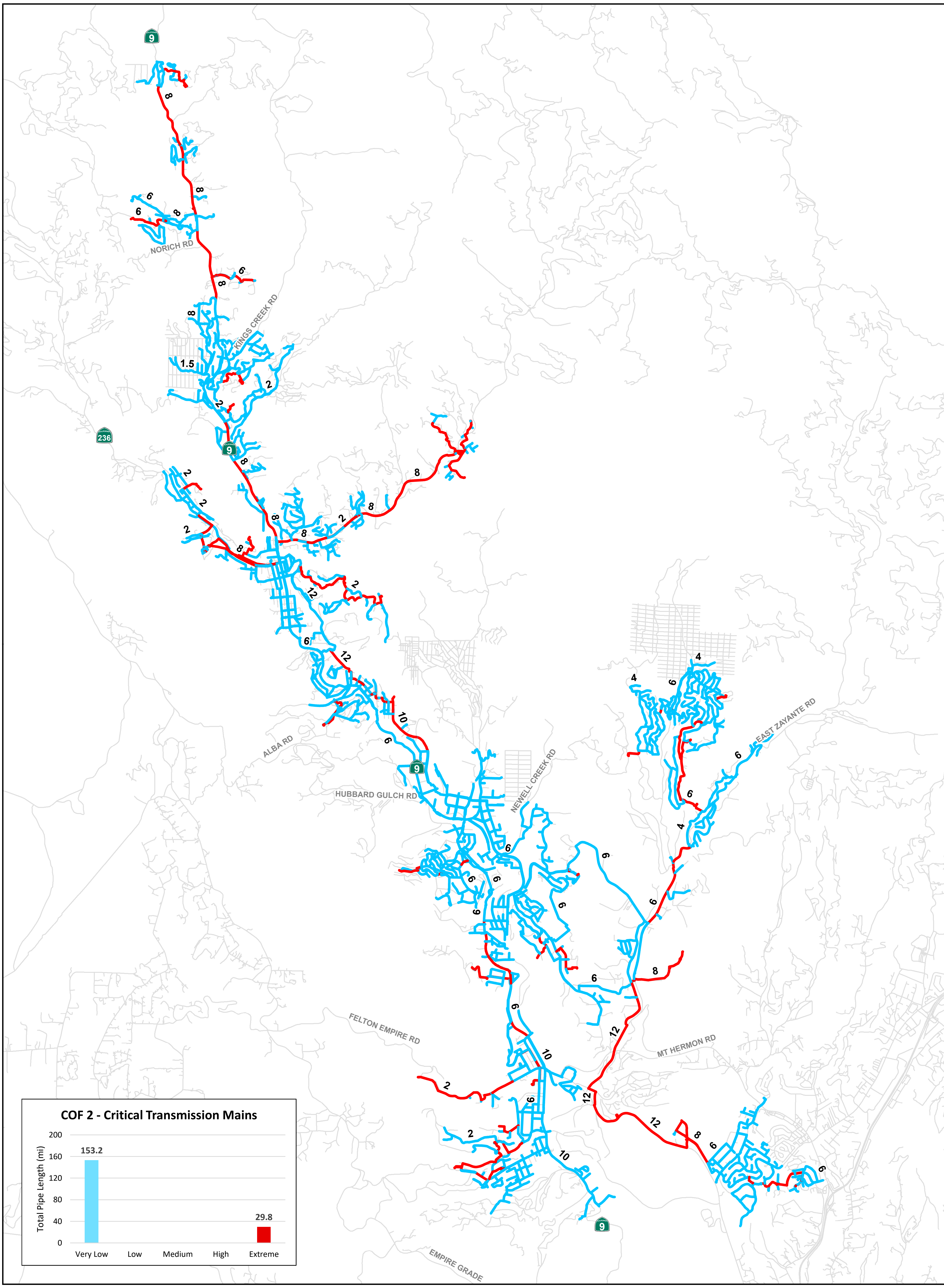
N W E S

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-1_COF1Peakflow_052121.mxd

Figure 8.1
COF 1 Peak Flow

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Consequence Score

Very Low (Other Mains) (153.2 Miles, 83.7%)

Extreme (Transmission Main) (29.8 Miles, 16.3%)

Roads

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Update: May 21, 2021

0 0.25 0.5 1 Mile

N E S W

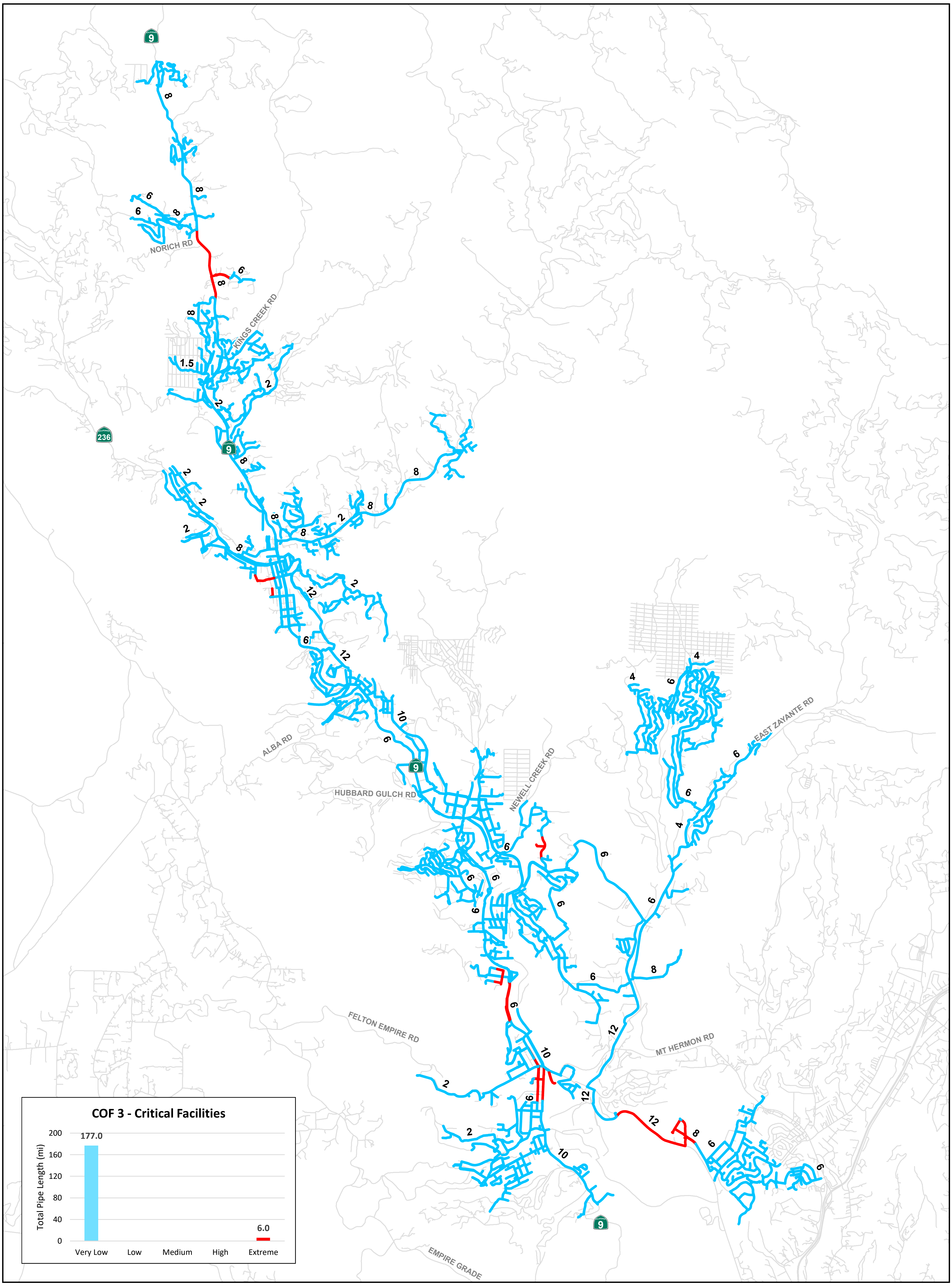
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-2_COF2TransMain_052121.mxd

Figure 8.2
COF 2
Critical Transmission Mains

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Consequence Score

Very Low (Other Mains) (177.0 Miles, 96.7%)

Extreme (Near Critical Facilities) (6.0 Miles, 3.3%)

Roads

Update: May 21, 2021

0 0.25 0.5 1 Mile

Figure 8.3
COF 3 Critical Facilities
Water Master Plan
San Lorenzo Valley Water District

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File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-3_COF3CritFac_052121.mxd

Table 8.2 Pipeline Consequence of Failure Criteria

Water Master Plan
San Lorenzo Valley Water District

				Consequence of Failure	Very Low	Low	Moderate	High	Extreme
				Rating	1	2	3	4	5
1	2	3	4	5	6	7	8	9	10
No.	Consequence Categories	Description	Weighting	Measure or Proxy	Consequence Scale				
1	Peak Flow	Failures in high flow pipelines result in larger spills and a higher likelihood of contamination of adjacent infrastructure.	40%	Maximum Pipeline Flow	< 2.5 gpm	2.5 - 25 gpm	25 - 100 gpm	100 - 250 gpm	>= 250 gpm
2	Critical Transmission Mains	Failures in non-redundant transmission mains will have a greater level of service interruption.	25%	Transmission Pipeline Redundancy	Other Mains				Transmission Main
3	Critical Facilities	Failures adjacent to schools and medical facilities may require greater levels of clean up, and more critical response.	20%	Proximity to critical customers	Other Mains				Within 150 feet of: Schools, Child Care Facilities, Medical Facilities, Skilled Nursing Facilities
4	Road Type	Failures in arterial streets are costly and have adverse impacts to public opinion.	10%	Traffic Disruption (Road Crossing)	Other Mains			Pipelines in Arterial Roads	Pipelines in Highway Roads
5	Diameter	Larger diameter pipelines typically carry higher flows, and failures can lead to larger spill quantities.	5%	Pipeline Diameter	<= 2''	3'' - 6''	8''	10''	>= 12''

for other pipelines. The existing pipelines in proximity to the aforementioned road types were identified and are documented on **Figure 8.4**.

- **Diameter (5%)**: This criterion characterizes the pipelines based on the diameter. The failure of a large diameter pipeline can have a greater impact to the level of service of the water system. Scores range from a value of 1 for pipelines with a diameter of 2 inches or smaller and a value of 5 for pipelines with a diameter of 12 inches or larger. The diameters of existing pipelines are documented on **Figure 8.5**.

Based on the consequence of failure criteria each pipeline was assigned a score. The breakdown of the pipeline COF is documented graphically on **Figure 8.6** and summarized below:

- Very Low: 24 miles (13%)
- Low: 101 miles (55%)
- Moderate: 35 miles (19%)
- High: 18 miles (10%)
- Extreme: 5 miles (3%)

8.4.1.2 Pipeline Likelihood of Failure Criteria

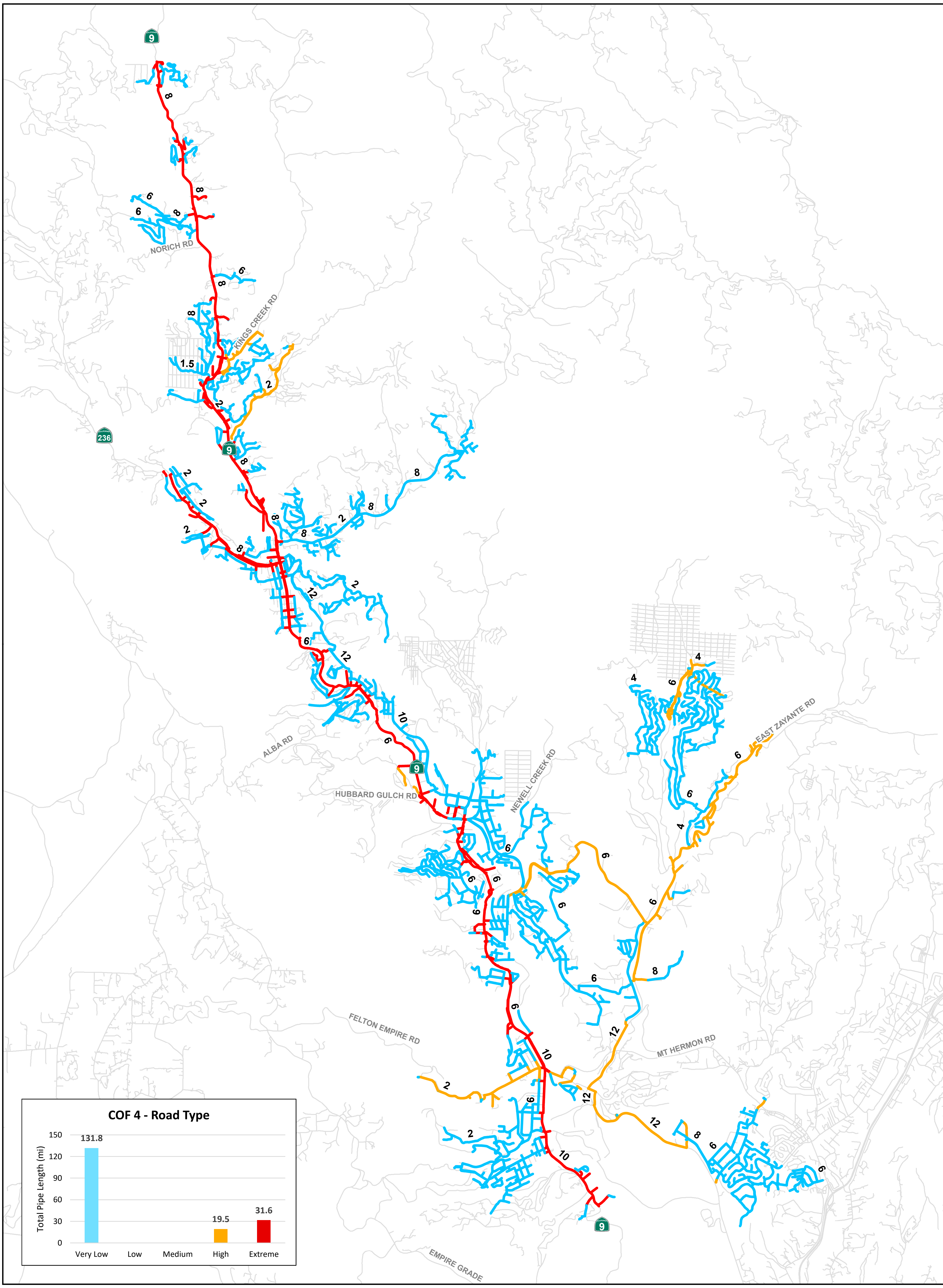
The specific score values and weights for pipeline likelihood of failure criteria are documented below, and summarized on **Table 8.3**.

- **Pipeline Age (50%)**: This criterion assesses the likelihood of failure of pipelines based on pipeline age. Scores range from a value of 1 for pipelines that are less than 50 years old to a value of 5 for pipelines older than 80 years. The ages of existing pipelines are documented on **Figure 8.7**.

- **Leakage History (30%)**: This criterion assesses the likelihood of failure of pipelines based on number of previous leak repairs. Scores range from a value of 1 for pipelines with no history of leak repair to a value of 5 for pipeline greater than 1 leak repair. Pipeline leaks can indicate a higher chance of failure. Maintenance records were spatially matched to pipelines using recorded addresses and pipeline diameters, and are documented on **Figure 8.8**.

- **Maximum Pressure (10%)**: This criterion assesses the likelihood of failure of pipelines based on maximum pipeline pressure under peak day demand condition. Scores range from a value of 1 for pipelines with maximum pressure less than 100 psi to a value of 5 for pipeline with maximum pressure greater than 200 psi. High water pressure can increase risk of pipeline failure and negatively impact customer level of service. The maximum pressures in modeled pipes were extracted from the hydraulic model and are documented on **Figure 8.9**.

- **Percentage Capacity (10%)**: This criterion assigns a score to each pipeline based on the pipelines design capacity. Based on the peak flow to design capacity under peak day



Legend

Consequence Score

Roads

Very Low (Other Mains) (131.8 Miles, 72.0%)

High (Near Arterial Roads) (19.5 Miles, 10.7%)

Extreme (Near Highways) (31.6 Miles, 17.3%)

0 0.25 0.5 1 Mile

Update: May 21, 2021

Figure 8.4
COF 4 Road Type

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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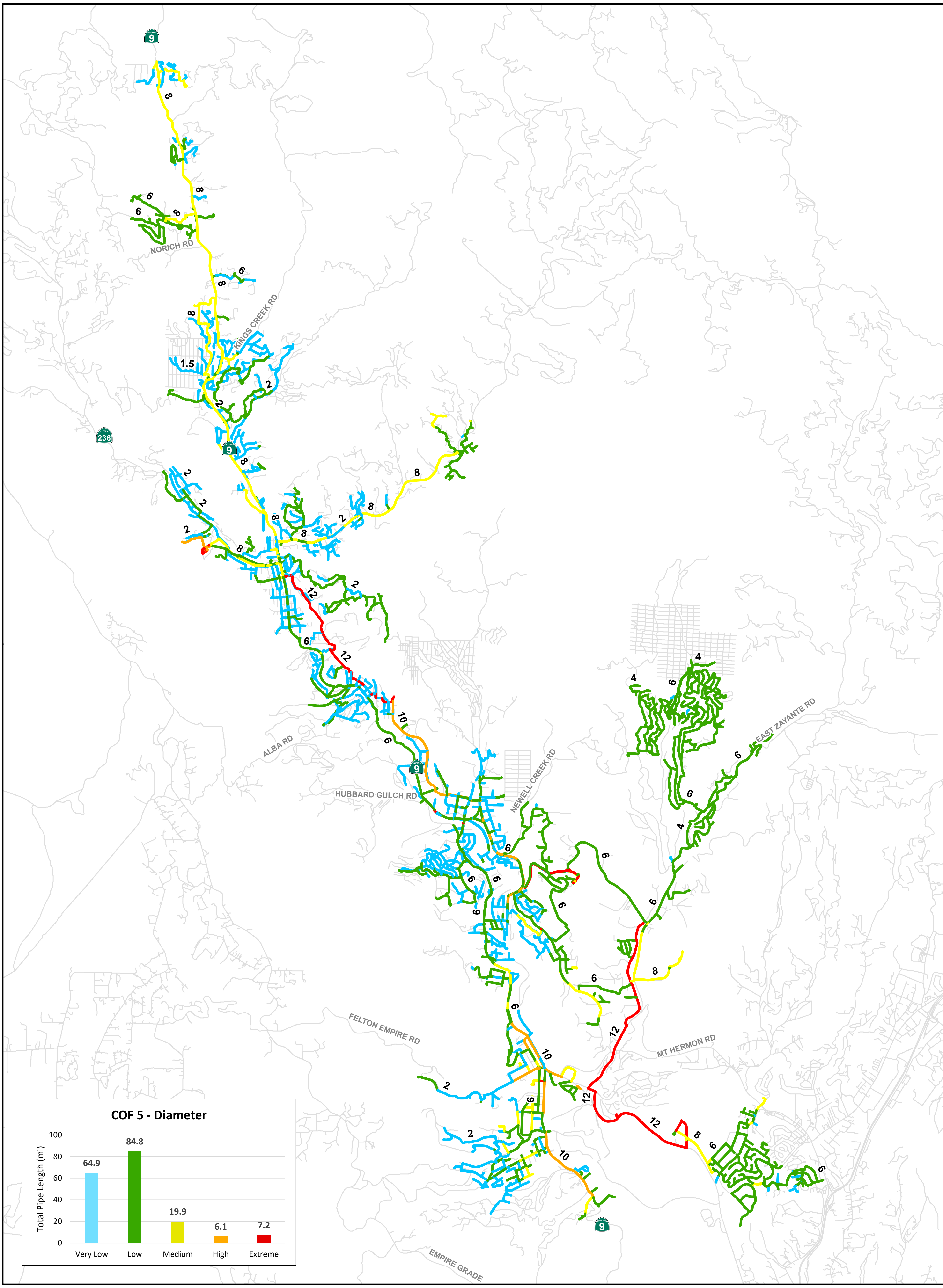

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Consequence Score

- Very Low (2" or Less) (64.9 Miles, 35.5%)
- Low (3" - 6") (84.8 Miles, 46.4%)
- Moderate (8") (19.9 Miles, 10.9%)
- High (10") (6.1 Miles, 3.4%)
- Extreme (12" or Greater) (7.2 Miles, 3.9%)

Roads

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Update: May 21, 2021

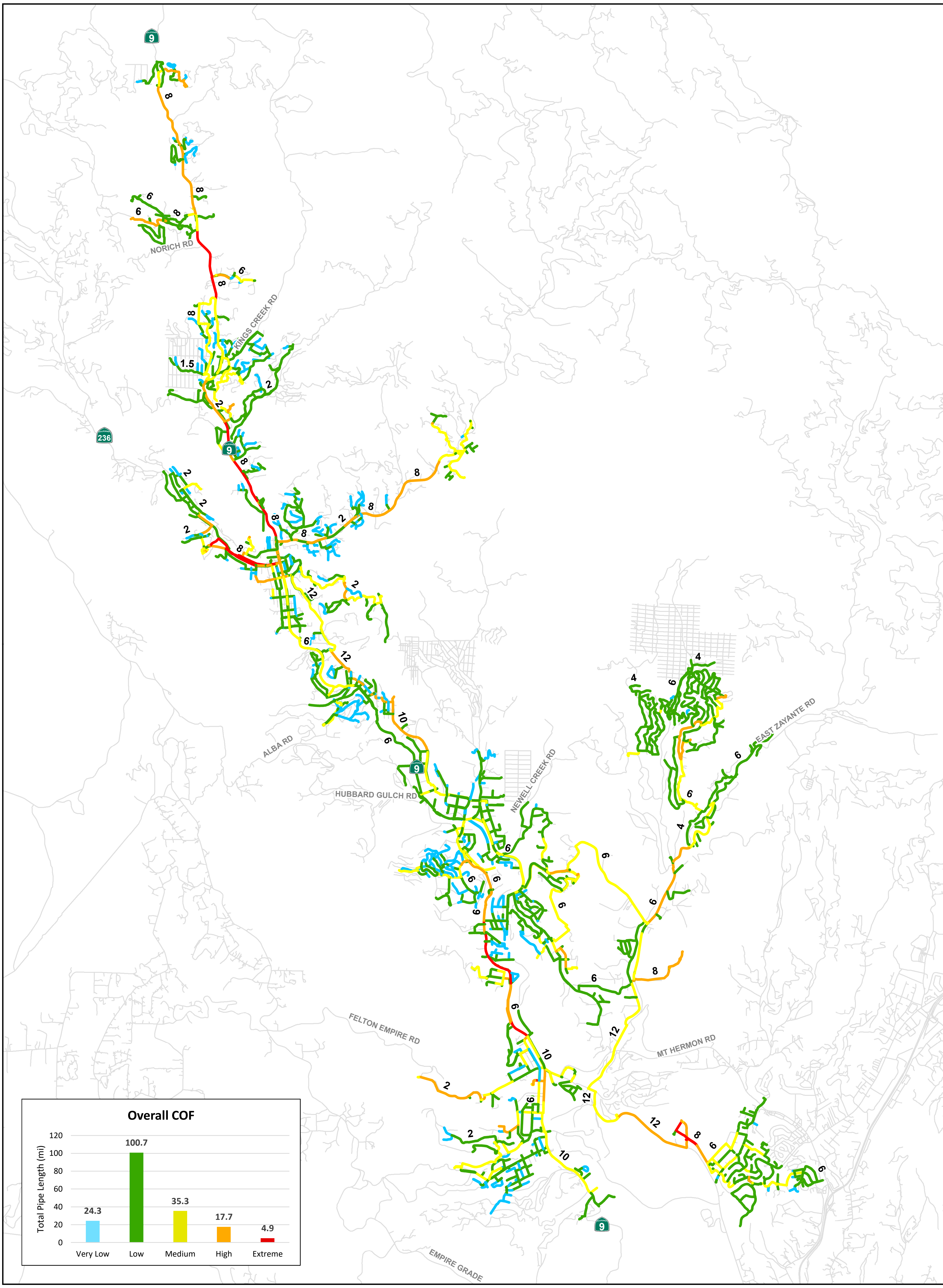
0 0.25 0.5 1 Mile

Figure 8.5
COF 5 Pipeline Diameter

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-5_COF5Diameter_052121.mxd



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Consequence Score

Roads

Very Low (24.3 Miles, 13.3%)

Low (100.7 Miles, 55.1%)

Moderate (35.3 Miles, 19.3%)

High (17.7 Miles, 9.7%)

Extreme (4.9 Miles, 2.7%)

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Update: July 16, 2021

0 0.25 0.5 1 Mile

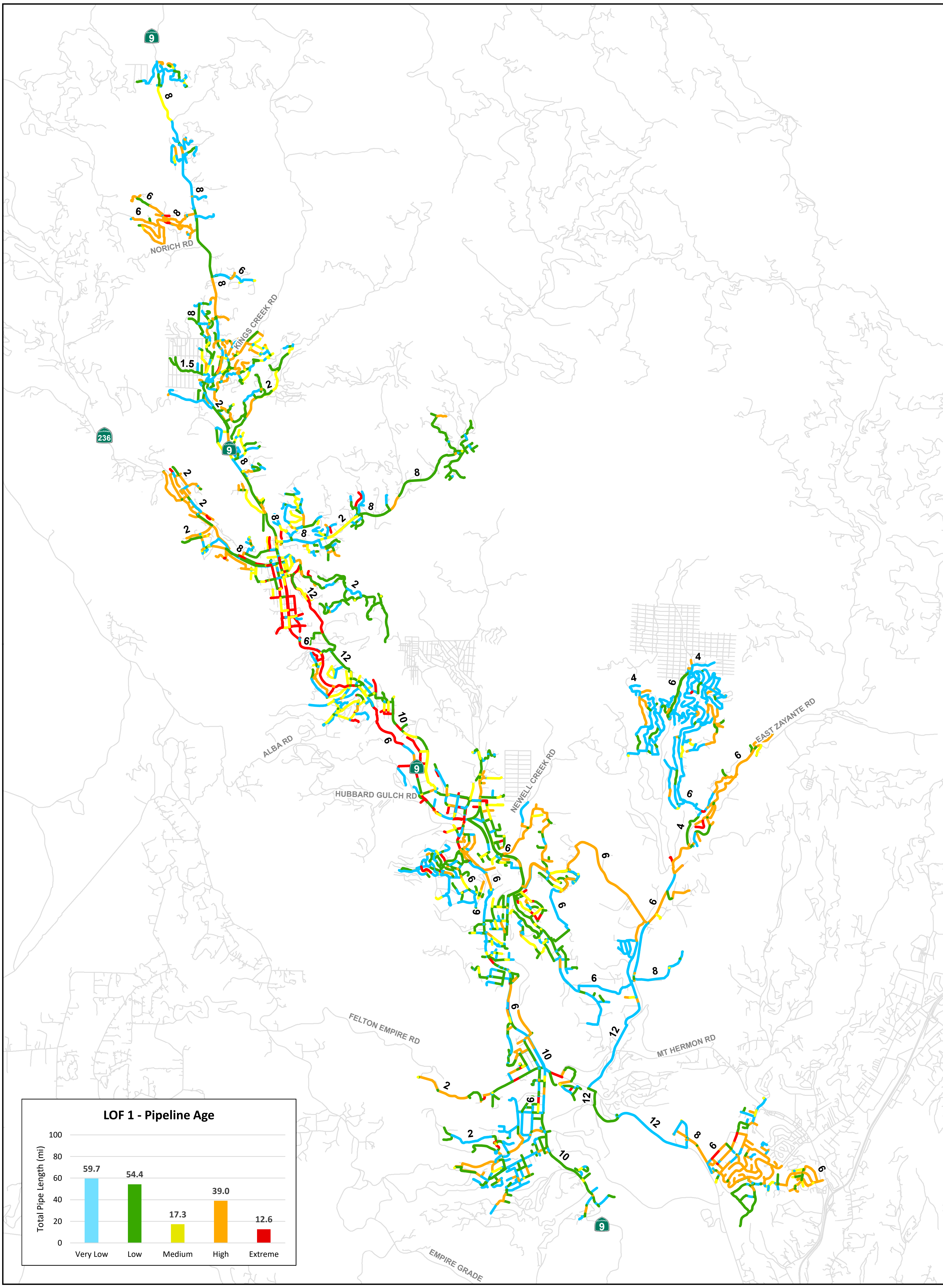
N S E W

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-6_OverallCOF_071621.mxd

Figure 8.6
Overall COF
Existing Pipelines

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley
WATER DISTRICT



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Likelihood Score

Very Low (Less than 50 Years Old) (59.7 Miles, 32.6%)

Low (50 - 70 Years) (54.4 Miles, 29.7%)

Moderate (Unknown) (17.3 Miles, 9.4%)

High (70 - 80 Years) (39.0 Miles, 21.3%)

Extreme (Greater than 80 Years Old) (12.6 Miles, 6.9%)

Roads

Update: May 21, 2021

0 0.25 0.5 1 Mile

N W E S

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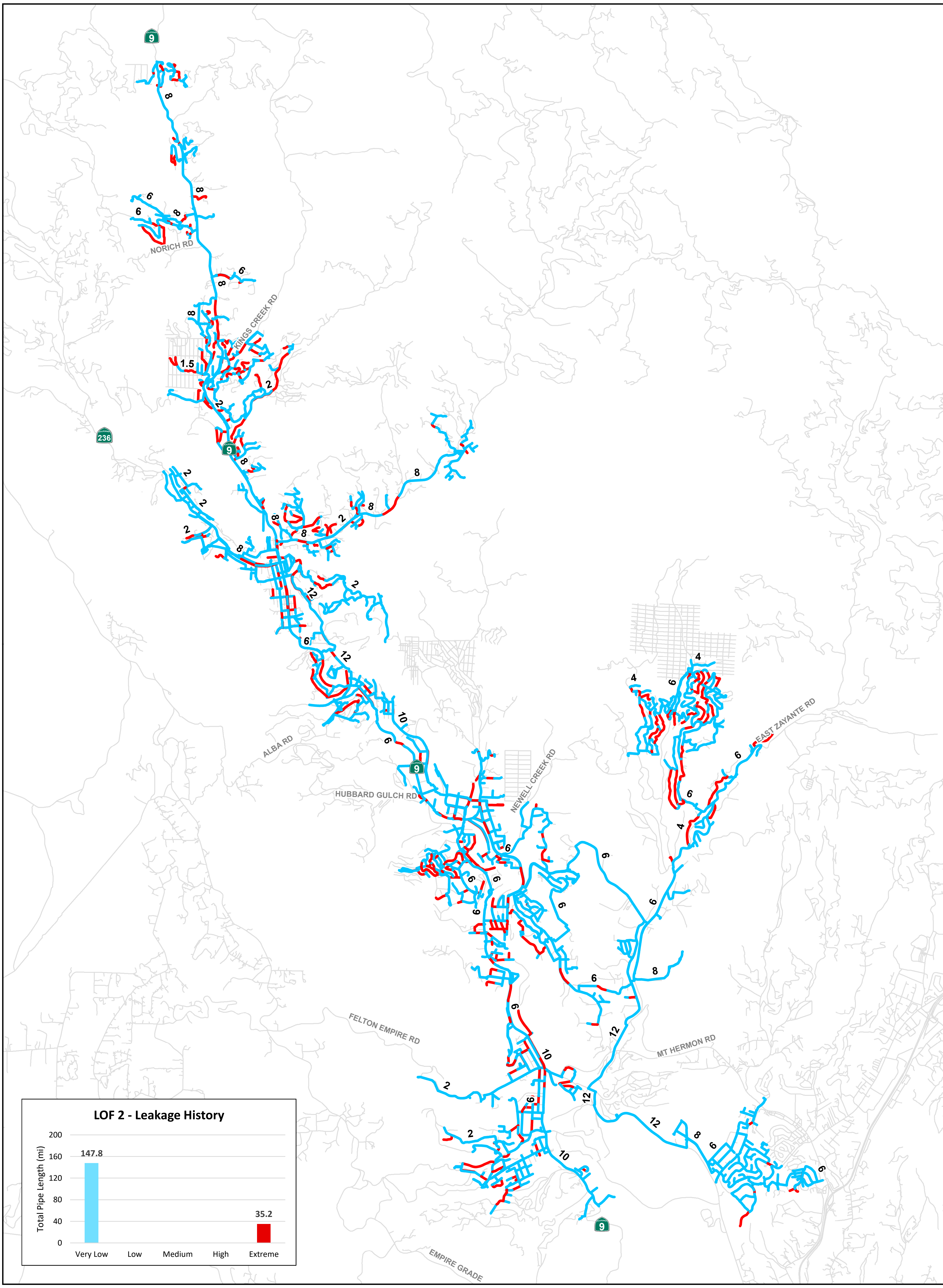
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-7_LOF1Age_052121.mxd

Figure 8.7
LOF 1 Pipeline Age

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



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Likelihood Score

Very Low (Other Mains) (147.8 Miles, 80.7%)

Extreme (Leakage History) (35.2 Miles, 19.3%)

Roads

0 0.25 0.5 1 Mile

Update: June 24, 2021

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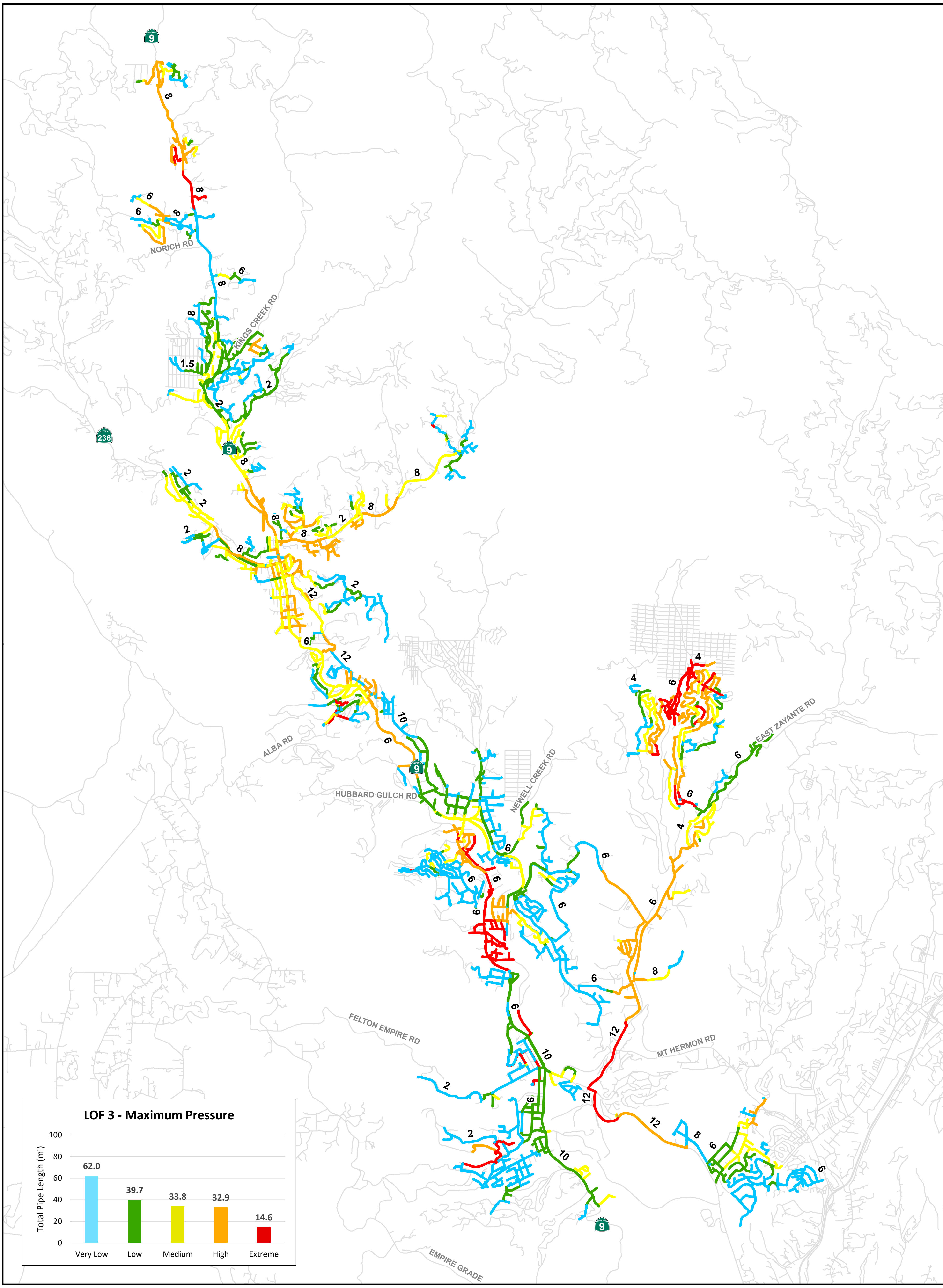
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-8_LOF2Leakage_062421.mxd

Figure 8.8
LOF 2 Leakage History
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



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Likelihood Score

Roads

- Very Low (Less than 100 psi) (62.0 Miles, 33.9%)
- Low (100 - 120 psi) (39.7 Miles, 21.7%)
- Moderate (120 - 150 psi) (33.8 Miles, 18.5%)
- High (150 - 200 psi) (32.9 Miles, 18.0%)
- Extreme (Greater than 200 psi) (14.6 Miles, 8.0%)

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Update: May 21, 2021

0 0.25 0.5 1 Mile

Figure 8.9
LOF 3 Maximum Pressure
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-9_LOF3MaxPressure_052121.mxd

Table 8.3 Pipeline Likelihood of Failure Criteria

Water Master Plan

San Lorenzo Valley Water District

				Likelihood of Failure	Very Low	Low	Moderate	High	Extreme
				Rating	1	2	3	4	5
1	2	3	4	5	6	7	8	9	10
No.	**Likelihood Categories**	**Description**	**Weighting**	**Measure or Proxy**	**Likelihood Scale**				
1	**Pipeline Age**	Pipeline Age can contribute to increased chance of failure.	**50%**	Pipeline Age	< 50 years	50 - 70 years	Unknown	70 - 80 years	> 80 years
2	**Leakage History**	Pipeline leaks can indicate a higher chance of failure.	**30%**	Pipeline Leak Repairs	Other Mains	-	-	-	Leakage History
3	**Maximum Pressure**	High water pressure can increase risk of pipeline failure and negatively impact customer level of service.	**10%**	Maximum Pipeline Pressure	< 100 psi	100 - 120 psi	120 - 150 psi	150 - 200 psi	> 200 psi
5	**Percent Capacity**	Pipelines that experience high peak flow compared to their design capacity have an increased chance of failure.	**10%**	Percent Capacity (Peak flow vs. design capacity)	< 5%	5 - 25%	25 - 50%	50 - 90%	>= 90%

- demand, a percentage was applied to each pipe. Scores range from a value of 1 for pipelines with percentage capacity less than 5% to a value of 5 for pipeline with percentage capacity greater than or equal to 90%. Pipelines with higher percentage capacities have a higher chance of failure than pipelines with low percentage capacities. The capacities in modeled pipes were calculated based on flows extracted from the hydraulic model and are documented on **Figure 8.10**.

Based on the likelihood of failure criteria each pipeline was assigned a score. The breakdown of the pipeline LOF is documented graphically on **Figure 8.11** and summarized below:

- Very Low: 6 miles (3%)
- Low: 86 miles (47%)
- Moderate: 60 miles (33%)
- High: 25 miles (14%)
- Extreme: 6 miles (3%)

8.4.2 Storage Tank Risk Criteria

This section documents the risk assessment criteria for existing storage tanks.

8.4.2.1 Storage Tank Consequence of Failure Criteria

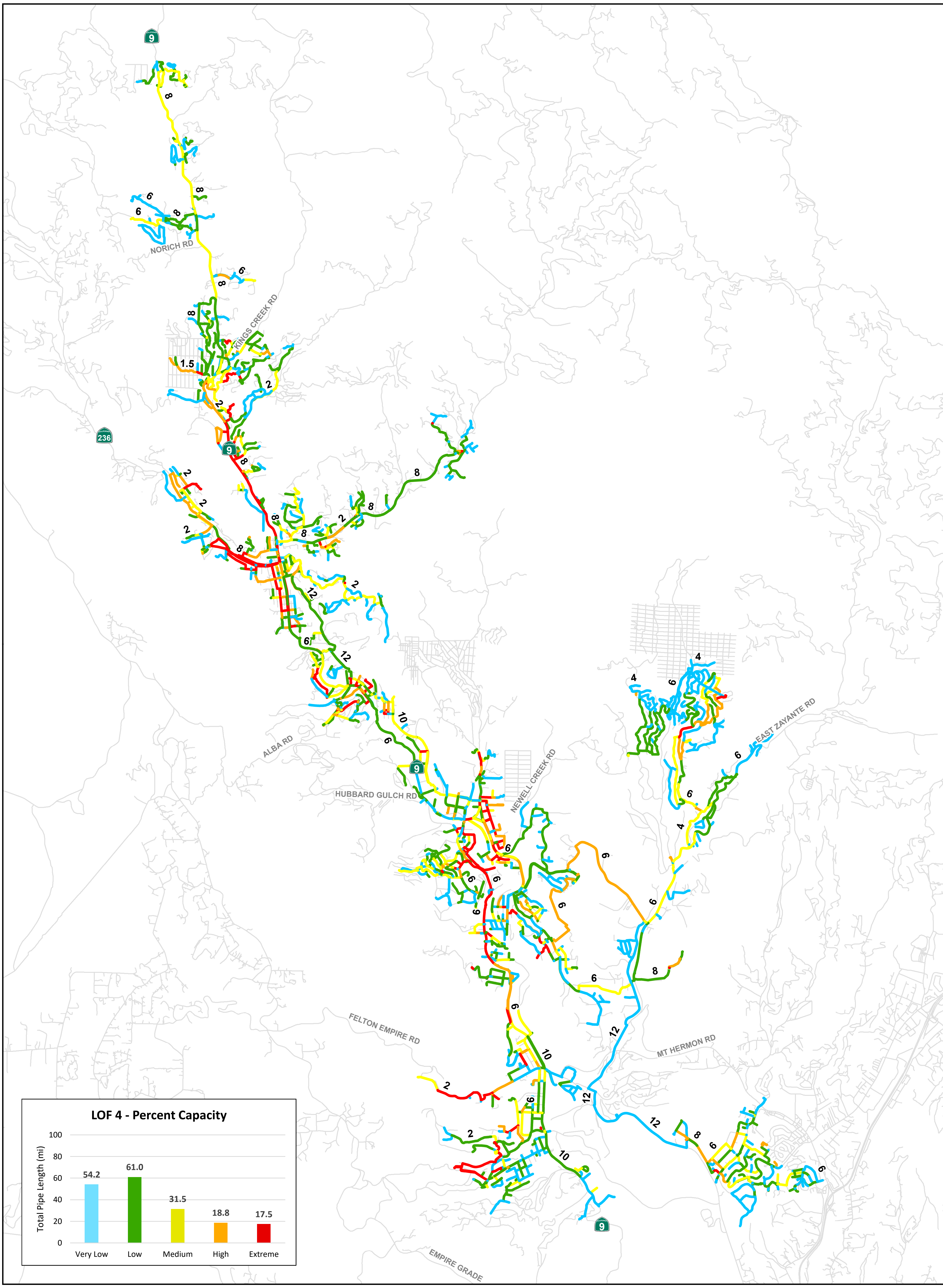
The specific score values and weights for storage consequence of failure criteria are documented below, and summarized on **Table 8.4**.

- **Capacity (50%)**: This criterion assesses the consequence of failure of storage based on storage design capacity. Scores range from a value of 1 for storage tanks with design capacity less than 0.1 MG to a value of 5 for storage tanks with design capacity greater than 2 MG. Higher capacity tanks have a higher consequence if they were to fail.

- **Service Demands (25%)**: This criterion assesses the consequence of failure of storage based on service demands. Scores range from a value of 1 for storage tanks with service demand less than 0.01 mgd to a value of 5 for storage tanks with service demand greater than 0.20 mgd. Tanks that serve a large portion of the system demand are more critical to the system operation.

- **Required Fire Flow Volume (25%)**: This criterion assesses the consequence of failure of storage based on required fire flow capacity. Scores vary between 1 for single-family residential requirements, 3 for multi-family residential requirements, and 5 for commercial or institutional requirements. Tanks that serve a large portion of the system demand are more critical to the system operation.

Based on the consequence of failure criteria listed above, each storage tank was assigned a score. The breakdown of the storage tank COF is documented graphically on **Figure 8.12**.



Legend

Likelihood Score

Roads

- Very Low (Less than 5%) (54.2 Miles, 29.6%)
- Low (5 - 25%) (61.0 Miles, 33.4%)
- Moderate (25 - 50%) (31.5 Miles, 17.2%)
- High (50 - 90%) (18.8 Miles, 10.3%)
- Extreme (90% or Greater) (17.5 Miles, 9.5%)

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0 0.25 0.5 1 Mile

N W E S

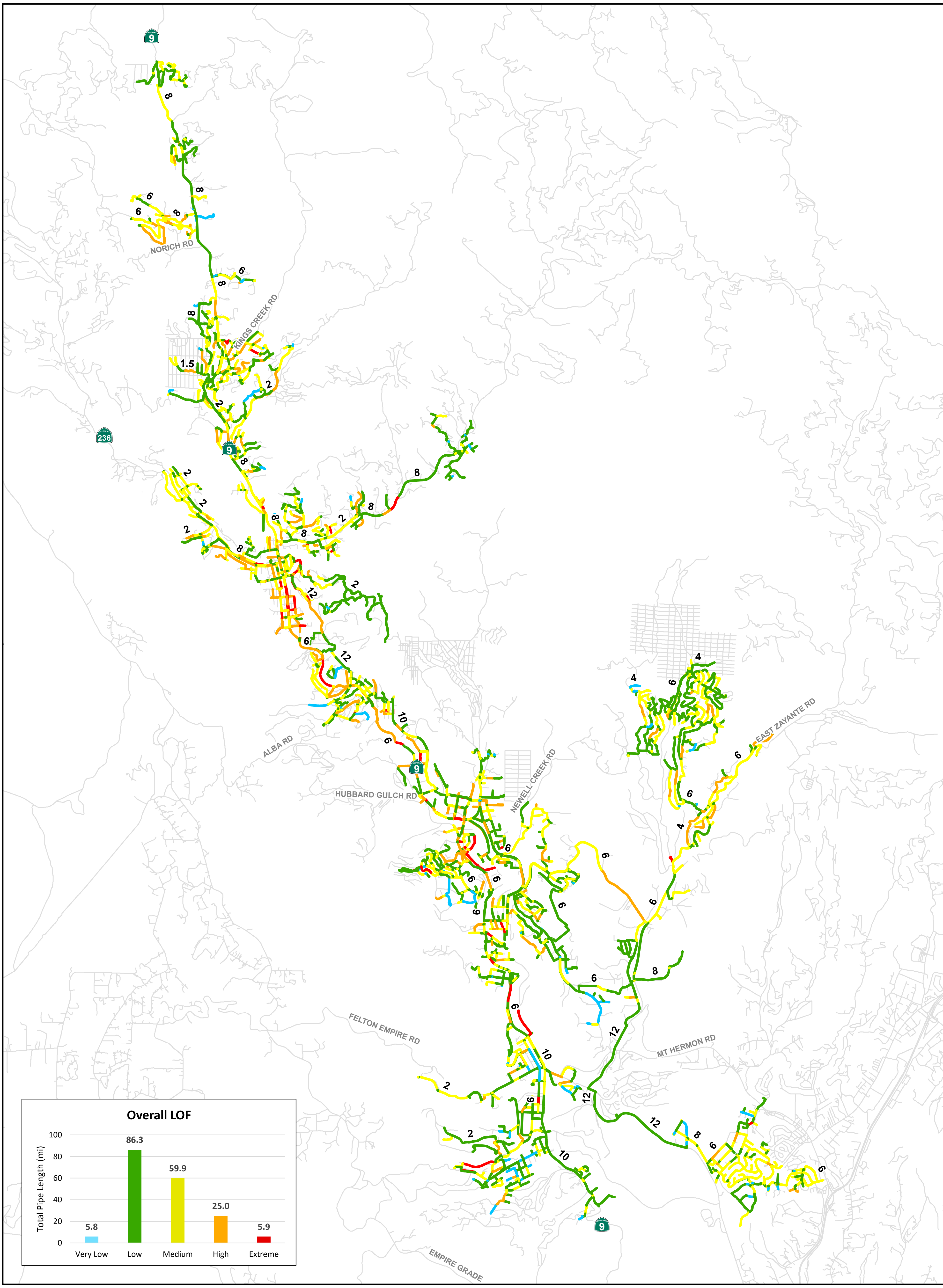
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-10_LOF4Capacity_052121.mxd

Figure 8.10
LOF 4 Percent Capacity

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Likelihood Score

Roads

Very Low (5.8 Miles, 3.2%)

Low (86.3 Miles, 47.2%)

Moderate (59.9 Miles, 32.7%)

High (25.0 Miles, 13.7%)

Extreme (5.9 Miles, 3.2%)

AKEL ENGINEERING GROUP, INC.

Update: July 16, 2021

0 0.25 0.5 1 Mile

N W E S

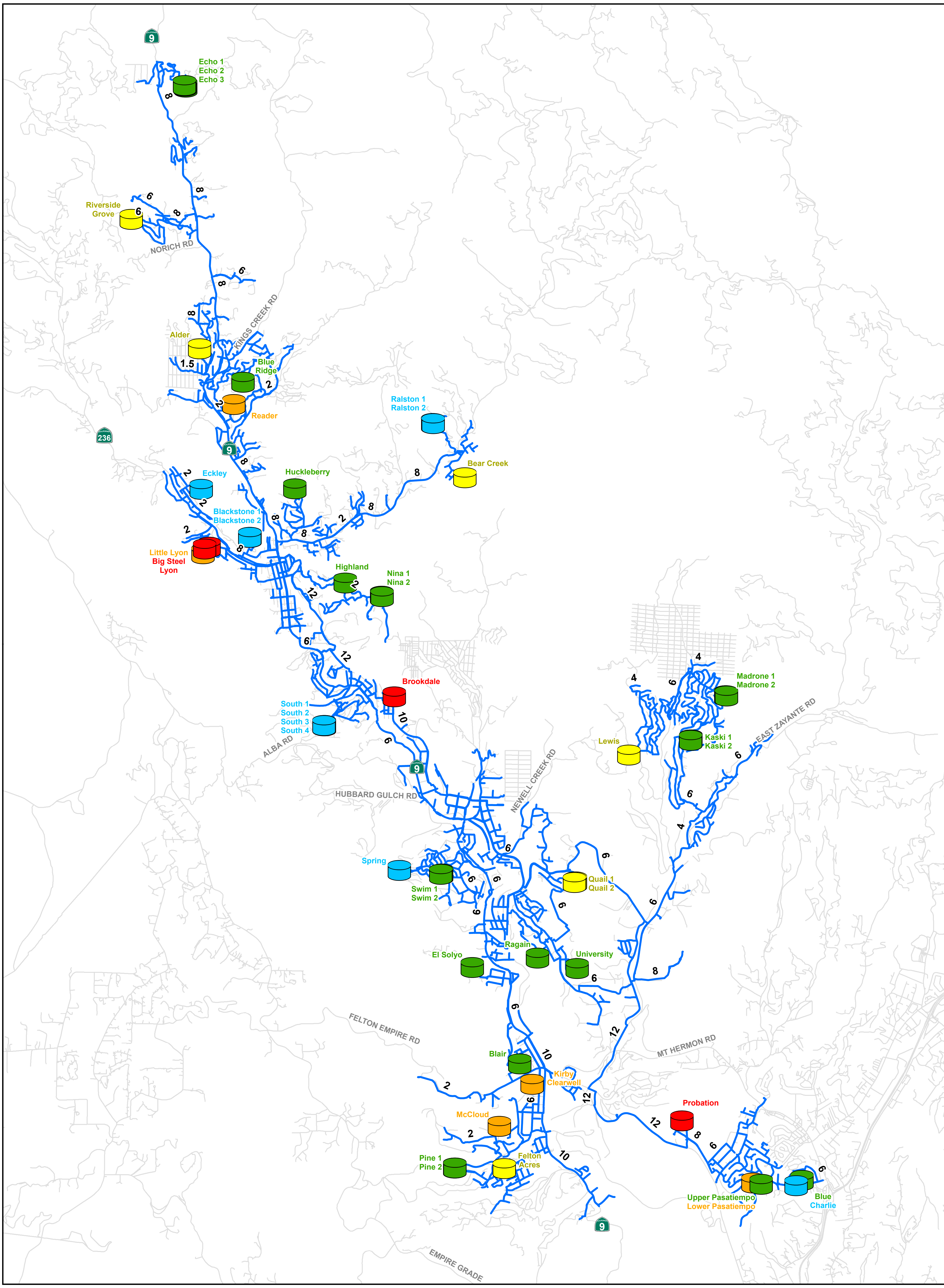
Figure 8.11
Overall LOF
Existing Pipelines

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-11_OverallLOF_071621.mxd



Legend

Consequence Score

- Very Low (Risk Score 0 - 1)
- Low (Risk Score 1 - 2)
- Moderate (Risk Score 2 - 3)
- High (Risk Score 3 - 4)
- Extreme (Risk Score 4 - 5)
- Pipes
- Roads

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Update: May 25, 2021

0 0.25 0.5 1 Mile

N E S W

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-12_COF_Tanks_052521.mxd

Figure 8.12 Consequence of Failure Existing Tanks

Risk Assessment
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Table 8.4 Storage Tank Consequence of Failure Criteria

Water Master Plan
San Lorenzo Valley Water District

				Consequence of Failure	Very Low	Low	Moderate	High	Extreme
				Rating	1	2	3	4	5
1	2	3	4	5	6	7	8	9	10
No.	**Consequence Categories**	**Description**	**Weighting**	**Measure or Proxy**	**Consequence Scale**				
1	**Capacity**	Higher capacity tanks have a higher consequence if they were to fail	**50%**	Tank Volume	< 0.1 MG	0.1 MG - 0.2 MG	0.2 MG - 0.5 MG	0.5 MG - 2 MG	> 2 MG
2	**Service Demands**	Tanks that serve a large portion of the system demand are more critical to the system operation	**25%**	Demands	< 0.01 mgd	0.01 - 0.05 mgd	0.05 - 0.10 mgd	0.10 - 0.20 mgd	> 0.20 mgd
3	**Required Fire Flow Volume**	Tanks required to maintain a larger fire flow volume due to commercial or institutional are more critical	**25%**	Required fire flow capacity	Residential		Multi-Family		Commercial/ Institutional

8.4.2.2 Storage Tank Likelihood of Failure Criteria

The specific score values and weights for storage tank likelihood of failure criteria are documented below, and are summarized on **Table 8.5**

- **Material (65%)**: This criterion assesses the likelihood of failure of storage based on tank material. Scores vary between 1 for welded steel and 2 for concrete bolted steel, 4 for polyethylene, and 5 for wood. Less durable tank material can contribute to increased chance of failure.

- **Tank Age (25%)**: This criterion assesses the likelihood of failure of storage based on tank age. Score range from a value of 1 for storage tanks with age less than 10 years to a value of 5 for storage tanks with age greater than 50 years or unknown tank age. Older tanks carry an increased chance of failure.

- **Fire Hazard Level (10%)**: This criterion assesses the likelihood of failure of storage based on fire hazard level. Scores range from 1 for moderate fire hazard level to 5 for very high fire hazard level. Structures in higher fire hazard areas have a higher likelihood of fail during a forest fire event.

Based on the likelihood of failure criteria listed above, each storage tank was assigned a score. The breakdown of the storage tank LOF is documented graphically on **Figure 8.13**.

8.4.3 Booster Pump Station Risk Criteria

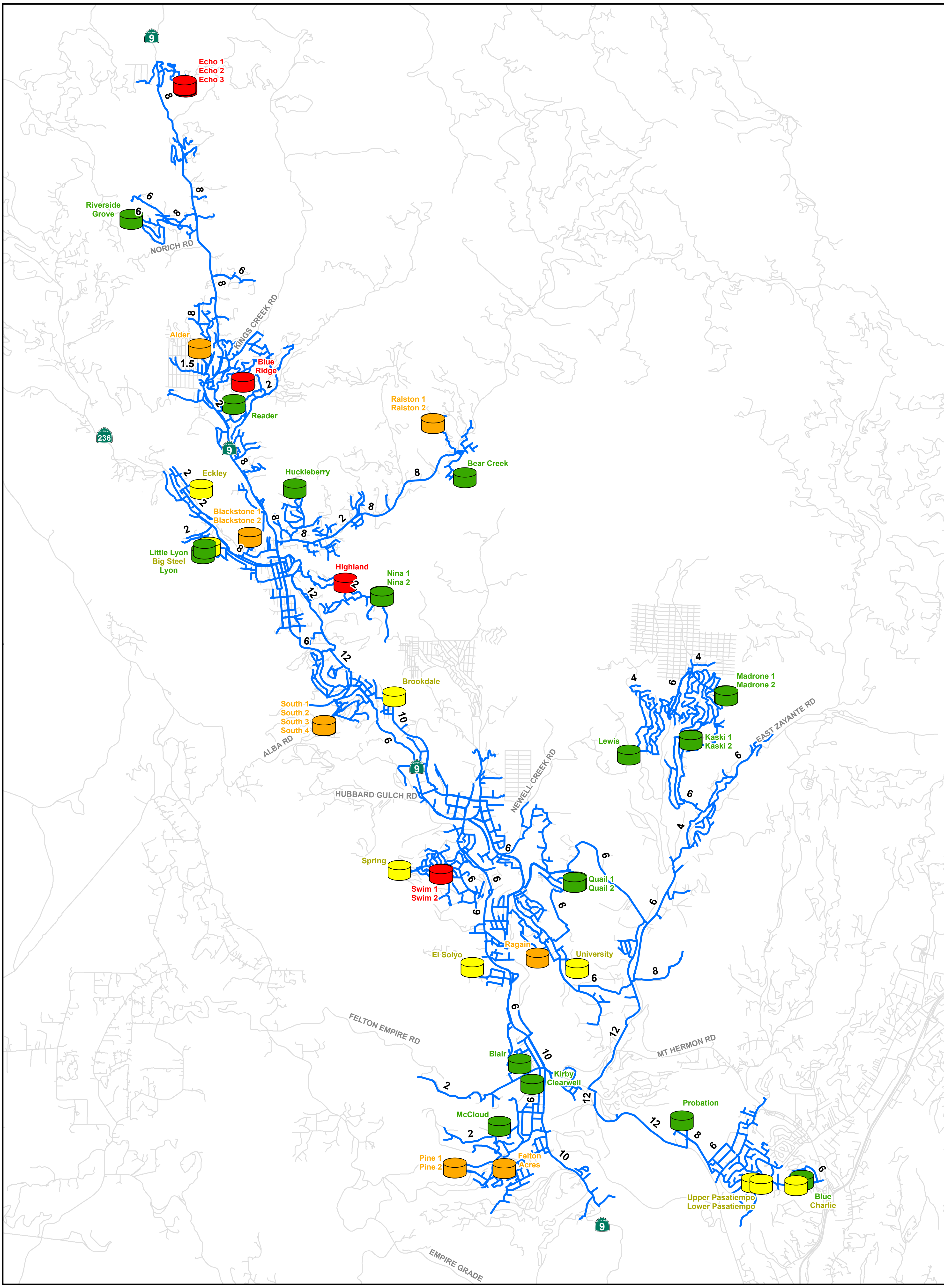
This section documents the risk assessment criteria for existing booster pump stations.

8.4.3.1 Booster Pump Station Consequence of Failure Criteria

The specific score values and weights for booster pump station consequence of failure criteria are documented below, and are summarized on **Table 8.6**.

- **Service Demand (50%)**: This criterion assesses the consequence of failure of booster stations based on pump station required capacity. Scores range from a value of 1 for booster pump stations with service demand less than 50 gpm to a value of 5 for booster pump stations with service demand greater than 1,000 gpm. Booster pump stations that supply a large portion of the system demands are more critical to the system.

- **Booster Capacity (25%)**: This criterion assesses the consequence of failure based on booster station total capacity. Scores ranges from a value of 1 for booster pump stations with total capacity less than 25 gpm to a value to 5 for booster pump stations with total capacity greater than 750 gpm. Larger booster pump stations may be responsible for supplying larger areas or transferring to other zones during an emergency.



Legend

Likelihood Score

- Very Low (Risk Score 0 - 1)
- Low (Risk Score 1 - 2)
- Moderate (Risk Score 2 - 3)
- High (Risk Score 3 - 4)
- Extreme (Risk Score 4-5)
- Pipes
- Roads

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Update: May 25, 2021

0 0.25 0.5 1 Mile

Figure 8.13
Likelihood of Failure Existing Tanks

Risk Assessment
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-13_LOF_Tanks_052521.mxd

Table 8.5 Storage Tank Likelihood of Failure Criteria
Water Master Plan
San Lorenzo Valley Water District

				Likelihood of Failure	Very Low	Low	Moderate	High	Extreme
				Rating	1	2	3	4	5
1	2	3	4	5	6	7	8	9	10
No.	Likelihood Categories	Description	Weighting	Measure or Proxy	Likelihood Scale				
1	Material	Tank material can contribute to chance of failure	65%	Tank Material	Welded Steel	Concrete Bolted Steel		Poly	Wood
2	Tank Age	Tank Age can contribute to increased chance of failure.	25%	Tank Age	< 10 years	10 - 20 years	20 - 30 years	30 - 50 years	> 50 years (or unknown)
3	Fire Hazard Level	Structures in higher fire hazard areas have a higher likelihood to fail during a forest fire event	10%	Fire Hazard Level	Moderate		High		Very High

Table 8.6 Booster Pump Station Consequence of Failure Criteria

Water Master Plan

San Lorenzo Valley Water District

				Consequence of Failure	Very Low	Low	Moderate	High	Extreme
				Rating	1	2	3	4	5
1	2	3	4	5	6	7	8	9	10
No.	Consequence Categories	Description	Weighting	Measure or Proxy	Consequence Scale				
1	**Service Demands**	Pump stations that supply a large portion of the system demands are more critical to the system	**50%**	Pump Station Required Capacity	< 50 gpm	50 - 100 gpm	100 - 250 gpm	250 - 1000 gpm	> 1,000 gpm
2	**Booster Capacity**	Larger booster stations can supply larger areas or can transfer water to other zones during an emergency	**25%**	Booster Station Total Capacity	< 25 gpm	25 - 100 gpm	100 - 500 gpm	500 -750 gpm	>750 gpm
3	**Redundancy**	Pump stations without a redundant pump are more critical to system operation	**25%**	Does the station have a standby pump	Yes				No

- **Redundancy (25%)**: This criterion assesses the consequence of failure of booster pump station based on redundancy. Scores identify if the booster pump station owns a standby pump. Pump stations without a redundant pump are more critical to system operation.

Based on the consequence of failure criteria listed above, each booster pump station was assigned a score. The breakdown of the booster pump station COF is documented graphically on **Figure 8.14.**

8.4.3.2 Booster Pump Station Likelihood of Failure Criteria

The specific score values and weights for booster pump station likelihood of failure criteria are documented below, and are summarized on **Table 8.7**

- **SLVWD Staff Rating (80%)**: This criterion assesses the likelihood of failure of booster pump station based on SLVWD Staff Rating. Scores range from a value of 1 for booster pump stations rated as in new condition to a value of 5 for booster pump stations rated as poor/unknown.

- **Fire Hazard Level (20%)**: This criterion assesses the likelihood of failure of booster pump station based on fire hazard level. Scores range from a value of 1 for booster pump stations with moderate fire hazard level to a value of 5 for very high fire hazard level. Structures in higher fire hazard areas have a higher likelihood to fail during a forest fire event.

Based on the likelihood of failure criteria listed above, each booster pump station was assigned a score. The breakdown of the booster pump station LOF is documented graphically on **Figure 8.15**.

8.4.4 Pressure Reducing Valve Risk Criteria

This section documents the risk assessment criteria for existing pressure reducing valves.

8.4.4.1 PRV Consequence of Failure Criteria

The specific score values and weights for PRV consequence of failure criteria are documented below, and are summarized on **Table 8.8**.

- **Service Demands (50%)**: This criterion assesses the consequence of failure of PRV based on average day demands. Scores range from a value of 1 for PRVs used as a backup connection to a value of 5 for PRVs that supply ADD greater than 50 gpm. PRVs that supply a larger demand have a higher consequence if they fail.

- **Supply Valve (50%)**: This criterion assesses the consequence of failure of PRV based on if it's supply valve or not. Scores assigned for a value of 1 if the PRV is not a supply valve and a value of 5 if the PRV serves as a supply valve. Failure of a PRV that actively supply system demands is more critical for maintaining proper levels of service.

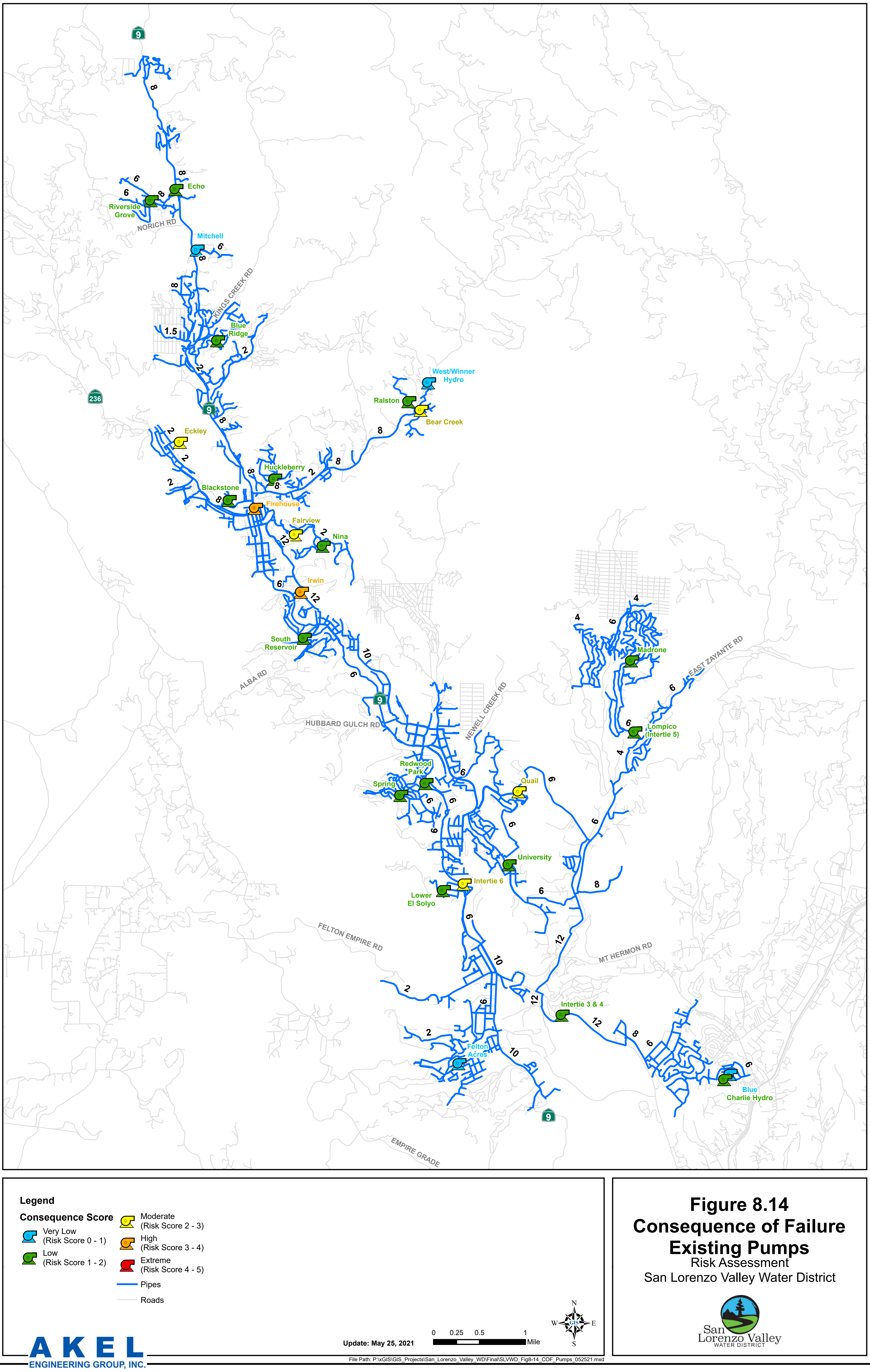

Figure 8.14
Consequence of Failure
Existing Pumps
Risk Assessment
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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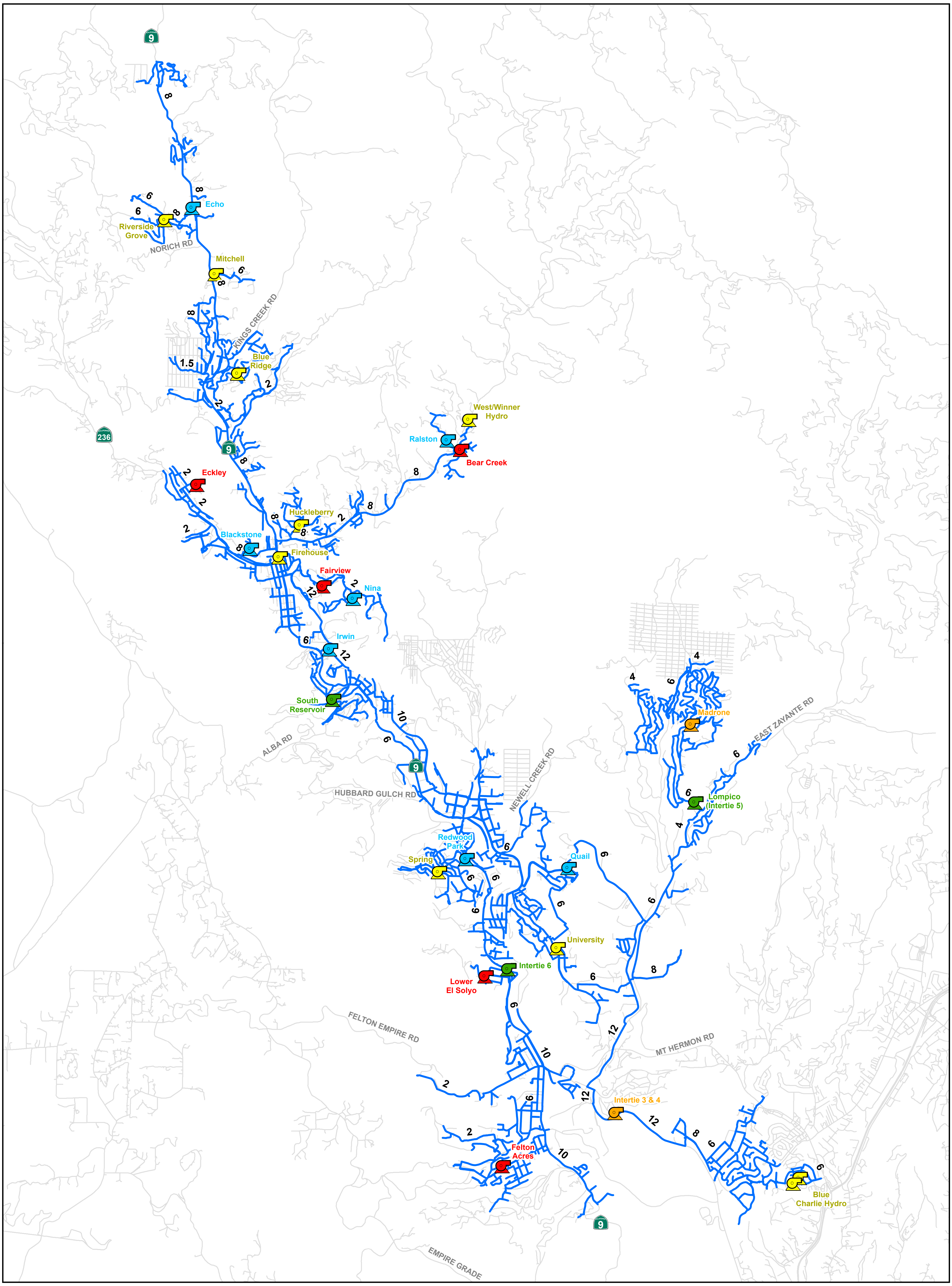

Legend

Likelihood Score

- Very Low (Risk Score 0 - 1)
- Low (Risk Score 1 - 2)
- Moderate (Risk Score 2 - 3)
- High (Risk Score 3 -4)
- Extreme (Risk Score 4 -5)
- Pipes
- Roads

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Update: May 25, 2021

0 0.25 0.5 1 Mile

N E S W

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-15_LOF_Pumps_052521.mxd

Figure 8.15
Likelihood of Failure
Existing Pumps

Risk Assessment

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Table 8.7 Booster Pump Station Likelihood of Failure Criteria

Water Master Plan
San Lorenzo Valley Water District

				Likelihood of Failure	Very Low	Low	Moderate	High	Extreme
				Rating	1	2	3	4	5
1	2	3	4	5	6	7	8	9	10
No.	Likelihood Categories	Description	Weighting	Measure or Proxy	Likelihood Scale				
1	**SLVWD Staff Rating**	SLVWD Operation staff condition ratings	**80%**	Operation Staff Knowledge	New	Good	Moderate		Poor/Unknown
2	**Fire Hazard Level**	Structures in higher fire hazard areas have a higher likelihood to fail during a forest fire event	**20%**	Fire Hazard Level	Moderate		High		Very High

Table 8.8 PRV Consequence of Failure Criteria

Water Master Plan

San Lorenzo Valley Water District

				Consequence of Failure	Very Low	Low	Moderate	High	Extreme
				Rating	1	2	3	4	5
1	2	3	4	5	6	7	8	9	10
No.	Consequence Categories	Description	Weighting	Measure or Proxy	Consequence Scale				
1	Service Demands	PRV's that supply a larger demand have a higher consequence if they fail	50%	Average Day Demands	Backup Connection	< 5 gpm	5 - 10 gpm	10 - 50 gpm	> 50 gpm
2	Supply Valve	Failure of a PRV that actively supply system demands is more critical for maintaining proper levels of service	50%	Supply Valve (y/n)	No				Yes

Based on the consequence of failure criteria listed above, each PRV was assigned a score. The breakdown of the PRV COF is documented graphically on **Figure 8.16**.

8.4.4.2 PRV Likelihood of Failure Criteria

The specific score values and weights for PRV likelihood of failure criteria are documented below, and are summarized on **Table 8.9**

- **SLVWD Staff Rating (100%)**: This criterion assesses the likelihood of failure for PRVs based on SLVWD staff rating. Scores range from a value of 1 for PRVs rated as in new condition to a value of 5 for PRVs rated as poor/unknown.

Based on the likelihood of failure criteria listed above, each PRV was assigned a score. The breakdown of the PRV LOF is documented graphically on **Figure 8.17**.

8.4.5 Groundwater Well Risk Criteria

This section documents the risk assessment criteria for existing groundwater wells.

8.4.5.1 Groundwater Well Consequence of Failure Criteria

The specific score values and weights for groundwater well consequence of failure criteria are documented below, and are summarized on **Table 8.10**.

- **Capacity (100%)**: This criterion assesses the consequence of failure of groundwater well based on well capacity. Scores range from a value of 1 for groundwater wells with capacity less than 100 gpm and a value of 5 for groundwater wells with capacity greater than 300 gpm. Failure of a large well can cause a drop in system level of service.

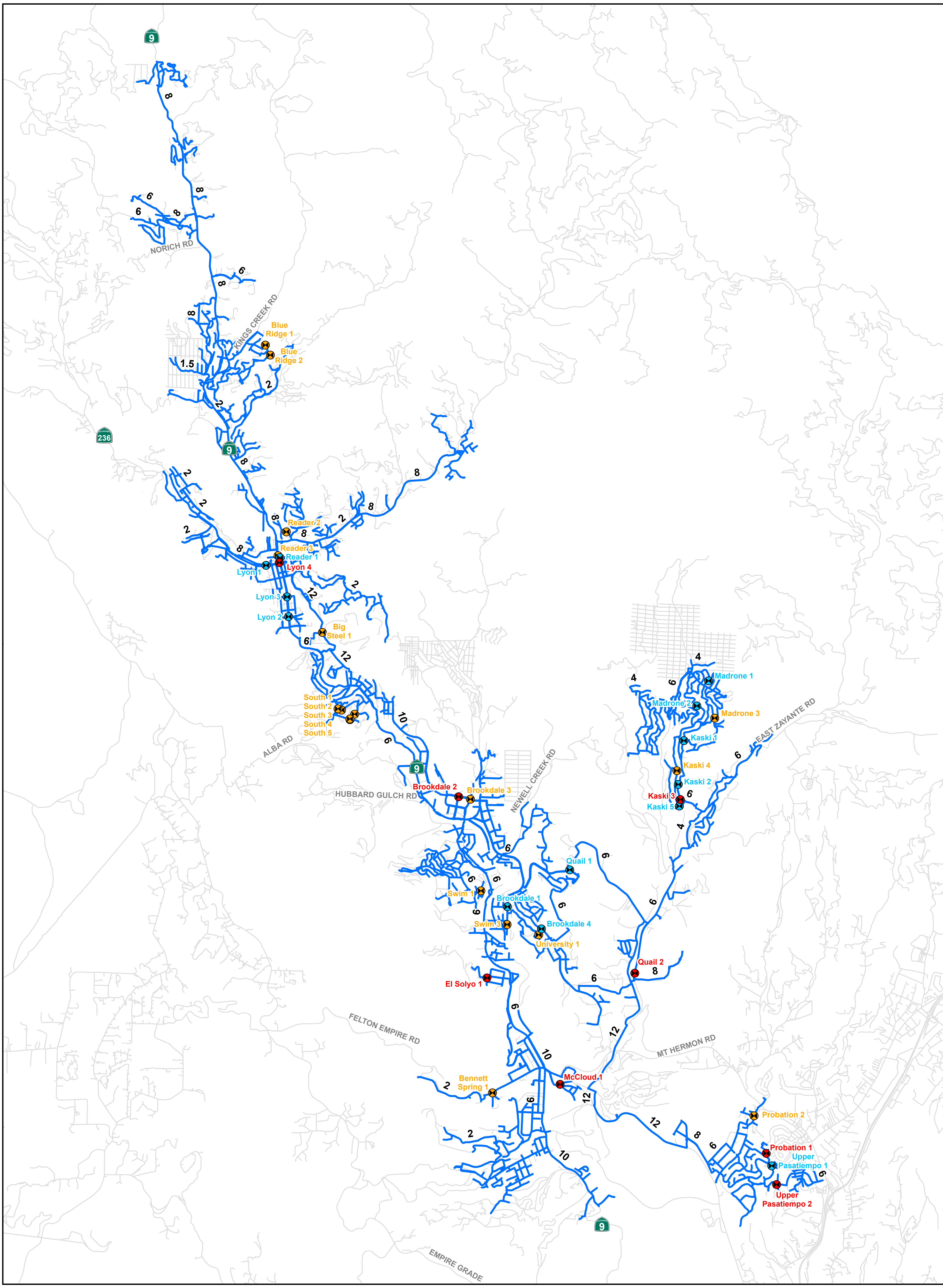
Based on the consequence of failure criteria listed above, each groundwater well was assigned a score.

8.4.5.2 Groundwater Well Likelihood of Failure Criteria

The specific score values and weights for groundwater well likelihood of failure criteria are documented below, and are summarized on **Table 8.11**

- **SLVWD Staff Rating (80%)**: This criterion assesses the likelihood of failure of groundwater wells based on SLVWD staff rating. Scores range from a value of 1 for groundwater wells rated as in new condition to a value of 5 for groundwater wells rated as poor/unknown by SLVWD operation staff.

- **Fire Hazard Level (20%)**: This criterion assesses the likelihood of failure of groundwater well based on fire hazard level. Scores range from a value of 1 for groundwater wells with moderate fire hazard level to a value of 5 for groundwater wells with very high fire hazard level. Structures in higher fire hazard areas have a higher likelihood of fail during a forest fire event.



Legend

Consequence Score

- Very Low (Risk Score 0 - 1)
- Low (Risk Score 1 - 2)
- Moderate (Risk Score 2 - 3)
- High (Risk Score 3 - 4)
- Extreme (Risk Score 4 - 5)

Pipes

Roads

Update: May 25, 2021

0 0.25 0.5 1 Mile

N W E S

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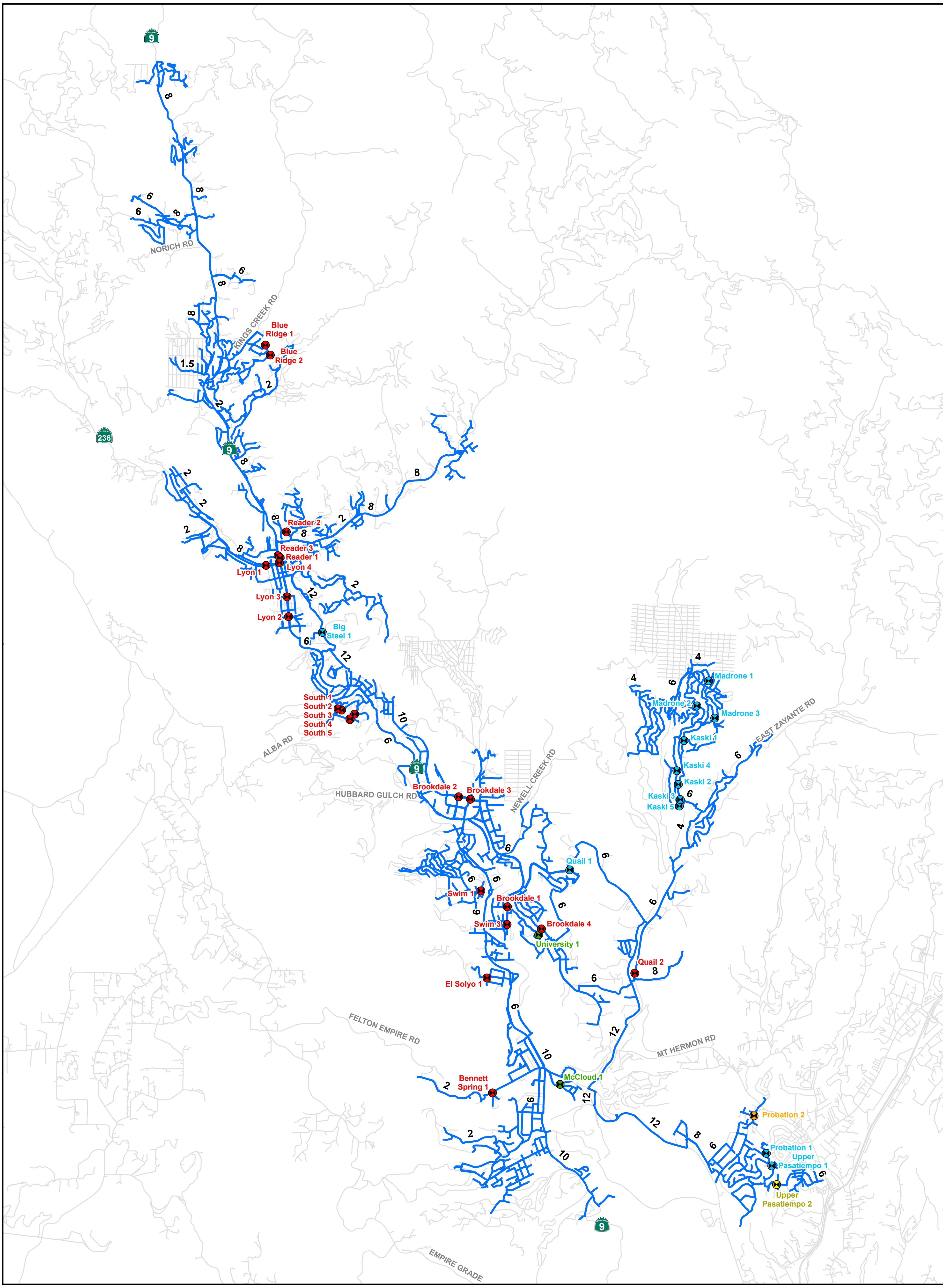
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-16_COF_Valves_052521.mxd

Figure 8.16
Consequence of Failure Existing PRVs

Risk Assessment

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Likelihood Score

- Very Low (Risk Score 0 - 1)
- Low (Risk Score 1 - 2)
- Moderate (Risk Score 2 - 3)
- High (Risk Score 3 - 4)
- Extreme (Risk Score 4 - 5)

Pipes

Roads

Update: May 25, 2021

0 0.25 0.5 1 Mile

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File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\210521-LOF_COF (Chp8)\SLVWD_Fig8-17_LOF_Valves_052521.mxd

Figure 8.17
Likelihood of Failure Existing PRVs

Risk Assessment

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Table 8.9 PRV Likelihood of Failure Criteria

Water Master Plan

San Lorenzo Valley Water District

				Likelihood of Failure	Very Low	Low	Moderate	High	Extreme
				Rating	1	2	3	4	5
1	2	3	4	5	6	7	8	9	10
No.	Likelihood Categories	Description	Weighting	Measure or Proxy	Likelihood Scale				
1	**SLVWD Staff Rating**	SLVWD Operation staff condition ratings	**100%**	Operation Staff Knowledge	New	Good	Moderate		Poor/Unknown

Table 8.10 Groundwater Well Consequence of Failure Criteria

Water Master Pla

San Lorenzo Valley Water District

				Consequence of Failure	Very Low	Low	Moderate	High	Extreme
				Rating	1	2	3	4	5
1	2	3	4	5	6	7	8	9	10
No.	Consequence Categories	Description	Weighting	Measure or Proxy	Consequence Scale				
1	**Capacity**	Failure of a large well can cause a drop in system level of service	**100%**	Well Capacity	< 100 gpm	100 - 150 gpm	150 - 200 gpm	200- 300 gpm	> 300 gpm

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3/23/2020

Table 8.11 Groundwater Well Likelihood of Failure Criteria

Water Master Plan

San Lorenzo Valley Water District

				Likelihood of Failure	Very Low	Low	Moderate	High	Extreme
				Rating	1	2	3	4	5
1	2	3	4	5	6	7	8	9	10
No.	Likelihood Categories	Description	Weighting	Measure or Proxy	Likelihood Scale				
1	SLVWD Staff Rating	SLVWD Operation staff condition ratings	80%	Operation Staff Knowledge	New	Good	Moderate		Poor/Unknown
2	Fire Hazard Level	Structures in higher fire hazard areas have a higher likelihood to fail during a forest fire event	20%	Fire Hazard Level	Moderate		High		Very High

Based on the likelihood of failure criteria listed above, each groundwater well was assigned a score.

8.5 RISK ASSESSMENT RESULTS

The risk assessment was performed to assess the risk of failure of assets within the SLVWD domestic water distribution system. Using the consequence and likelihood of failure criteria discussed in the previous section, a consequence of failure score and likelihood of failure score was determined for each asset. Following the calculation of the COF and LOF scores, an asset risk assessment was conducted.

8.5.1 Pipeline Risk Assessment Results

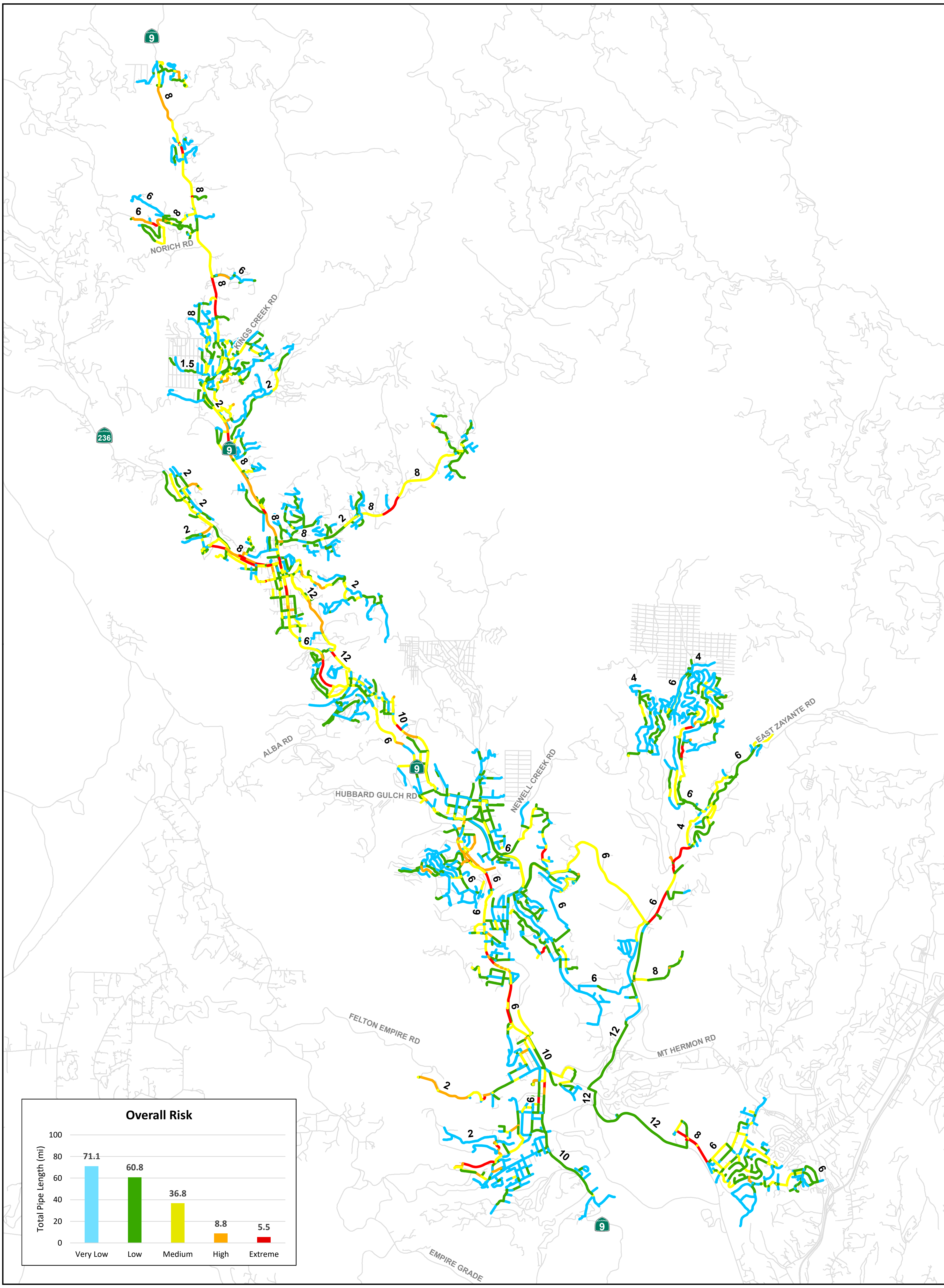
Following calculation of COF and LOF scores, a pipeline risk assessment was conducted. Based on the breakdown of the COF and LOF scores, thresholds were determined to classify the pipelines as Very Low, Low, Moderate, High, and Extreme risk. These risk thresholds for pipelines are briefly summarized as follows:

- **Very Low**: Pipelines with an overall risk score of 3 or less were categorized as Very Low Risk. This resulted in approximately **71 miles** of pipelines being categorized as Very Low Risk, which represented 39% of all pipelines included in the risk analysis.
- **Low**: Pipelines with an overall risk score of 3 to 5 were categorized as Low Risk. This resulted in approximately **61 miles** of pipelines being categorized as Low Risk, which represented 33% of all pipelines included in the risk analysis.
- **Moderate**: Pipelines with an overall risk score of 5 to 8 were categorized as Moderate Risk. This resulted in approximately **37 miles** of pipelines being categorized as Moderate Risk, which represented 20% of all pipelines included in the risk analysis.
- **High**: Pipelines with an overall risk score of 8 to 10 were categorized as High Risk. This resulted in approximately **9 miles** of pipelines being categorized as High Risk, which represented 5% of all pipelines included in the risk analysis.
- **Extreme**: Pipelines with an overall risk score of 10 or higher were categorized as Extreme Risk. This resulted in approximately **5 miles** of pipelines being categorized as Extreme Risk, which represented 3% of all pipelines included in the risk analysis.

The results of the risk assessment are shown graphically on **Figure 8.18**; additionally, **Figure 8.19** documents only the High and Extreme risk pipelines.

8.5.2 Storage Risk Assessment Results

Following calculation of COF and LOF scores, a storage tank risk assessment was conducted. Based on the breakdown of the COF and LOF scores, thresholds were determined to classify the



Legend

Overall Risk

Roads

- Very Low (71.1 Miles, 38.9%)
- Low (60.8 Miles, 33.2%)
- Moderate (36.8 Miles, 20.1%)
- High (8.8 Miles, 4.8%)
- Extreme (5.5 Miles, 3.0%)

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Update: July 16, 2021

0 0.25 0.5 1 Mile

N W E S

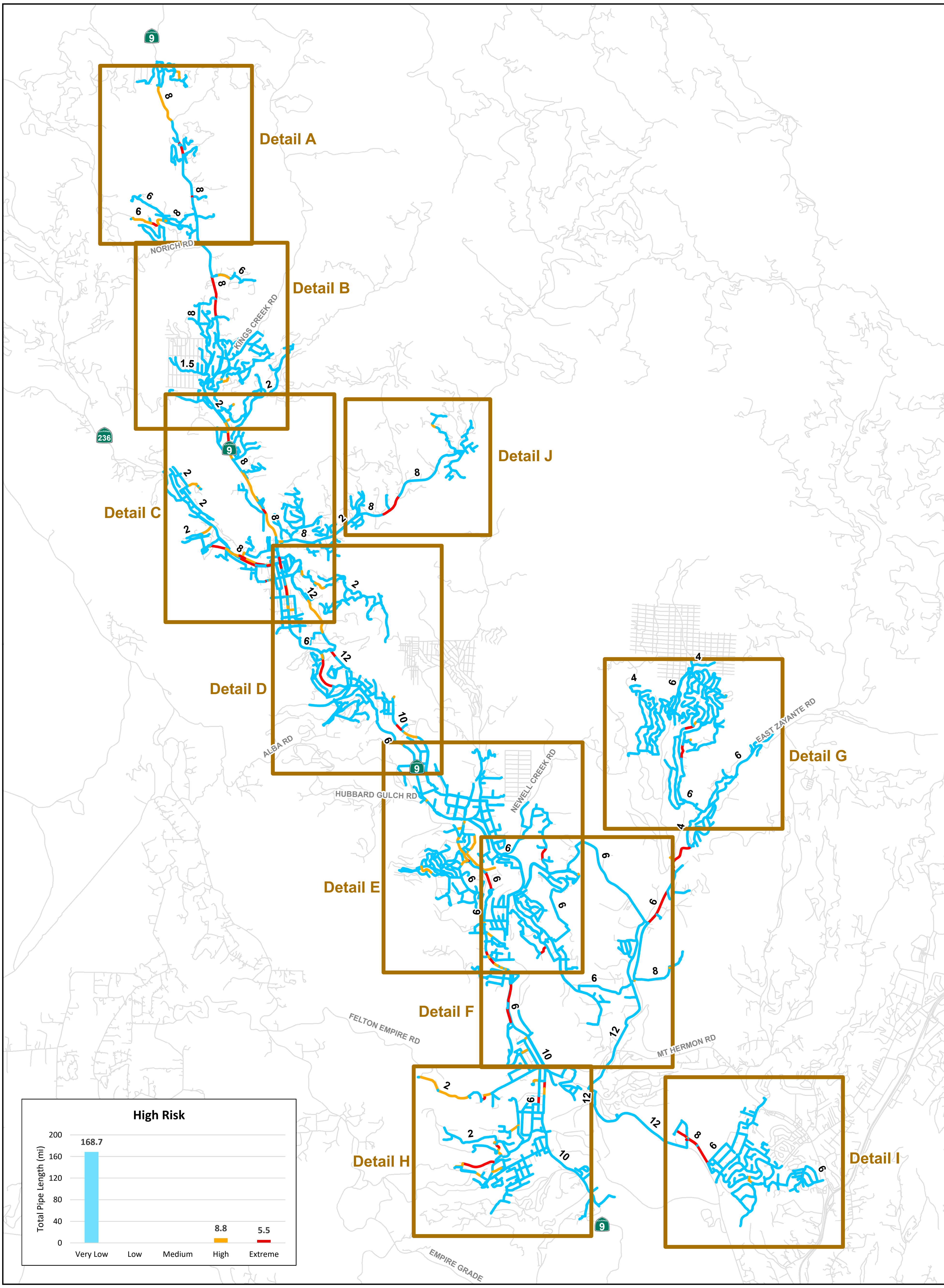
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-18_OverallRisk_071621.mxd

Figure 8.18
Overall Risk
Existing Pipelines

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

High Risk

Very Low (168.7 Miles, 92.2%)

High (8.8 Miles, 4.8%)

Extreme (5.5 Miles, 3.0%)

Roads

AKEL ENGINEERING GROUP, INC.

Update: July 16, 2021

0 0.25 0.5 1 Mile

N W E S

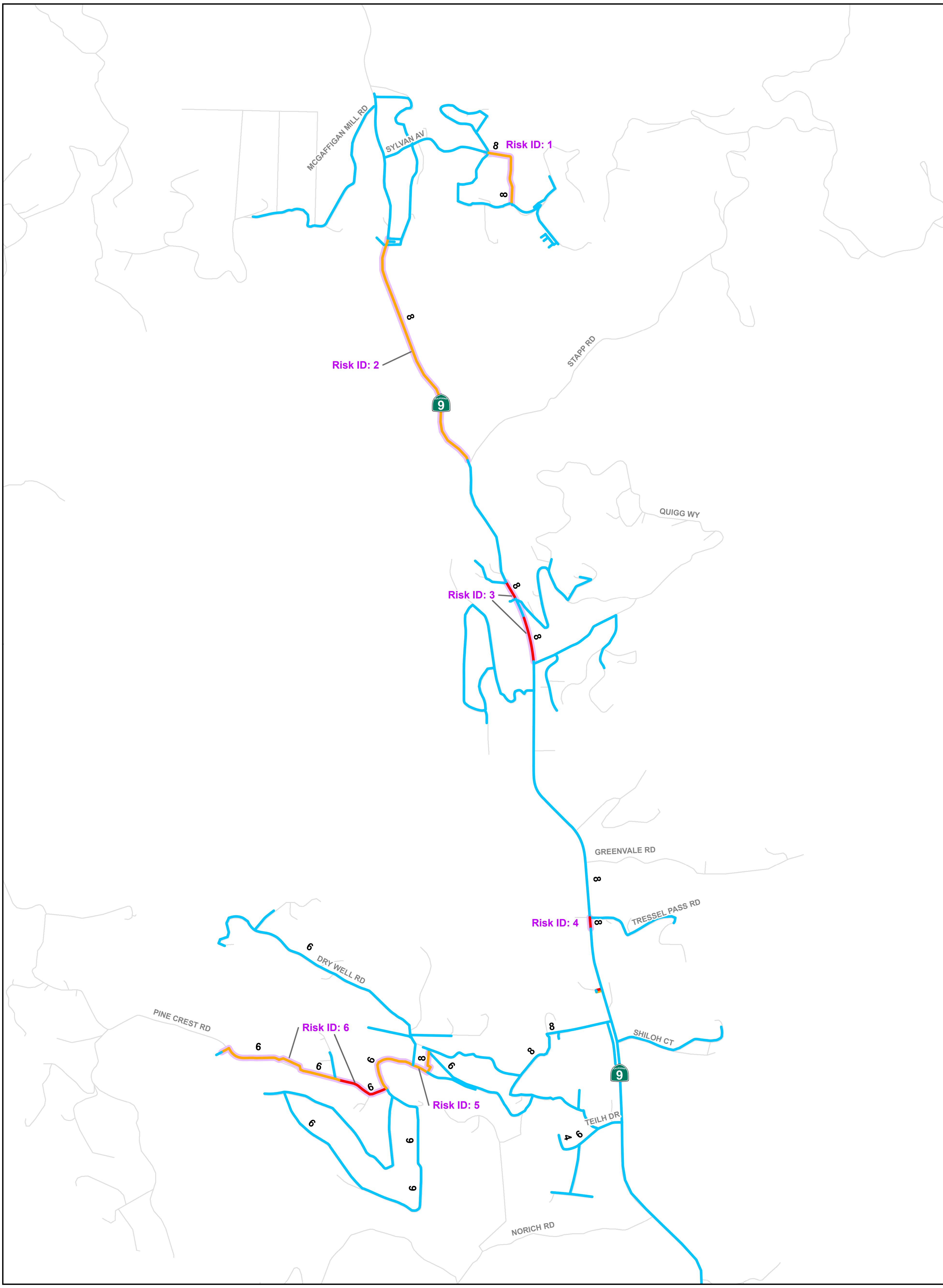
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-19_HighRisk_071621.mxd

Figure 8.19
High Risk
Existing Pipelines

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

High Risk

Very Low (168.7 Miles, 92.2%)

High (8.8 Miles, 4.8%)

Extreme (5.5 Miles, 3.0%)

Roads

Update: July 16, 2021

0 250 500 1,000 Feet

N E S W

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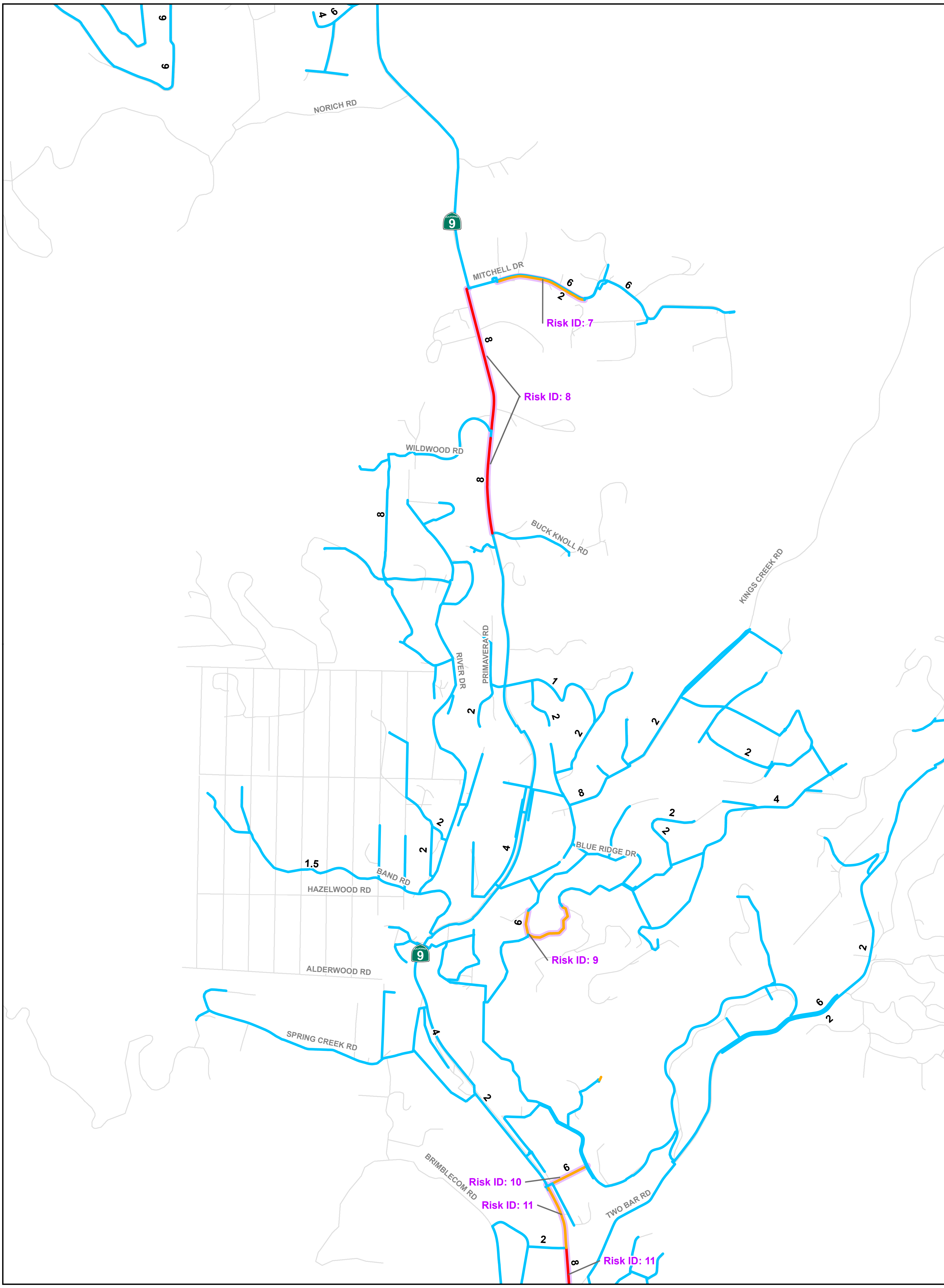
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-19_DetailA_071621.mxd

Detail A
High Risk
Existing Pipelines

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

High Risk

Very Low (168.7 Miles, 92.2%)

High (8.8 Miles, 4.8%)

Extreme (5.5 Miles, 3.0%)

Roads

AKEL
ENGINEERING GROUP, INC.

Update: July 16, 2021

0 250 500 1,000 Feet

N W E S

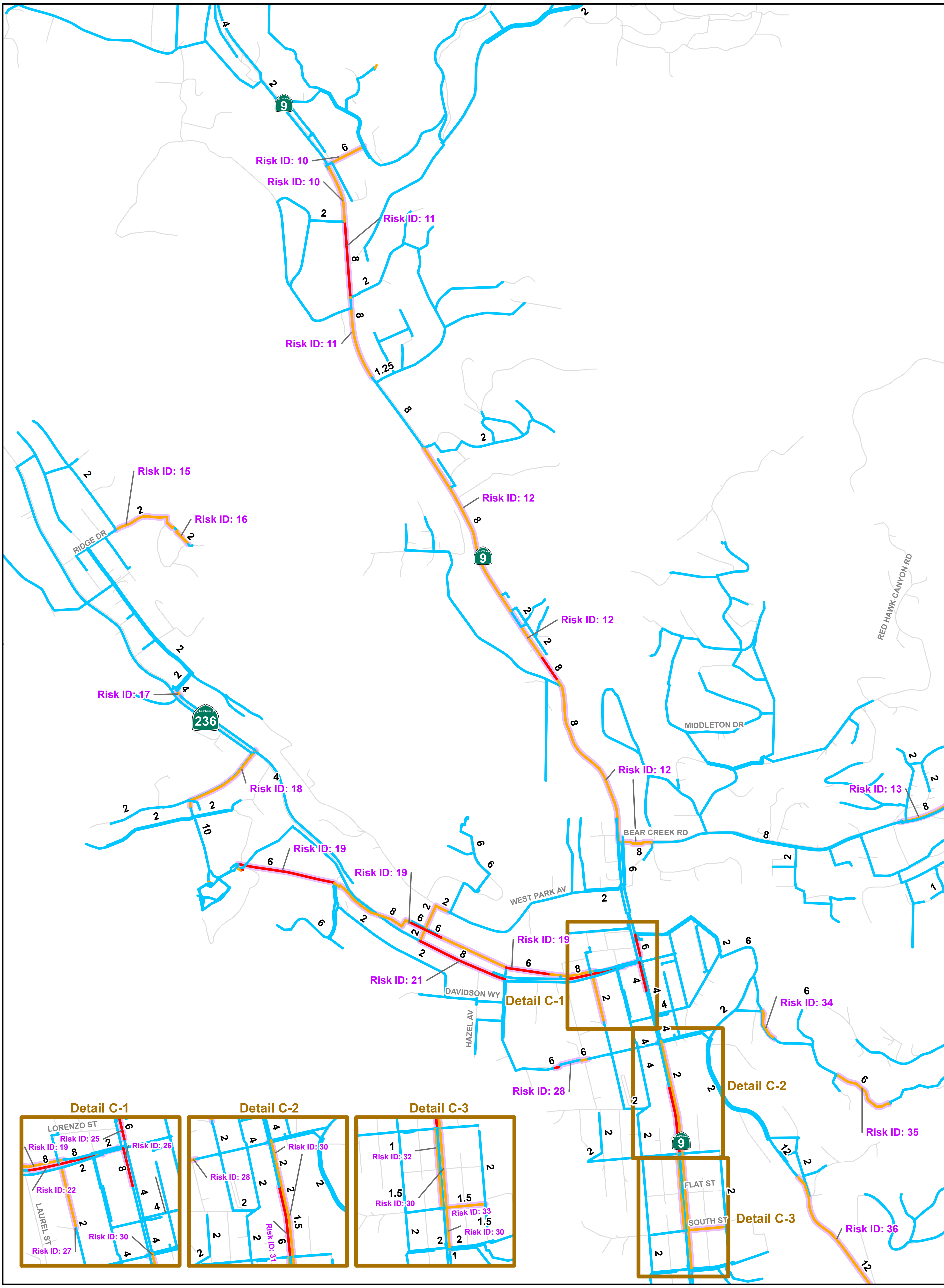
Detail B
High Risk
Existing Pipelines

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-19_DetailB_071621.mxd



Legend

High Risk

Very Low (168.7 Miles, 92.2%)

High (8.8 Miles, 4.8%)

Extreme (5.5 Miles, 3.0%)

Roads

0 250 500 1,000 Feet

Update: July 16, 2021

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-19_DetailC_071621.mxd

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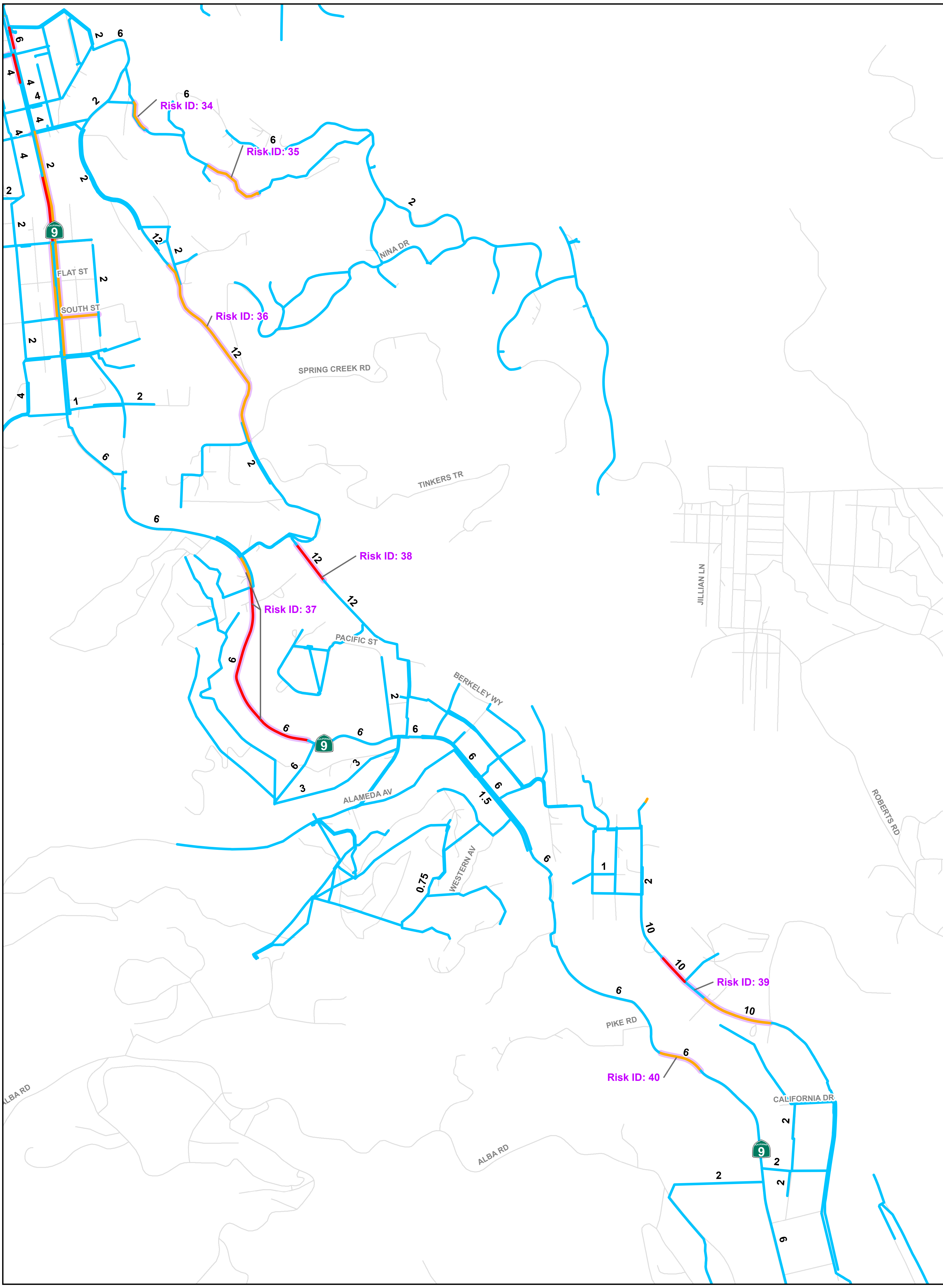
Detail C High Risk Existing Pipelines

Water Master Plan

San Lorenzo Valley Water District



Legend

High Risk

Very Low (168.7 Miles, 92.2%)

High (8.8 Miles, 4.8%)

Extreme (5.5 Miles, 3.0%)

Roads

AKEL ENGINEERING GROUP, INC.

Update: July 16, 2021

0 250 500 1,000 Feet

N S E W

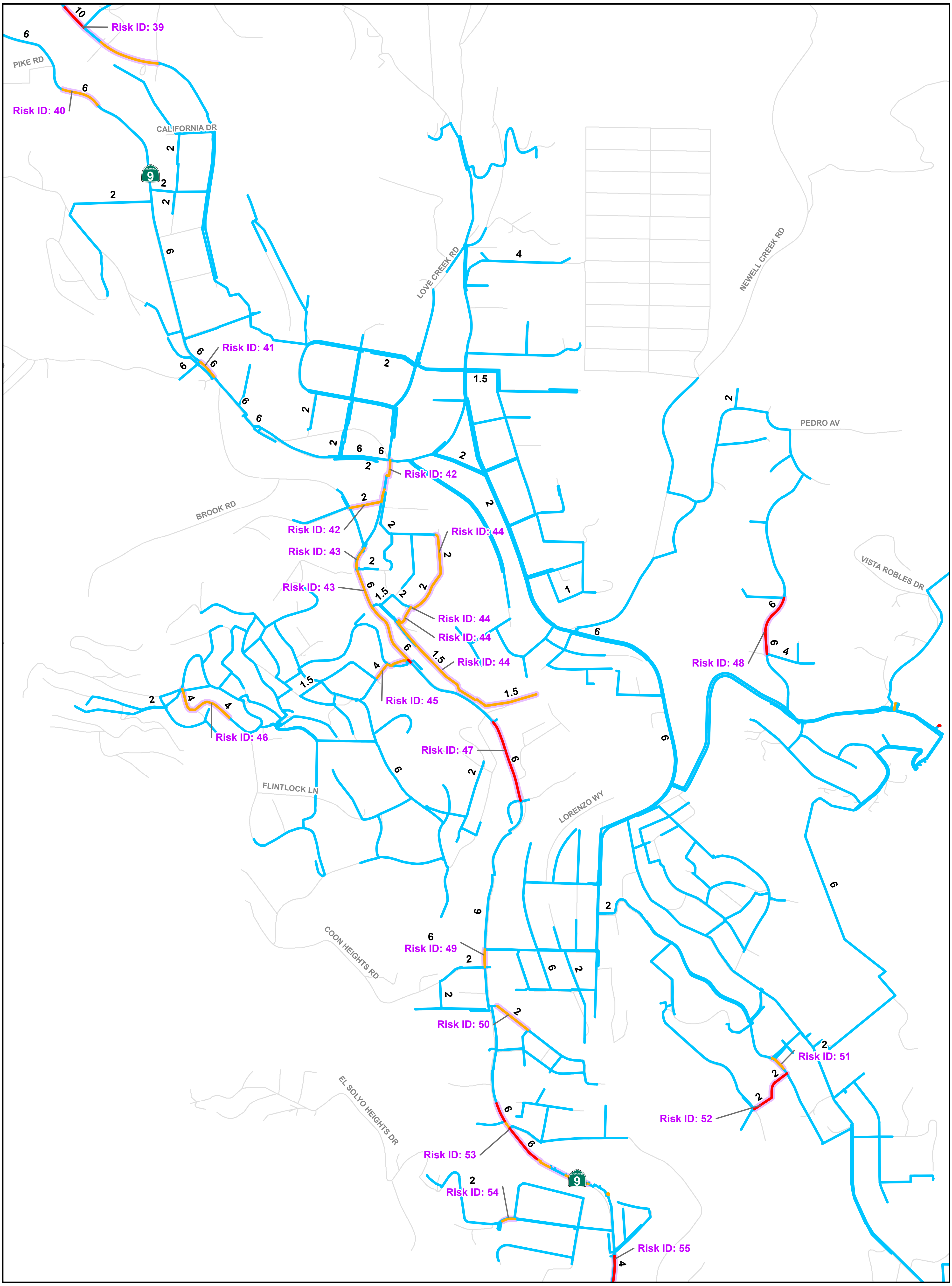
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-19_DetailD_071621.mxd

Detail D High Risk Existing Pipelines

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

High Risk

Very Low (168.7 Miles, 92.2%)

High (8.8 Miles, 4.8%)

Extreme (5.5 Miles, 3.0%)

Roads

Update: July 16, 2021

0 375 750 1,500 Feet

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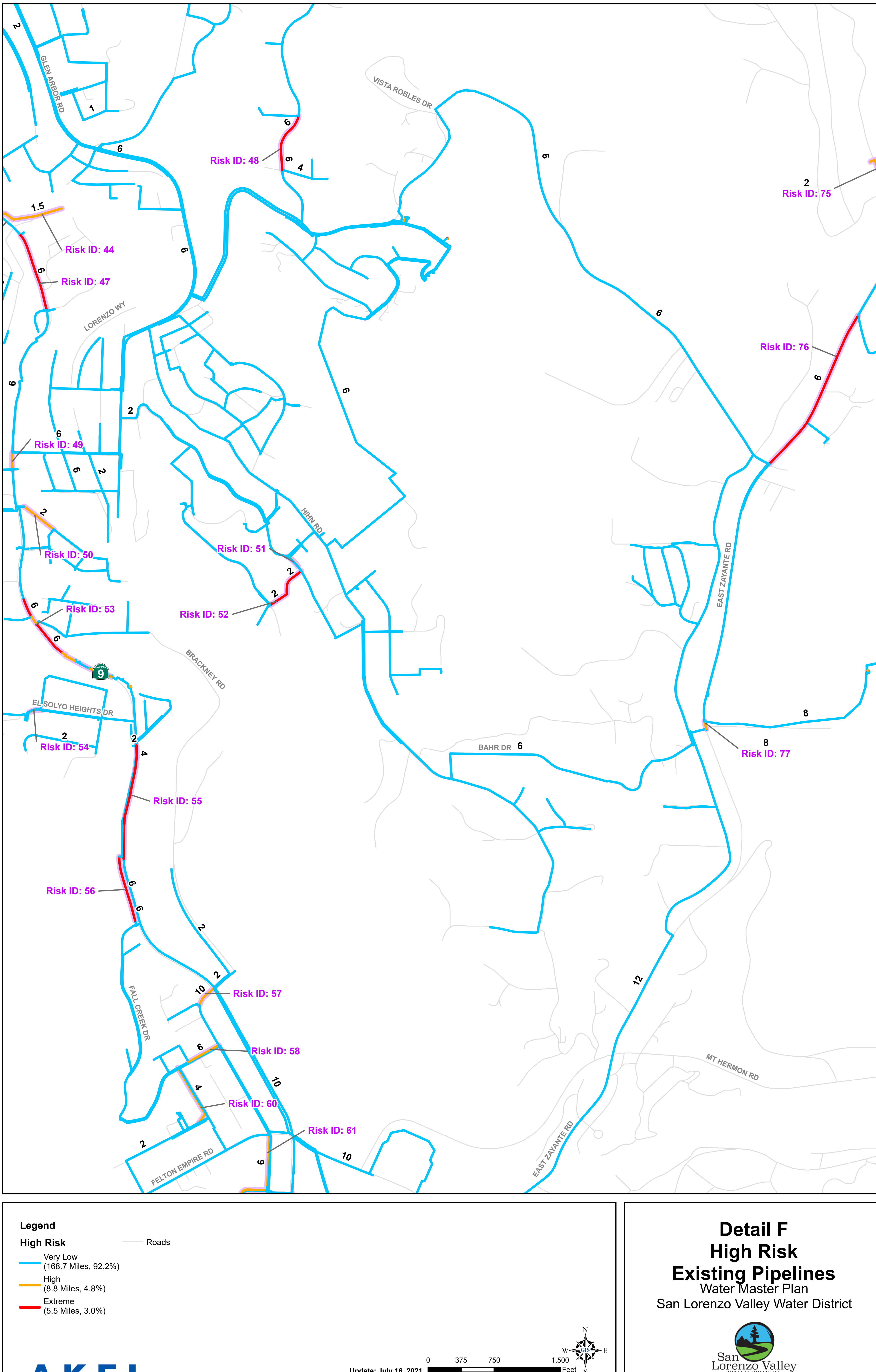
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-19_DetailE_071621.mxd

Detail E High Risk Existing Pipelines

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Detail F
High Risk
Existing Pipelines
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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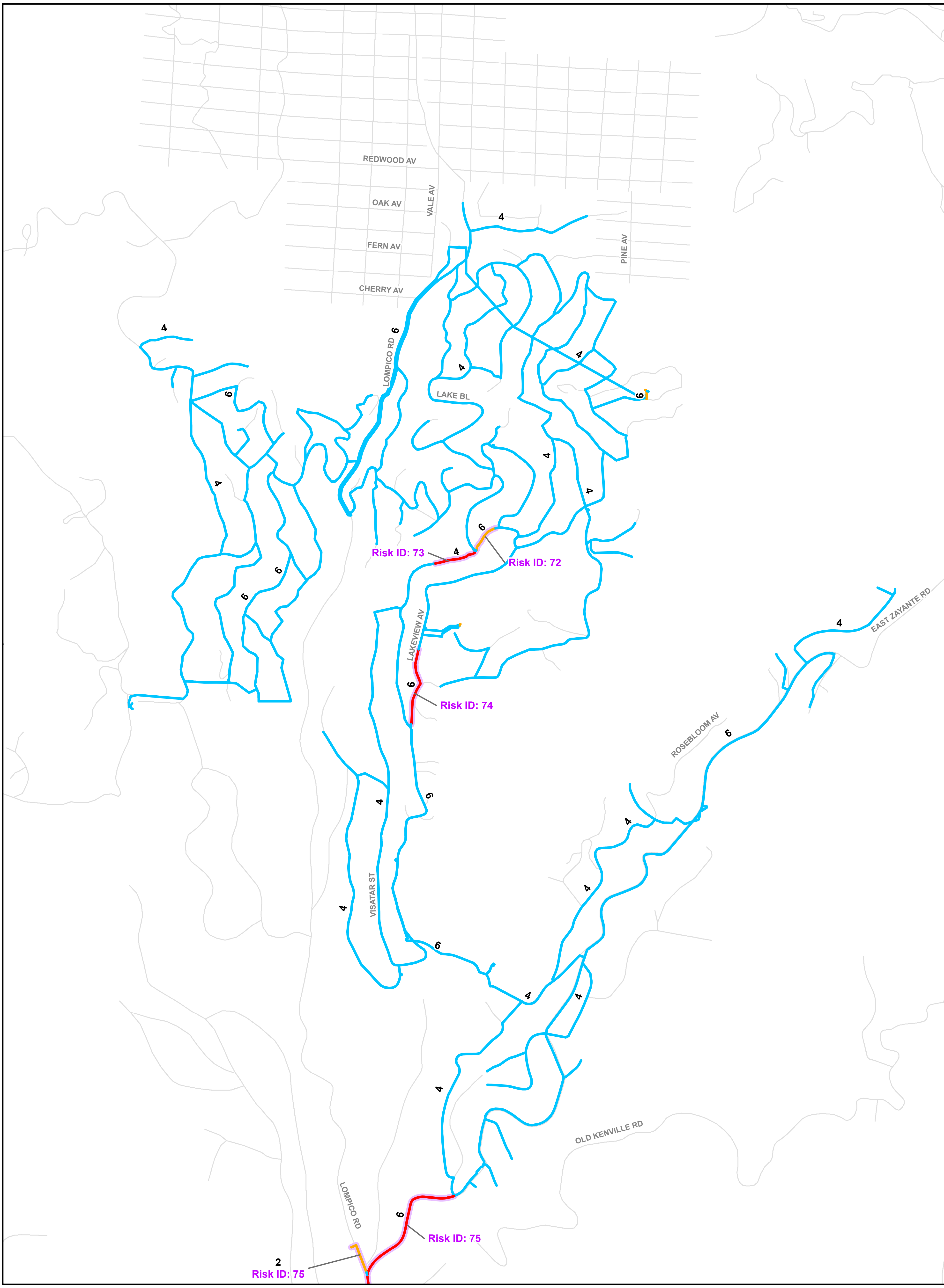


Legend

High Risk

Very Low (168.7 Miles, 92.2%)

High (8.8 Miles, 4.8%)

Extreme (5.5 Miles, 3.0%)

Roads

Update: July 16, 2021

0 350 700 1,400 Feet

AKEL ENGINEERING GROUP, INC.

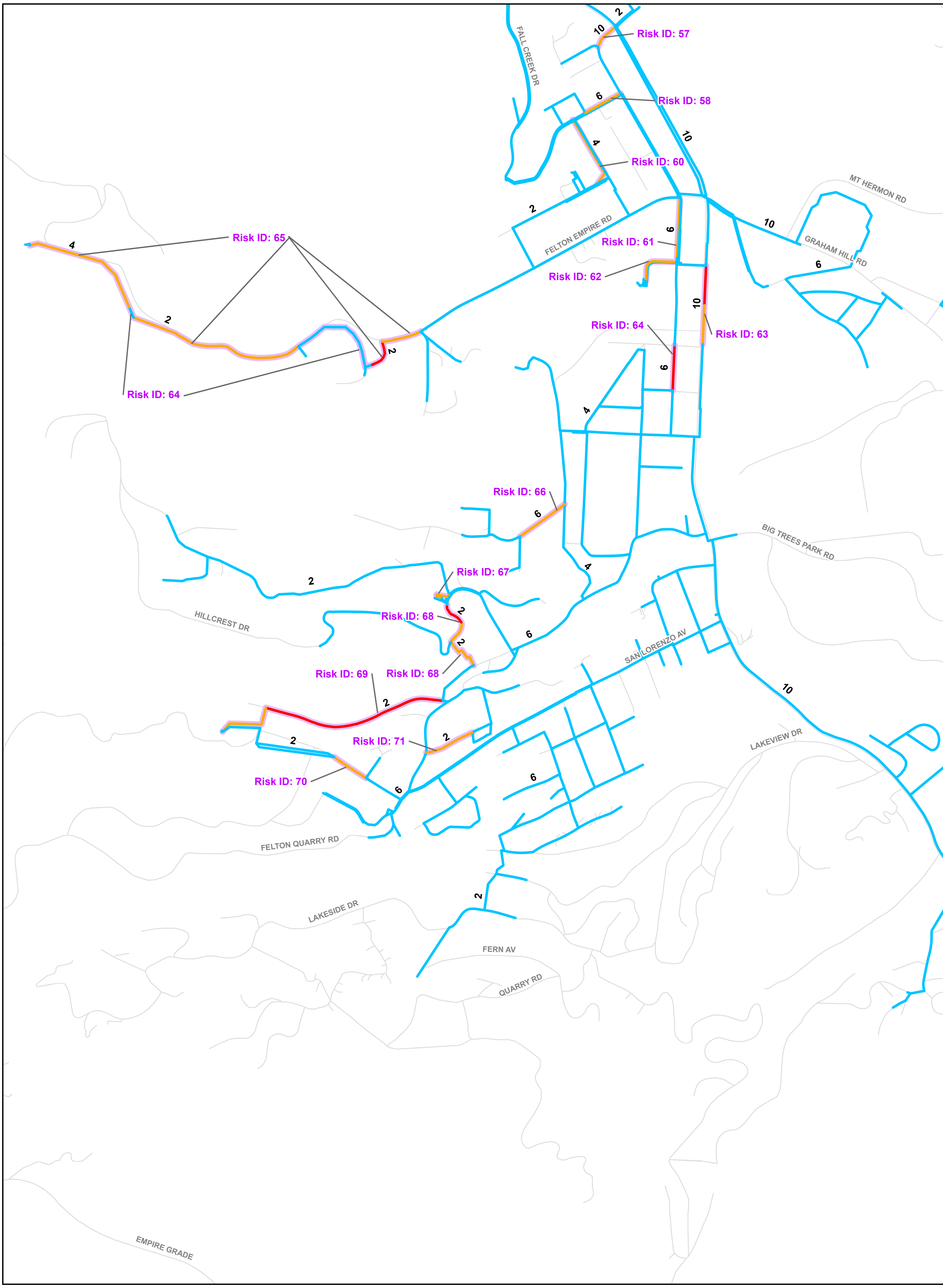
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-19_DetailG_071621.mxd

Detail G
High Risk
Exisiting Pipelines

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

High Risk

Roads

Very Low (168.7 Miles, 92.2%)

High (8.8 Miles, 4.8%)

Extreme (5.5 Miles, 3.0%)

AKEL ENGINEERING GROUP, INC.

Update: July 16, 2021

0 250 500 1,000 Feet

N E S W

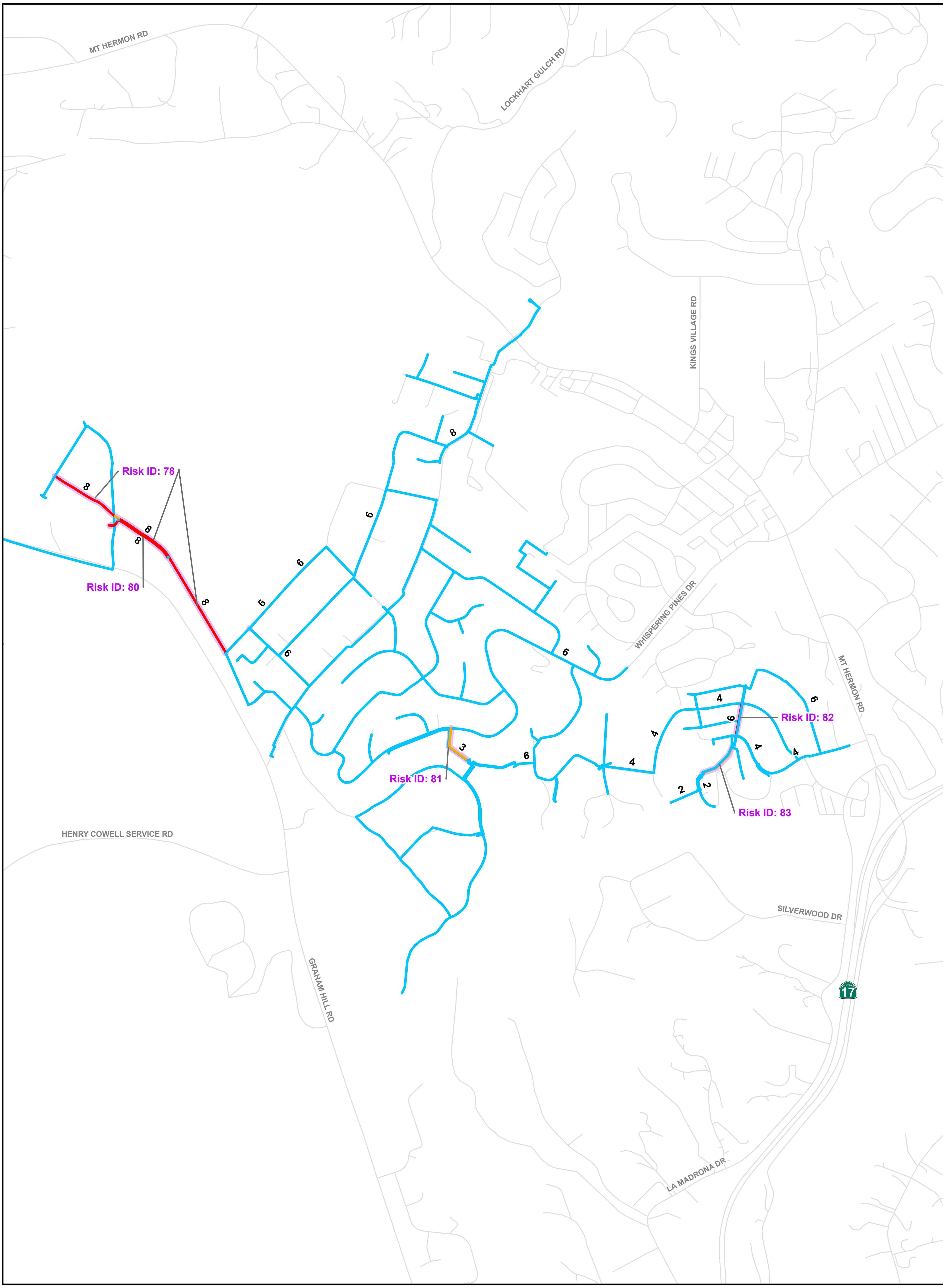
Detail H
High Risk
Existing Pipelines

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-19_DetailH_071621.mxd



Legend

High Risk

Very Low (168.7 Miles, 92.2%)

High (8.8 Miles, 4.8%)

Extreme (5.5 Miles, 3.0%)

Roads

0 250 500 1,000 Feet

Update: July 16, 2021

Detail I
High Risk
Existing Pipelines

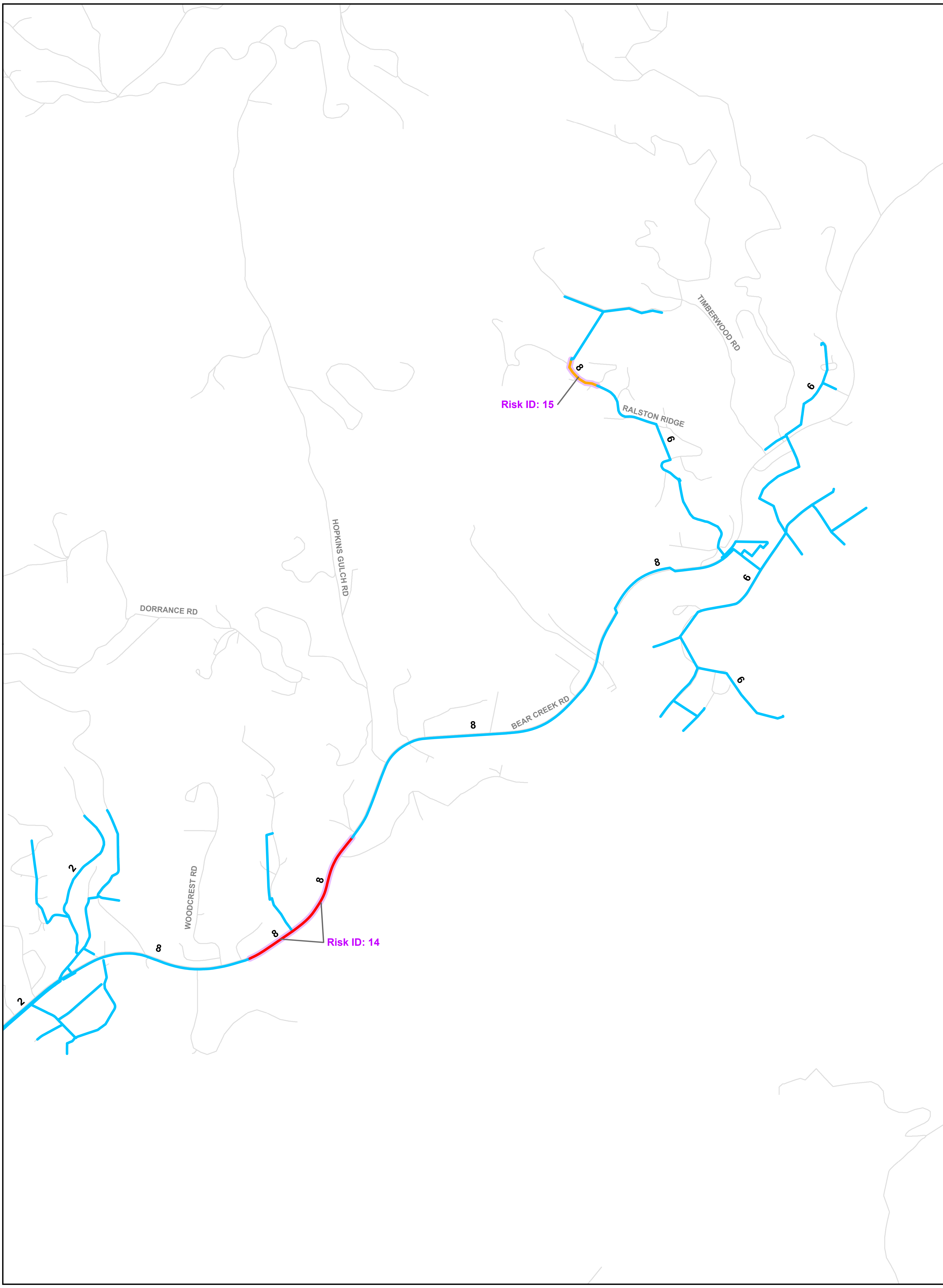
Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-19_DetailI_071621.mxd



Legend

High Risk

Very Low (168.7 Miles, 92.2%)

High (8.8 Miles, 4.8%)

Extreme (5.5 Miles, 3.0%)

Roads

AKEL ENGINEERING GROUP, INC.

Update: July 16, 2021

0 250 500 1,000 Feet

N S E W

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-19_DetailJ_071621.mxd

Detail J
High Risk
Existing Pipelines

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

storage tanks as Very Low, Low, Moderate, High, and Extreme risk. These risk thresholds for storage tanks are briefly summarized as follows:

- **Very Low**: Storage tanks with an overall risk score of 3 or less were categorized as Very Low Risk, resulting in 10 storage tanks being categorized as Very Low Risk.
- **Low**: Storage tanks with an overall risk score of 3 to 5 were categorized as Low Risk, resulting in 19 storage tanks being categorized as Low Risk.
- **Moderate**: Storage tanks with an overall risk score of 5 to 7 were categorized as Moderate Risk, resulting in 9 storage tanks being categorized as Moderate Risk.
- **High**: Storage tanks with an overall risk score of 7 to 9 were categorized as High Risk, resulting in 6 storage tanks being categorized as High Risk.
- **Extreme**: Storage tanks with an overall risk score of 9 or more were categorized as Extreme Risk, resulting in 8 storage tanks being categorized as Extreme Risk.

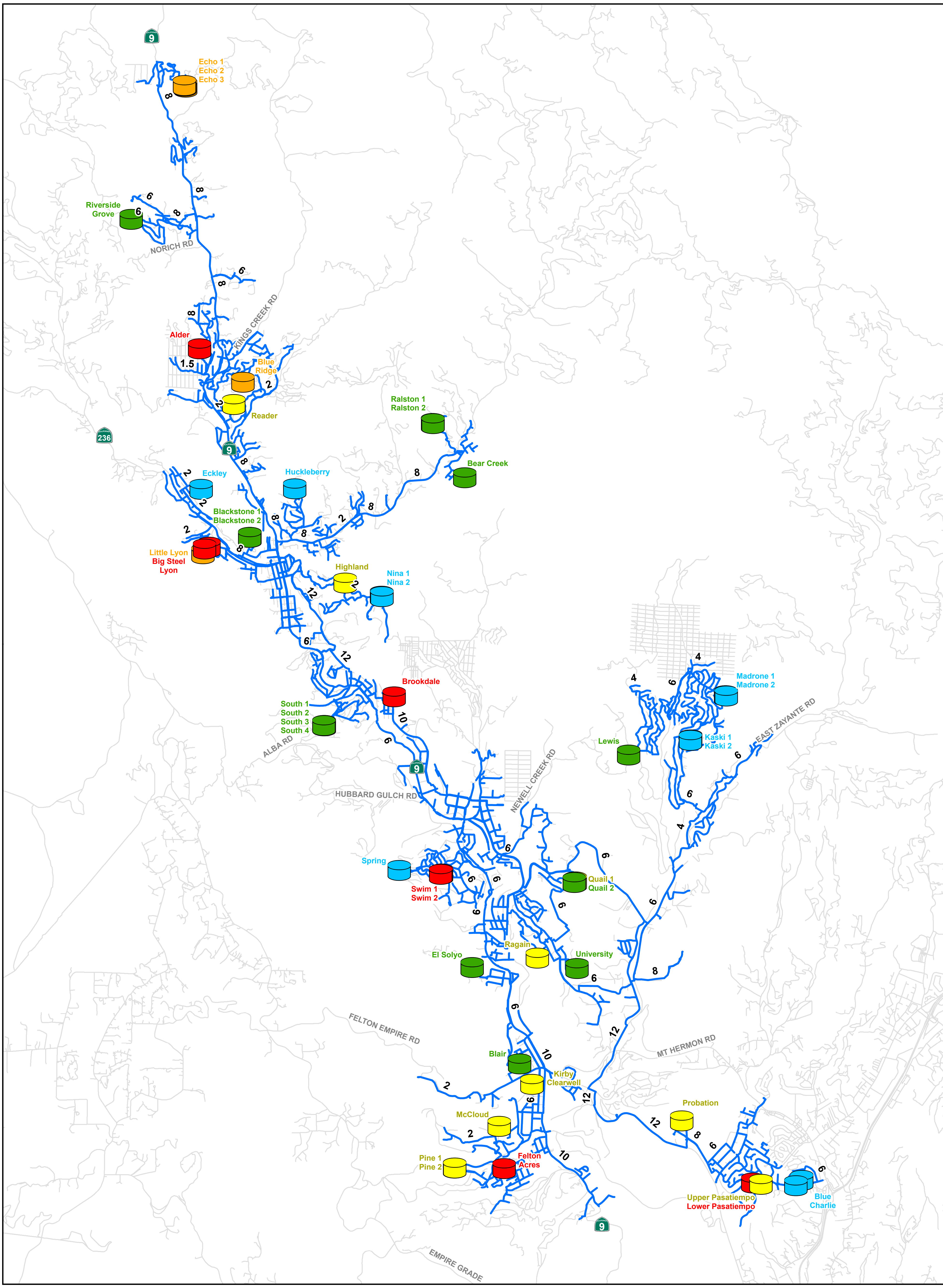
The results of the risk assessment are tabulated on **Table 8.12** and shown graphically on **Figure 8.20**.

8.5.3 Booster Pump Station Risk Assessment Results

Following calculation of COF and LOF scores, a booster pump station risk assessment was conducted. Based on the breakdown of the COF and LOF scores, thresholds were determined to classify the booster pump stations as Very Low, Low, Moderate, High, and Extreme risk. These risk thresholds for booster pump stations are briefly summarized as follows:

- **Very Low**: Booster pump stations with an overall risk score of 2 or less were categorized as Very Low Risk, resulting in 6 booster pump stations being categorized as Very Low Risk.
- **Low**: Booster pump stations with an overall risk score of 2 to 4 were categorized as Low Risk, resulting in 13 booster pump stations being categorized as Low Risk.
- **Moderate**: Booster pump stations with an overall risk score of 4 to 6 were categorized as Moderate Risk, resulting in 4 booster pump stations being categorized as Moderate Risk.
- **High**: Booster pump stations with an overall risk score of 6 to 8 were categorized as High Risk, resulting in 2 booster pump stations being categorized as High Risk.
- **Extreme**: Booster pump stations with an overall risk score of 8 or more were categorized as Extreme Risk, resulting in 4 booster pump stations being categorized as Extreme Risk.

The results of the risk assessment are tabulated on **Table 8.13** and shown graphically on **Figure 8.21**.



Legend

Overall Risk

Very Low
(Overall Risk Score > 3)

Low
(Overall Risk Score 3 - 5)

Moderate
(Overall Risk Score 5 - 7)

High
(Overall Risk Score 7 - 9)

Extreme
(Overall Risk Score 9 <)

Pipes

Roads

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Update: May 25, 2021

0 0.25 0.5 1 Mile

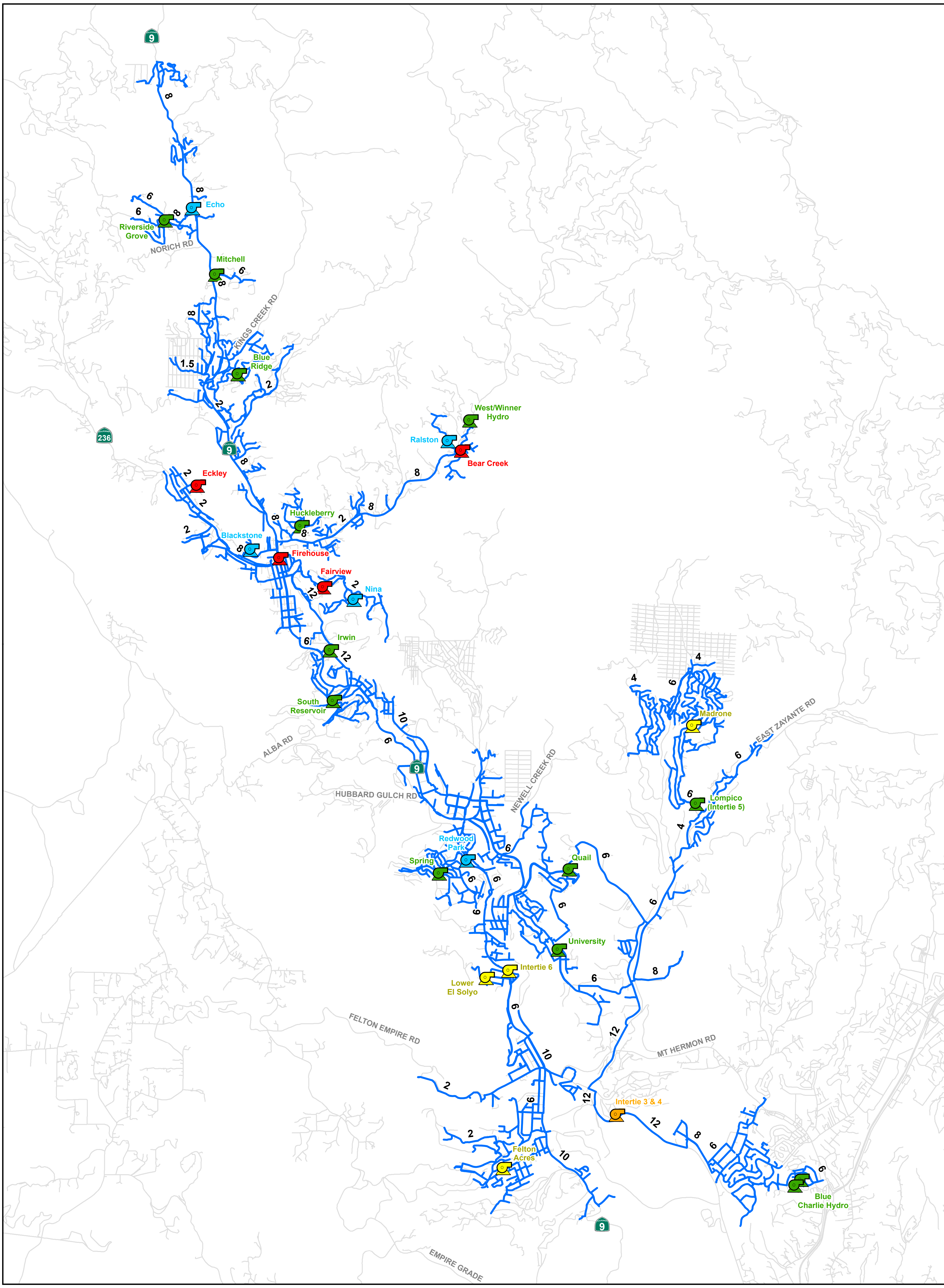
N W E S

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-20_Overall_Tanks_052521.mxd

Figure 8.20
Overall Risk
Existing Tanks

Risk Assessment
San Lorenzo Valley Water District

San Lorenzo Valley
WATER DISTRICT



Legend

Overall Risk

- Very Low (Overall Risk Score < 2)
- Low (Overall Risk Score 2 - 4)
- Moderate (Overall Risk Score 4 - 6)
- High (Overall Risk Score 6 - 8)
- Extreme (Overall Risk Score > 8)
- Pipes
- Roads

Update: May 25, 2021

0 0.25 0.5 1 Mile

Figure 8.21
Overall Risk
Existing Pumps

Risk Assessment

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig8-21_Overall_Pumps_052521.mxd

Table 8.12 Storage Reservoir Risk Assessment
Water Master Plan
San Lorenzo Valley Water District

Reservoir Name	Pressure Zone	Consequence of Failure – Criteria Categories: Tank Operating Capacity (MG)	Service Demands (mgd)	Required Fire Flow Volume	Consequence of Failure – Criteria Ratings: Tank Operating Capacity 50%	Service Demands 25%	Required Fire Flow Volume 25%	COF Score	Likelihood of Failure – Criteria Categories: Tank Material	Tank Age (yr)	Tank Age (age)	Fire Hazard Level	Likelihood of Failure – Criteria Ratings: Tank Material 65%	Tank Age 25%	Fire Hazard Level 10%	LOF Score	Total Risk Score
North System																	
Bear Creek	Bear Creek Zone	0.05	0.03	COM	1	2	5	**2.3**	Welded Steel	1968	53	Moderate	1	4	1	**1.8**	**3.9**
Blackstone 1	Blackstone Zone	0.01	0.01	SFR	1	1	1	**1.0**	Poly	2020	1	High	4	1	3	**3.2**	**3.2**
Blackstone 2	Blackstone Zone	0.01	0.01	SFR	1	1	1	**1.0**	Poly	2020	1	High	4	1	3	**3.2**	**3.2**
Blue Ridge	Blue Ridge Zone	0.04	0.02	MFR	1	2	3	**1.8**	Wood	old	Unk	Moderate	5	5	1	**4.6**	**8.1**
Brookdale	Brookdale Zone	0.65	0.56	COM	4	5	5	**4.5**	Welded Steel	1971	50	High	1	5	3	**2.2**	**9.9**
Eckley	Eckley Zone	0.003	0.001	SFR	1	1	1	**1.0**	Poly	2020	1	Moderate	4	1	1	**3.0**	**3.0**
Highland	Highland Zone	0.06	0.02	SFR	1	2	1	**1.3**	Wood	old	Unk	Moderate	5	5	1	**4.6**	**5.8**
Huckleberry	Huckleberry Zone	0.12	0.02	SFR	2	2	1	**1.8**	Welded Steel	1992	29	Moderate	1	3	1	**1.5**	**2.6**
Big Steel	Big Steel Zone	1.02	0.13	COM	4	4	5	**4.3**	Welded Steel	1941	80	High	1	5	3	**2.2**	**9.4**
Little Lyon	Lyon Zone	0.23	0.13	COM	3	4	5	**3.8**	Welded Steel	1991	30	High	1	4	3	**2.0**	**7.3**
Lyon	Lyon Zone	2.99	0.13	COM	5	4	5	**4.8**	Welded Steel	1990	31	High	1	4	3	**2.0**	**9.3**
Nina 1	Nina Zone	0.05	0.03	SFR	1	2	1	**1.3**	Bolted Steel	2011	10	Moderate	2	2	1	**1.9**	**2.4**
Nina 2	Nina Zone	0.05	0.03	SFR	1	2	1	**1.3**	Bolted Steel	2011	10	Moderate	2	2	1	**1.9**	**2.4**
Echo 1	North Boulder Creek Zone	0.02	0.04	MFR	1	2	3	**1.8**	Wood	old	Unk	Moderate	5	5	1	**4.6**	**8.1**
Echo 3	North Boulder Creek Zone	0.02	0.04	MFR	1	2	3	**1.8**	Wood	old	Unk	Moderate	5	5	1	**4.6**	**8.1**

Table 8.12 Storage Reservoir Risk Assessment

Water Master Plan
San Lorenzo Valley Water District

		Consequence of Failure							Likelihood of Failure								
		Criteria Categories			Criteria Ratings				Criteria Categories				Criteria Ratings				
Reservoir Name	Pressure Zone	Tank Operating Capacity (MG)	Service Demands (mgd)	Required Fire Flow Volume	Tank Operating Capacity 50%	Service Demands 25%	Required Fire Flow Volume 25%	COF Score	Tank Material	Tank Age (yr)	Tank Age (age)	Fire Hazard Level	Tank Material 65%	Tank Age 25%	Fire Hazard Level 10%	LOF Score	Total Risk Score
Echo 4	North Boulder Creek Zone	0.02	0.04	MFR	1	2	3	**1.8**	Wood	old	Unk	Moderate	5	5	1	**4.6**	**8.1**
Quail 1	Quail Zone	0.20	0.21	COM	1	5	5	**3.0**	Welded Steel	1990	31	Moderate	1	4	1	**1.8**	**5.3**
Quail 2	Quail Zone	0.21	0.21	COM	1	5	5	**3.0**	Welded Steel	1992	29	Moderate	1	3	1	**1.5**	**4.5**
Ralston 1	Ralston Zone	0.01	0.01	SFR	1	1	1	**1.0**	Poly	2010	11	Moderate	4	2	1	**3.2**	**3.2**
Ralston 2	Ralston Zone	0.01	0.01	SFR	1	1	1	**1.0**	Poly	2010	11	Moderate	4	2	1	**3.2**	**3.2**
Alder	Reader Zone	0.00	0.37	COM	1	5	5	**3.0**	Poly	1989	32	Moderate	4	4	1	**3.7**	**11.1**
Reader	Reader Zone	0.13	0.37	COM	2	5	5	**3.5**	Welded Steel	1991	30	Moderate	1	4	1	**1.8**	**6.1**
Riverside Grove	Riverside Grove Zone	0.32	0.02	SFR	3	2	1	**2.3**	Welded Steel	1971	50	Moderate	1	5	1	**2.0**	**4.5**
South 1	South Zone	0.01	0.01	SFR	1	1	1	**1.0**	Poly	Unk		High	4	1	3	**3.2**	**3.2**
South 2	South Zone	0.01	0.01	SFR	1	1	1	**1.0**	Poly	Unk		High	4	1	3	**3.2**	**3.2**
South 3	South Zone	0.01	0.01	SFR	1	1	1	**1.0**	Poly	Unk		High	4	1	3	**3.2**	**3.2**
South 4	South Zone	0.01	0.01	SFR	1	1	1	**1.0**	Poly	Unk		High	4	1	3	**3.2**	**3.2**
Spring	Spring Zone	0.06	0.01	SFR	1	1	1	**1.0**	Bolted Steel	1980	41	Moderate	2	4	1	**2.4**	**2.4**
Swim 1	Swim Zone	0.01	0.05	MFR	1	3	3	**2.0**	Wood	old	Unk	Moderate	5	5	1	**4.6**	**9.2**
Swim 2	Swim Zone	0.01	0.05	MFR	1	3	3	**2.0**	Wood	old	Unk	Moderate	5	5	1	**4.6**	**9.2**
Ragain	University Zone	0.001	0.05	SFR	1	3	1	**1.5**	Poly	Unk		Moderate	4	5	1	**4.0**	**5.9**

Table 8.12 Storage Reservoir Risk Assessment

Water Master Plan
San Lorenzo Valley Water District

Reservoir Name	Pressure Zone	Consequence of Failure: Criteria Categories: Tank Operating Capacity (MG)	Service Demands (mgd)	Required Fire Flow Volume	Criteria Ratings: Tank Operating Capacity 50%	Service Demands 25%	Required Fire Flow Volume 25%	COF Score	Likelihood of Failure: Criteria Categories: Tank Material	Tank Age (yr)	Tank Age (age)	Fire Hazard Level	Criteria Ratings: Tank Material 65%	Tank Age 25%	Fire Hazard Level 10%	LOF Score	Total Risk Score
University 1	University Zone	0.06	0.05	SFR	1	3	1	**1.5**	Concrete	Unk		Moderate	2	5	1	**2.7**	**4.0**
Lompico System																	
Kaski 1	Kaski Zone	0.04	0.02	SFR	1	2	1	**1.3**	Bolted Steel	2021	0	Moderate	2	1	1	**1.7**	**2.1**
Kaski 2	Kaski Zone	0.04	0.02	SFR	1	2	1	**1.3**	Bolted Steel	2021	0	Moderate	2	1	1	**1.7**	**2.1**
Lewis	Lewis Zone	0.11	0.06	MFR	2	3	3	**2.5**	Bolted Steel	2020	1	Moderate	2	1	1	**1.7**	**4.1**
Lewis	Lewis Zone	0.11	0.06	MFR	2	3	3	**2.5**	Bolted Steel	2020	1	Moderate	2	1	1	**1.7**	**4.1**
Madrone 1	Madrone Zone	0.07	0.01	MFR	1	1	3	**1.5**	Bolted Steel	2020	1	Moderate	2	1	1	**1.7**	**2.5**
Madrone 2	Madrone Zone	0.07	0.01	MFR	1	1	3	**1.5**	Bolted Steel	2020	1	Moderate	2	1	1	**1.7**	**2.5**
Manana Woods System																	
Blue	Blue Zone	0.06	0.04	MFR	1	2	3	**1.8**	Bolted Steel	2019	2	Moderate	2	1	1	**1.7**	**2.9**
Charlie	Charlie Zone	0.04	0.01	SFR	1	1	1	**1.0**	Bolted Steel	1988	33	Moderate	2	4	1	**2.4**	**2.4**
Lower Pasatiempo	Probation Zone	0.10	0.4	COM	2	5	5	**3.5**	Concrete	Unk		Moderate	2	5	1	**2.7**	**9.3**
Probation	Probation Zone	0.50	0.4	COM	4	5	5	**4.5**	Welded Steel	2019	2	High	1	1	3	**1.2**	**5.4**
Upper Pasatiempo	Upper Pasatiempo Zone	0.10	0.05	SFR	2	3	1	**2.0**	Concrete	Unk		High	2	5	3	**2.9**	**5.7**

Table 8.12 Storage Reservoir Risk Assessment

Water Master Plan

San Lorenzo Valley Water District

Reservoir Name	Pressure Zone	Consequence of Failure							Likelihood of Failure								Total Risk Score
		Criteria Categories			Criteria Ratings				Criteria Categories				Criteria Ratings				
		Tank Operating Capacity (MG)	Service Demands (mgd)	Required Fire Flow Volume	Tank Operating Capacity 50%	Service Demands 25%	Required Fire Flow Volume 25%	COF Score	Tank Material	Tank Age (yr)	Tank Age (age)	Fire Hazard Level	Tank Material 65%	Tank Age 25%	Fire Hazard Level 10%	LOF Score	
Felton System																	
El Solyo	El Solyo Zone	0.01	0.06	SFR	1	3	1	1.5	Poly	2019	2	Moderate	4	1	1	3.0	4.4
El Solyo	El Solyo Zone	0.01	0.06	SFR	1	3	1	1.5	Poly	2020	1	Moderate	4	1	1	3.0	4.4
Bennett Spring	Bennett Spring Zone	0.004	0.01	SFR	1	1	1	1.0	Poly	Unk		High	4	5	3	4.2	4.2
Blair	Blair Zone	0.26	0.01	SFR	3	1	1	2.0	Welded Steel	1968	53	Moderate	1	5	1	2.0	4.0
Kirby Clearwell	McCloud Zone	0.21	0.38	COM	3	5	5	4.0	Welded Steel	1993	28	Moderate	1	3	1	1.5	6.0
McCloud	McCloud Zone	0.30	0.38	COM	3	5	5	4.0	Welded Steel	1980	41	Moderate	1	4	1	1.8	7.0
Felton Acres	Pine Zone	0.00	0.38	COM	1	5	5	3.0	Poly	2018	3	High	4	1	3	3.2	9.5
Pine 1	Pine Zone	0.01	0.09	MFR	1	3	3	2.0	Poly	2017	4	High	4	1	3	3.2	6.3
Pine 2	Pine Zone	0.01	0.09	MFR	1	3	3	2.0	Poly	2017	4	High	4	1	3	3.2	6.3

Table 8.13 Booster Station Risk Assessment
Water Master Plan
San Lorenzo Valley Water District

Pump Station Name	Pressure Zones: PZ Source	Pressure Zones: PZ Destination	Consequence of Failure — Criteria Categories: Service Demands (gpm)	Booster Station Capacity (gpm)	Pump Redundancy (Y/N)	Criteria Ratings: Service Demands 50%	Booster Station Capacity 25%	Pump Redundancy 25%	COF Score	Likelihood of Failure — Criteria Categories: SLVWD Operation Staff Rating	Fire Hazard Level	Criteria Ratings: SLVWD Operation Staff Rating 80%	Fire Hazard Level 20%	LOF Score	Total Risk Score
North System															
Bear Creek	Reader	Bear Creek	26	45	No	1	2	5	2.3	5	Moderate	5	1	4.2	9.5
Blackstone	Big Steel	Blackstone	5	60	Yes	1	2	1	1.3	1	Moderate	1	1	1.0	1.3
Blue Ridge	Reader	Blue Ridge	14	84	Yes	1	2	1	1.3	3	Moderate	3	1	2.6	3.3
Echo	Reader	North Boulder Creek	27	300	Yes	1	3	1	1.5	1	Moderate	1	1	1.0	1.5
Eckley	Lyon	Eckley	1	36	No	1	2	5	2.3	5	Moderate	5	1	4.2	9.5
Fairview	Reader	Highland	34	50	No	1	2	5	2.3	5	Moderate	5	1	4.2	9.5
Firehouse	Big Steel	Reader	384	500	Yes	4	4	1	3.3	3	Moderate	3	1	2.6	8.5
Huckleberry	Reader	Huckleberry	11	100	Yes	1	3	1	1.5	3	Moderate	3	1	2.6	3.9
Irwin	Brookdale	Big Steel	486	800	Yes	4	5	1	3.5	1	Moderate	1	1	1.0	3.5
Mitchell	Reader	Mitchell	6	20	Yes	1	1	1	1.0	2	High	2	3	2.2	2.2
Nina	Highland	Nina	21	150	Yes	1	3	1	1.5	1	Moderate	1	1	1.0	1.5
Nina Hydro	Nina	Nina Hydro	0	20	Yes	1	1	1	1.0	2	Moderate	2	1	1.8	1.8
Quail	Brookdale	Quail	178	700	Yes	3	4	1	2.8	1	Moderate	1	1	1.0	2.8
Ralston	Bear Creek	Ralston	4	80	Yes	1	2	1	1.3	1	Moderate	1	1	1.0	1.3

Table 8.13 Booster Station Risk Assessment
Water Master Plan
San Lorenzo Valley Water District

Pump Station Name	Pressure Zones		Consequence of Failure							Likelihood of Failure					Total Risk Score
			Criteria Categories			Criteria Ratings				Criteria Categories		Criteria Ratings			
	PZ Source	PZ Destination	Service Demands (gpm)	Booster Station Capacity (gpm)	Pump Redundancy (Y/N)	Service Demands 50%	Booster Station Capacity 25%	Pump Redundancy 25%	COF Score	SLVWD Operation Staff Rating	Fire Hazard Level	SLVWD Operation Staff Rating 80%	Fire Hazard Level 20%	LOF Score	
Redwood Park	Brookdale	Swim	37	180	Yes	1	3	1	**1.5**	1	Moderate	1	1	**1.0**	**1.5**
Riverside Grove	Reader	Riverside Grove	15	200	Yes	1	3	1	**1.5**	3	Moderate	3	1	**2.6**	**3.9**
South Reservoir	Big Steel	South	8	60	Yes	1	2	1	**1.3**	2	Moderate	2	1	**1.8**	**2.3**
Spring	Swim	Spring	4	90	Yes	1	2	1	**1.3**	3	Moderate	3	1	**2.6**	**3.3**
University	Quail	University	32	170	Yes	1	3	1	**1.5**	3	Moderate	3	1	**2.6**	**3.9**
West/Winner Hydro	Bear Creek	Bear Creek Hydro	0	20	Yes	1	1	1	**1.0**	3	Moderate	3	1	**2.6**	**2.6**
Intertie 3&4 (SLVWD South to North)	Quail	Probation	140	2100	Yes	1	5	1	**2.0**	3	High	3	5	**3.4**	**6.8**
Intertie 6, Felton to SLVWD North	McCloud	Brookdale	150	350	Yes	3	3	1	**2.5**	2	Moderate	2	1	**1.8**	**4.5**
Lompico System															
Lompico (Intertie 5)	Quail	Kaski	53	140	Yes	2	3	1	**2.0**	2	Moderate	2	1	**1.8**	**3.6**
Madrone	Kaski	Madrone	42	300	Yes	1	2	1	**1.3**	4	Moderate	4	1	**3.4**	**4.3**
Manana Woods System															
Blue	Blue	Charlie	6	12	Yes	1	1	1	**1.0**	3	Moderate	3	1	**2.6**	**2.6**
Charlie Hydro	Charlie	Charlie Hydro	1	60	Yes	1	2	1	**1.3**	3	Moderate	3	1	**2.6**	**3.3**
Lower Pasatiempo	Lower Pasatiempo	Upper Pasatiempo	67	150	Yes	2	3	1	**2.0**	4	Moderate	4	1	**3.4**	**6.8**

Table 8.13 Booster Station Risk Assessment
Water Master Plan
San Lorenzo Valley Water District

Pump Station Name	Pressure Zones: PZ Source	Pressure Zones: PZ Destination	Consequence of Failure: Criteria Categories: Service Demands (gpm)	Consequence of Failure: Criteria Categories: Booster Station Capacity (gpm)	Consequence of Failure: Criteria Categories: Pump Redundancy (Y/N)	Consequence of Failure: Criteria Ratings: Service Demands 50%	Consequence of Failure: Criteria Ratings: Booster Station Capacity 25%	Consequence of Failure: Criteria Ratings: Pump Redundancy 25%	COF Score	Likelihood of Failure: Criteria Categories: SLVWD Operation Staff Rating	Likelihood of Failure: Criteria Categories: Fire Hazard Level	Likelihood of Failure: Criteria Ratings: SLVWD Operation Staff Rating 80%	Likelihood of Failure: Criteria Ratings: Fire Hazard Level 20%	LOF Score	Total Risk Score
Felton System															
Felton Acres	Pine	Pine	5	20	Yes	1	1	1	**1.0**	5	Moderate	5	1	**4.2**	**4.2**
Lower El Solyo	McCloud	El Solyo	43	60	Yes	1	2	1	**1.3**	5	Moderate	5	1	**4.2**	**5.3**

8.5.4 Pressure Reduce Valve Risk Assessment Results

Following calculation of COF and LOF scores, a PRV risk assessment was conducted. Based on the breakdown of the COF and LOF scores, thresholds were determined to classify the PRVs as Very Low, Low, Moderate, High, and Extreme risk. These risk thresholds for PRVs are briefly summarized as follows:

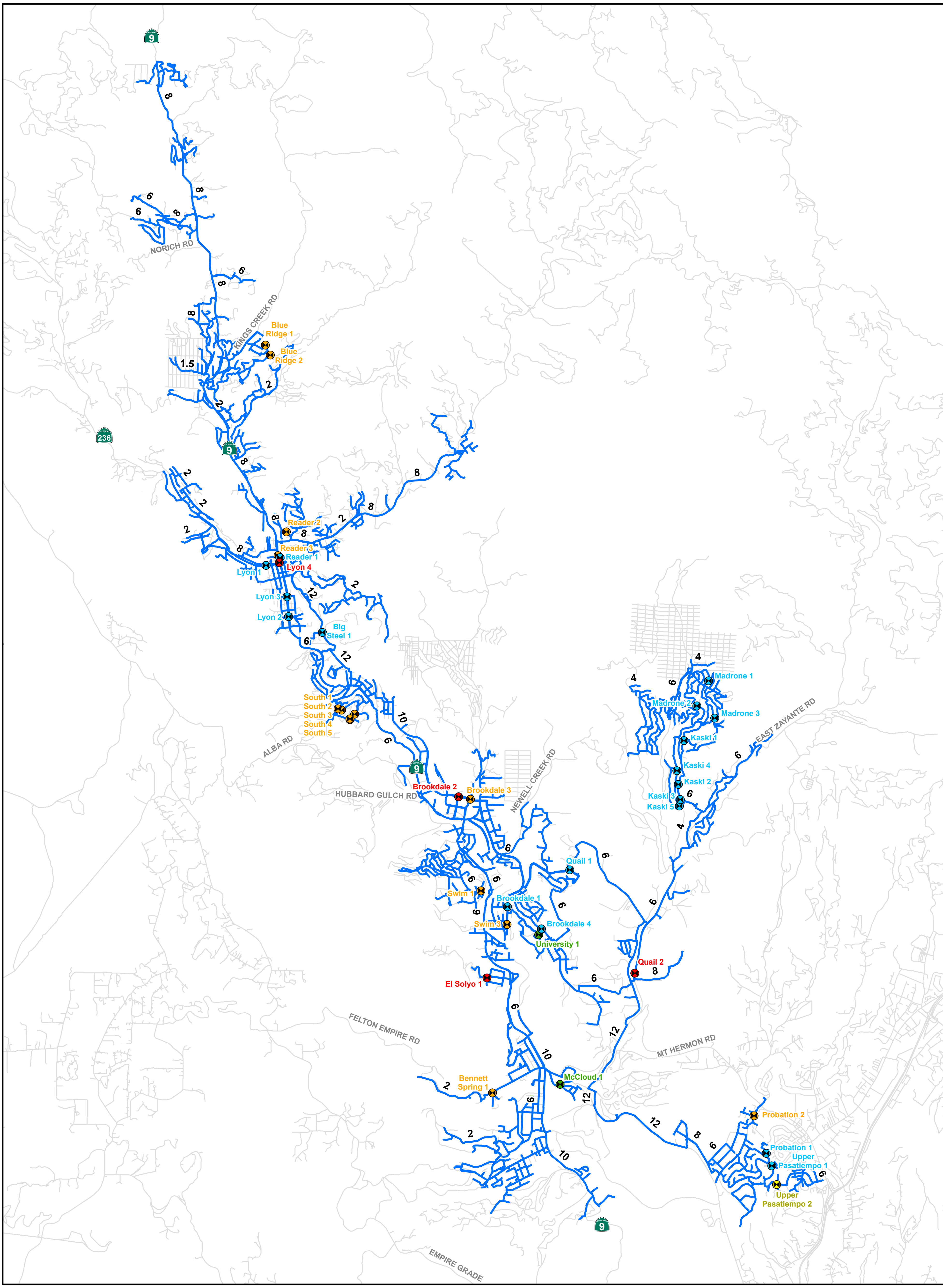
- **Very Low**: PRVs with an overall risk score of 5 or less were categorized as Very Low Risk, resulting in 12 PRVs being categorized as Very Low Risk.
- **Low**: PRVs with an overall risk score of 5 to 10 were categorized as Low Risk, resulting in 9 PRVs being categorized as Low Risk.
- **Moderate**: PRVs with an overall risk score of 10 to 15 were categorized as Moderate Risk, resulting in 1 PRV being categorized as Moderate Risk.
- **High**: PRVs with an overall risk score of 15 to 20 were categorized as High Risk, resulting in 11 PRVs being categorized as High Risk.
- **Extreme**: PRVs with an overall risk score of 20 or more were categorized as Extreme Risk, resulting in 4 PRVs being categorized as Extreme Risk.

The results of the risk assessment are tabulated on **Table 8.14** and shown graphically on **Figure 8.22**.

8.5.5 Groundwater Well Risk Assessment Result

Following calculation of COF and LOF scores, a groundwater well risk assessment was conducted. Based on the breakdown of the COF and LOF scores, thresholds were determined to classify the groundwater wells as Very Low, Low, Moderate, High, and Extreme risk. These risk thresholds for PRVs are briefly summarized as follows:

- **Very Low**: Wells with an overall risk score of 3 or less were categorized as Very Low Risk, resulting in 2 wells being categorized as Very Low Risk.
- **Low**: Wells with an overall risk score of 3 to 5 were categorized as Low Risk, resulting in no wells being categorized as Low Risk.
- **Moderate**: Wells with an overall risk score of 5 to 7 were categorized as Moderate Risk, resulting in 1 well being categorized as Moderate Risk.
- **High**: Wells with an overall risk score of 7 to 9 were categorized as High Risk, resulting in 2 wells being categorized as High Risk.
- **Extreme**: Wells with an overall risk score of 9 or more were categorized as Extreme Risk, resulting in 2 wells being categorized as Extreme Risk.



Legend

Overall Risk

- Very Low (Overall Risk Score < 5)
- Low (Overall Risk Score 5 - 10)
- Moderate (Overall Risk Score 10 - 15)
- High (Overall Risk Score 15 - 20)
- Extreme (Overall Risk Score 20 <)

- Pipes
- Roads

Update: May 25, 2021

0 0.25 0.5 1 Mile

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Figure 8.22
Overall Risk
Existing PRVs

Risk Assessment
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Table 8.14 Pressure Reducing Valves Risk Assessment

Water Master Plan
San Lorenzo Valley Water District

PRV ID	Location	Pressure Zone		Consequence of Failure					Likelihood of Failure		Total Risk Score
				Criteria Categories		Criteria Rating		COF Score	Criteria and Rating	LOF Score	
		Upstream	Downstream	Service Demands (gpm)	Supply Valve (Y/N)	Service Demands 50%	Supply Valve 50%		SLVWD Operation Staff Rating 100%		
North System											
Big Steel 1	Intersection of Irwin Wy & Spring Creek Rd	Big Steel	PRV Zone	4.2	Yes	2	5	3.5	1	1.0	3.5
Blue Ridge 1	Bar King Rd, S/o Alto Dr	Blue Ridge	PRV Zone	8.5	Yes	3	5	4.0	5	5.0	20.0
Blue Ridge 2	Alto Dr, E/o Meadow Dr	Blue Ridge	PRV Zone	1.3	Yes	2	5	3.5	5	5.0	17.5
Brookdale 1	NW intersection of Ardena Ave & Glen Arbor Rd	Brookdale	Quail	0.0	No	1	1	1.0	5	5.0	5.0
Brookdale 2	SW intersection of Main St & Sunnyside Ave	Brookdale	PRV Zone	40.8	Yes	4	5	4.5	5	5.0	22.5
Brookdale 3	Love Creek Rd, N/o Sunnyside Ave	Brookdale	PRV Zone	0.0	Yes	2	5	3.5	5	5.0	17.5
Brookdale 4	North intersection of Hihn Rd & Condor Ave	Brookdale	Quail	0.0	No	1	1	1.0	5	5.0	5.0
Lyon 1	NW intersection of State Highway 236 & Laurel St	Lyon	Big Steel	0.0	No	1	1	1.0	5	5.0	5.0
Lyon 2	NW intersection of Grove St & State Highway 9	Lyon	Big Steel	0.0	No	1	1	1.0	5	5.0	5.0
Lyon 3	SW intersection of State Highway 9 & Mountain St	Lyon	Big Steel	0.0	No	1	1	1.0	5	5.0	5.0
Lyon 4	NW intersection of State Highway 9 & State Highway 236	Lyon	Reader	218.8	Yes	5	5	5.0	5	5.0	25.0
Quail 1	NE intersection of Quail Hollow Rd and Cumora Ln	Quail	Brookdale	0.0	No	1	1	1.0	1	1.0	1.0
Quail 2	East Zayante Rd, S/o Olympia Station Rd	Quail	Quail	29.7	yes	4	5	4.5	5	5.0	22.5
Quail 3	Caledonium Ave, N/o Tipping Wy	Brookdale	PRV Zone	2.2	Yes	2	5	3.5	5	5.0	17.5
Reader 1	East intersection of Middleton Ave & State Highway 9	Reader	Big Steel	0.0	No	1	1	1.0	5	5.0	5.0
Reader 2	Mayfair Rd, W/o Oak Rd	Reader	PRV Zone	5.2	Yes	3	5	4.0	5	5.0	20.0
Reader 3	NW intersection of State Highway 9 & Haven Lane	Reader	PRV Zone	1.6	Yes	2	5	3.5	5	5.0	17.5
South 1	Forest Wy, E/o Forest Ave	South	PRV Zone	0.4	Yes	2	5	3.5	5	5.0	17.5
South 2	Forest Wy, W/o Western Ave	South	PRV Zone	0.1	Yes	2	5	3.5	5	5.0	17.5
South 3	Forest Wy, E/o Forest Ave	South	PRV Zone	0.9	Yes	2	5	3.5	5	5.0	17.5

Table 8.14 Pressure Reducing Valves Risk Assessment

Water Master Plan
San Lorenzo Valley Water District

PRV ID	Location	Pressure Zone		Consequence of Failure					Likelihood of Failure		Total Risk Score
				Criteria Categories		Criteria Rating			Criteria and Rating		
		Upstream	Downstream	Service Demands (gpm)	Supply Valve (Y/N)	Service Demands 50%	Supply Valve 50%	COF Score	SLVWD Operation Staff Rating 100%	LOF Score	
South 4	Azalea Ave, N/o Oak St	South	PRV Zone	0.3	Yes	2	5	3.5	5	5.0	17.5
South 5	Melwin Ave, W/o Azalea Ave	South	PRV Zone	1.7	Yes	2	5	3.5	5	5.0	17.5
Swim 1	Center Wy, W/o Park Dr	Swim	PRV Zone	2.2	Yes	2	5	3.5	5	5.0	17.5
University 1	NW intersection of Azalea Ave & Melin Ave	University	PRV Zone	5.3	Yes	3	5	4.0	2	2.0	8.0
Lompico System											
Kaski 1	Lakeview Ave, E/o Lake Blvd	Kaski	Madrone	0.0	No	1	1	1.0	1	1.0	1.0
Kaski 2	Lake Blvd, E/o Visatar St	Kaski	PRV Zone	0.0	No	1	1	1.0	1	1.0	1.0
Kaski 3	Lake Blvd, E/o Visatar St	PRV Zone	PRV Zone	10.3	Yes	4	5	4.5	1	1.0	4.5
Kaski 4	Visatar St, N/o Lake Blvd	Kaski	PRV Zone	2.9	Yes	2	5	3.5	1	1.0	3.5
Kaski 5	South intersection of Lake Blvd & Visatar St	Kaski	PRV Zone	0.0	No	1	1	1.0	1	1.0	1.0
Madrone 1	NE intersection of Volver Ave & Coleman Ave	Madrone	Lewis	0.0	No	1	1	1.0	1	1.0	1.0
Madrone 2	East intersection of Bideawee Wy & Van Allen Rd	Madrone	Lewis	0.0	No	1	1	1.0	1	1.0	1.0
Madrone 3	SE intersection of Ocean View Ave & Gladys Ave	Madrone	PRV Zone	2.7	Yes	2	5	3.5	1	1.0	3.5
Madrone 4	Lake Blvd, w/o Madrone Pump Station	Madrone	Lewis	32.3	Yes	4	5	4.5	1	1.0	4.5
Manana Woods System											
Probation 1	Caliente Dr, N/o Estrella Dr	Probation	PRV Zone	51.7	Yes	5	5	5.0	1	1.0	5.0
Probation 2	Locke Wy, E/o Lockewood Ln	Probation	PRV Zone	5.5	Yes	3	5	4.0	4	4.0	16.0
Upper Pasatiempo 1	Blueberry Dr, S/o Whispering Pines Dr	Upper Pasatiempo	Probation	0.0	No	1	1	1.0	1	1.0	1.0
Upper Pasatiempo 2	West intersection of Elena Ct & Canepa Dr	Upper Pasatiempo	Blue	34.5	Yes	4	5	4.5	3	3.0	13.5

Table 8.14 Pressure Reducing Valves Risk Assessment
Water Master Plan
San Lorenzo Valley Water District

PRV ID	Location	Pressure Zone		Consequence of Failure					Likelihood of Failure		Total Risk Score
				Criteria Categories		Criteria Rating		COF Score	Criteria and Rating	LOF Score	
		Upstream	Downstream	Service Demands (gpm)	Supply Valve (Y/N)	Service Demands 50%	Supply Valve 50%		SLVWD Operation Staff Rating 100%		
Felton System											
Bennett Spring 1	SE intersection of Felton Empire Rd & Jenny Wy	Bennett Spring	Blair	9.7	Yes	3	5	**4.0**	5	**5.0**	**20.0**
El Solyo 1	SE intersection of El Solyo Heights Dr & Quail Glen	El Solyo	PRV Zone	32.9	Yes	4	5	**4.5**	5	**5.0**	**22.5**
McCloud 1	Covered Bridge Rd, E/o Graham Hill Rd	McCloud	PRV Zone	16.0	Yes	4	5	**4.5**	2	**2.0**	**9.0**

The results of the risk assessment are tabulated on Table 8.15.

8.6 RENEWAL AND REPLACEMENT RECOMMENDED PRIORITIES

The following section summarize the storage, booster pump station, pressure reduce valve and groundwater well renewal and replacement priorities. These risk priorities are intended to acknowledge the criticality of each water asset, and should be used to guide capital improvement priorities and help District staff justify the budget spending strategy.

8.6.1 Pipeline Priorities

The recommended pipeline priorities are tabulated on Table 8.16. It should be noted that only High and Extreme Risk pipelines were documented as priorities. The results indicate that high priority pipelines are generally older pipes located in zones with significant demands such as Lyon, Brookdale, Big Steel, and Reader.

8.6.2 Storage Priorities

The recommended storage tank priorities are tabulated on Table 8.17. Due to the criticality of storage tank assets, likelihood of failure was given increased consideration in ordering priorities. The results indicate that high priority storage tanks are generally old wood or polyethylene tanks. As documented in the storage recommendations in Section 7, these tanks are recommended for replacement when storage is constructed.

8.6.3 Booster Station Priorities

The recommended booster pump station priorities are tabulated on Table 8.18. Due to the criticality of booster pump station assets, likelihood of failure was given increased consideration in ordering priorities. The results indicate that high priority booster pump stations are generally determined using staff condition ratings, and the highest priority booster pump stations lack redundancy. As documented in the pump recommendations in Section 7, it is recommended that an additional pump is constructed at these stations for reliability.

8.6.4 Pressure Reduce Valve Priorities

The recommended PRV priorities are tabulated on Table 8.19. The results indicate that high priority PRVs are generally active supply valves.

8.6.5 Groundwater Well Priorities

The recommended groundwater well priorities are tabulated on Table 8.20. The results indicate that high priority groundwater wells were primarily determined based on well capacity and staff rating.

Table 8.15 Groundwater Well Risk Assessment
Water Master Plan
San Lorenzo Valley Water District

Source Name	Discharge Pressure Zone	Consequence of Failure: Criteria Categories – Well Capacity (gpm)	Consequence of Failure: Criteria Rating – Well Capacity 100%	COF Score	Likelihood of Failure: Criteria Categories – SLVWD Operation Staff Rating	Likelihood of Failure: Criteria Categories – Fire Hazard Level	Likelihood of Failure: Criteria Rating – SLVWD Operation Staff Rating 80%	Likelihood of Failure: Criteria Rating – Fire Hazard Level 20%	LOF Score	Total Risk Score
North System										
Olympia 2	Quail	360	5	**5.0**	1	High	1	3	**1.4**	**7.0**
Olympia 3	Quail	150	3	**3.0**	2	High	2	3	**2.2**	**6.6**
Quail 4A	Brookdale	280	4	**4.0**	3	Moderate	3	1	**2.6**	**10.4**
Quail 5A	Brookdale Or Quail	85	1	**1.0**	2	Moderate	2	1	**1.8**	**1.8**
Manana Woods System										
Pasatiempo 5A	Probation	350	5	**5.0**	2	High	2	3	**2.2**	**11.0**
Pasatiempo 7	Probation	100	2	**2.0**	1	Moderate	1	1	**1.0**	**2.0**
Pasatiempo 8	Probation	350	5	**5.0**	1	High	1	3	**1.4**	**7.0**
Pasatiempo 6 (Inactive)	Probation									
Lompico System										
Lewis Well 1 (Inactive)	Lewis									
Lewis Well 7 (Inactive)	Lewis									
Well #6 (Inactive)	Lewis									

Table 8.16 Recommended Pipeline Priorities

Water Master Plan

San Lorenzo Valley Water District

Risk Group ID	Pressure Zone	Diameter (in)	Length (LF)	Pipe Age	COF Score	LOF Score	Total Risk Score
53	Brookdale	6 / 8	1,393	80	4.1	5.0	20.3
19	Lyon	6	3,604	80	4.1	4.9	19.9
56	McCloud	6	752	71	3.9	3.7	14.3
14	Reader	8	1,307	61	3.3	4.1	13.5
12	Reader	8	4,484	61	4.1	3.2	13.1
21	Big Steel	8	860	26	4.1	3.2	13.1
6	Riverside Grove	6	2,308	71	3.3	4.0	13.0
80	Probation	6 / 8	744	71	4.5	2.9	12.9
11	Reader	8	2,065	61	4.1	3.1	12.7
69	Pine	2	2,391	71	2.8	4.5	12.6
78	Probation	8	2,460	71	4.5	2.8	12.6
55	McCloud	4	1,305	80	3.1	4.1	12.5
37	Big Steel	6	2,158	80	2.7	4.6	12.2
8	Reader	8	2,129	71	4.5	2.7	12.2
39	Brookdale	10	1,216	51	3.8	3.2	12.0
3	North Boulder Creek	6 / 8	731	26	3.7	3.2	11.8
74	Kaski	6	777	43	3.3	3.6	11.7
64	Bennett Spring	2 / 4 / 6	1,572	80	2.7	4.4	11.7
4	North Boulder Creek	8	97	26	3.7	3.1	11.5
28	Big Steel	6	327	71	3.5	3.3	11.4
43	Brookdale	6	1,447	80	3.1	3.7	11.3
25	Reader	6	198	61	3.1	3.7	11.3
26	Big Steel	8	283	80	3.1	3.6	11.2
22	Big Steel	8	498	71	3.1	3.6	11.2
65	Bennett Spring	2 / 4	3,688	80	3.1	3.5	10.9
82	Blue	6	314	71	2.9	3.8	10.8
75	Quail	2 / 6	2,254	80	3.6	3.0	10.7
76	Quail	6	1,992	71	3.6	3.0	10.7
68	Pine	2	839	80	2.8	3.8	10.6
38	Brookdale	12	427	51	3.8	2.8	10.6
73	Kaski	4	415	43	3.7	2.9	10.6
63	McCloud	10	770	44	3.6	2.9	10.3
31	Big Steel	6	657	80	2.3	4.5	10.1
52	University	2	562	0	2.8	3.6	10.1
48	Brookdale	6	674	71	2.7	3.8	10.1

Table 8.16 Recommended Pipeline Priorities
Water Master Plan
San Lorenzo Valley Water District

Risk Group ID	Pressure Zone	Diameter (in)	Length (LF)	Pipe Age	COF Score	LOF Score	Total Risk Score
47	Brookdale	6	907	23	3.1	3.3	10.1
44	Brookdale	1.5 / 2	3,143	71	2.2	4.5	9.9
1	North Boulder Creek	8	612	26	3.3	3.0	9.9
59	McCloud	2	6	80	2.6	3.8	9.9
20	Big Steel	2	492	80	2.8	3.5	9.8
10	Reader	6	334	61	3.1	3.2	9.8
17	Lyon	4	53	71	3.3	3.0	9.8
18	Lyon	4	839	71	3.3	3.0	9.8
42	Brookdale	2 / 6 /12	843	80	2.6	3.7	9.6
24	Reader	8	23	71	3.1	3.1	9.6
13	Reader	8	1,112	61	3.3	2.9	9.6
67	McCloud	2	186	80	2.8	3.4	9.5
66	McCloud	6	538	26	3.7	2.6	9.5
49	Brookdale	6	193	61	4.1	2.3	9.3
29	Big Steel	8	1	0	3.1	3.0	9.3
15	Ralston	2 / 8	965	71	2.9	3.2	9.3
77	Quail	8	87	41	3.2	2.9	9.3
2	North Boulder Creek	8	2,118	44	3.7	2.5	9.3
36	Big Steel	12	1,945	51	2.8	3.3	9.2
60	McCloud	4	733	71	2.3	4.1	9.2
79	Probation	6	1	80	2.7	3.4	9.0
58	McCloud	6	392	26	2.3	4.0	9.0
23	Lyon	2 / 6	132	80	4.1	2.2	8.9
61	McCloud	6	593	51	3.0	3.0	8.9
30	Reader	1.5 / 2	2,162	80	1.8	4.9	8.8
32	Lyon	1	713	80	1.8	4.9	8.8
57	McCloud	10	267	71	3.2	2.8	8.8
9	Reader	1.25 / 6	763	71	2.3	3.9	8.8
81	Probation	6	403	71	3.3	2.7	8.8
33	Lyon	1.5	365	80	1.8	4.8	8.6
71	Pine	2	496	61	2.4	3.6	8.6
83	Charlie	2	413	0	2.4	3.6	8.6
7	Mitchell	2	792	32	3.2	2.7	8.6
5	Reader	8	131	71	3.3	2.6	8.6
34	Reader	6	300	71	2.9	3.0	8.6
35	Reader	6	607	61	2.9	3.0	8.6

Table 8.16 Recommended Pipeline Priorities

Water Master Plan

San Lorenzo Valley Water District

Risk Group ID	Pressure Zone	Diameter (in)	Length (LF)	Pipe Age	COF Score	LOF Score	Total Risk Score
40	Big Steel	6	424	80	**1.9**	**4.6**	**8.5**
51	University	2	171	71	**2.8**	**3.0**	**8.4**
62	McCloud	8	455	51	**4.8**	**1.7**	**8.2**
41	Brookdale	6	224	80	**1.9**	**4.4**	**8.1**
46	Spring	4	761	26	**1.9**	**4.4**	**8.1**
27	Lyon	2	433	80	**2.2**	**3.7**	**8.1**
16	Eckley	2	157	71	**2.8**	**2.9**	**8.1**
54	McCloud	2	145	71	**2.8**	**2.9**	**8.1**
70	Pine	2	372	71	**2.8**	**2.9**	**8.1**
50	Brookdale	2	426	71	**1.8**	**4.5**	**8.1**
72	Madrone	6	308	43	**3.7**	**2.2**	**8.0**
45	Swim	4	403	26	**3.7**	**2.2**	**8.0**

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Table 8.17 Recommended Storage Reservoir Priorities

Water Master Plan
San Lorenzo Valley Water District

Reservoir Name	Pressure Zone	Tank Material	Tank Age	Tank Age	COF Score	LOF Score	Total Risk Score
Swim 1	Swim Zone	Wood	old	Unk	**2.0**	**4.6**	**9.2**
Swim 2	Swim Zone	Wood	old	Unk	**2.0**	**4.6**	**9.2**
Blue Ridge	Blue Ridge Zone	Wood	old	Unk	**1.8**	**4.6**	**8.1**
Echo 1	North Boulder Creek Zone	Wood	old	Unk	**1.8**	**4.6**	**8.1**
Echo 3	North Boulder Creek Zone	Wood	old	Unk	**1.8**	**4.6**	**8.1**
Echo 4	North Boulder Creek Zone	Wood	old	Unk	**1.8**	**4.6**	**8.1**
Highland	Highland Zone	Wood	old	Unk	**1.3**	**4.6**	**5.8**
Bennett Spring	Bennett Spring Zone	Poly	Unk		**1.0**	**4.2**	**4.2**
Ragain	University Zone	Poly	Unk		**1.5**	**4.0**	**5.9**
Alder	Reader Zone	Poly	1989	32	**3.0**	**3.7**	**11.1**
Ralston 1	Ralston Zone	Poly	2010	11	**1.0**	**3.2**	**3.2**
Ralston 2	Ralston Zone	Poly	2010	11	**1.0**	**3.2**	**3.2**
Felton Acres	Pine Zone	Poly	2018	3	**3.0**	**3.2**	**9.5**
Pine 1	Pine Zone	Poly	2017	4	**2.0**	**3.2**	**6.3**
Pine 2	Pine Zone	Poly	2017	4	**2.0**	**3.2**	**6.3**
Blackstone 1	Blackstone Zone	Poly	2020	1	**1.0**	**3.2**	**3.2**
Blackstone 2	Blackstone Zone	Poly	2020	1	**1.0**	**3.2**	**3.2**
South 1	South Zone	Poly	Unk		**1.0**	**3.2**	**3.2**
South 2	South Zone	Poly	Unk		**1.0**	**3.2**	**3.2**

Table 8.17 Recommended Storage Reservoir Priorities

Water Master Plan

San Lorenzo Valley Water District

Reservoir Name	Pressure Zone	Tank Material	Tank Age	Tank Age	COF Score	LOF Score	Total Risk Score
South 3	South Zone	Poly	Unk		1.0	3.2	3.2
South 4	South Zone	Poly	Unk		1.0	3.2	3.2
El Solyo	El Solyo Zone	Poly	2019	2	1.5	3.0	4.4
El Solyo	El Solyo Zone	Poly	2020	1	1.5	3.0	4.4
Eckley	Eckley Zone	Poly	2020	1	1.0	3.0	3.0
Upper Pasatiempo	Upper Pasatiempo Zone	Concrete	Unk		2.0	2.9	5.7
Lower Pasatiempo	Probation Zone	Concrete	Unk		3.5	2.7	9.3
University 1	University Zone	Concrete	Unk		1.5	2.7	4.0
Spring	Spring Zone	Bolted Steel	1980	41	1.0	2.4	2.4
Charlie	Charlie Zone	Bolted Steel	1988	33	1.0	2.4	2.4
Brookdale	Brookdale Zone	Welded Steel	1971	50	4.5	2.2	9.9
Big Steel	Big Steel Zone	Welded Steel	1941	80	4.3	2.2	9.4
Riverside Grove	Riverside Grove Zone	Welded Steel	1971	50	2.3	2.0	4.5
Blair	Blair Zone	Welded Steel	1968	53	2.0	2.0	4.0
Lyon	Lyon Zone	Welded Steel	1990	31	4.8	2.0	9.3
Little Lyon	Lyon Zone	Welded Steel	1991	30	3.8	2.0	7.3
Nina 1	Nina Zone	Bolted Steel	2011	10	1.3	1.9	2.4
Nina 2	Nina Zone	Bolted Steel	2011	10	1.3	1.9	2.4
McCloud	McCloud Zone	Welded Steel	1980	41	4.0	1.8	7.0

Table 8.17 Recommended Storage Reservoir Priorities

Water Master Plan

San Lorenzo Valley Water District

Reservoir Name	Pressure Zone	Tank Material	Tank Age	Tank Age	COF Score	LOF Score	Total Risk Score
Reader	Reader Zone	Welded Steel	1991	30	3.5	1.8	6.1
Quail 1	Quail Zone	Welded Steel	1990	31	3.0	1.8	5.3
Bear Creek	Bear Creek Zone	Welded Steel	1968	53	2.3	1.8	3.9
Lewis	Lewis Zone	Bolted Steel	2020	1	2.5	1.7	4.1
Lewis	Lewis Zone	Bolted Steel	2020	1	2.5	1.7	4.1
Blue	Blue Zone	Bolted Steel	2019	2	1.8	1.7	2.9
Madrone 1	Madrone Zone	Bolted Steel	2020	1	1.5	1.7	2.5
Madrone 2	Madrone Zone	Bolted Steel	2020	1	1.5	1.7	2.5
Kaski 1	Kaski Zone	Bolted Steel	2021	0	1.3	1.7	2.1
Kaski 2	Kaski Zone	Bolted Steel	2021	0	1.3	1.7	2.1
Kirby Clearwell	McCloud Zone	Welded Steel	1993	28	4.0	1.5	6.0
Quail 2	Quail Zone	Welded Steel	1992	29	3.0	1.5	4.5
Huckleberry	Huckleberry Zone	Welded Steel	1992	29	1.8	1.5	2.6
Probation	Probation Zone	Welded Steel	2019	2	4.5	1.2	5.4

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Table 8.18 Recommended Booster Station Priorities

Water Master Plan

San Lorenzo Valley Water District

Pump Station Name	PZ Source	PZ Destination	Service Demands	Booster Station Capacity	Pump Redundancy	COF Score	LOF Score	Total Risk Score
Bear Creek	Reader	Bear Creek	26	45	No	2.3	4.2	9.5
Eckley	Lyon	Eckley	1	36	No	2.3	4.2	9.5
Fairview	Reader	Highland	34	50	No	2.3	4.2	9.5
Lower El Solyo	McCloud	El Solyo	43	60	Yes	1.3	4.2	5.3
Felton Acres	Pine	Pine	5	20	Yes	1.0	4.2	4.2
Lower Pasatiempo	Lower Pasatiempo	Upper Pasatiempo	67	150	Yes	2.0	3.4	6.8
Intertie 3&4 (SLVWD South to North)	Quail	Probation	140	2100	Yes	2.0	3.4	6.8
Madrone	Kaski	Madrone	42	300	Yes	1.3	3.4	4.3
Firehouse	Big Steel	Reader	384	500	Yes	3.3	2.6	8.5
Huckleberry	Reader	Huckleberry	11	100	Yes	1.5	2.6	3.9
Riverside Grove	Reader	Riverside Grove	15	200	Yes	1.5	2.6	3.9
University	Quail	University	32	170	Yes	1.5	2.6	3.9
Blue Ridge	Reader	Blue Ridge	14	84	Yes	1.3	2.6	3.3
Spring	Swim	Spring	4	90	Yes	1.3	2.6	3.3
Charlie Hydro	Charlie	Charlie Hydro	1	60	Yes	1.3	2.6	3.3
West/Winner Hydro	Bear Creek	Bear Creek Hydro	0	20	Yes	1.0	2.6	2.6
Blue	Blue	Charlie	6	12	Yes	1.0	2.6	2.6
Mitchell	Reader	Mitchell	6	20	Yes	1.0	2.2	2.2
Intertie 6, Felton to SLVWD North	McCloud	Brookdale	150	350	Yes	2.5	1.8	4.5
Lompico (Intertie 5)	Quail	Kaski	53	140	Yes	2.0	1.8	3.6
South Reservoir	Big Steel	South	8	60	Yes	1.3	1.8	2.3
Nina Hydro	Nina	Nina Hydro	0	20	Yes	1.0	1.8	1.8
Irwin	Brookdale	Big Steel	486	800	Yes	3.5	1.0	3.5
Quail	Brookdale	Quail	178	700	Yes	2.8	1.0	2.8
Echo	Reader	North Boulder Creek	27	300	Yes	1.5	1.0	1.5
Nina	Highland	Nina	21	150	Yes	1.5	1.0	1.5
Redwood Park	Brookdale	Swim	37	180	Yes	1.5	1.0	1.5
Blackstone	Big Steel	Blackstone	5	60	Yes	1.3	1.0	1.3
Ralston	Bear Creek	Ralston	4	80	Yes	1.3	1.0	1.3

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Table 8.19 Recommended Pressure Reducing Valve Priorities

Water Master Plan

San Lorenzo Valley Water District

PRV ID	Location	PZ Upstream	PZ Downstream	Service Demands (gpm)	Supply Valve (Y/N)	COF Score	LOF Score	Total Risk Score
Lyon 4	NW intersection of State Highway 9 & State Highway 236	Lyon	Reader	218.8	Yes	5.0	5.0	25.0
Brookdale 2	SW intersection of Main St & Sunnyside Ave	Brookdale	PRV Zone	40.8	Yes	4.5	5.0	22.5
Quail 2	East Zayante Rd, S/o Olympia Station Rd	Quail	Quail	29.7	yes	4.5	5.0	22.5
El Solyo 1	SE intersection of El Solyo Heights Dr & Quail Glen	El Solyo	PRV Zone	32.9	Yes	4.5	5.0	22.5
Blue Ridge 1	Bar King Rd, S/o Alto Dr	Blue Ridge	PRV Zone	8.5	Yes	4.0	5.0	20.0
Reader 2	Mayfair Rd, W/o Oak Rd	Reader	PRV Zone	5.2	Yes	4.0	5.0	20.0
Bennett Spring 1	SE intersection of Felton Empire Rd & Jenny Wy	Bennett Spring	Blair	9.7	Yes	4.0	5.0	20.0
Blue Ridge 2	Alto Dr, E/o Meadow Dr	Blue Ridge	PRV Zone	1.3	Yes	3.5	5.0	17.5
Brookdale 3	Love Creek Rd, N/o Sunnyside Ave	Brookdale	PRV Zone	0.0	Yes	3.5	5.0	17.5
Quail 3	Caledonium Ave, N/o Tipping Wy	Brookdale	PRV Zone	2.2	Yes	3.5	5.0	17.5
Reader 3	NW intersection of State Highway 9 & Haven Lane	Reader	PRV Zone	1.6	Yes	3.5	5.0	17.5
South 1	Forest Wy, E/o Forest Ave	South	PRV Zone	0.4	Yes	3.5	5.0	17.5
South 2	Forest Wy, W/o Western Ave	South	PRV Zone	0.1	Yes	3.5	5.0	17.5
South 3	Forest Wy, E/o Forest Ave	South	PRV Zone	0.9	Yes	3.5	5.0	17.5
South 4	Azalea Ave, N/o Oak St	South	PRV Zone	0.3	Yes	3.5	5.0	17.5
South 5	Melwin Ave, W/o Azalea Ave	South	PRV Zone	1.7	Yes	3.5	5.0	17.5
Swim 1	Center Wy, W/o Park Dr	Swim	PRV Zone	2.2	Yes	3.5	5.0	17.5
Probation 2	Locke Wy, E/o Lockewood Ln	Probation	PRV Zone	5.5	Yes	4.0	4.0	16.0
Upper Pasatiempo 2	West intersection of Elena Ct & Canepa Dr	Upper Pasatiempo	Blue	34.5	Yes	4.5	3.0	13.5
McCloud 1	Covered Bridge Rd, E/o Graham Hill Rd	McCloud	PRV Zone	16.0	Yes	4.5	2.0	9.0
University 1	NW intersection of Azalea Ave & Melin Ave	University	PRV Zone	5.3	Yes	4.0	2.0	8.0
Probation 1	Caliente Dr, N/o Estrella Dr	Probation	PRV Zone	51.7	Yes	5.0	1.0	5.0
Kaski 3	Lake Blvd, E/o Visatar St	PRV Zone	PRV Zone	10.3	Yes	4.5	1.0	4.5

Table 8.19 Recommended Pressure Reducing Valve Priorities

Water Master Plan

San Lorenzo Valley Water District

PRV ID	Location	PZ Upstream	PZ Downstream	Service Demands (gpm)	Supply Valve (Y/N)	COF Score	LOF Score	Total Risk Score
Madrone 4	Lake Blvd, w/o Madrone Pump Station	Madrone	Lewis	32.3	Yes	4.5	1.0	4.5
Big Steel 1	Intersection of Irwin Wy & Spring Creek Rd	Big Steel	PRV Zone	4.2	Yes	3.5	1.0	3.5
Kaski 4	Visatar St, N/o Lake Blvd	Kaski	PRV Zone	2.9	Yes	3.5	1.0	3.5
Madrone 3	SE intersection of Ocean View Ave & Gladys Ave	Madrone	PRV Zone	2.7	Yes	3.5	1.0	3.5
Brookdale 1	NW intersection of Ardena Ave & Glen Arbor Rd	Brookdale	Quail	0.0	No	1.0	5.0	5.0
Brookdale 4	North intersection of Hihn Rd & Condor Ave	Brookdale	Quail	0.0	No	1.0	5.0	5.0
Lyon 1	NW intersection of State Highway 236 & Laurel St	Lyon	Big Steel	0.0	No	1.0	5.0	5.0
Lyon 2	NW intersection of Grove St & State Highway 9	Lyon	Big Steel	0.0	No	1.0	5.0	5.0
Lyon 3	SW intersection of State Highway 9 & Mountain St	Lyon	Big Steel	0.0	No	1.0	5.0	5.0
Reader 1	East intersection of Middleton Ave & State Highway 9	Reader	Big Steel	0.0	No	1.0	5.0	5.0
Quail 1	NE intersection of Quail Hollow Rd and Cumora Ln	Quail	Brookdale	0.0	No	1.0	1.0	1.0
Kaski 1	Lakeview Ave, E/o Lake Blvd	Kaski	Madrone	0.0	No	1.0	1.0	1.0
Kaski 2	Lake Blvd, E/o Visatar St	Kaski	PRV Zone	0.0	No	1.0	1.0	1.0
Kaski 5	South intersection of Lake Blvd & Visatar St	Kaski	PRV Zone	0.0	No	1.0	1.0	1.0
Madrone 1	NE intersection of Volver Ave & Coleman Ave	Madrone	Lewis	0.0	No	1.0	1.0	1.0
Madrone 2	East intersection of Bideawee Wy & Van Allen Rd	Madrone	Lewis	0.0	No	1.0	1.0	1.0
Upper Pasatiempo 1	Blueberry Dr, S/o Whispering Pines Dr	Upper Pasatiempo	Probation	0.0	No	1.0	1.0	1.0

Table 8.20 Recommended Groundwater Well Priorities

Water Master Plan

San Lorenzo Valley Water District

Source Name	Discharge Pressure Zone	Well Capacity (gpm)	COF Score	LOF Score	Total Risk Score
Quail 4A	Brookdale	280	**4.0**	**2.6**	**10.4**
Pasatiempo 5A	Probation	350	**5.0**	**2.2**	**11.0**
Olympia 3	Quail	150	**3.0**	**2.2**	**6.6**
Quail 5A	Brookdale Or Quail	85	**1.0**	**1.8**	**1.8**
Pasatiempo 8	Probation	350	**5.0**	**1.4**	**7.0**
Olympia 2	Quail	360	**5.0**	**1.4**	**7.0**
Pasatiempo 7	Probation	100	**2.0**	**1.0**	**2.0**
Pasatiempo 6 (Inactive)	Probation				
Lewis Well 1 (Inactive)	Lewis				
Lewis Well 7 (Inactive)	Lewis				
Well #6 (Inactive)	Lewis				

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5/25/2021

CHAPTER 10 – CAPITAL IMPROVEMENT PROGRAM

This chapter provides a summary of the recommended domestic water system improvements to mitigate existing capacity deficiencies and to accommodate anticipated future growth. The chapter also presents the cost criteria and methodologies for developing the capital improvement program. Finally, a capacity allocation analysis, usually used for cost sharing purposes, is also included.

10.1 COST ESTIMATE ACCURACY

Cost estimates presented in the CIP were prepared for general master planning purposes and, where relevant, for further project evaluation. Final costs of a project will depend on several factors including the final project scope, costs of labor and material, and market conditions during construction.

The Association for the Advancement of Cost Engineering (AACE International), formerly known as the American Association of Cost Engineers has defined three classifications of assessing project costs. These classifications are presented in order of increasing accuracy: Order of Magnitude, Budget, and Definitive.

- **Order of Magnitude Estimate.** This classification is also known as an “original estimate”, “study estimate”, or “preliminary estimate”, and is generally intended for master plans and studies.

  This estimate is not supported with detailed engineering data about the specific project, and its accuracy is dependent on historical data and cost indexes. It is generally expected that this estimate would be accurate within -30 percent to +50 percent.

- **Budget Estimate.** This classification is also known as an “official estimate” and generally intended for predesign studies. This estimate is prepared to include flow sheets and equipment layouts and details. It is generally expected that this estimate would be accurate within -15 percent to +30 percent.

- **Definitive Estimate.** This classification is also known as a “final estimate” and prepared during the time of contract bidding. The data includes complete plot plans and elevations, equipment data sheets, and complete specifications. It is generally expected that this estimate would be accurate within -5 percent to + 15 percent.

Costs developed in this study should be considered “Order of Magnitude” and have an expected accuracy range of **-30 percent** and **+50 percent**.

10.2 COST ESTIMATE METHODOLOGY

Cost estimates presented in this chapter are opinions of probable construction and other relevant costs developed from several sources including cost curves, Akel experience on other master planning projects, and input from District staff on the development of public and private cost sharing. Where appropriate, costs were escalated to reflect the more current Engineering News Records (ENR) Construction Cost Index (CCI).

This section documents the unit costs used in developing the opinion of probable construction costs, the Construction Cost Index, the land acquisition costs, and markups to account for construction contingency and other project related costs.

10.2.1 Unit Costs

The unit cost estimates used in developing the Capital Improvement Program are summarized on **Table 10.1**. Domestic water pipeline unit costs are based on length of pipes, in feet. Storage reservoir unit costs are based on capacity, per million gallons (MG). Pump Station costs are based on an equation that replaces the pump curve. Valve improvements are a flat cost based on previous projects constructed by the District.

The unit costs are intended for developing the Order of Magnitude estimate and do not account for site specific conditions, labor and material costs during the time of construction, final project scope, implementation schedule, detailed utility and topography surveys for reservoir sites, investigation of alternative routings for pipes, and other various factors. The capital improvement program included in this report accounts for construction and project-related contingencies as described in this chapter.

10.2.2 Construction Cost Index

Costs estimated in this study are adjusted utilizing the Engineering News Record (ENR) Construction Cost Index (CCI), which is widely used in the engineering and construction industries.

The costs in this Water System Master Plan were benchmarked using a 20-City national average ENR CCI of 12,112 reflecting a date of June 2021.

10.2.3 Construction Contingency Allowance

Knowledge about site-specific conditions for each proposed project is limited at the master planning stage; therefore, construction contingencies were used. The estimated construction costs in this master plan include a **30 percent** contingency allowance to account for unforeseen events and unknown field conditions.

Table 10.1 Unit Costs

Water Master Plan
San Lorenzo Valley Water District

Pipelines

Pipe Size (in)	Cost ($/Lineal Foot)
6	188
8	202
10	217
12	233
16	280
18	301
20	345
24	378
30	418
36	493

Valves [2]

New Valve	$32,000 per Valve

Booster Pump Station

Estimated Pumping Station Unit Cost ($/gpm), where Q is equal to the total station capacity in gpm

Construct New Pump	Unit Cost = 209.70 x $e^{-0.0001 \times Q}$
Upgrade Existing Pump	Unit Cost = 175.82 x $e^{-0.00008 \times Q}$

Storage [2]

$3.11 / gallon

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9/7/2021

Notes :

1. Construction costs estimated using June 2021 ENR CCI of 12,112.
2. Unit costs based on comparable projects shown in SLVWD Capital Improvement Projects.

10.2.4 Project Related Costs

The capital improvement costs also account for project-related costs, comprising of engineering design, project administration (developer and District staff), construction management and inspection, and legal costs. The project related costs in this master plan were estimated by applying an additional **30 percent** to the estimated construction costs.

10.3 CAPITAL IMPROVEMENT PROGRAM

This section documents the capital improvement program, contingencies included in the costs, and the allocation of costs to meet the requirements of AB1600.

10.3.1 Capital Improvement Identifiers

Each improvement was assigned a unique coded identifier associated with the improvement type and pressure zone and is summarized graphically on **Figure 10.1**. These identifiers were assigned as described below.

Each improvement begins with characters corresponding to its facility type, as follows:

- Pipeline improvement identifiers begin with **P**
- Tank improvement identifiers begin with **T**
- Pump Station improvement identifiers begin with **PS**
- Pressure Reducing Valve improvement identifiers begin with **PRV**
- Other Valve improvement identifiers begin with **VLV**

Each improvement is then given a number representing the pressure zone it services, followed by a numerical value unique to each improvement of a specific type within the zone.

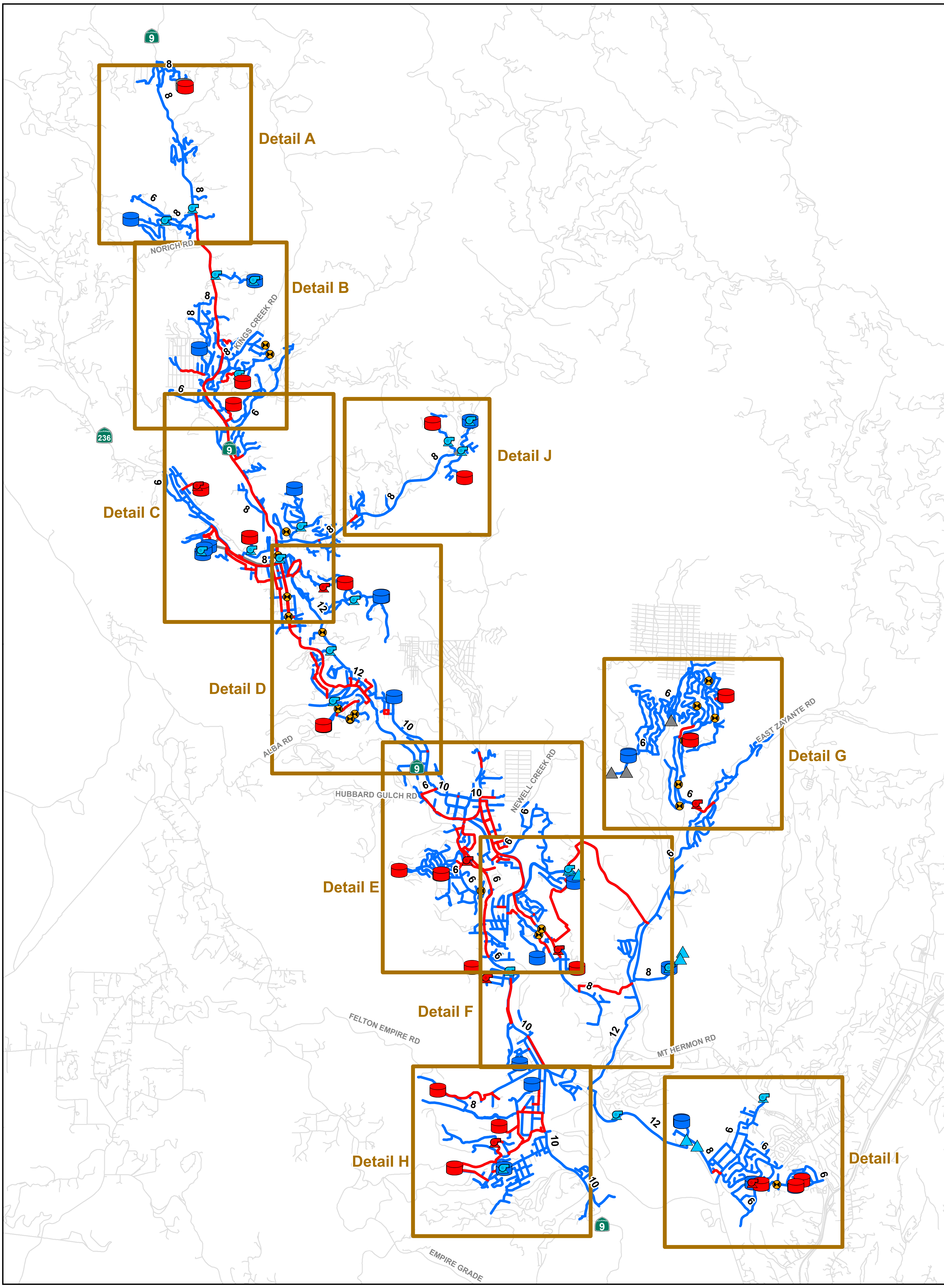
10.3.2 Capital Improvement Costs

The Capital Improvement Program costs for the projects identified in this master plan for mitigating existing system deficiencies and for serving anticipated future growth throughout the District are summarized on **Table 10.2**.

The estimated construction costs include the baseline costs plus **30 percent** contingency allowance to account for unforeseen events and unknown field conditions, as described in a previous section. Capital improvement costs include the estimated construction costs plus **30 percent** project-related costs (engineering design, project administration, construction management and inspection, and legal costs).

10.3.3 Recommended Cost Allocation Analysis

Cost allocation analysis is needed to identify improvement funding sources, and to establish a nexus between development impact fees and improvements needed to service growth. In compliance with the provisions of Assembly Bill AB 1600, the analysis differentiates between the



Legend

Recommended Improvements
- Pump Station
- Tank
- Pipelines

Existing System
- Pump Station
- Wells
- Wells (Inactive)
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines
- Abandoned Pipelines

0 0.25 0.5 1 Mile

Update: July 12, 2021

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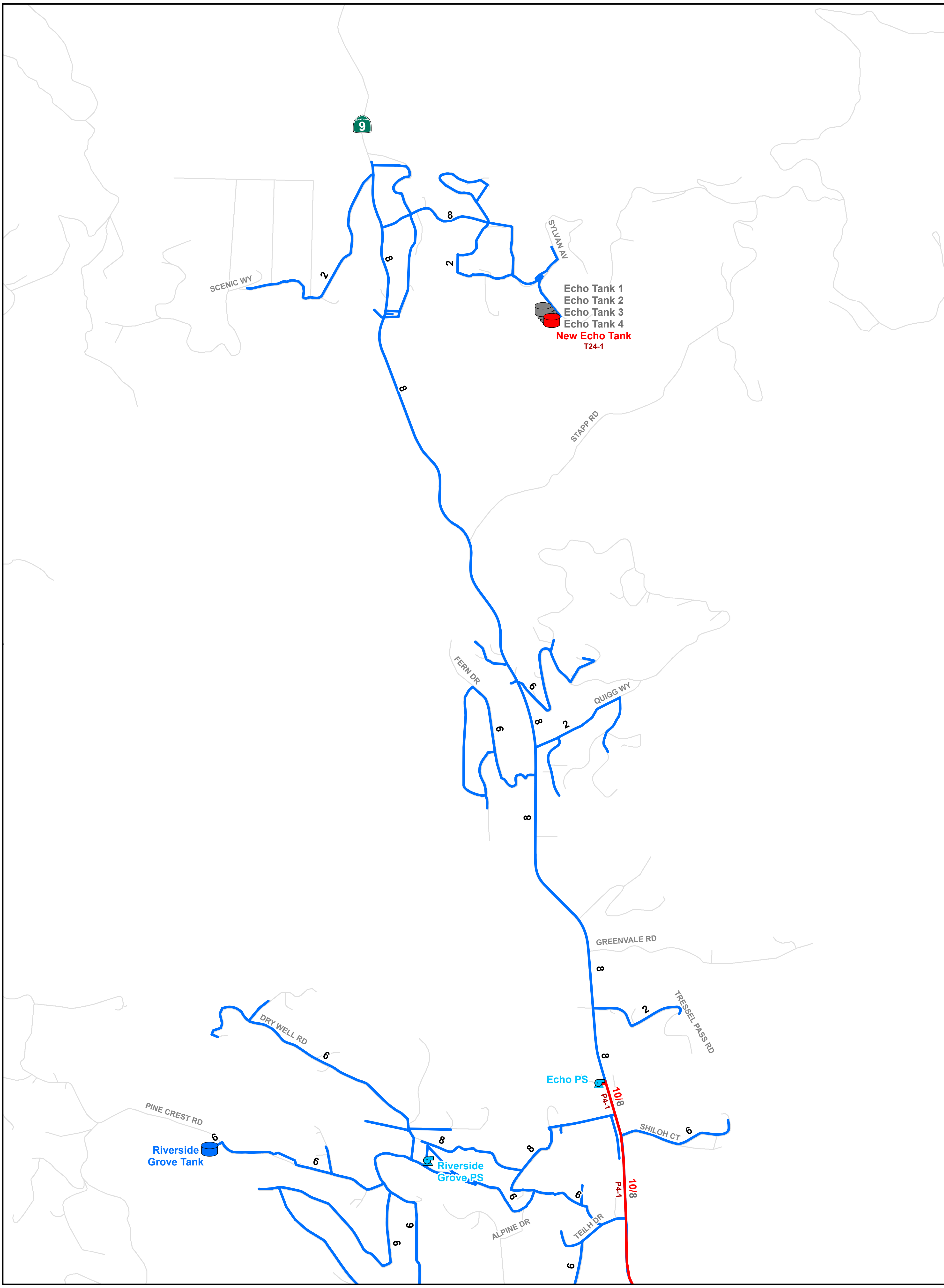
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig10-1_CIP_071321.mxd

Figure 10.1 Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Existing Tank
Pipelines	Abandoned Tank
	Valve
	Existing Pipelines

Update: September 10, 2021

0 250 500 1,000 Feet

N W E S

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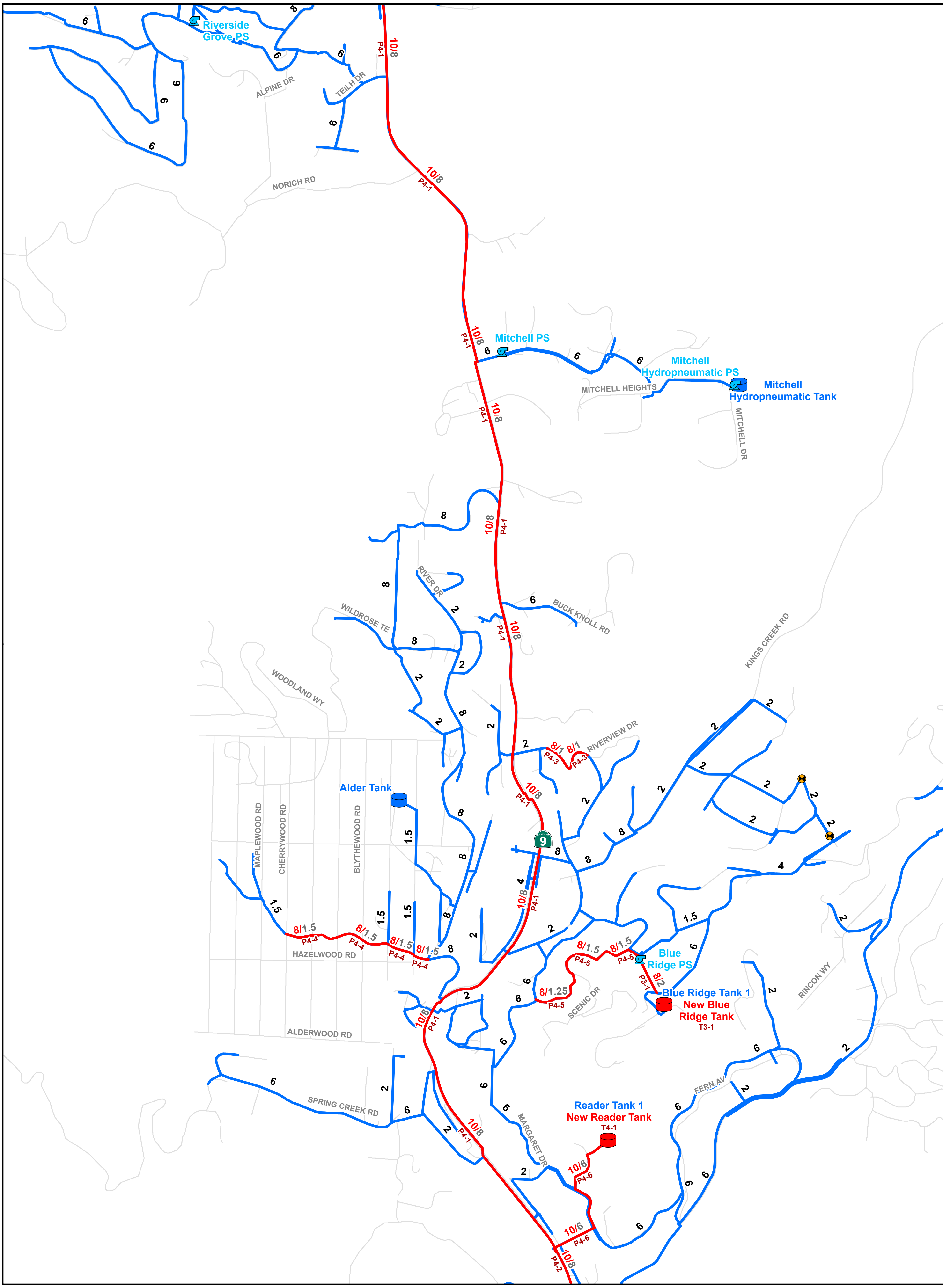
Detail A Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements
- Pump Station
- Tank
- Pipelines

Existing System
- Pump Station
- Tank
- Valve
- Existing Pipelines

Update: September 10, 2021

0 250 500 1,000 Feet

N S E W

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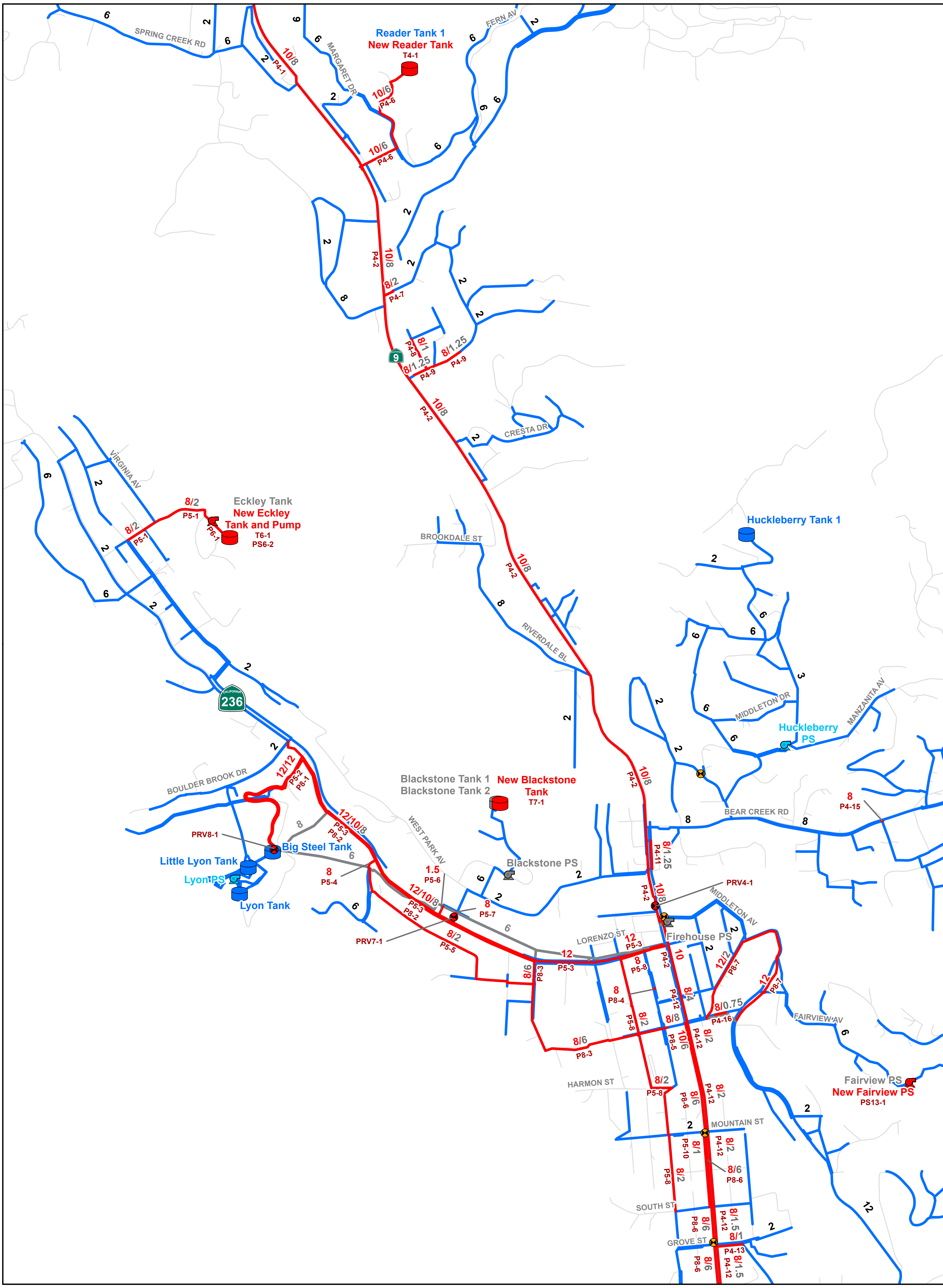
Detail B
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Abandoned Pump Station
PRV	Existing Tank
Pipelines	Abandoned Tank
	Valve
	Existing Pipelines
	Abandoned Pipelines

0 250 500 1,000 Feet

N E S W

Update: September 10, 2021

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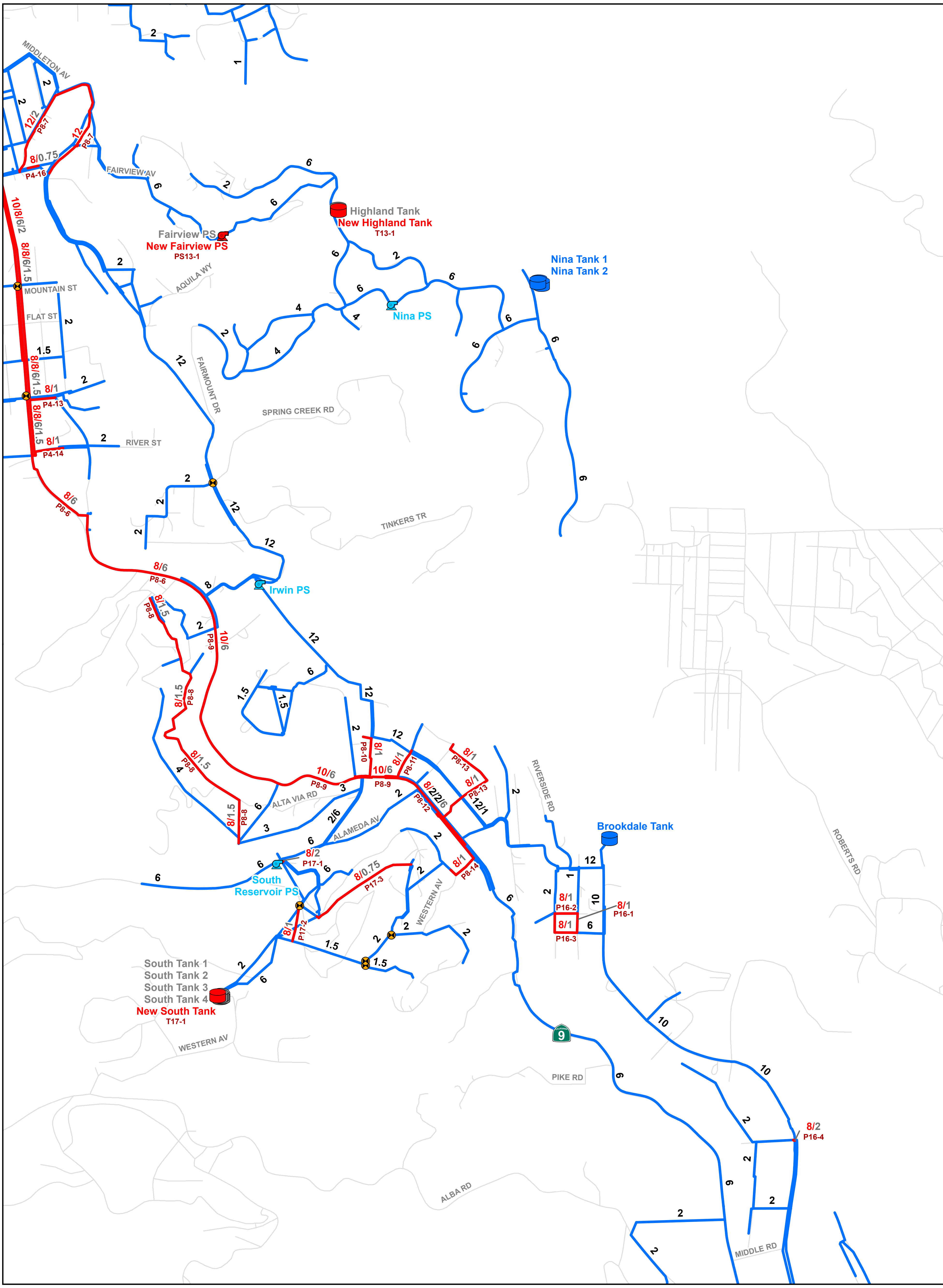
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig10-1_DetailC_CIP_091021.mxd

Detail C Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements
- Pump Station
- Tank
- Pipelines

Existing System
- Pump Station
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines

Update: September 10, 2021

0 250 500 1,000 Feet

N W E S

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig10-1_DetailD_CIP_091021.mxd

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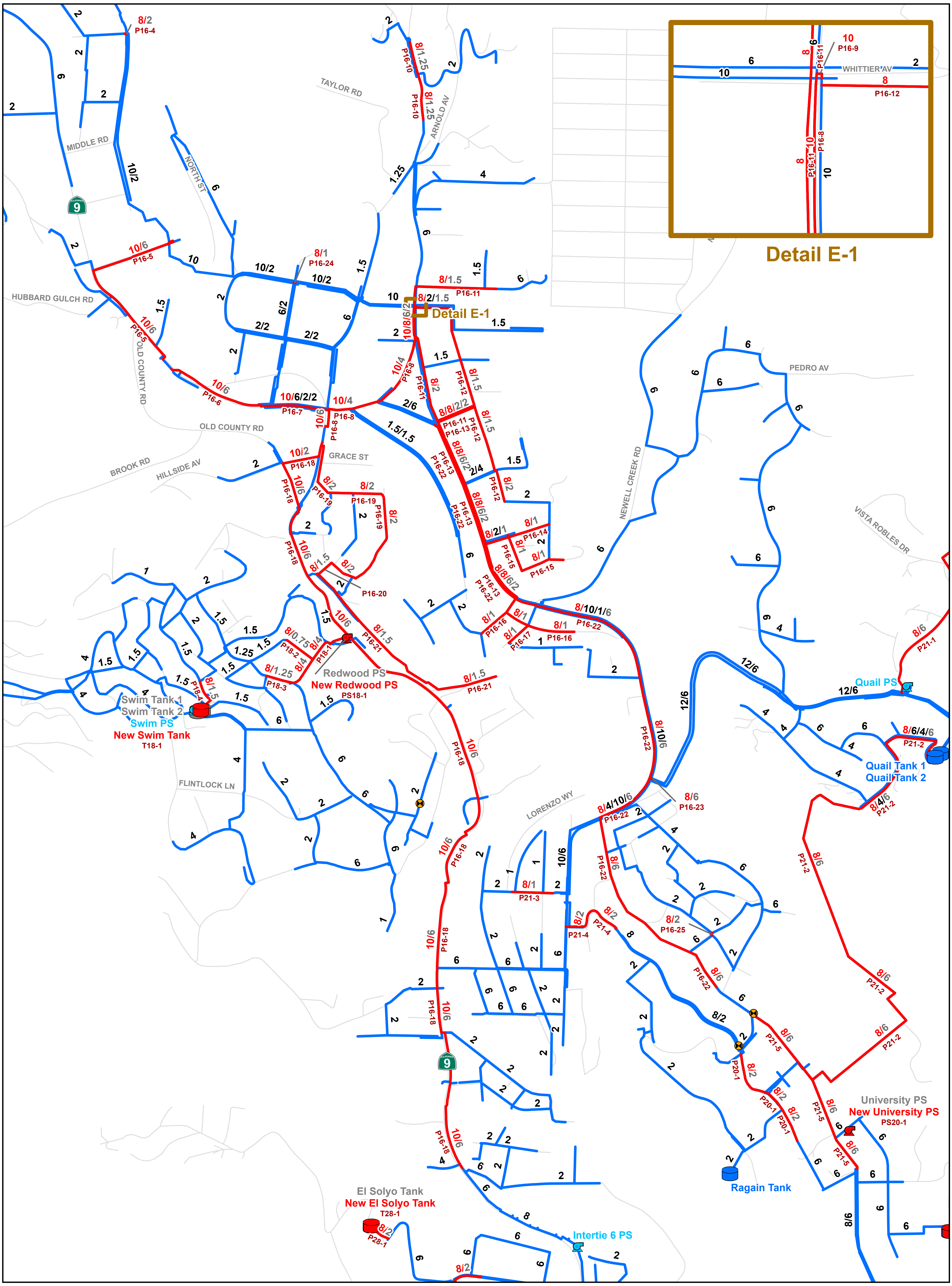
Detail D
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements

- Pump Station
- Tank
- Pipelines

Existing System

- Pump Station
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines

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Update: September 10, 2021

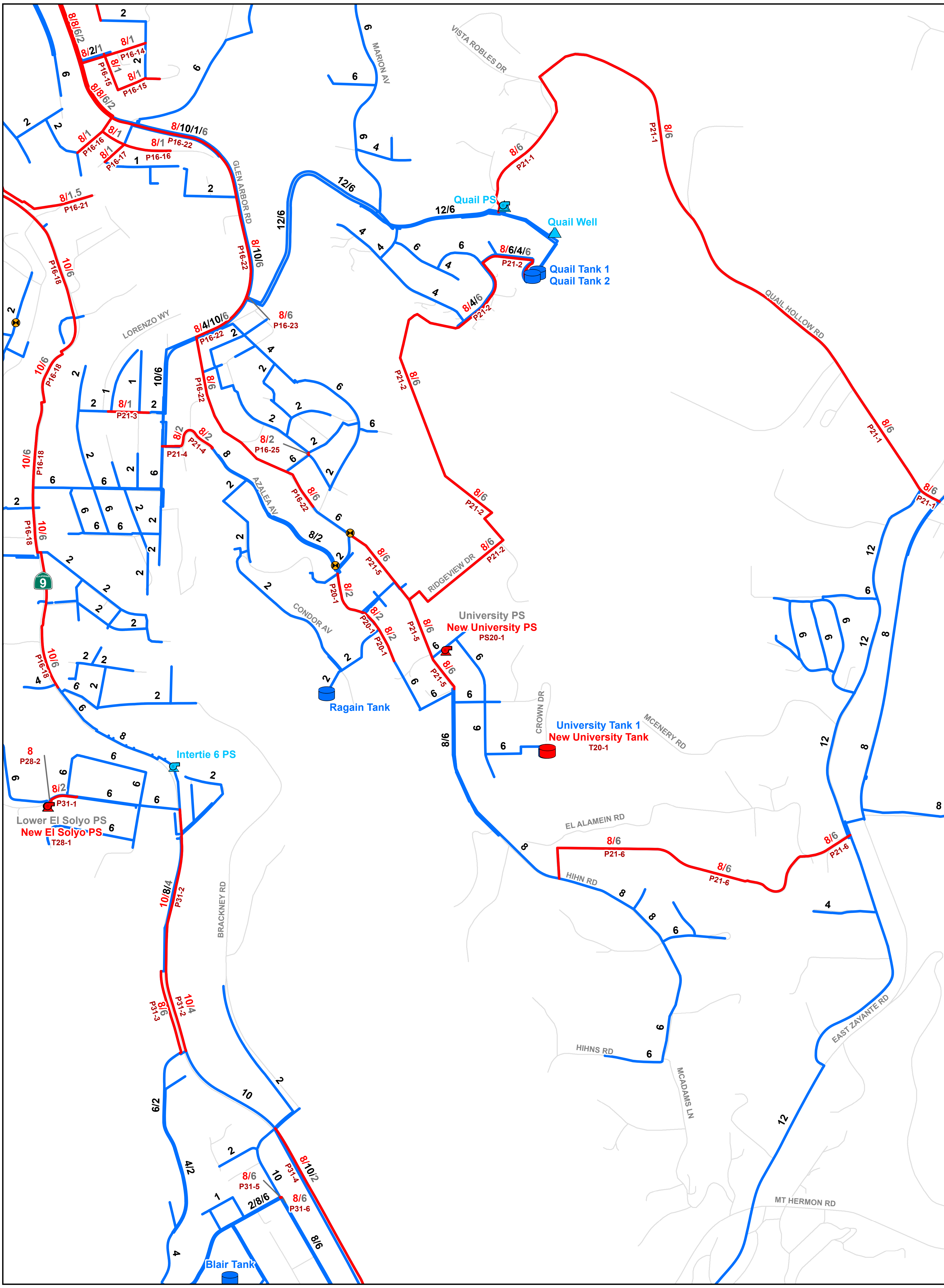
0 250 500 1,000 Feet

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig10-1_DetailE_CIP_091021.mxd

Detail E
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements

- Pump Station
- Tank
- Pipelines

Existing System

- Pump Station
- Wells
- Wells (Inactive)
- Tank
- Valve
- Existing Pipelines

0 250 500 1,000 Feet

Update: September 10, 2021

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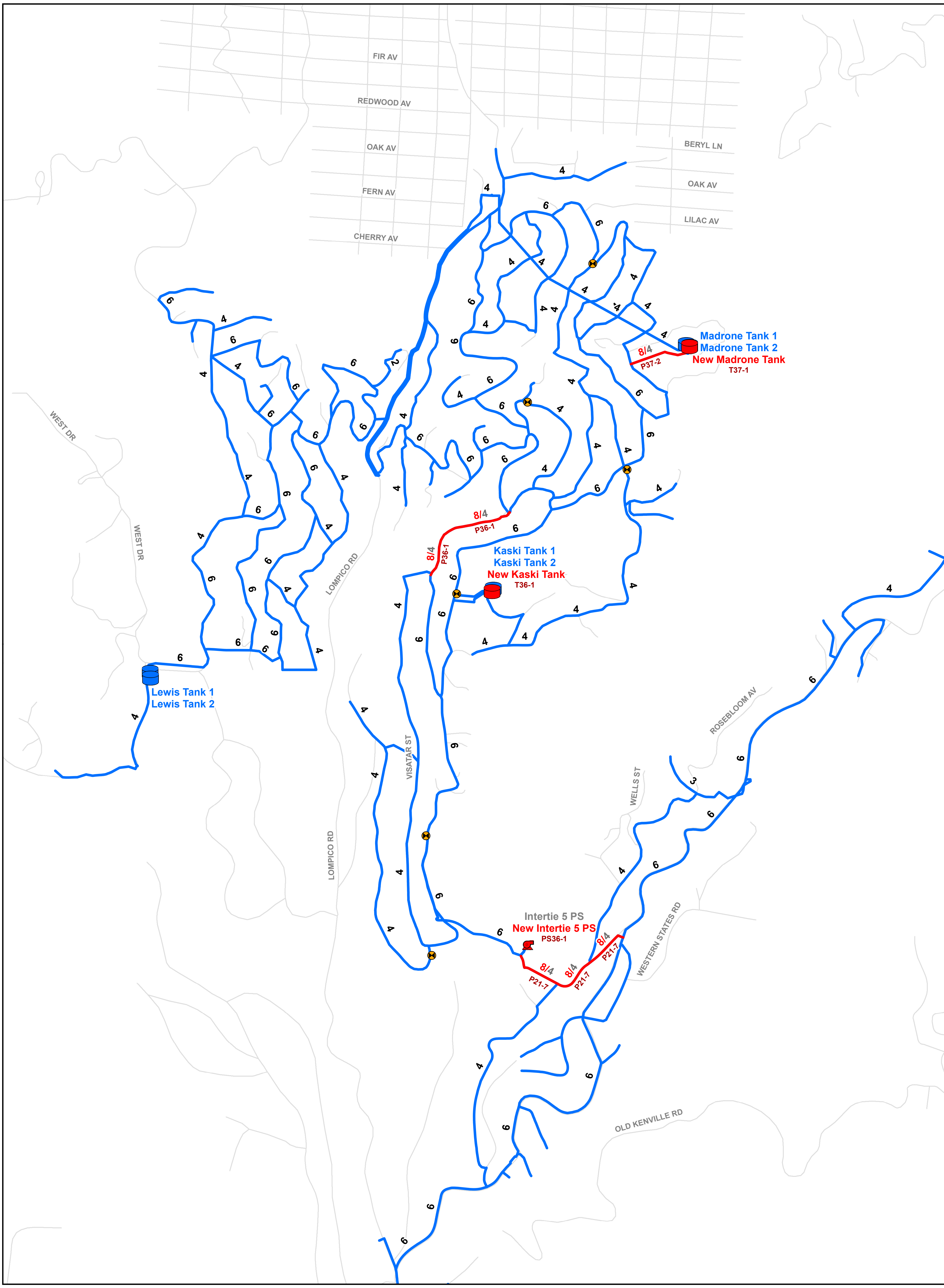
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig10-1_DetailF_CIP_091021.mxd

Detail F Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Wells
Pipelines	Existing Tank
	Abandoned Tank
	Valve
	Existing Pipelines

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Update: September 10, 2021

0 250 500 1,000 Feet

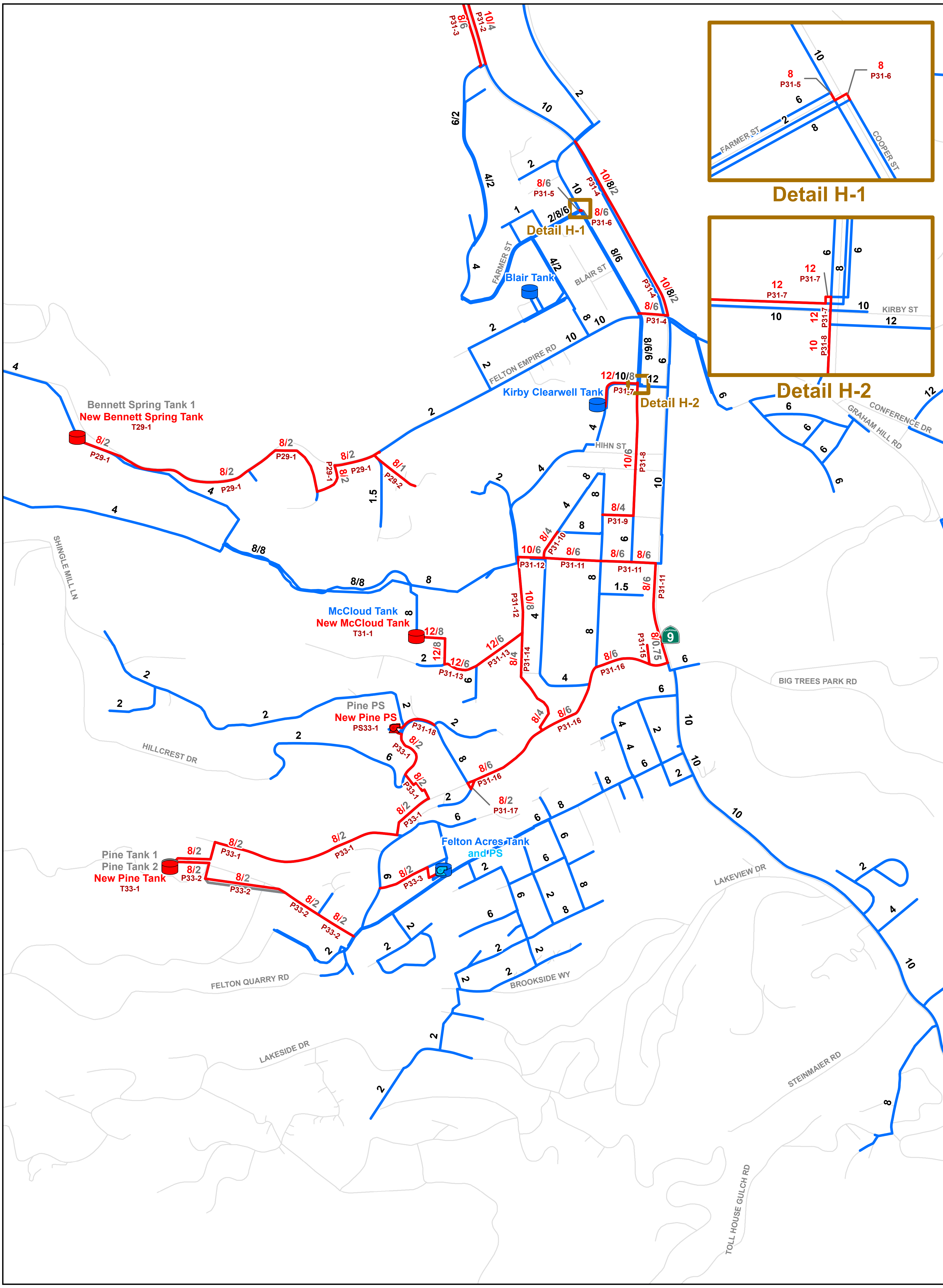
N W E S

Detail G
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig10-1_DetailG_CIP_091021.mxd



Legend

Recommended Improvements

- Pump Station
- Tank
- Pipelines

Existing System

- Pump Station
- Existing Tank
- Abandoned Tank
- Valve
- Existing Pipelines
- Abandoned Pipelines

Update: September 10, 2021

0 250 500 1,000 Feet

N E S W

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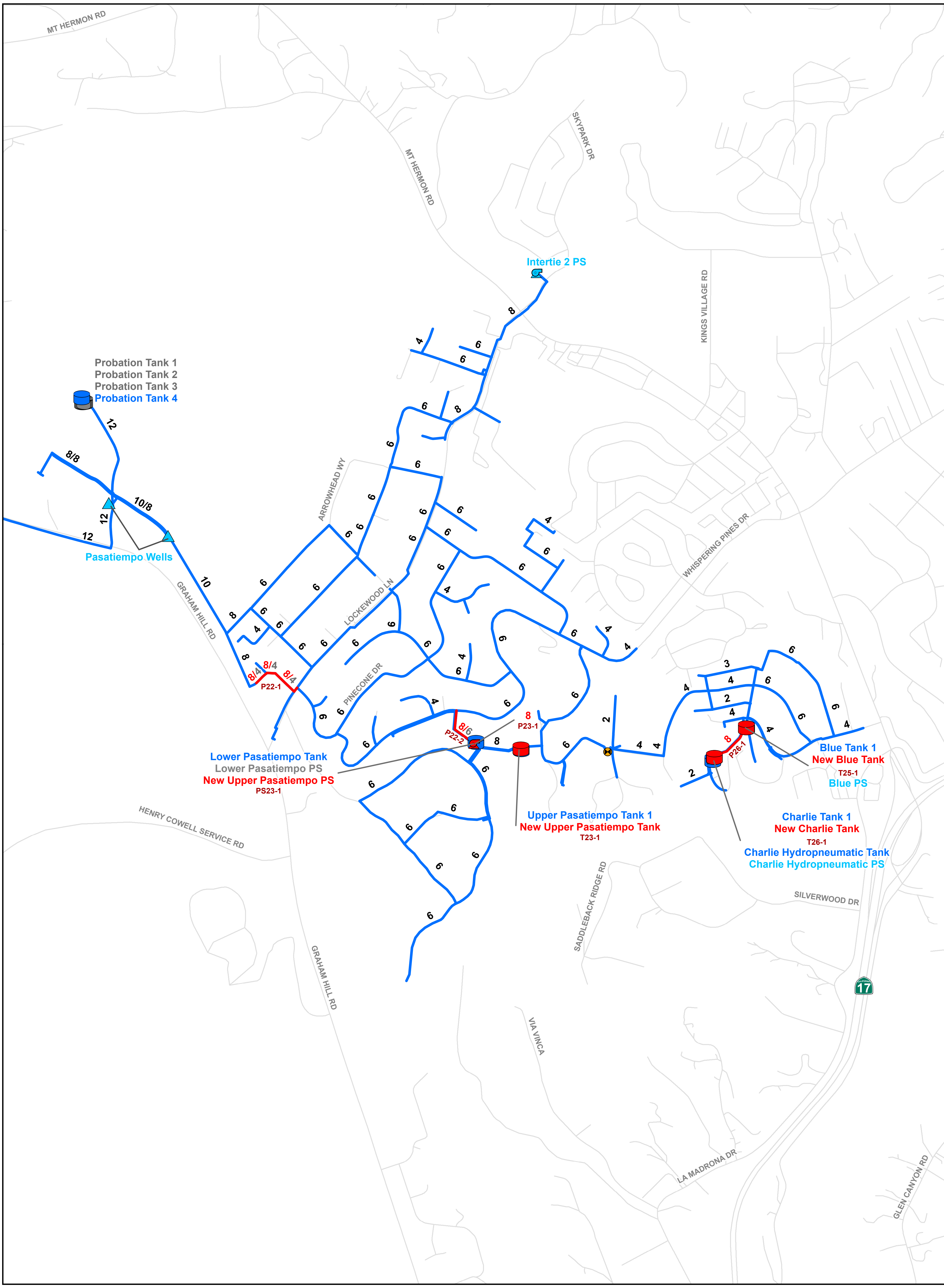
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig10-1_DetailH_CIP_091021.mxd

Detail H
Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements
- Pump Station
- Tank
- Pipelines

Existing System
- Pump Station
- Existing Tank
- Abandoned Tank
- Wells
- Wells (Inactive)
- Valve
- Existing Pipelines

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Update: September 10, 2021

0 250 500 1,000 Feet

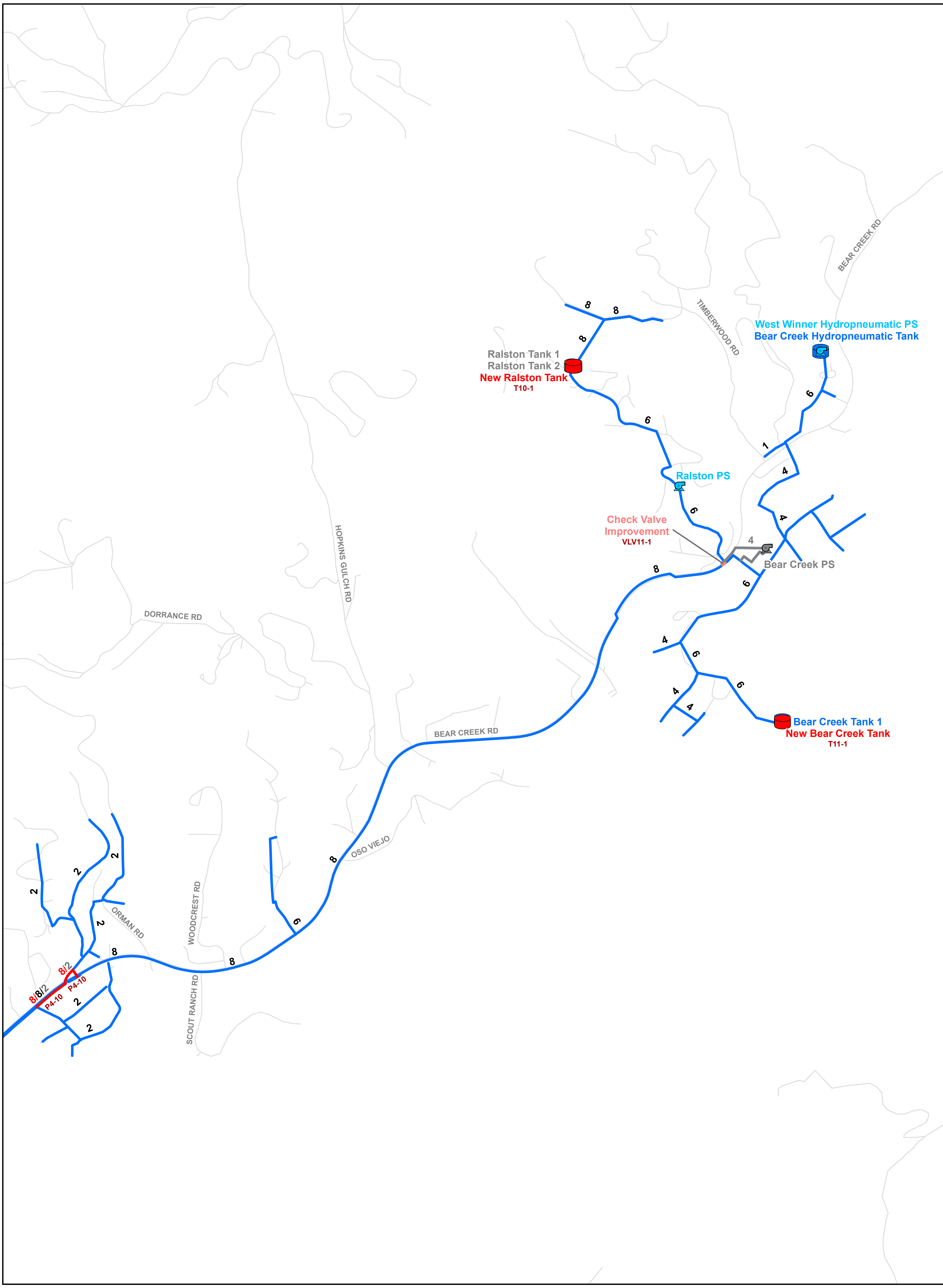
N S E W

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig10-1_DetailI_CIP_091021.mxd

Detail I Capital Improvement Project

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements	Existing System
Pump Station	Pump Station
Tank	Abandoned Pump Station
Pipelines	Existing Tank
Check Valve Improvement	Abandoned Tank
	Valve
	Existing Pipelines
	Abandoned Pipelines

0 250 500 1,000 Feet

Update: September 10, 2021

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Detail J
Capital Improvement Project

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\SLVWD_Fig10-1_DetailJ_CIP_091021.mxd

Table 10.2 Capital Improvement Program
Water Master Plan
San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Priority	Direct Service to Disadvantaged Communities (%)	Improvement Details: Existing Diameter (in)	Improvement Details: New/ Replace	Improvement Details: Diameter (in)	Improvement Details: Length (ft)	Infrastructure Costs: Unit Cost ($/unit)	Infrastructure Costs: Infr. Cost ($)	Baseline Construction Cost ($)	Estimated Construction Cost[1] ($)	Capital Improvement Cost[2] ($)	Construction Trigger	Suggested Cost Allocation: Existing Users	Suggested Cost Allocation: Future Users	Cost Sharing: Existing Users ($)	Cost Sharing: Future Users ($)
Pipeline Improvements																				
P3-1	Blue Ridge	Existing Deficiency	Grove Dr	From Blue Ridge PS to Blue Ridge Dr	1	0%	2	Replace	8	320	202	64,700	64,700	84,200	109,500	Existing Deficiency	100%	0%	109,500	0
P4-1	Reader	Fire Flow Reliability	Hwy 9	From Echo PS to approx. 700' se/o Douglas Ave	3	0%	4 / 6 / 8	Replace	10	13,100	217	2,840,100	2,840,100	3,692,200	4,799,900	As Funding is Available	100%	0%	4,799,900	0
P4-2	Reader	Existing Deficiency / Fire Flow Reliability	Hwy 9	From approx. 700' se/o Douglas Ave to approx. 250' s/o Big Basin Wy	1	9%	8	Replace	10	7,920	217	1,717,100	1,717,100	2,232,300	2,902,000	Existing Deficiency	100%	0%	2,902,000	0
P4-3	Reader	Capacity	Riverview Dr	From Old Country Hwy to approx. 520' e/o Old Country Hwy	3	0%	1	Replace	8	520	202	105,100	105,100	136,700	177,800	2 EDUs	94%	6%	167,400	10,400
P4-4	Reader	Existing Deficiency	Band Rd	From River Dr to approx. 450' w/o Baywood Rd	1	0%	1.5	Replace	8	1,300	202	262,700	262,700	341,600	444,100	Existing Deficiency	100%	0%	444,100	0
P4-5	Reader	Existing Deficiency	Scenic Dr / Blue Ridge Dr	From Hoot Owl Wy to Blue Ridge PS	1	0%	1.25 / 1.5 / 2	Replace	8	1,400	202	282,900	282,900	367,800	478,200	Existing Deficiency	100%	0%	478,200	0
P4-6	Reader	Existing Deficiency / Fire Flow Reliability	Dolores Dr / Douglas Ave	From Reader Reservoir to Hwy 9	1	22%	6	Replace	10	1,410	217	305,700	305,700	397,500	516,800	As Funding is Available	100%	0%	516,800	0
P4-7	Reader	Capacity	Brookside Dr	From Hwy 9 to approx 110' e/o Hwy 9	3	0%	2	Replace	8	110	202	22,300	22,300	29,000	37,700	8 EDUs	96%	4%	36,400	1,300
P4-8	Reader	Existing Deficiency	Orchard Dr	From approx. 330' n/o Juanita Rd to Juanita Rd	1	0%	1	Replace	8	330	202	66,700	66,700	86,800	112,900	Existing Deficiency	100%	0%	112,900	0
P4-9	Reader	Existing Deficiency	Juanita Rd	From approx. 150' w/o Orchard Dr to approx. 250' e/o Apple Ln	1	0%	1.25 / 2	Replace	8	500	202	101,100	101,100	131,500	171,000	Existing Deficiency	100%	0%	171,000	0
P4-10	Reader	Existing Deficiency	Hiawatha Rd	From Keller Dr to approx. 400' ne/o Keller Dr	1	100%	1 / 1.25 / 2	Replace	8	510	202	103,100	103,100	134,100	174,400	Existing Deficiency	100%	0%	174,400	0
P4-11	Reader	Capacity	Hwy 9	From approx. 150' s/o Bear Creek Rd to Park Ave	3	0%	1.25	Replace	8	270	202	54,600	54,600	71,000	92,300	4 EDUs	93%	7%	86,100	6,200
P4-12	Reader	Fire Flow Reliability	Central Ave	From approx. 250' s/o Big Basin Wy to River St	3	0%	1.5 / 2 / 4	Replace	8	3,200	202	646,500	646,500	840,500	1,092,700	As Funding is Available	100%	0%	1,092,700	0
P4-13	Reader	Existing Deficiency	Grove St	From Central Ave to Lorenzo Ave	1	0%	1	Replace	8	250	202	50,600	50,600	65,800	85,600	Existing Deficiency	100%	0%	85,600	0
P4-14	Reader	Existing Deficiency	River St	From Central Ave to approx. 250' w/o Lorenzo Ave	1	0%	1	Replace	8	320	202	64,700	64,700	84,200	109,500	Existing Deficiency	100%	0%	109,500	0
P4-15	Reader	Existing Deficiency	ROW	From Irene Ave to approx. 10' w/o Irene Ave	1	100%	1.5	Replace	8	10	202	2,100	2,100	2,800	3,700	Existing Deficiency	100%	0%	3,700	0
P4-16	Reader	Existing Deficiency	ROW	From Lomond St to approx. 110' e/o Lomond St	1	0%	0.75	Replace	8	110	202	22,300	22,300	29,000	37,700	Existing Deficiency	100%	0%	37,700	0
P5-1	Lyon	Existing Deficiency	Ridge Dr	From Park Ave to Eckley PS	1	0%	2	Replace	8	970	202	196,000	196,000	254,800	331,300	Existing Deficiency	100%	0%	331,300	0
P5-2	Lyon	Capacity	Redwood Dr / Madrone Dr	From Big Steel Reservoir site to Big Basin Wy	1	0%	-	New	12	1,570	233	365,300	365,300	474,900	617,400	As Funding is Available	100%	0%	617,400	0
P5-3	Lyon	Capacity	Big Basin Wy	From Boulder Brook Dr to Central Ave	1	0%	-	New	12	4,570	233	1,063,300	1,063,300	1,382,300	1,797,000	Construction of P5-2	100%	0%	1,797,000	0
P5-4	Lyon	Capacity	St Francis Dr	From Big Basin Wy to approx. 120' s/o Big Basin Wy	1	0%	-	New	8	120	202	24,300	24,300	31,600	41,100	Construction of P5-2	100%	0%	41,100	0
P5-5	Lyon	Existing Deficiency	St Francis Dr / Davidson Wy / Sunshine Ln	From approx. 100' s/o Big Basin Wy to Redwood Ave	1	0%	2 / 6	Replace	8	2,200	202	444,500	444,500	577,900	751,300	Existing Deficiency	100%	0%	751,300	0
P5-6	Lyon	Capacity	ROW	From Big Basin Wy to approx. 100' n/o Big Basin Wy	1	0%	-	New	8	100	202	20,300	20,300	26,400	34,400	Construction of P5-2	100%	0%	34,400	0
P5-7	Lyon	Capacity	ROW	From Big Basin Wy to approx. 110' n/o Big Basin Wy	1	0%	-	New	8	110	202	22,300	22,300	29,000	37,700	Construction of P5-2	100%	0%	37,700	0
P5-8	Lyon	Existing Deficiency	Big Basin Wy / Oak St / Boulder St	From Hwy 9 to South St	1	0%	2	Replace	8	3,120	202	630,400	630,400	819,600	1,065,500	Existing Deficiency	100%	0%	1,065,500	0
P5-9	Lyon	Existing Deficiency	South St	From Central Ave to approx. 30' w/o Central Ave	1	0%	1	Replace	10	30	217	6,600	6,600	8,600	11,200	Existing Deficiency	100%	0%	11,200	0
P5-10	Lyon	Existing Deficiency	Central Ave	From South St to Mountain St	1	0%	1	Replace	8	720	202	145,500	145,500	189,200	246,000	Existing Deficiency	100%	0%	246,000	0
P6-1	Eckley	Existing Deficiency	Ridge Dr	From Eckley PS to Eckley Reservoir	1	0%	2	Replace	8	240	202	48,500	48,500	63,100	82,100	Existing Deficiency	100%	0%	82,100	0
P8-1	Big Steel	Capacity	Redwood Dr / Madrone Dr / Big Basin Wy	From Big Steel Reservoir to approx. 600' se/o Redwood Dr	1	0%	-	New	12	2,120	233	493,300	493,300	641,300	833,700	As Funding is Available	100%	0%	833,700	0
P8-2	Big Steel	Fire Flow Reliability	Big Basin Wy	From approx. 600' se/o Redwood Dr to Redwood Ave	3	0%	8	Replace	10	2,480	217	537,700	537,700	699,100	908,900	As Funding is Available	100%	0%	908,900	0
P8-3	Big Steel	Fire Flow Reliability	Redwood Ave / Lomond St	From Big Basin Wy to Central Ave	3	0%	6	Replace	8	2,080	202	420,300	420,300	546,400	710,400	As Funding is Available	100%	0%	710,400	0
P8-4	Big Steel	Existing Deficiency	ROW	From Pine St to approx. 20' w/o Pine St	1	0%	1	Replace	8	20	202	4,100	4,100	5,400	7,100	Existing Deficiency	100%	0%	7,100	0
P8-5	Big Steel	Fire Flow Reliability	Central Ave	From Lomond St to approx. 420' s/o Lomond St	4	0%	6/ 8	Replace	10	420	217	91,100	91,100	118,500	154,100	As Funding is Available	100%	0%	154,100	0
P8-6	Big Steel	Fire Flow Reliability	Central Ave / Lorenzo Ave	From approx. 400' s/o Lomond St to Irwin Wy	3	0%	6	Replace	8	4,660	202	941,500	941,500	1,224,000	1,591,200	As Funding is Available	100%	0%	1,591,200	0

Table 10.2 Capital Improvement Program

Water Master Plan
San Lorenzo Valley Water District

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Priority	Direct Service to Disadvantaged Communities (%)	Improvement Details				Infrastructure Costs		Baseline Construction Cost ($)	Estimated Construction Cost[1] ($)	Capital Improvement Cost[2] ($)	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
											Unit Cost ($/unit)	Infr. Cost ($)					Existing Users	Future Users	Existing Users ($)	Future Users ($)
P8-7	Big Steel	Capacity	Lomond St / Irwin Wy	From Railroad Ave to approx. 700' sw/o Maple Wy	1	0%	-	New	12	2,170	233	504,900	504,900	656,400	853,400	As Funding is Available	100%	0%	853,400	0
P8-8	Big Steel	Capacity	Monan Wy / Alta Via Dr	From Prospect Ave to approx. 450' s/o Alta Via Dr	3	0%	2	Replace	8	2,970	202	600,100	600,100	780,200	1,014,300	13 EDUs	93%	7%	944,400	69,900
P8-9	Big Steel	Fire Flow Reliability	Hwy 9	From Irwin Wy to Alameda Ave	3	0%	6	Replace	10	3,610	217	782,700	782,700	1,017,600	1,322,900	As Funding is Available	100%	0%	1,322,900	0
P8-10	Big Steel	Existing Deficiency	Reed St / ROW	From approx. 50' w/o Reed St to Pacific St	1	0%	1	Replace	8	610	202	123,300	123,300	160,300	208,400	Existing Deficiency	100%	0%	208,400	0
P8-11	Big Steel	Existing Deficiency	Cascade St / ROW	From Center St to approx. 100' w/o Cascade St	1	0%	1 / 2	Replace	8	420	202	84,900	84,900	110,400	143,600	Existing Deficiency	100%	0%	143,600	0
P8-12	Big Steel	Fire Flow Reliability	Hwy 9	From Alameda Ave to Larkspur St	4	0%	6	Replace	8	730	202	147,500	147,500	191,800	249,400	As Funding is Available	100%	0%	249,400	0
P8-13	Big Steel	Existing Deficiency	Berkeley Wy / ROW	From Alameda Ave to approx. 250' sw/o Center St	1	0%	1	Replace	8	1,070	202	216,200	216,200	281,100	365,500	Existing Deficiency	100%	0%	365,500	0
P8-14	Big Steel	Existing Deficiency	ROW / Western Ave / High St	From approx. 300' nw/o Larkspur Ave to approx. 100' nw/o Western Ave	1	0%	1 / 1.5	Replace	8	860	202	173,800	173,800	226,000	293,800	Existing Deficiency	100%	0%	293,800	0
P16-1	Brookdale	Existing Deficiency	Redwood St	From Hazel St to Fern St	1	0%	1	Replace	8	190	202	38,400	38,400	50,000	65,000	Existing Deficiency	100%	0%	65,000	0
P16-2	Brookdale	Existing Deficiency	Hazel St	From Redwood St to Riverside Rd	1	0%	1	Replace	8	220	202	44,500	44,500	57,900	75,300	Existing Deficiency	100%	0%	75,300	0
P16-3	Brookdale	Existing Deficiency	Riverside Rd / Fern St	From Hazel St to Redwood St	1	0%	1	Replace	8	390	202	78,800	78,800	102,500	133,300	Existing Deficiency	100%	0%	133,300	0
P16-4	Brookdale	Existing Deficiency	California Ave	From approx. 30' w/o Riverside Dr to Riverside Dr	1	0%	2	Replace	8	30	202	6,100	6,100	8,000	10,400	Existing Deficiency	100%	0%	10,400	0
P16-5	Brookdale	Fire Flow Reliability	Brown Gables Rd / Hwy 9	From approx. 800' e/o Hwy 9 to approx. 100' se/o Marshall Creek Ct	3	0%	6	Replace	10	1,980	217	429,300	429,300	558,100	725,600	As Funding is Available	100%	0%	725,600	0
P16-6	Brookdale	Fire Flow Reliability	Mill St	From Hwy 9 to approx. 100' w/o Main St	4	0%	6	Replace	10	950	217	206,000	206,000	267,800	348,200	As Funding is Available	100%	0%	348,200	0
P16-7	Brookdale	Fire Flow Reliability	Mill St	From approx. 100' w/o Main St to Oak St	3	0%	-	New	10	670	217	145,300	145,300	188,900	245,600	As Funding is Available	100%	0%	245,600	0
P16-8	Brookdale	Existing Deficiency / Fire Flow Reliability	Hwy 9 / Brookside Ave	From approx. 100' s/o Brookside Ave to Whittier Ave	1	0%	4 / 6	Replace	10	1,720	217	372,900	372,900	484,800	630,300	Existing Deficiency	100%	0%	630,300	0
P16-9	Brookdale	Fire Flow Reliability	Brookside Ave	From approx. 50' w/o Brookside Ave to Whittier Ave	3	0%	-	New	10	20	217	4,400	4,400	5,800	7,600	As Funding is Available	100%	0%	7,600	0
P16-10	Brookdale	Existing Deficiency	Love Creek Rd	From Roberts Rd to approx. 350' s/o Berts Rd	1	100%	1.25	Replace	8	760	202	153,600	153,600	199,700	259,700	Existing Deficiency	100%	0%	259,700	0
P16-11	Brookdale	Existing Deficiency	Kipling Ave / Live Oak Ave / Pine St	From Longfellow Ave to Manzanita Ave	1	100%	1.5 / 2	Replace	8	2,470	202	499,100	499,100	648,900	843,600	Existing Deficiency	100%	0%	843,600	0
P16-12	Brookdale	Existing Deficiency	Whittier Ave / Manzanita Ave	From Brookside Ave to approx. 300' s/o Locust St	1	100%	1.5 / 2	Replace	8	2,280	202	460,700	460,700	599,000	778,700	Existing Deficiency	100%	0%	778,700	0
P16-13	Brookdale	Existing Deficiency	Pine St / Glen Arbor Rd / Madrone Ave	From Manzanita Ave to Railroad Ave	1	100%	1 / 2	Replace	8	2,410	202	486,900	486,900	633,000	822,900	Existing Deficiency	100%	0%	822,900	0
P16-14	Brookdale	Existing Deficiency	Hillcrest Ave	From Hwy 9 to Manzanita Ave	3	100%	1	Replace	8	640	202	129,300	129,300	168,100	218,600	Existing Deficiency	100%	0%	218,600	0
P16-15	Brookdale	Existing Deficiency	Circle Dr / Urbana Ln	From Hillcrest Ave to approx. 50' e/o Manzanita Ave	1	100%	1	Replace	8	790	202	159,600	159,600	207,500	269,800	Existing Deficiency	100%	0%	269,800	0
P16-16	Brookdale	Existing Deficiency	Madrone Ave / Railroad Ave	From approx. 300' sw/o Railroad Ave to approx. 450' e/o Oak Ave	1	0%	1	Replace	8	1,000	202	202,100	202,100	262,800	341,700	Existing Deficiency	100%	0%	341,700	0
P16-17	Brookdale	Existing Deficiency	Oak Ave	From Railroad Ave to Riverside Park Dr	1	0%	1	Replace	8	250	202	50,600	50,600	65,800	85,600	Existing Deficiency	100%	0%	85,600	0
P16-18	Brookdale	Existing Deficiency / Fire Flow Reliability	Hwy 9	From approx. 100' n/o Hillside Ave to Glen Lomond Ln	1	0%	2 / 4 / 6	Replace	10	8,210	217	1,780,000	1,780,000	2,314,000	3,008,200	Existing Deficiency	100%	0%	3,008,200	0
P16-19	Brookdale	Existing Deficiency	Hwy 9 / Lorenzo Ave / Woodland Dr	From approx. 100' n/o Hillside Ave to Madrona Way	1	0%	2	Replace	8	2,200	202	444,500	444,500	577,900	751,300	Existing Deficiency	100%	0%	751,300	0
P16-20	Brookdale	Existing Deficiency	ROW	From Redwood Dr to Woodland Dr	1	0%	1.5	Replace	8	170	202	34,400	34,400	44,800	58,300	Existing Deficiency	100%	0%	58,300	0
P16-21	Brookdale	Existing Deficiency	Woodland Dr / ROW / Shadowbrook Rd	From Hwy 9 to approx. 650' e/o Hwy 9	1	0%	1.5 / 2	Replace	8	2,200	202	444,500	444,500	577,900	751,300	Existing Deficiency	100%	0%	751,300	0
P16-22	Brookdale	Fire Flow Reliability	Glen Arbor Rd / Hihn Rd	From Pine St to Eleana Dr	4	41%	6	Replace	8	7,070	202	1,428,400	1,428,400	1,857,000	2,414,100	As Funding is Available	100%	0%	2,414,100	0
P16-23	Brookdale	Fire Flow Reliability	ROW	From Glen Arbor Rd to approx. 40' e/o Glen Arbor Rd	4	0%	6	Replace	8	40	202	8,100	8,100	10,600	13,800	As Funding is Available	100%	0%	13,800	0
P16-24	Brookdale	Existing Deficiency	Sunnyside Ave	From approx. 20' w/o Main St to Main St	1	0%	1	Replace	8	20	202	4,100	4,100	5,400	7,100	Existing Deficiency	100%	0%	7,100	0
P16-25	Brookdale	Existing Deficiency	Larita Dr	From Archer Wy to approx. 40' se/o Archer Wy	1	0%	2	Replace	8	40	202	8,100	8,100	10,600	13,800	Existing Deficiency	100%	0%	13,800	0
P17-1	South	Existing Deficiency	Clear Creek Rd	From South PS to High St	1	0%	2	Replace	8	90	202	18,200	18,200	23,700	30,900	Existing Deficiency	100%	0%	30,900	0
P17-2	South	Existing Deficiency	Melwin	From Oak St to Logan Wy	1	0%	1	Replace	8	330	202	66,700	66,700	86,800	112,900	Existing Deficiency	100%	0%	112,900	0

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Water Master Plan
San Lorenzo Valley Water District

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P17-3	South	Existing Deficiency	ROW	From Azalea Ave to Forest Wy	1	0%	0.75	Replace	8	1,070	202	216,200	216,200	281,100	365,500	Existing Deficiency	100%	0%	365,500	0
P18-1	Swim	Existing Deficiency	Greenfield St	From Redwood Park PS to Park Dr	1	0%	4	Replace	8	720	202	145,500	145,500	189,200	246,000	Existing Deficiency	100%	0%	246,000	0
P18-2	Swim	Existing Deficiency	Hillcrest Dr	From approx. 310' nw/o Greenfield St to Greenfield St	1	0%	0.75	Replace	8	310	202	62,700	62,700	81,600	106,100	Existing Deficiency	100%	0%	106,100	0
P18-3	Swim	Existing Deficiency	Scenic Wy	From approx. 250' nw/o Greenfield St to Greenfield St	1	0%	1.25	Replace	8	250	202	50,600	50,600	65,800	85,600	Existing Deficiency	100%	0%	85,600	0
P18-4	Swim	Existing Deficiency	Country Club Dr / Mountain View Dr	From approx. 250' n/o Mountain View Dr to Swim PS	1	0%	1.5 / 4	Replace	8	390	202	78,800	78,800	102,500	133,300	Existing Deficiency	100%	0%	133,300	0
P20-1	University	Existing Deficiency	Melin Ave	From Condor Ave to approx. 1,060' se/o Condor Ave	1	0%	2	Replace	8	1,060	202	214,200	214,200	278,500	362,100	Existing Deficiency	100%	0%	362,100	0
P21-1	Quail	Fire Flow Reliability	Quail Hollow Rd	From Cumora Ln to approx. 200' e/o Derick Ln	4	0%	6	Replace	8	7,740	202	1,563,700	1,563,700	2,032,900	2,642,800	As Funding is Available	100%	0%	2,642,800	0
P21-2	Quail	Fire Flow Reliability	Quail Ter / Webster Dr / Ridgeview Dr	From Quail Reservoirs to Hihn Rd	4	0%	6	Replace	8	5,730	202	1,157,600	1,157,600	1,504,900	1,956,400	As Funding is Available	100%	0%	1,956,400	0
P21-3	Quail	Existing Deficiency	Arden Ave	From Lorenzo Wy to approx. 150' w/o Glen Arbor Rd	1	0%	1	Replace	8	390	202	78,800	78,800	102,500	133,300	Existing Deficiency	100%	0%	133,300	0
P21-4	Quail	Existing Deficiency	Azalea Ave	From Glen Arbor Rd to approx. 300' e/o Cook Wy	1	0%	2	Replace	8	660	202	133,400	133,400	173,500	225,600	Existing Deficiency	100%	0%	225,600	0
P21-5	Quail	Fire Flow Reliability	Hihn Rd	From Condor Ave to approx. 150' s/o Stanford Dr	4	0%	6	Replace	8	1,800	202	363,700	363,700	472,900	614,800	As Funding is Available	100%	0%	614,800	0
P21-6	Quail	Fire Flow Reliability	Kim Wy / Bahr Dr / Moon Meadow Ln	From Hihn Rd to Zayante Rd	4	0%	6	Replace	8	3,420	202	691,000	691,000	898,300	1,167,800	As Funding is Available	100%	0%	1,167,800	0
P21-7	Quail	Capacity	Zayante Dr	From Intertie 5 PS to approx. 400' ne/o Rosebloom Ave	3	0%	4	Replace	8	1,310	202	264,700	264,700	344,200	447,500	Construction of PS-Z36	100%	0%	447,500	0
P22-1	Probation	Existing Deficiency	Casera Wy	From approx. 100' sw/o Caseta Ct to Lockwood Ln	1	0%	4 / 6	Replace	8	520	202	105,100	105,100	136,700	177,800	Existing Deficiency	100%	0%	177,800	0
P22-2	Probation	Capacity	Tank Rd	From Whispering Pines Dr to Lower Pasatiempo PS	2	0%	4 / 6	Replace	8	420	202	84,900	84,900	110,400	143,600	Construction of PS-Z23	100%	0%	143,600	0
P23-1	Upper Pasatiempo	Capacity	Tank Rd	Parallel lines from Lower Pasatiempo PS to approx. 20' se/o Lower Pasatiempo PS	3	0%	4	Replace	8	20	202	4,100	4,100	5,400	7,100	Construction of PS-Z23	100%	0%	7,100	0
P25-1	Blue	Existing Deficiency	ROW	From approx. 100' sw/o Miraflores Rd to Blue PS	1	0%	2	Replace	8	20	202	4,100	4,100	5,400	7,100	Existing Deficiency	100%	0%	7,100	0
P26-1	Charlie	Existing Deficiency	ROW	From Blue PS to Charlie Reservoir	1	0%	2	Replace	8	430	202	86,900	86,900	113,000	146,900	Existing Deficiency	100%	0%	146,900	0
P28-1	El Solyo	Existing Deficiency	El Solyo Heights Dr	From El Solyo Reservoir to approx. 210' se/o El Solyo Reservoir	1	0%	2	Replace	8	210	202	42,500	42,500	55,300	71,900	Existing Deficiency	100%	0%	71,900	0
P28-2	El Solyo	Existing Deficiency	ROW	From El Solyo Heights Dr to approx. 30' s/o El Solyo Heights Dr	1	0%	2	Replace	8	30	202	6,100	6,100	8,000	10,400	Existing Deficiency	100%	0%	10,400	0
P29-1	Bennett Spring	Existing Deficiency	Felton Empire Rd	From Bennett Spring Reservoir to Blair PRV	1	0%	2	Replace	8	3,520	202	711,200	711,200	924,600	1,202,000	Existing Deficiency	100%	0%	1,202,000	0
P29-2	Bennett Spring	Existing Deficiency	Ley Rd	From Felton Empire Rd to approx. 500' se/o Felton Empire Rd	1	0%	1 / 1.5	Replace	8	500	202	101,100	101,100	131,500	171,000	Existing Deficiency	100%	0%	171,000	0
P31-1	McCloud	Existing Deficiency	El Solyo Heights Dr	From approx. 100' e/o Hillview Dr to El Solyo PS	1	0%	2	Replace	8	370	202	74,800	74,800	97,300	126,500	Existing Deficiency	100%	0%	126,500	0
P31-2	McCloud	Fire Flow Reliability	Hwy 9	From El Solyo Heights Dr to Fall Creek Dr	3	0%	4 / 8	Replace	10	2,340	217	507,400	507,400	659,700	857,700	As Funding is Available	100%	0%	857,700	0
P31-3	McCloud	Existing Deficiency	Hwy 9	From approx. 300' n/o Fall Creek Dr to Fall Creek Dr	1	0%	6	Replace	8	820	202	165,700	165,700	215,500	280,200	Existing Deficiency	100%	0%	280,200	0
P31-4	McCloud	Fire Flow Reliability	Hwy 9 / Felton Empire Rd	From Clearview Pl to Gushee St	4	0%	2 / 6	Replace	8	2,170	202	438,400	438,400	570,000	741,000	As Funding is Available	100%	0%	741,000	0
P31-5	McCloud	Capacity	Cooper St	From approx. 10' nw/o Farmer St to Farmer St	3	0%	6	Replace	8	10	202	2,100	2,100	2,800	3,700	Construction of P31-6 and P31-7	100%	0%	3,700	0
P31-6	McCloud	Existing Deficiency	Farmer St	From approx. 20' sw/o Cooper St to Cooper St	1	0%	-	New	8	20	202	4,100	4,100	5,400	7,100	Existing Deficiency	100%	0%	7,100	0
P31-7	McCloud	Existing Deficiency	Wright St / Kirby St	From Kirby WTP to Gushee St	1	0%	6 / 8 / 10	Replace	12	560	233	130,300	130,300	169,400	220,300	Existing Deficiency	100%	0%	220,300	0
P31-8	McCloud	Capacity	Gushee St	From Kirby St to Russell Ave	2	0%	6	Replace	10	1,240	217	268,900	268,900	349,600	454,500	Construction of P31-6 and P31-7	100%	0%	454,500	0
P31-9	McCloud	Capacity	Russell Ave	From Valley Dr to Gushee St	2	0%	4	Replace	8	300	202	60,700	60,700	79,000	102,700	Construction of P31-6 and P31-7	100%	0%	102,700	0
P31-10	McCloud	Capacity	Plateau Ave	From Ada Ave to Laurel Dr	2	0%	2 / 4	Replace	8	290	202	58,600	58,600	76,200	99,100	Construction of P31-6 and P31-7	100%	0%	99,100	0
P31-11	McCloud	Capacity	Laurel Dr / Hwy 9	From Plateau Dr to Redwood Dr	2	0%	6	Replace	8	2,030	202	410,200	410,200	533,300	693,300	Construction of P31-6 and P31-7	100%	0%	693,300	0
P31-12	McCloud	Capacity	Laurel Dr / Hillside Dr	From Plateau Dr to Orchard Rd	2	0%	6 / 8	Replace	10	970	217	210,300	210,300	273,400	355,500	Construction of P31-6 and P31-7	100%	0%	355,500	0
P31-13	McCloud	Existing Deficiency	Orchard Rd	From McCloud Reservoir to Hillside Dr	1	0%	6 / 8	Replace	12	1,360	233	316,500	316,500	411,500	535,000	Existing Deficiency	100%	0%	535,000	0

Table 10.2 Capital Improvement Program
Water Master Plan
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Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Priority	Direct Service to Disadvantaged Communities (%)	Improvement Details				Infrastructure Costs Unit Cost ($/unit)	Infrastructure Costs Infr. Cost ($)	Baseline Construction Cost ($)	Estimated Construction Cost[1] ($)	Capital Improvement Cost[2] ($)	Construction Trigger	Suggested Cost Allocation Existing Users	Suggested Cost Allocation Future Users	Cost Sharing Existing Users ($)	Cost Sharing Future Users ($)
P31-14	McCloud	Capacity	Hillside Dr	From Orchard Rd to Redwood Dr	2	0%	4	Replace	8	1,060	202	214,200	214,200	278,500	362,100	Construction of P31-6 and P31-7	100%	0%	362,100	0
P31-15	McCloud	Existing Deficiency	ROW	From approx. 190' n/o Redwood Dr to Redwood Dr	1	0%	0.75	Replace	8	190	202	38,400	38,400	50,000	65,000	Existing Deficiency	100%	0%	65,000	0
P31-16	McCloud	Existing Deficiency	Redwood Dr	Hillcrest Dr to Hwy 9	1	0%	2 / 6	Replace	8	2,440	202	493,000	493,000	640,900	833,200	Existing Deficiency	100%	0%	833,200	0
P31-17	McCloud	Existing Deficiency	ROW / Oak Dr	From Redwood Dr to Redwood Dr	1	0%	2	Replace	8	160	202	32,400	32,400	42,200	54,900	Existing Deficiency	100%	0%	54,900	0
P31-18	McCloud	Existing Deficiency	Hillcrest Dr	From Skyline Dr to Upper Hillcrest PS	1	0%	2 / 6	Replace	8	520	202	105,100	105,100	136,700	177,800	Existing Deficiency	100%	0%	177,800	0
P33-1	Pine	Existing Deficiency	Hillcrest Dr / Pleasant Wy / Brookside Dr	From Upper Hillcrest PS to Pine Reservoir	1	0%	2	Replace	8	3,830	202	773,800	773,800	1,006,000	1,307,800	Existing Deficiency	100%	0%	1,307,800	0
P33-2	Pine	Existing Deficiency	Pine Dr	From Pine Reservoir to Redwood Dr	1	0%	2	Replace	8	2,090	202	422,300	422,300	549,000	713,700	Existing Deficiency	100%	0%	713,700	0
P33-3	Pine	Existing Deficiency	Madrona Dr	From Redwood Dr to Felton Acres PS	1	0%	2	Replace	8	720	202	145,500	145,500	189,200	246,000	Existing Deficiency	100%	0%	246,000	0
P36-1	Kaski	Existing Deficiency	Lake Blvd	From approx. 1,000' n/o Ocean View Ave to Madrone PS	1	0%	4	Replace	8	1,070	202	216,200	216,200	281,100	365,500	Existing Deficiency	100%	0%	365,500	0
P37-1	Madrone	Existing Deficiency	Lake Blvd	From Madrone PS to Lakeshore Blvd	1	0%	4	Replace	8	20	202	4,100	4,100	5,400	7,100	Existing Deficiency	100%	0%	7,100	0
P37-2	Madrone	Existing Deficiency	Whilaway Ave	From Madrone Ave to Madrone Reservoir	1	0%	4	Replace	8	550	202	111,200	111,200	144,600	188,000	Existing Deficiency	100%	0%	188,000	0
							Subtotal - Pipeline Improvements					33,876,400	33,876,400	44,045,100	57,263,400				57,175,600	87,800
Valve Improvements							Existing Capacity (MG)	New/Replace	Capacity (gpm)	Valve Size (in)										
PRV4-1	Reader	PRV	Hwy 9 & Lorenzo St		1	11%	-	New	2,403	8		32,000	32,000	41,600	54,100	As Funding is Available	100%	0%	54,100	0
PRV7-1	Blackstone	PRV	Big Basin Wy & Blackstone Dr		1	0%	-	New	1,005	6		32,000	32,000	41,600	54,100	As Funding is Available	100%	0%	54,100	0
PRV8-1	Big Steel	PRV	Existing Big Steel Tank Site		1	0%	-	New	2,071	8		32,000	32,000	41,600	54,100	As Funding is Available	100%	0%	54,100	0
VLV11-1	Bear Creek	Check Valve	Bear Creek Rd & Deerwood Dr		2	0%	-	New	2,023	8		32,000	32,000	41,600	54,100	As Funding is Available	100%	0%	54,100	0
							Subtotal - Valve Improvements					128,000	128,000	166,400	216,400				216,400	0
Booster Station Improvements							Existing Capacity (gpm)	New/Replace	Capacity (gpm)	No. of Pumps										
PS1-2	Riverside Grove	Booster Pump	Existing Riverside Grove Pump Station		2	0%	-	New	100	1	174	17,442	17,442	22,700	29,600	Existing Deficiency	100%	0%	29,600	0
PS6-2	Eckley	Booster Pump	Existing Eckley Pump Station		1	0%	-	New	15	1	176	2,634	2,634	3,500	4,600	Existing Deficiency	100%	0%	4,600	0
PS13-1	Highland	Booster Pump	Existing Fairview Pump Station		1	27%	50	Replace	220	2	205	45,130	45,130	58,700	76,400	Existing Deficiency	100%	0%	76,400	0
PS18-1	Swim	Booster Pump	Existing Redwood Park Pump Station		3	0%	180	Replace	240	2	205	49,135	49,135	63,900	83,100	Existing Deficiency	100%	0%	83,100	0
PS20-1	University	Booster Pump	Existing University Pump Station		3	0%	170	Replace	200	2	206	41,110	41,110	53,500	69,600	Existing Deficiency	100%	0%	69,600	0
PS23-1	Upper Pasatiempo	Booster Pump	Existing Upper Pasatiempo Pump Station		2	0%	150	Replace	440	2	201	88,296	88,296	114,800	149,300	Existing Deficiency	100%	0%	149,300	0
PS28-1	El Solyo	Booster Pump	Existing Lower El Solyo Pump Station		2	0%	60	Replace	300	2	204	61,051	61,051	79,400	103,300	Existing Deficiency	100%	0%	103,300	0
PS33-1	Pine	Booster Pump	Existing Hillcrest Pump Station		3	0%	120	Replace	400	2	201	80,591	80,591	104,800	136,300	Existing Deficiency	100%	0%	136,300	0
PS36-1	Kaski	Booster Pump	Existing Intertie 5 Pump Station		3	0%	140	Replace	400	2	201	80,591	80,591	104,800	136,300	Existing Deficiency	100%	0%	136,300	0
							Subtotal - Booster Station Improvements					465,979	465,979	606,100	788,500				788,500	0
Reservoir Improvements							Existing Capacity (gal)	New/Replace	Capacity (gal)											
T3-1	Blue Ridge	Storage Reservoir	Existing Blue Ridge Tank Site		1	0%	40,000	Replace	200,000			622,000	622,000	808,600	1,051,200	Existing Deficiency	100%	0%	1,051,200	0
T4-1	Reader	Storage Reservoir	Existing Reader Tank Site		3	11%	-	New	420,000			1,306,200	1,306,200	1,698,100	2,207,600	Existing Deficiency	100%	0%	2,207,600	0
T6-1	Eckley	Storage Reservoir	Existing Eckley Tank Site		2	0%	5,000	Replace	130,000			404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0
T7-1	Blackstone	Storage Reservoir	Existing Blackstone Tank Site		2	0%	24,000	Replace	130,000			404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0

Table 10.2 Capital Improvement Program
Water Master Plan
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Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Priority	Direct Service to Disadvantaged Communities (%)	Improvement Details			Infrastructure Costs: Unit Cost ($/unit)	Infrastructure Costs: Infr. Cost ($)	Baseline Construction Cost ($)	Estimated Construction Cost[1] ($)	Capital Improvement Cost[2] ($)	Construction Trigger	Suggested Cost Allocation: Existing Users	Suggested Cost Allocation: Future Users	Cost Sharing: Existing Users ($)	Cost Sharing: Future Users ($)
T10-1	Ralston	Storage Reservoir	Existing Ralston Tank Site		2	0%	20,000	Replace	130,000		404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0
T11-1	Bear Creek	Storage Reservoir	Existing Bear Creek Tank Site		3	100%	-	New	310,000		964,100	964,100	1,253,400	1,629,500	Existing Deficiency	100%	0%	1,629,500	0
T13-1	Highland	Storage Reservoir	Existing Highland Tank Site		1	100%	60,000	Replace	130,000		404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0
T17-1	South	Storage Reservoir	Existing South Tank Site		2	0%	36,400	Replace	130,000		404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0
T18-1	Swim	Storage Reservoir	Existing Swim Tank Site		1	0%	19,600	Replace	210,000		653,100	653,100	849,100	1,103,900	Existing Deficiency	100%	0%	1,103,900	0
T19-1	Spring	Storage Reservoir	Existing Spring Tank Site		3	0%	-	New	60,000		186,600	186,600	242,600	315,400	Existing Deficiency	100%	0%	315,400	0
T20-1	University	Storage Reservoir	Existing University Tank Site		3	0%	-	New	80,000		248,800	248,800	323,500	420,600	Existing Deficiency	100%	0%	420,600	0
T23-1	Upper Pasatiempo	Storage Reservoir	Existing Upper Pasatiempo Tank Site		3	0%	-	New	50,000		155,500	155,500	202,200	262,900	Existing Deficiency	100%	0%	262,900	0
T24-1	North Boulder Creek	Storage Reservoir	Existing Echo Tank Site		1	0%	75,000	Replace	400,000		1,244,000	1,244,000	1,617,200	2,102,400	Existing Deficiency	100%	0%	2,102,400	0
T25-1	Blue	Storage Reservoir	Existing Blue Tank Site		3	0%	-	New	140,000		435,400	435,400	566,100	736,000	Existing Deficiency	100%	0%	736,000	0
T26-1	Charlie	Storage Reservoir	Existing Charlie Tank Site		3	0%	-	New	80,000		248,800	248,800	323,500	420,600	Existing Deficiency	100%	0%	420,600	0
T28-1	El Solyo	Storage Reservoir	Existing El Solyo Tank Site		2	0%	20,000	Replace	160,000		497,600	497,600	646,900	841,000	Existing Deficiency	100%	0%	841,000	0
T29-1	Bennett Spring	Storage Reservoir	Existing Bennett Spring Tank Site		1	0%	6,000	Replace	130,000		404,300	404,300	525,600	683,300	Existing Deficiency	100%	0%	683,300	0
T31-1	McCloud	Storage Reservoir	Existing McCloud Tank Site		1	0%	-	New	40,000		124,400	124,400	161,800	210,400	Existing Deficiency	100%	0%	210,400	0
T33-1	Pine	Storage Reservoir	Existing Pine Tank Site		2	0%	18,500	Replace	230,000		715,300	715,300	929,900	1,208,900	Existing Deficiency	100%	0%	1,208,900	0
T36-1	Kaski	Storage Reservoir	Existing Kaski Tank Site		3	0%	-	New	50,000		155,500	155,500	202,200	262,900	Existing Deficiency	100%	0%	262,900	0
T37-1	Madrone	Storage Reservoir	Existing Madrone Tank Site		3	0%	-	New	30,000		93,300	93,300	121,300	157,700	Existing Deficiency	100%	0%	157,700	0
										Subtotal - Reservoir Improvements	**10,076,400**	**10,076,400**	**13,100,000**	**17,030,800**				**17,030,800**	**0**
Total Water System Improvement Costs																			
										Pipeline Improvements	**33,876,400**	**33,876,400**	**44,045,100**	**57,263,400**				**57,175,600**	**87,800**
										Valve Improvements	**128,000**	**128,000**	**166,400**	**216,400**				**216,400**	**0**
										Booster Station Improvements	**465,979**	**465,979**	**606,100**	**788,500**				**788,500**	**0**
										Reservoir Improvements	**10,076,400**	**10,076,400**	**13,100,000**	**17,030,800**				**17,030,800**	**0**
										Total - Improvement Cost	**44,546,779**	**44,546,779**	**57,917,600**	**75,299,100**				**75,211,300**	**87,800**

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9/10/2021

Notes:
1. Baseline construction costs plus 30% to account for unforeseen events and unknown conditions.
2. Estimated construction costs plus 30% to cover other costs including: engineering design, project administration (developer and District staff), construction management and inspection, and legal costs.

project needs of servicing existing users and for those required to service anticipated future developments. The cost responsibility is based on model parameters for existing and future land use, and may change depending on the nature of development. **Table 10.2** lists each improvement, and separates the cost by responsibility between existing and future users.

10.3.4 Improvements Servicing Disadvantaged Communities

There are regions within the District's service area that are identified as disadvantaged communities (**Figure 10.2**). During the system evaluation there were several improvements identified which partially or fully service these areas, and may be eligible for grant funding. These improvements, and the portion of demands served which are attributable to the disadvantage communities, are identified on **Table 10.2**. As part of this Master Plan a separate technical memorandum has been developed to address the improvements within (or directly servicing) these disadvantaged communities, this technical memorandum can be found in **Appendix B**.

10.3.5 Construction Triggers

As part of this master planning process, construction triggers were developed in an effort to plan the expansion of the water system in an orderly manner. The construction triggers for multiple improvements are based on mitigating an existing system deficiency, increasing hydraulic reliability, or continuing improvements currently planned by the District. Other improvements will replace existing infrastructure that is not currently deficient but will violate master plan criteria with the construction of other improvements or with future development. The construction triggers quantify the amount of additional development that may occur before the improvement becomes necessary.

10.4 SUGGESTED EXPENDITURE BUDGET

This section discusses the suggested expenditure budget for the capital improvement plan horizon as well as the recommended sequence of construction for capital improvement planning.

10.4.1 Sequence of Construction

Suggested expenditure budget phasing is intended to provide general guidance for implementing the capital improvement projects listed in this master plan. The sequence of construction for the improvements takes into consideration the existing system deficiencies (fire flow and capacity) along with the risk assessment and replacement priorities identified in the renewal and replacement section. **Table 10.3** summarizes the reasoning for prioritization for each facility type. Additional improvements may be constructed as development occurs and the phasing and implementation of a sequence of construction is subject to the approval of the District Engineer.

10.4.2 5-Year Capital Improvement Costs and Phasing

The capital improvement program costs and phasing for the next five fiscal years (FY) are summarized on **Table 10.4**; this plan includes the total costs for pipelines, tanks, booster stations, and valves to be constructed. The improvements listed are also categorized by improvement

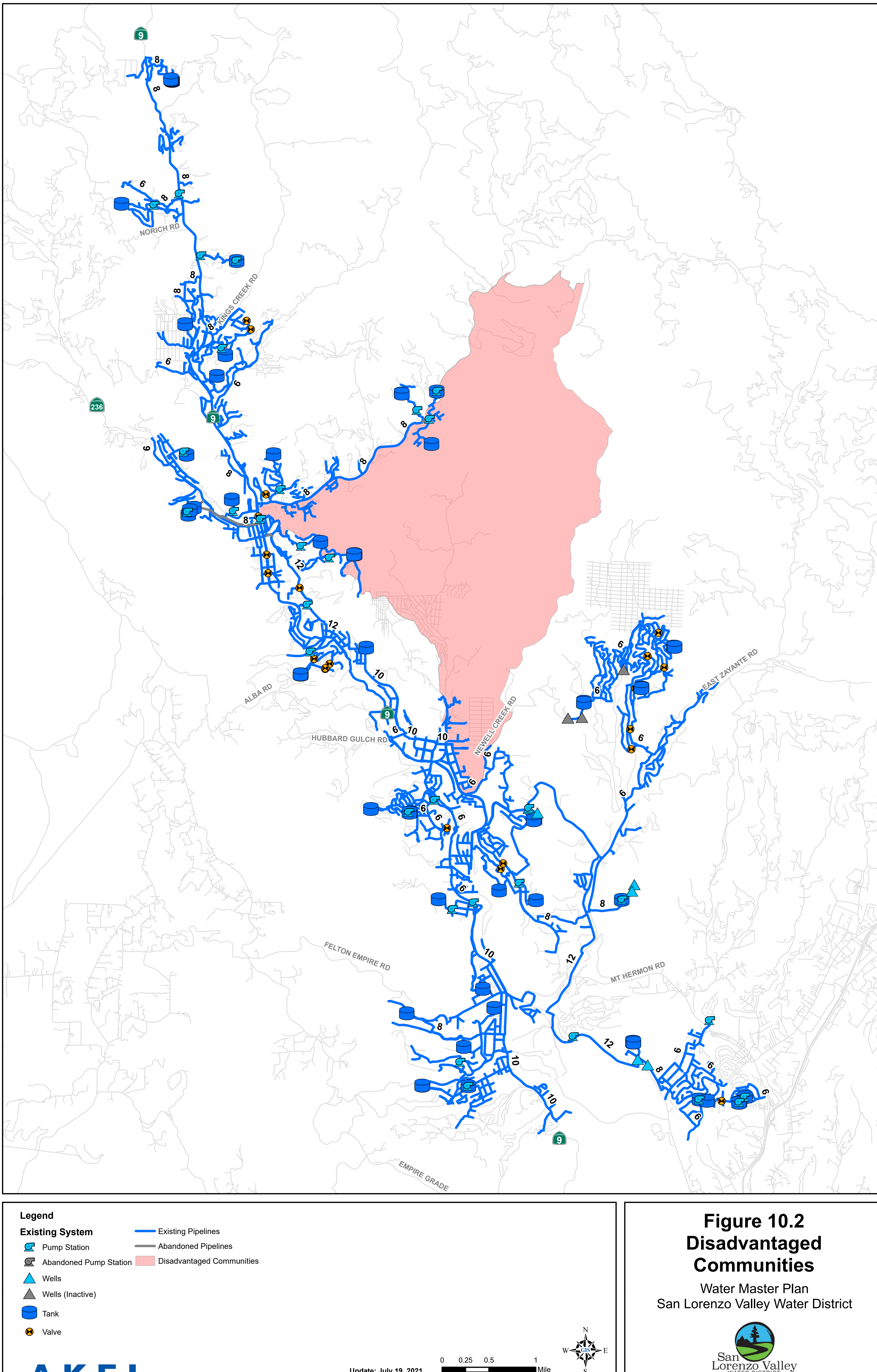

Figure 10.2 Disadvantaged Communities

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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Table 10.3 Capital Improvement Prioritization

Water Master Plan

San Lorenzo Valley Water District

Priority	Pipeline Prioritization	Valve Prioritization	Booster Station Prioritization	Reservoir Prioritization
1	Existing Deficiency	Supply Capacity Improvement Triggered by Pipeline Capacity Improvement	Supply Capacity Improvement **Extreme** Risk	**High** or **Extreme** Likelihood of Failure
2	**High** or **Extreme** Risk Capacity Improvement	Other Valve Improvements	Reliability Improvement **High** Risk	**Moderate** Likelihood of Failure
3	Other Capacity Improvement **High** or **Extreme** Risk Fire Flow Reliability Improvements	-	Other Booster Station Improvement	Other Reservoir Improvement
4	Other Fire Flow Reliability Improvement	-	-	-

Table 10.4 20-Year Improvement Phasing
Water Master Plan
San Lorenzo Valley Water District

CIP ID	Pressure Zone	Project Description	Fiscal Year Improvement Phasing FY 2022/23 ($)	FY 2023/24 ($)	FY 2024/25 ($)	FY 2025/26 ($)	FY 2026/27 ($)	FY 2027 - 2031 ($)	FY 2032 - 2036 ($)	FY 2037 - 2041 ($)	Total Cost ($)
Pipeline Improvements											
P3-1	Blue Ridge	Replace existing 2-inch pipelines with new 8-inch pipelines in Grove Dr						109,500			109,500
P4-1	Reader	Replace existing 4-inch, 6-inch, and 8-inch pipelines with new 10-inch pipelines in Hwy 9							4,799,900		4,799,900
P4-2	Reader	Replace existing 8-inch pipelines with new 10-inch pipelines in Hwy 9		2,902,000							2,902,000
P4-3	Reader	Replace existing 1-inch pipelines with new 8-inch pipelines in Riverview Dr							177,800		177,800
P4-4	Reader	Replace existing 1.5-inch pipelines with new 8-inch pipelines in Band Rd					444,100				444,100
P4-5	Reader	Replace existing 1.25-inch, 1.5-inch, and 2-inch pipelines with new 8-inch pipelines in Scenic Dr and Blue Ridge Dr					478,200				478,200
P4-6	Reader	Replace existing 6-inch pipelines with new 10-inch pipelines in Dolores Dr and Douglas Ave		516,800							516,800
P4-7	Reader	Replace existing 2-inch pipelines with new 8-inch pipelines in Brookside Dr							37,700		37,700
P4-8	Reader	Replace existing 1-inch pipelines with new 8-inch pipelines in Orchard Dr					112,900				112,900
P4-9	Reader	Replace existing 1.25-inch and 2-inch pipelines with new 8-inch pipelines in Juanita Rd					171,000				171,000
P4-10	Reader	Replace existing 1-inch, 1.25-inch, and 2-inch pipelines with new 8-inch pipelines in Hiawatha Rd					174,400				174,400
P4-11	Reader	Replace existing 1.25-inch pipelines with new 8-inch pipelines in Hwy 9							92,300		92,300
P4-12	Reader	Replace existing 1.5-inch, 2-inch, and 4-inch pipelines with new 8-inch pipelines in Central Ave							1,092,700		1,092,700
P4-13	Reader	Replace existing 1-inch pipelines with new 8-inch pipelines in Grove St					85,600				85,600
P4-14	Reader	Replace existing 1-inch pipelines with new 8-inch pipelines in River St					109,500				109,500
P4-15	Reader	Replace existing 1.5-inch pipelines with new 8-inch pipelines within ROW					3,700				3,700
P4-16	Reader	Replace existing 0.75-inch pipelines with new 8-inch pipelines within ROW					37,700				37,700
P5-1	Lyon	Replace existing 2-inch pipelines with new 8-inch pipelines in Ridge Dr		331,300							331,300
P5-2	Lyon	Construct new 12-inch pipelines in Redwood Dr and Madrone Dr	617,400								617,400
P5-3	Lyon	Construct new 12-inch pipelines in Big Basin Wy	1,797,000								1,797,000
P5-4	Lyon	Construct new 8-inch pipelines in St Francis Dr	41,100								41,100
P5-5	Lyon	Replace existing 2-inch and 6-inch pipelines with new 8-inch pipelines in St Francis Dr, Davidson Wy, and Sunshine Ln			751,300						751,300
P5-6	Lyon	Construct new 8-inch pipelines within ROW	34,400								34,400
P5-7	Lyon	Construct new 8-inch pipelines within ROW	37,700								37,700
P5-8	Lyon	Replace existing 2-inch pipelines with new 8-inch pipelines in Big Basin Wy, Oak St, and Boulder St			1,065,500						1,065,500
P5-9	Lyon	Replace existing 1-inch pipelines with new 10-inch pipelines in South St			11,200						11,200
P5-10	Lyon	Replace existing 1-inch pipelines with new 8-inch pipelines in Central Ave			246,000						246,000
P6-1	Eckley	Replace existing 2-inch pipelines with new 8-inch pipelines in Ridge Dr		82,100							82,100
P8-1	Big Steel	Construct new 12-inch pipelines in Redwood Dr, Madrone Dr, and Big Basin Wy	833,700								833,700

Table 10.4 20-Year Improvement Phasing

Water Master Plan
San Lorenzo Valley Water District

CIP ID	Pressure Zone	Project Description	Fiscal Year Improvement Phasing								
			FY 2022/23 ($)	FY 2023/24 ($)	FY 2024/25 ($)	FY 2025/26 ($)	FY 2026/27 ($)	FY 2027 - 2031 ($)	FY 2032 - 2036 ($)	FY 2037 - 2041 ($)	Total Cost ($)
P8-2	Big Steel	Replace existing 8-inch pipelines with new 10-inch pipelines in Big Basin Wy							908,900		908,900
P8-3	Big Steel	Replace existing 6-inch pipelines with new 8-inch pipelines in Redwood Ave and Lomond St							710,400		710,400
P8-4	Big Steel	Replace existing 1-inch pipelines with new 8-inch pipelines in ROW			7,100						7,100
P8-5	Big Steel	Replace existing 6-inch and 8-inch pipelines with new 10-inch pipelines in Central Ave								154,100	154,100
P8-6	Big Steel	Replace existing 6-inch pipelines with new 8-inch pipelines in Central Ave and Lorenzo Ave							1,591,200		1,591,200
P8-7	Big Steel	Construct new 12-inch pipelines in Lomond St and Irwin Wy			853,400						853,400
P8-8	Big Steel	Replace existing 1.5-inch pipelines with new 8-inch pipelines in Monan Wy and Alta Via Dr							1,014,300		1,014,300
P8-9	Big Steel	Replace existing 6-inch pipelines with new 10-inch pipelines in Hwy 9							1,322,900		1,322,900
P8-10	Big Steel	Replace existing 1-inch pipelines with new 8-inch pipelines in Reed St and within ROW			208,400						208,400
P8-11	Big Steel	Replace existing 1-inch and 2-inch pipelines with new 8-inch pipelines in Cascade St and within ROW			143,600						143,600
P8-12	Big Steel	Replace existing 6-inch pipelines with new 8-inch pipelines in Hwy 9								249,400	249,400
P8-13	Big Steel	Replace existing 1-inch pipelines with new 8-inch pipelines in Berkeley Wy and within ROW			365,500						365,500
P8-14	Big Steel	Replace existing 1-inch and 1.5-inch pipelines with new 8-inch pipelines in Western Ave, High St, and within ROW			293,800						293,800
P16-1	Brookdale	Replace existing 1-inch pipelines with new 8-inch pipelines in Redwood St						65,000			65,000
P16-2	Brookdale	Replace existing 1-inch pipelines with new 8-inch pipelines in Hazel St						75,300			75,300
P16-3	Brookdale	Replace existing 1-inch pipelines with new 8-inch pipelines in Riverside Rd and Fern St						133,300			133,300
P16-4	Brookdale	Replace existing 2-inch pipelines with new 8-inch pipelines in California Ave						10,400			10,400
P16-5	Brookdale	Replace existing 6-inch pipelines with new 10-inch pipelines in Brown Gables Rd and Hwy 9						725,600			725,600
P16-6	Brookdale	Replace existing 6-inch pipelines with new 10-inch pipelines in Mill St								348,200	348,200
P16-7	Brookdale	Construct new 10-inch pipelines in Mill St							245,600		245,600
P16-8	Brookdale	Replace existing 4-inch and 6-inch pipelines with new 10-inch pipelines in Hwy 9 and Brookside Ave				630,300					630,300
P16-9	Brookdale	Construct new 10-inch pipelines in Brookside Ave							7,600		7,600
P16-10	Brookdale	Replace existing 1.25-inch pipelines with new 8-inch pipelines in Love Creek Rd						259,700			259,700
P16-11	Brookdale	Replace existing 1.5-inch and 2-inch pipelines with new 8-inch pipelines in Kipling Ave, Live Oak Ave, and Pine St						843,600			843,600
P16-12	Brookdale	Replace existing 1.5-inch and 2-inch pipelines with new 8-inch pipelines in Whittier Ave and Manzanita Ave						778,700			778,700
P16-13	Brookdale	Replace existing 1-inch and 2-inch pipelines with new 8-inch pipelines in Pine St, Glen Arbor Rd, and Madrone Ave						822,900			822,900
P16-14	Brookdale	Replace existing 1-inch pipelines with new 8-inch pipelines in Hillcrest Ave							218,600		218,600
P16-15	Brookdale	Replace existing 1-inch pipelines with new 8-inch pipelines in Circle Dr and Urbana Ln						269,800			269,800
P16-16	Brookdale	Replace existing 1-inch pipelines with new 8-inch pipelines in Madrone Ave and Railroad Ave						341,700			341,700
P16-17	Brookdale	Replace existing 1-inch pipelines with new 8-inch pipelines in Oak Ave						85,600			85,600

Table 10.4 20-Year Improvement Phasing

Water Master Plan

San Lorenzo Valley Water District

CIP ID	Pressure Zone	Project Description	Fiscal Year Improvement Phasing								
			FY 2022/23 ($)	FY 2023/24 ($)	FY 2024/25 ($)	FY 2025/26 ($)	FY 2026/27 ($)	FY 2027 - 2031 ($)	FY 2032 - 2036 ($)	FY 2037 - 2041 ($)	Total Cost ($)
P16-18	Brookdale	Replace existing 2-inch, 4-inch, and 6-inch pipelines with new 10-inch pipelines in Hwy 9				3,008,200					3,008,200
P16-19	Brookdale	Replace existing 2-inch pipelines with new 8-inch pipelines in Hwy 9, Lorenzo Ave, and Woodland Dr						751,300			751,300
P16-20	Brookdale	Replace existing 1.5-inch pipelines with new 8-inch pipelines within ROW						58,300			58,300
P16-21	Brookdale	Replace existing 1.5-inch and 2-inch pipelines with new 8-inch pipelines in Woodland Dr, Shadowbrook Rd, and within ROW						751,300			751,300
P16-22	Brookdale	Replace existing 6-inch pipelines with new 8-inch pipelines in Glen Arbor Rd and Hihn Rd								2,414,100	2,414,100
P16-23	Brookdale	Replace existing 6-inch pipelines with new 8-inch pipelines within ROW								13,800	13,800
P16-24	Brookdale	Replace existing 1-inch pipelines with new 8-inch pipelines in Sunnyside Ave						7,100			7,100
P16-25	Brookdale	Replace existing 2-inch pipelines with new 8-inch pipelines in Larita Dr						13,800			13,800
P17-1	South	Replace existing 2-inch pipelines with new 8-inch pipelines in Clear Creek Rd						30,900			30,900
P17-2	South	Replace existing 1-inch pipelines with new 8-inch pipelines in Melwin						112,900			112,900
P17-3	South	Replace existing 0.75-inch pipelines with new 8-inch pipelines within ROW						365,500			365,500
P18-1	Swim	Replace existing 4-inch pipelines with new 8-inch pipelines in Greenfield St						246,000			246,000
P18-2	Swim	Replace existing 0.75-inch pipelines with new 8-inch pipelines in Hillcrest Dr						106,100			106,100
P18-3	Swim	Replace existing 1.25-inch pipelines with new 8-inch pipelines in Scenic Wy						85,600			85,600
P18-4	Swim	Replace existing 1.5-inch and 4-inch pipelines with new 8-inch pipelines in Country Club Dr and Mountain View Dr						133,300			133,300
P20-1	University	Replace existing 2-inch pipelines with new 8-inch pipelines in Melin Ave						362,100			362,100
P21-1	Quail	Replace existing 6-inch pipelines with new 8-inch pipelines in Quail Hollow Rd								2,642,800	2,642,800
P21-2	Quail	Replace existing 6-inch pipelines with new 8-inch pipelines in Quail Ter, Webster Dr, and Ridgeview Dr								1,956,400	1,956,400
P21-3	Quail	Replace existing 1-inch pipelines with new 8-inch pipelines in Arden Ave						133,300			133,300
P21-4	Quail	Replace existing 2-inch pipelines with new 8-inch pipelines in Azalea Ave						225,600			225,600
P21-5	Quail	Replace existing 6-inch pipelines with new 8-inch pipelines in Hihn Rd								614,800	614,800
P21-6	Quail	Replace existing 6-inch pipelines with new 8-inch pipelines in Kim Wy, Bahr Dr, and Moon Meadow Ln								1,167,800	1,167,800
P21-7	Quail	Replace existing 4-inch pipelines with new 8-inch pipelines in Zayante Dr							447,500		447,500
P22-1	Probation	Replace existing 4-inch and 6-inch pipelines with new 8-inch pipelines in Casera Wy						177,800			177,800
P22-2	Probation	Replace existing 4-inch and 6-inch pipelines with new 8-inch pipelines in Tank Rd							143,600		143,600
P23-1	Upper Pasatiempo	Replace existing 4-inch pipelines with new 8-inch pipelines in Tank Rd							7,100		7,100
P25-1	Blue	Replace existing 2-inch pipelines with new 8-inch pipelines within ROW						7,100			7,100
P26-1	Charlie	Replace existing 2-inch pipelines with new 8-inch pipelines within ROW						146,900			146,900
P28-1	El Solyo	Replace existing 2-inch pipelines with new 8-inch pipelines in El Solyo Heights Dr						71,900			71,900
P28-2	El Solyo	Replace existing 2-inch pipelines with new 8-inch pipelines within ROW						10,400			10,400

Table 10.4 20-Year Improvement Phasing

Water Master Plan
San Lorenzo Valley Water District

CIP ID	Pressure Zone	Project Description	Fiscal Year Improvement Phasing FY 2022/23 ($)	FY 2023/24 ($)	FY 2024/25 ($)	FY 2025/26 ($)	FY 2026/27 ($)	FY 2027 - 2031 ($)	FY 2032 - 2036 ($)	FY 2037 - 2041 ($)	Total Cost ($)
P29-1	Bennett Spring	Replace existing 2-inch pipelines with new 8-inch pipelines in Felton Empire Rd						1,202,000			1,202,000
P29-2	Bennett Spring	Replace existing 1-inch and 1.5-inch pipelines with new 8-inch pipelines in Ley Rd						171,000			171,000
P31-1	McCloud	Replace existing 2-inch pipelines with new 8-inch pipelines in El Solyo Heights Dr						126,500			126,500
P31-2	McCloud	Replace existing 4-inch and 8-inch pipelines with new 10-inch pipelines in Hwy 9							857,700		857,700
P31-3	McCloud	Replace existing 6-inch pipelines with new 8-inch pipelines in Hwy 9					280,200				280,200
P31-4	McCloud	Replace existing 2-inch and 6-inch pipelines with new 8-inch pipelines in Hwy 9 and Felton Empire Rd								741,000	741,000
P31-5	McCloud	Replace existing 6-inch pipelines with new 8-inch pipelines in Cooper St					3,700				3,700
P31-6	McCloud	Construct new 8-inch pipelines in Farmer St				7,100					7,100
P31-7	McCloud	Replace existing 6-inch, 8-inch, and 10-inch pipelines with new 12-inch pipelines in Wright St and Kirby St				220,300					220,300
P31-8	McCloud	Replace existing 6-inch pipelines with new 10-inch pipelines in Gushee St					454,500				454,500
P31-9	McCloud	Replace existing 4-inch pipelines with new 8-inch pipelines in Russell Ave					102,700				102,700
P31-10	McCloud	Replace existing 2-inch and 4-inch pipeline with new 8-inch pipelines in Plateau Ave					99,100				99,100
P31-11	McCloud	Replace existing 6-inch pipelines with new 8-inch pipelines in Laurel Dr and Hwy 9					693,300				693,300
P31-12	McCloud	Replace existing 6-inch and 8-inch pipelines with new 10-inch pipelines in Laurel Dr and Hillside Dr					355,500				355,500
P31-13	McCloud	Replace existing 6-inch and 8-inch pipelines with new 12-inch pipelines in Orchard Rd					535,000				535,000
P31-14	McCloud	Replace existing 4-inch pipelines with new 8-inch pipelines in Hillside Dr						362,100			362,100
P31-15	McCloud	Replace existing 0.75-inch pipelines with new 8-inch pipelines within ROW						65,000			65,000
P31-16	McCloud	Replace existing 2-inch and 6-inch pipelines with new 8-inch pipelines in Redwood Dr						833,200			833,200
P31-17	McCloud	Replace existing 2-inch pipelines with new 8-inch pipelines in Oak Dr and within ROW						54,900			54,900
P31-18	McCloud	Replace existing 2-inch and 6-inch pipelines with new 8-inch pipelines in Hillcrest Dr						177,800			177,800
P33-1	Pine	Replace existing 2-inch pipelines with new 8-inch pipelines in Hillcrest Dr, Pleasant Wy, and Brookside Dr						1,307,800			1,307,800
P33-2	Pine	Replace existing 2-inch pipelines with new 8-inch pipelines in Pine Dr						713,700			713,700
P33-3	Pine	Replace existing 2-inch pipelines with new 8-inch pipelines in Madrona Dr						246,000			246,000
P36-1	Kaski	Replace existing 4-inch pipelines with new 8-inch pipelines in Lake Blvd						365,500			365,500
P37-1	Madrone	Replace existing 4-inch pipelines with new 8-inch pipelines in Lake Blvd						7,100			7,100
P37-2	Madrone	Replace existing 4-inch pipelines with new 8-inch pipelines in Whilaway Ave						188,000			188,000
		Subtotal - Pipeline Improvements	**3,361,300**	**3,832,200**	**3,945,800**	**3,865,900**	**4,141,100**	**14,138,900**	**13,675,800**	**10,302,400**	**57,263,400**

Table 10.4 20-Year Improvement Phasing
Water Master Plan
San Lorenzo Valley Water District

CIP ID	Pressure Zone	Project Description	Fiscal Year Improvement Phasing								
			FY 2022/23 ($)	FY 2023/24 ($)	FY 2024/25 ($)	FY 2025/26 ($)	FY 2026/27 ($)	FY 2027 - 2031 ($)	FY 2032 - 2036 ($)	FY 2037 - 2041 ($)	Total Cost ($)
Valve Improvements											
PRV4-1	Reader	Construct new 8-inch PRV near Hwy 9 and Lorenzo St		54,100							54,100
PRV7-1	Blackstone	Construct new 6-inch PRV near Big Basin Wy and Blackstone Dr	54,100								54,100
PRV8-1	Big Steel	Construct new 8-inch PRV near the existing Big Steel tank site	54,100								54,100
VLV11-1	Bear Creek	Construct new 8-inch check valve near Bear Creek Rd and Deerwood Dr		54,100							54,100
		Subtotal - Valve Improvements	**108,200**	**108,200**	**0**	**0**	**0**	**0**	**0**	**0**	**216,400**
Booster Station Improvements											
PS1-2	Riverside Grove	Construct additional pump at Riverside Grove Pump Station for reliability		29,600							29,600
PS6-2	Eckley	Construct additional pump at Eckley Pump Station for reliability		4,600							4,600
PS13-1	Highland	Upgrade the existing Fairview Pump Station with larger capacity pumps						76,400			76,400
PS18-1	Swim	Upgrade the existing Redwood Park Pump Station with larger capacity pumps								83,100	83,100
PS20-1	University	Upgrade the existing University Pump Station with larger capacity pumps								69,600	69,600
PS23-1	Upper Pasatiempo	Upgrade the existing Lower Pasatiempo Pump Station with larger capacity pumps								149,300	149,300
PS28-1	El Solyo	Upgrade the existing Lower El Solyo Pump Station with larger capacity pumps								103,300	103,300
PS33-1	Pine	Upgrade the existing Upper Hillcrest Pump Station with larger capacity pumps								136,300	136,300
PS36-1	Kaski	Upgrade the existing Lompico Pump Station with larger capacity pumps								136,300	136,300
		Subtotal - Booster Station Improvements	**0**	**34,200**	**0**	**0**	**0**	**76,400**	**0**	**677,900**	**788,500**
Reservoir Improvements											
T3-1	Blue Ridge	Construct additional storage at existing Bear Creek tank site								1,051,200	1,051,200
T4-1	Reader	Replace existing Blackstone storage tanks							2,207,600		2,207,600
T6-1	Eckley	Replace existing Blue Ridge storage tank							683,300		683,300
T7-1	Blackstone	Replace existing Eckley storage tank						683,300			683,300
T10-1	Ralston	Replace existing Highland storage tank						683,300			683,300
T11-1	Bear Creek	Replace existing Echo storage tanks						1,629,500			1,629,500
T13-1	Highland	Replace existing Ralston storage tanks							683,300		683,300
T17-1	South	Construct additional storage at existing Reader tank site								683,300	683,300
T18-1	Swim	Replace existing South storage tanks							1,103,900		1,103,900
T19-1	Spring	Construct additional storage at existing Spring tank site								315,400	315,400
T20-1	University	Replace existing Swim storage tanks						420,600			420,600

Table 10.4 20-Year Improvement Phasing
Water Master Plan
San Lorenzo Valley Water District

CIP ID	Pressure Zone	Project Description	Fiscal Year Improvement Phasing								
			FY 2022/23 ($)	FY 2023/24 ($)	FY 2024/25 ($)	FY 2025/26 ($)	FY 2026/27 ($)	FY 2027 - 2031 ($)	FY 2032 - 2036 ($)	FY 2037 - 2041 ($)	Total Cost ($)
T23-1	Upper Pasatiempo	Construct additional storage at existing University tank site								262,900	262,900
T24-1	North Boulder Creek	Construct additional storage at existing Madrone tank site								2,102,400	2,102,400
T25-1	Blue	Construct additional storage at existing Blue tank site								736,000	736,000
T26-1	Charlie	Construct additional storage at existing Charlie tank site								420,600	420,600
T28-1	El Solyo	Construct additional storage at existing Upper Pasatiempo tank site								841,000	841,000
T29-1	Bennett Spring	Replace existing Lower El Solyo storage tank								683,300	683,300
T31-1	McCloud	Construct additional storage at existing McCloud tank site								210,400	210,400
T33-1	Pine	Replace existing Bennett Spring storage tank							1,208,900		1,208,900
T36-1	Kaski	Construct additional storage at existing Kaski tank site								262,900	262,900
T37-1	Madrone	Replace existing Pine storage tanks							157,700		157,700
		Subtotal - Reservoir Improvements	**0**	**0**	**0**	**0**	**0**	**3,416,700**	**6,044,700**	**7,569,400**	**17,030,800**
Total Water System Improvement Costs											
		Fiscal Year Total	**3,469,500**	**3,974,600**	**3,945,800**	**3,865,900**	**4,141,100**	**17,632,000**	**19,720,500**	**18,549,700**	**75,299,100**
		Cumulative Total	**3,469,500**	**7,444,100**	**11,389,900**	**15,255,800**	**19,396,900**	**37,028,900**	**56,749,400**	**75,299,100**	**75,299,100**

classification, indicating whether the improvement is intended to expand or replace the existing water distribution system infrastructure.

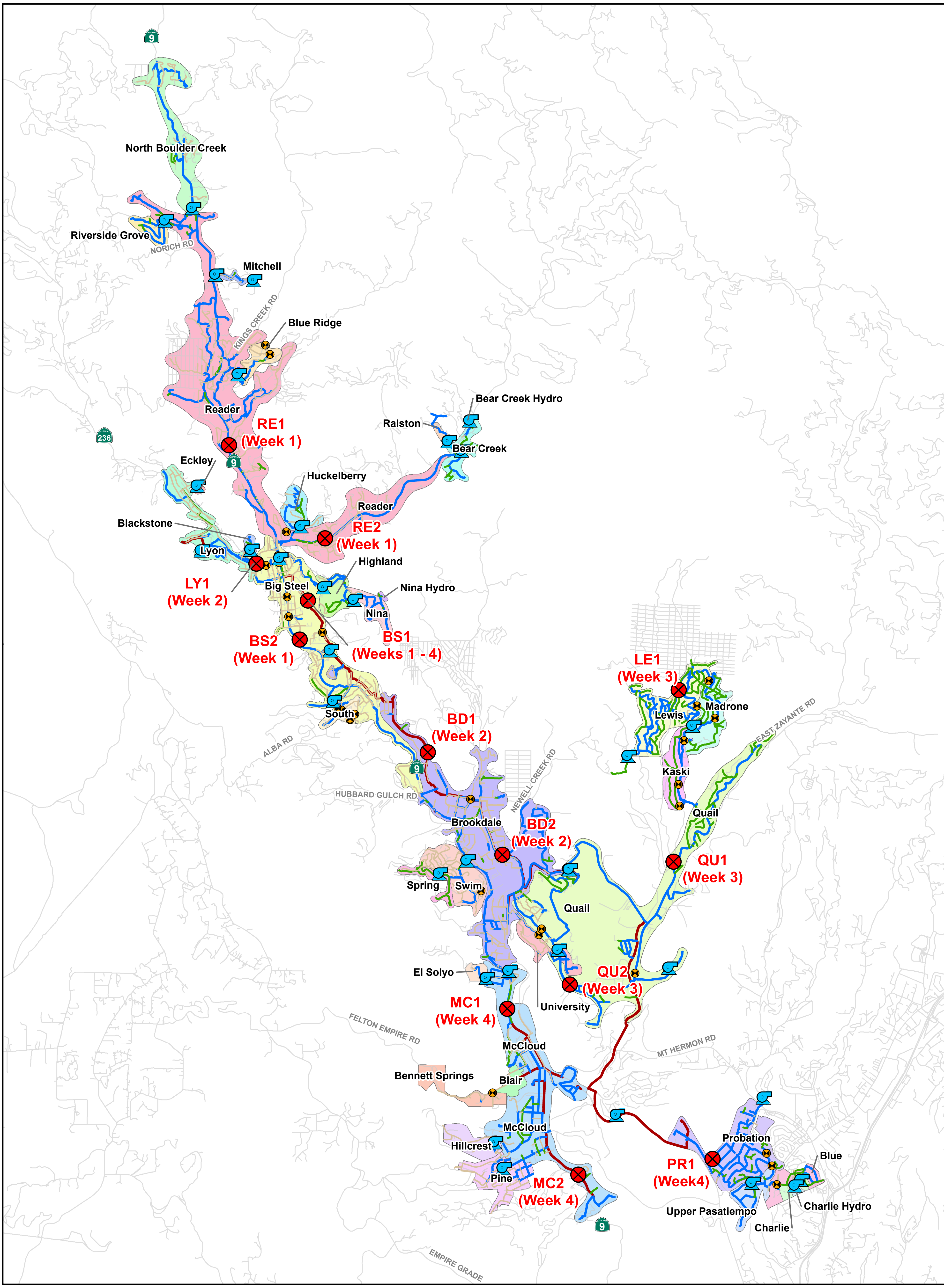
10.4.3 Suggested Expenditure Budget (20yr)

The suggested 20-year expenditure budget is shown on **Table 10.4**, and includes the total costs for pipelines, tanks, pump stations, valves, and wells phased by 5-year fiscal periods through the year 2041.

APPENDICES

APPENDIX A

Calibration Plan & Exhibits



Legend

Tank

Pressure Logger Location

Pump Station

Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Pressure Zones

Bear Creek	Blue	Hillcrest	Nina	Riverside Grove
Bear Creek Hydro	Blue Ridge	Huckelberry	Nina Hydro	South
Bennett Springs	Brookdale	Kaski	North Boulder Creek	Spring
Big Steel	Charlie	Lewis	Pine	Swim
Blackstone	Charlie Hydro	Lyon	Probation	University
Blair	Eckley	Madrone	Quail	Upper Pasatiempo
	El Solyo	McCloud	Ralston	
	Highland	Mitchell	Reader	

Update: October 22, 2019

0 0.25 0.5 1 Mile

N E S W

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File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_Fig1_PressureLoggers_Overview_102219.mxd

Figure 1
Pressure Logger Locations

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Legend

Pressure Logger Location

Tank

Pump Station

Valve

Pipes by Diameter

- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Pressure Zones

- Big Steel
- Highland

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

0 37.5 75 150 Feet

Update: October 21, 2019

AKEL ENGINEERING GROUP, INC.

BS1
(Weeks 1 - 4)

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_BS1_PressureLogger_102119.mxd

Legend

Pressure Logger Location
Tank
Pump Station
Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Pressure Zones
- Big Steel

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

0 37.5 75 150 Feet

N W E S GIS

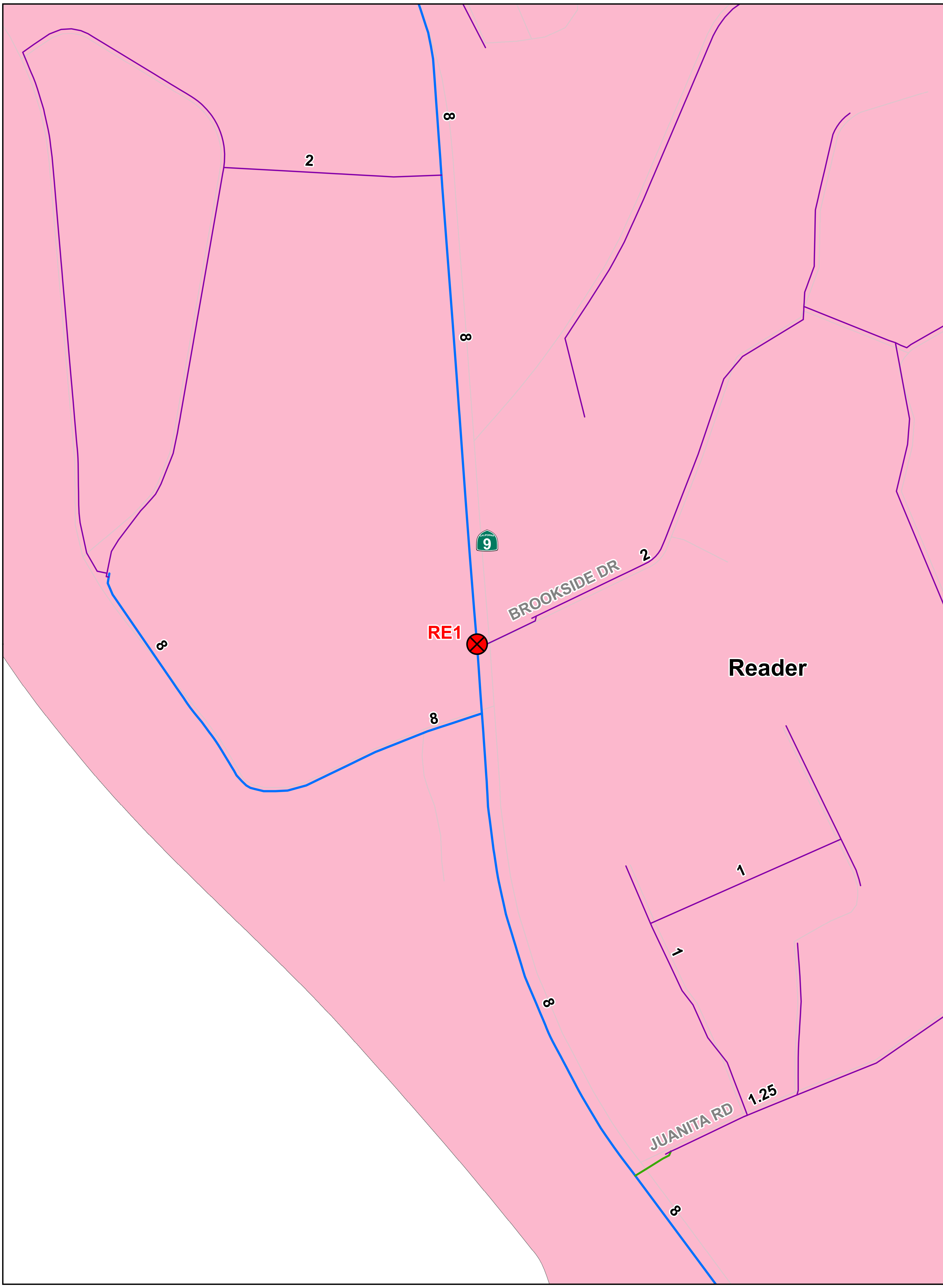
Update: October 21, 2019

AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_BS2_PressureLogger_102119.mxd

BS2
(Week 1)
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Pressure Logger Location
Tank
Pump Station
Valve

Pipes by Diameter
2" or Less
3" - 4"
6" - 8"
10" or Greater

Pressure Zones
Reader

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

Update: October 21, 2019

0 37.5 75 150 Feet

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File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_RE1_PressureLogger_102119.mxd

RE1
(Week 1)
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Legend

Pressure Logger Location
Tank
Pump Station
Valve

Pipes by Diameter
2" or Less
3" - 4"
6" - 8"
10" or Greater

Pressure Zones
Huckelberry
Reader

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

0 37.5 75 150 Feet

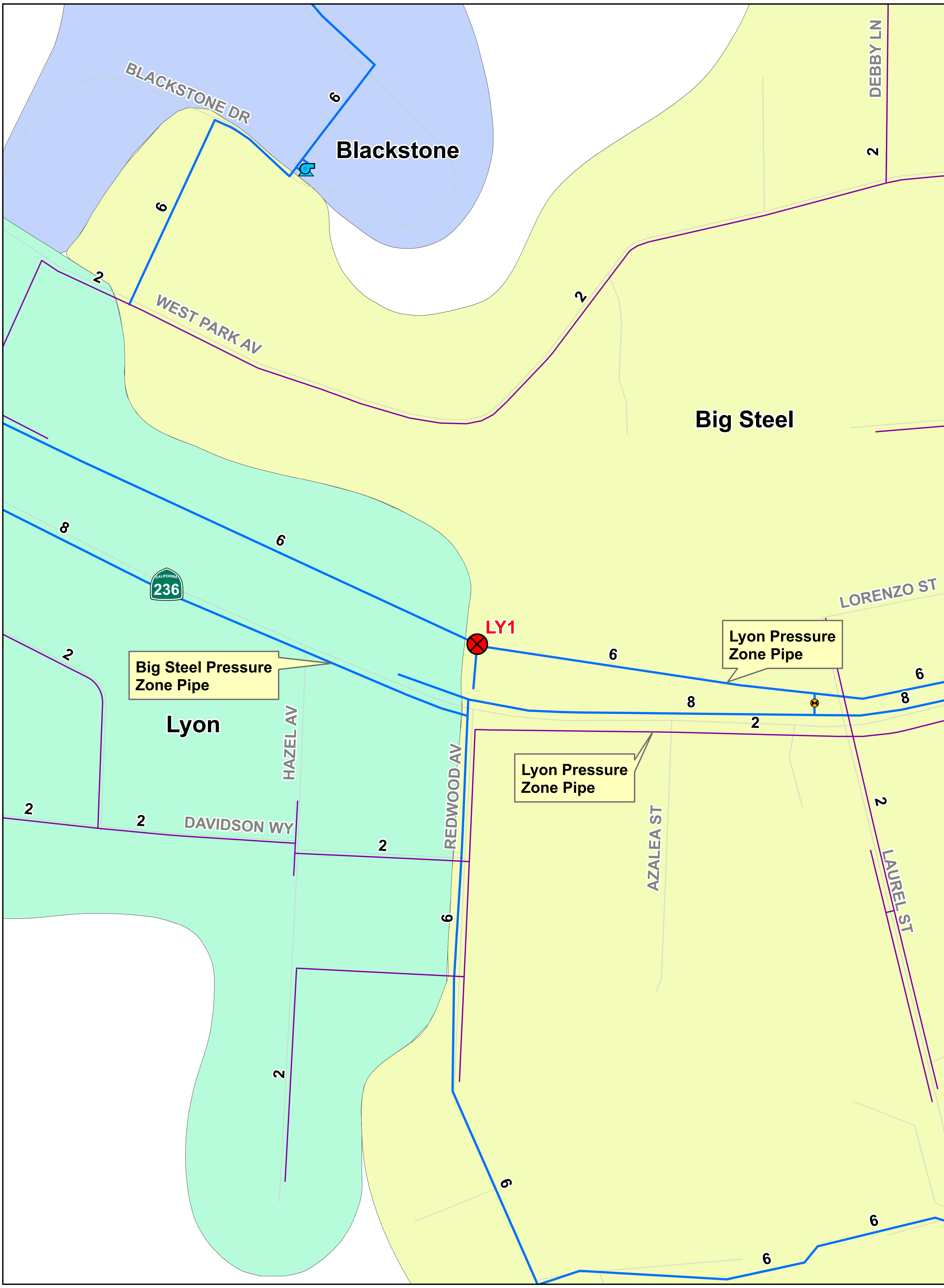
Update: October 21, 2019

AKEL ENGINEERING GROUP, INC.

RE2
(Week 1)

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

- Pressure Logger Location
- Tank
- Pump Station
- Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Pressure Zones
- Big Steel
- Blackstone
- Lyon

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

Update: October 21, 2019

0 37.5 75 150 Feet

N W E S

AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_LY1_PressureLogger_102119.mxd

LY1
(Week 2)
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Legend

Pressure Logger Location
Tank
Pump Station
Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Pressure Zones
- Big Steel
- Brookdale

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

Update: October 21, 2019

0 37.5 75 150 Feet

N W E S

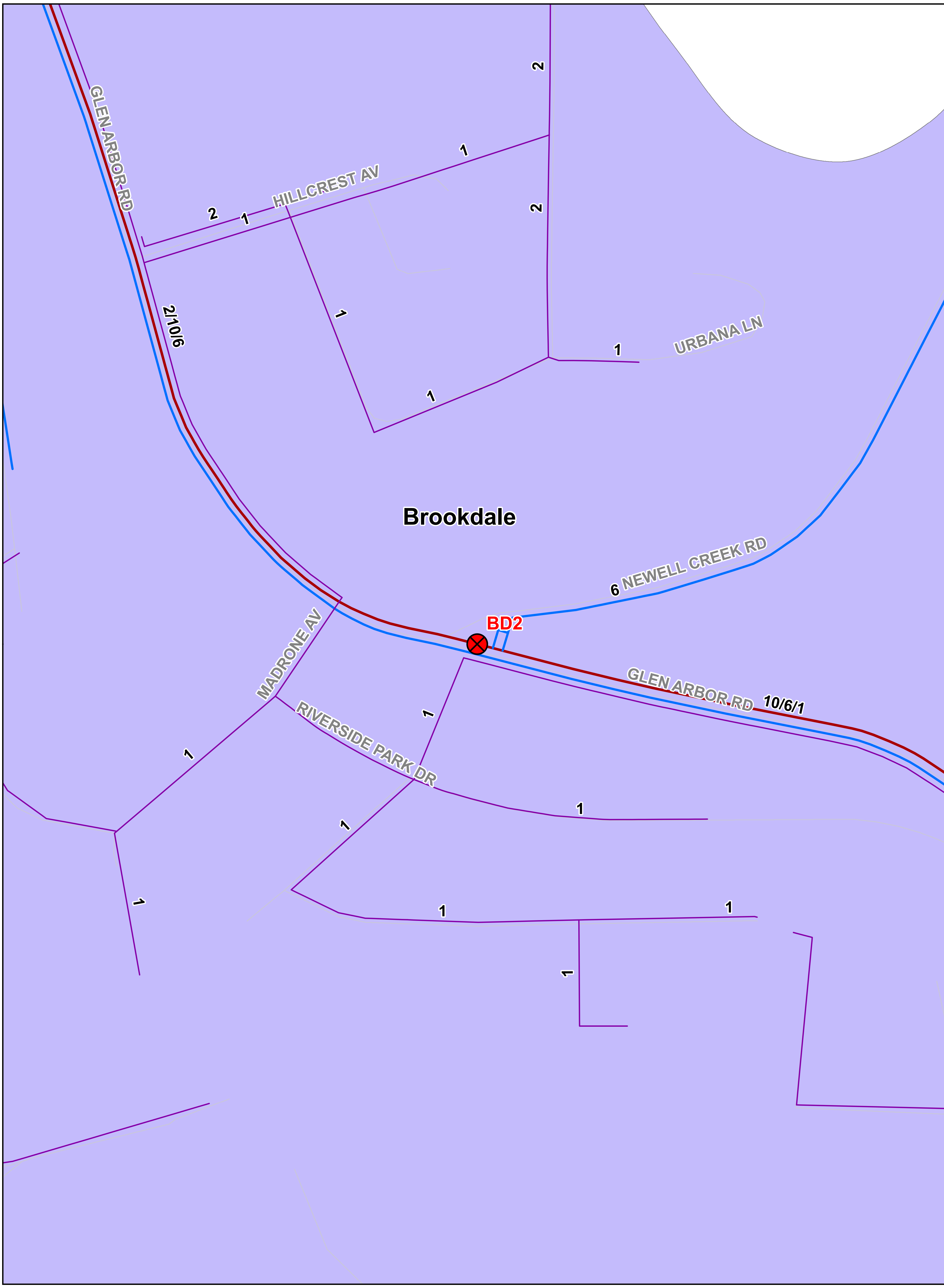
AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_BD1_PressureLogger_102119.mxd

BD1
(Week 2)

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

- Pressure Logger Location
- Tank
- Pump Station
- Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Pressure Zones
- Brookdale

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

0 37.5 75 150 Feet

N W E S

Update: October 21, 2019

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BD2
(Week 2)
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

Legend

Pressure Logger Location

Tank

Pump Station

Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Pressure Zones
- Quail

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

AKEL ENGINEERING GROUP, INC.

Update: October 21, 2019

0 37.5 75 150 Feet

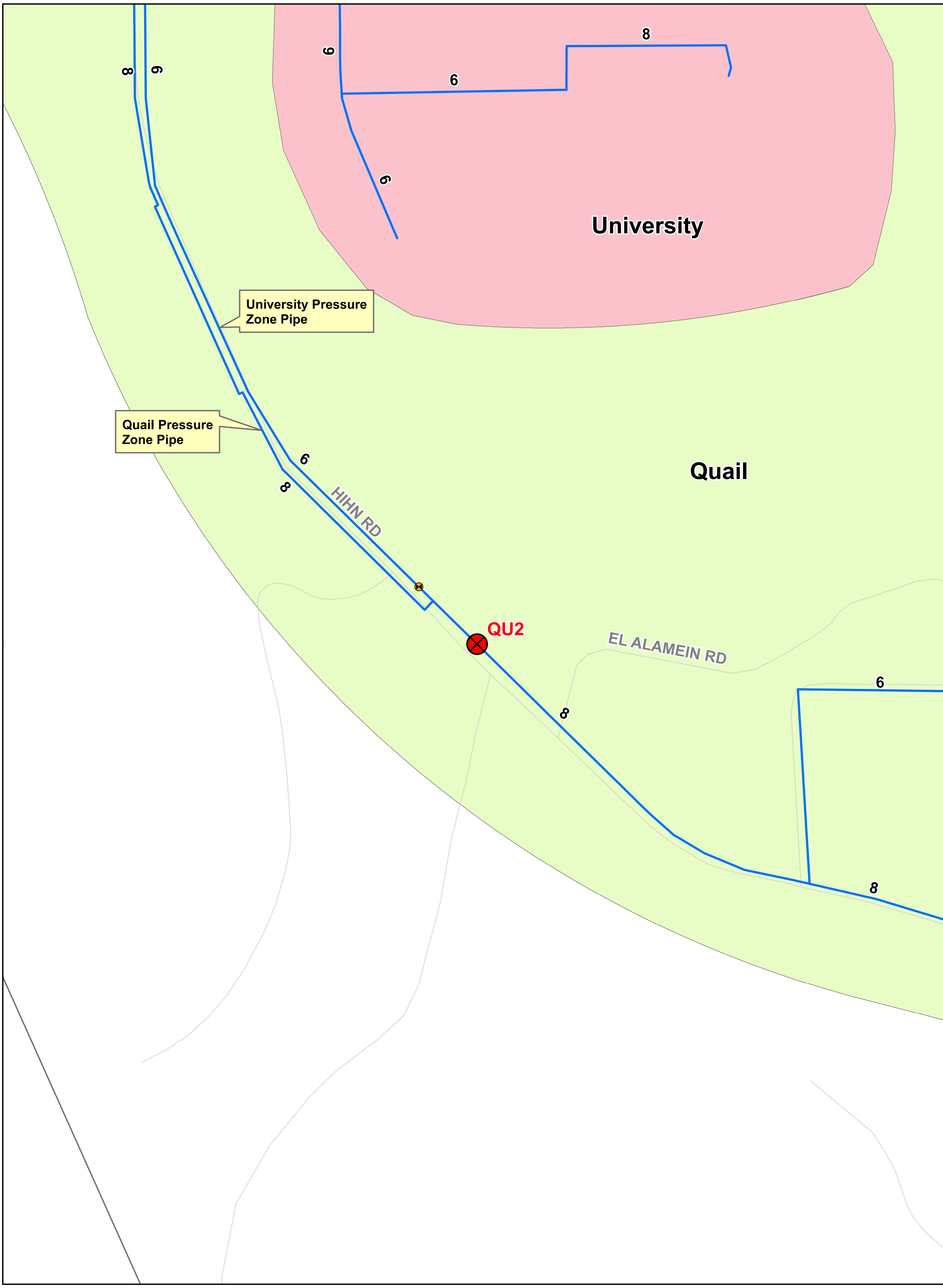
N W E S

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_QU1_PressureLogger_102119.mxd

QU1
(Week 3)

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Pressure Logger Location
Tank
Pump Station
Valve

Pipes by Diameter
- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Pressure Zones
- Quail
- University

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

0 37.5 75 150 Feet

N W E S GIS

Update: October 21, 2019

AKEL ENGINEERING GROUP, INC.

QU2
(Week 3)

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_QU2_PressureLogger_102119.mxd

Legend

Pressure Logger Location

Tank

Pump Station

Valve

Pipes by Diameter

2" or Less

3" - 4"

6" - 8"

10" or Greater

Pressure Zones

Lewis

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

N W E S

0 37.5 75 150 Feet

Update: October 21, 2019

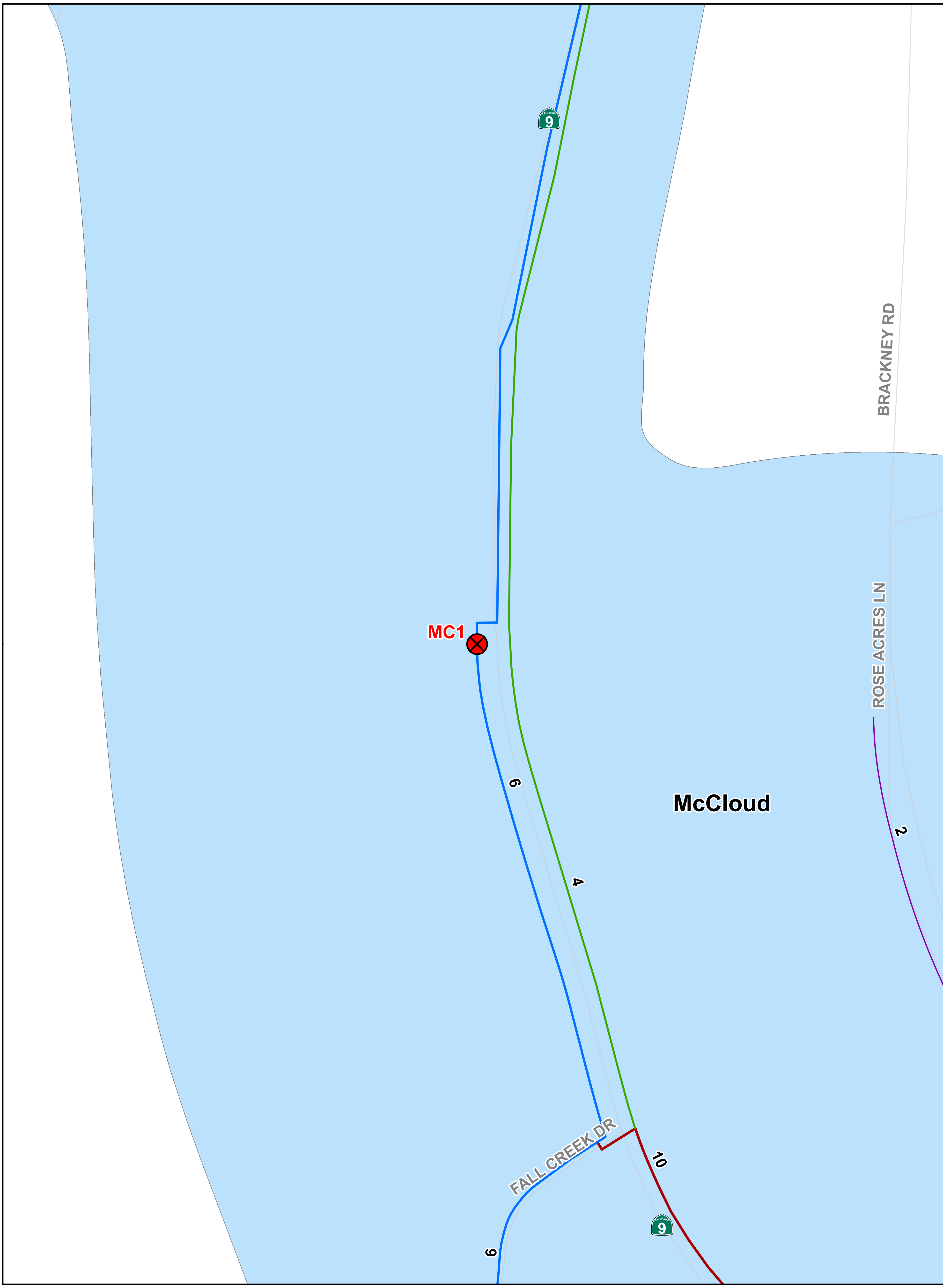
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_LE1_PressureLogger_102119.mxd

AKEL ENGINEERING GROUP, INC.

LE1
(Week 3)

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Pressure Logger Location

Tank

Pump Station

Valve

Pipes by Diameter

2" or Less

3" - 4"

6" - 8"

10" or Greater

Pressure Zones

McCloud

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

0 37.5 75 150 Feet

N W E S

Update: October 21, 2019

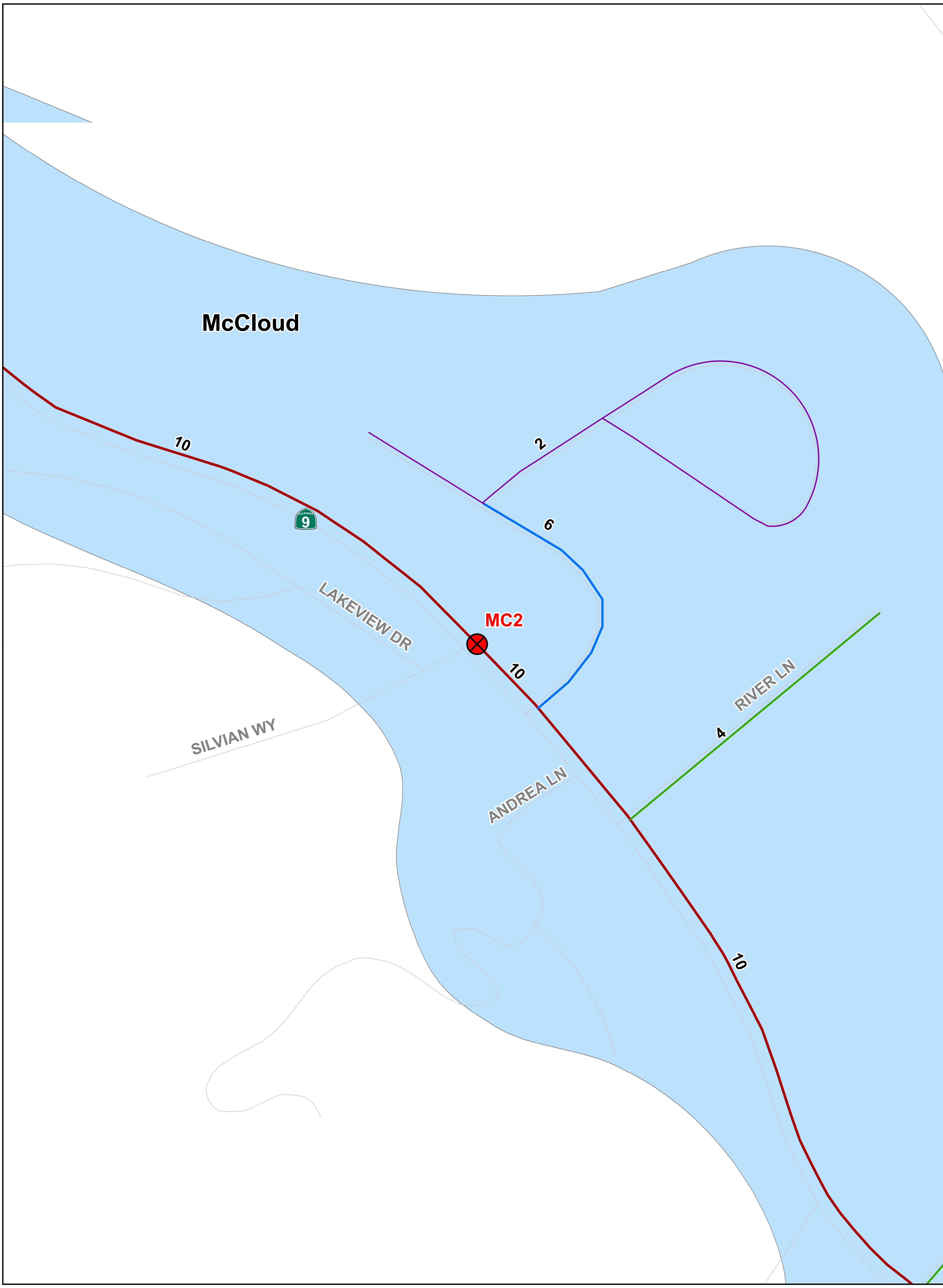
AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_MC1_PressureLogger_102119.mxd

MC1
(Week 4)

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Pressure Logger Location

Tank

Pump Station

Valve

Pipes by Diameter

2" or Less

3" - 4"

6" - 8"

10" or Greater

Pressure Zones

McCloud

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

0 37.5 75 150 Feet

N W E S

Update: October 21, 2019

AKEL ENGINEERING GROUP, INC.

MC2
(Week 4)

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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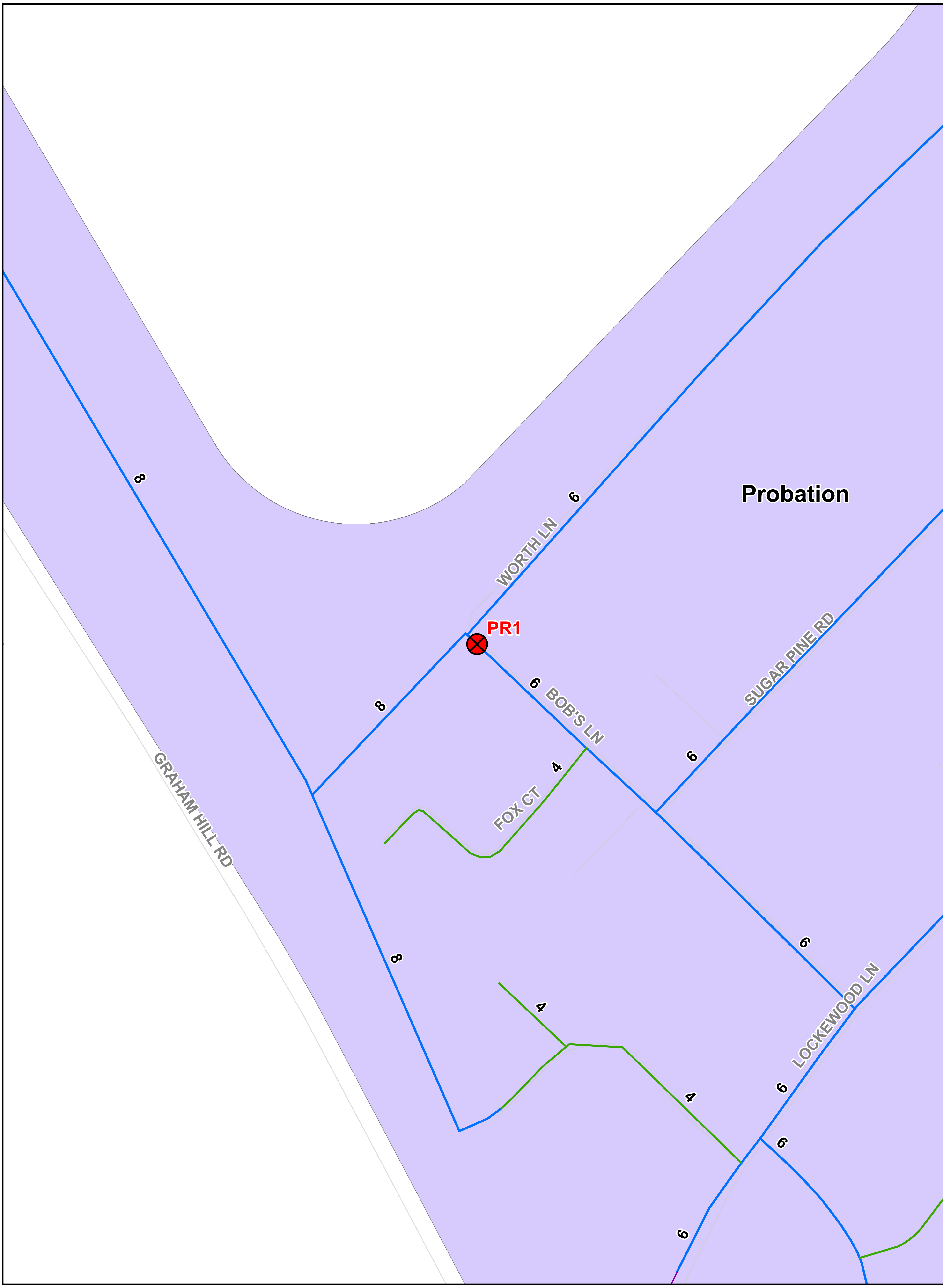

Legend

Pressure Logger Location

Tank

Pump Station

Valve

Pipes by Diameter

- 2" or Less
- 3" - 4"
- 6" - 8"
- 10" or Greater

Pressure Zones

- Probation

Note:
Pressure logger to be placed on the fire hydrant nearest to the location indicated. Fire hydrant should be connected to pipeline shown.

0 37.5 75 150 Feet

N E S W

Update: October 21, 2019

PR1
(Week 4)

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley
WATER DISTRICT

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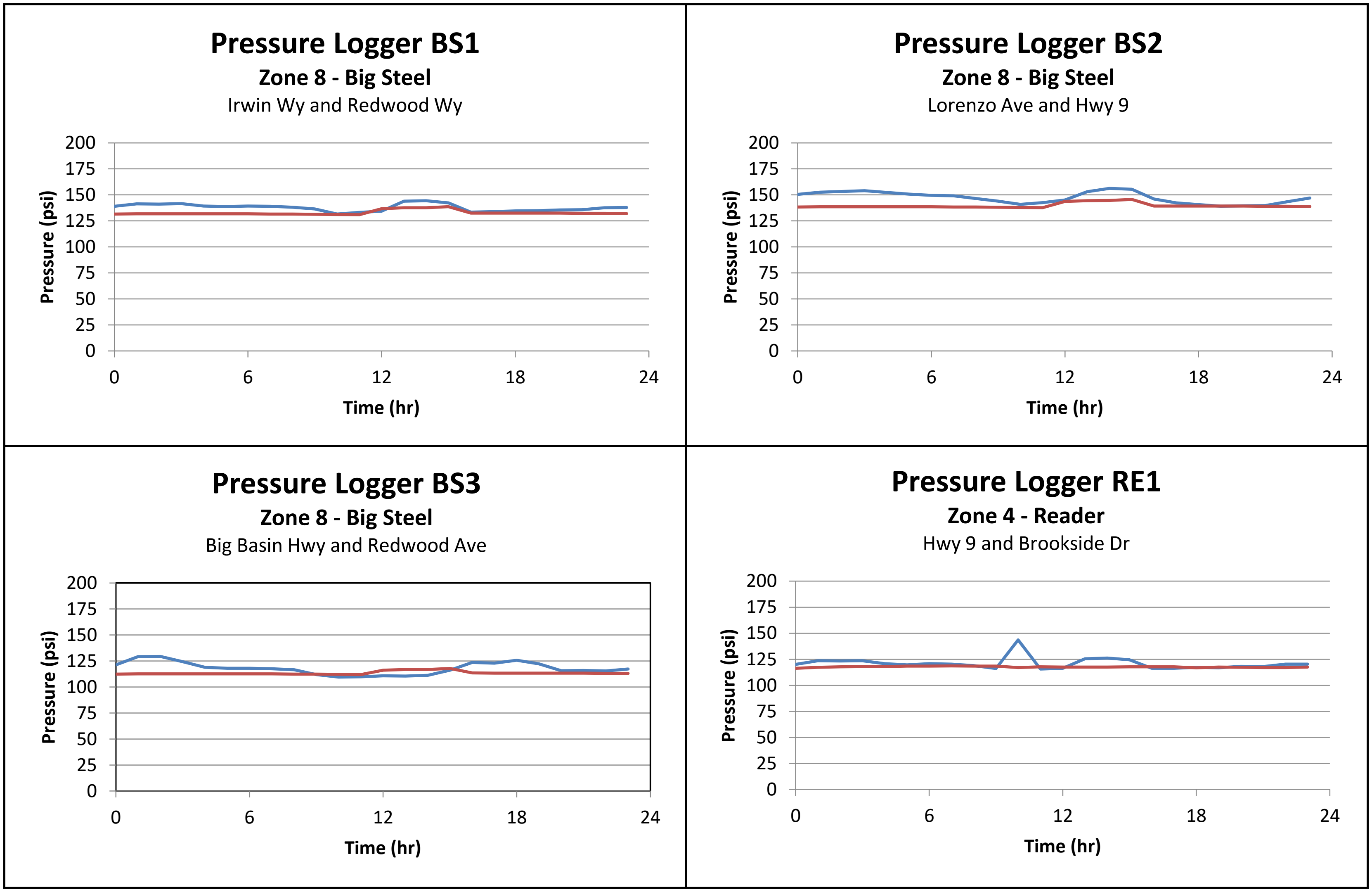
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_PR1_PressureLogger_102119.mxd



LEGEND

Telemetry Data
Model Data

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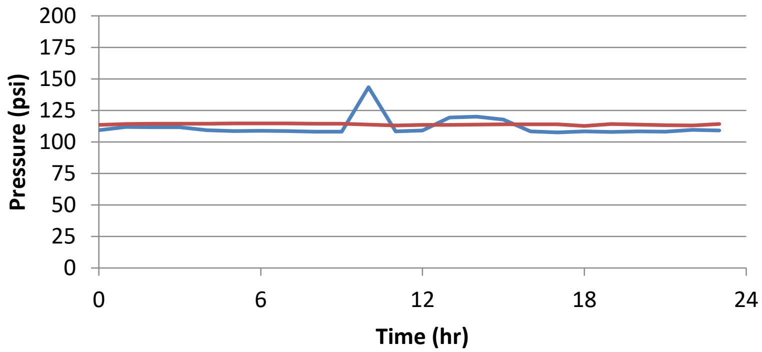
April 14, 2021

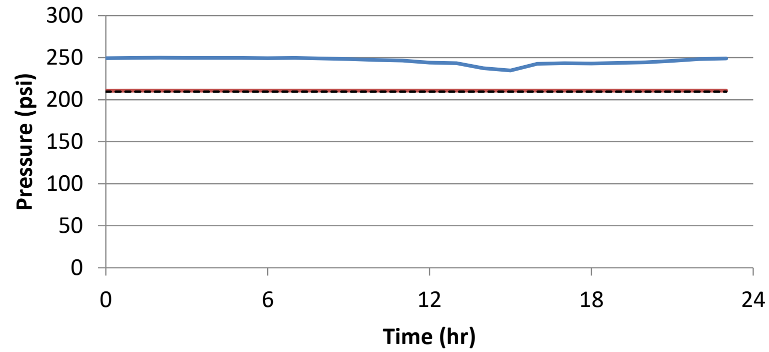
Figure 6.3
Pressure Logger Calibration
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

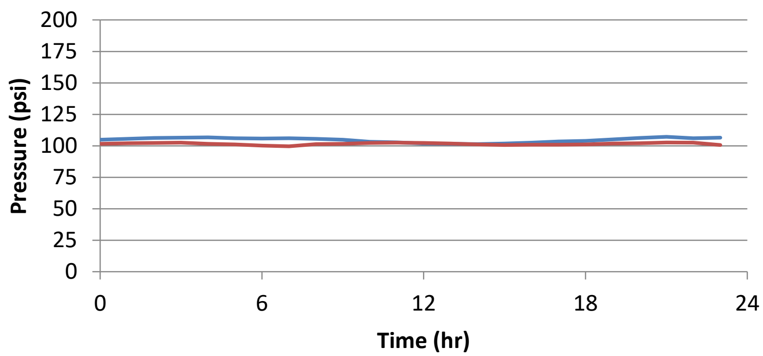
Pressure Logger RE2
Zone 4 - Reader
Bear Creek Rd and Monte Vista Ln



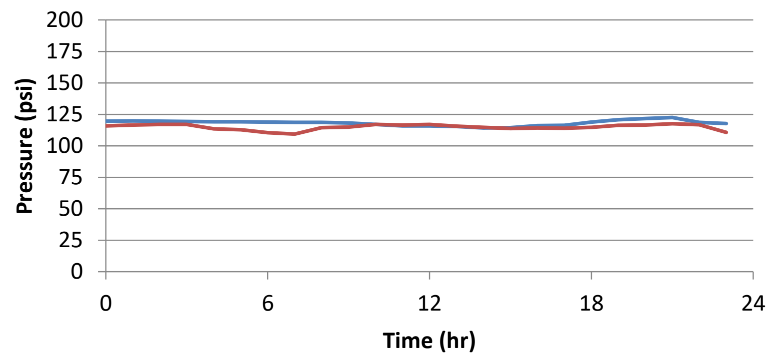
Pressure Logger LE1
Zone 35 - Lewis
Lompico Ave and Creekwood Dr



Pressure Logger BD1
Zone 16 - Brookdale
Riverside Dr and California Dr



Pressure Logger BD2
Zone 16 - Brookdale
Glen Arbor Rd and Newell Creek



LEGEND

- Telemetry Data
- Model Data
- Expected Data based on HGL (does not include head loss through pipe)

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April 14, 2021

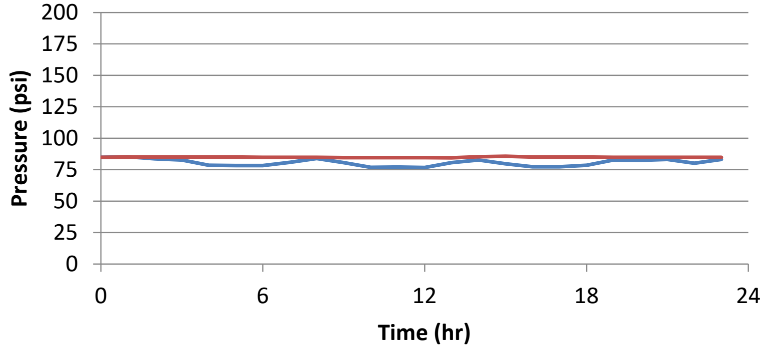
Figure 6.3
Pressure Logger Calibration
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley Water District

Pressure Logger UN1

Zone 20 - University

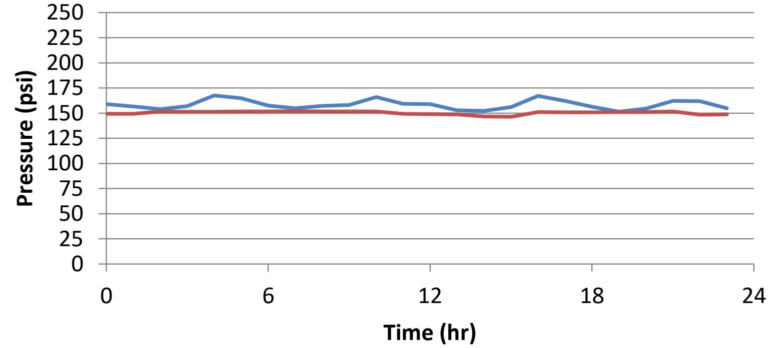
Hihn Rd and El Alamein Rd



Pressure Logger QU1

Zone 21 - Quail

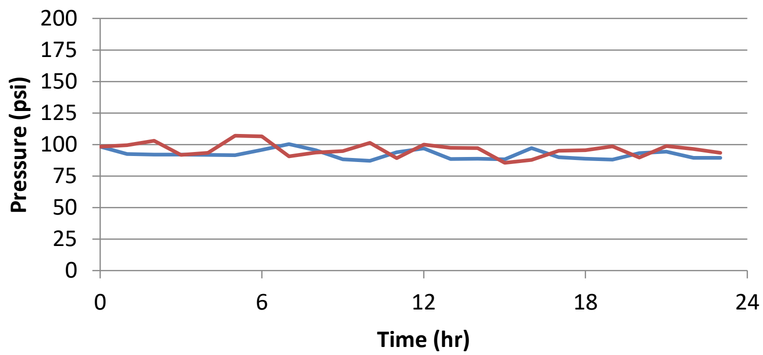
East Zayante Rd and Lompico Rd



Pressure Logger MC1

Zone 31 - McCloud

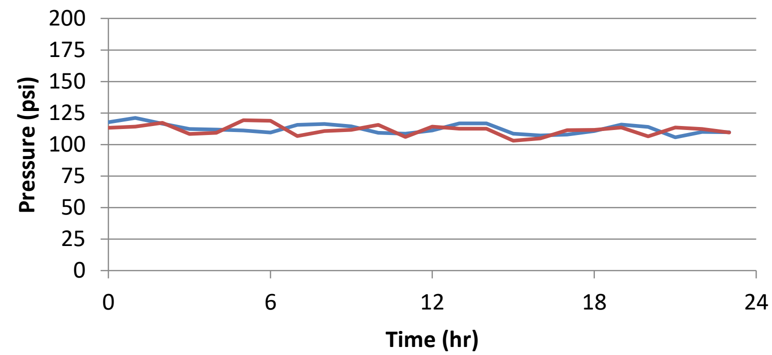
Hwy 9 and SLV High School



Pressure Logger MC2

Zone 31 - McCloud

Hwy 9 and River Ln



LEGEND

Telemetry Data

Model Data

Expected Data based on HGL (does not include head loss through pipe)

AKEL ENGINEERING GROUP, INC.

April 14, 2021

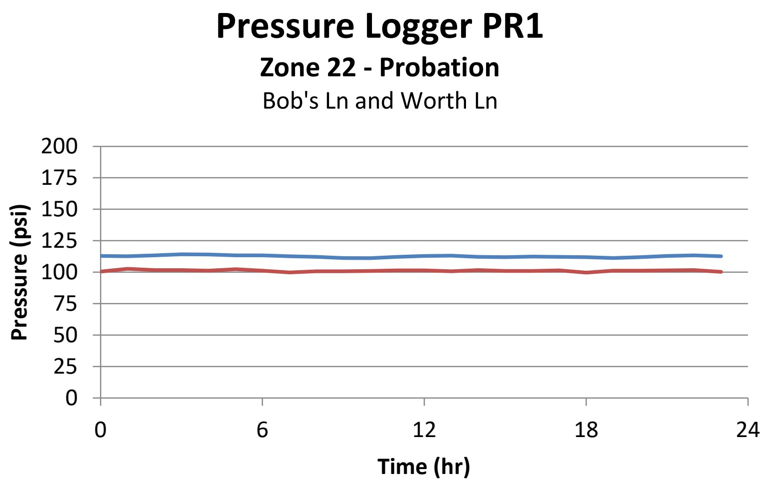
Figure 6.3

Pressure Logger Calibration

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley Water District



LEGEND

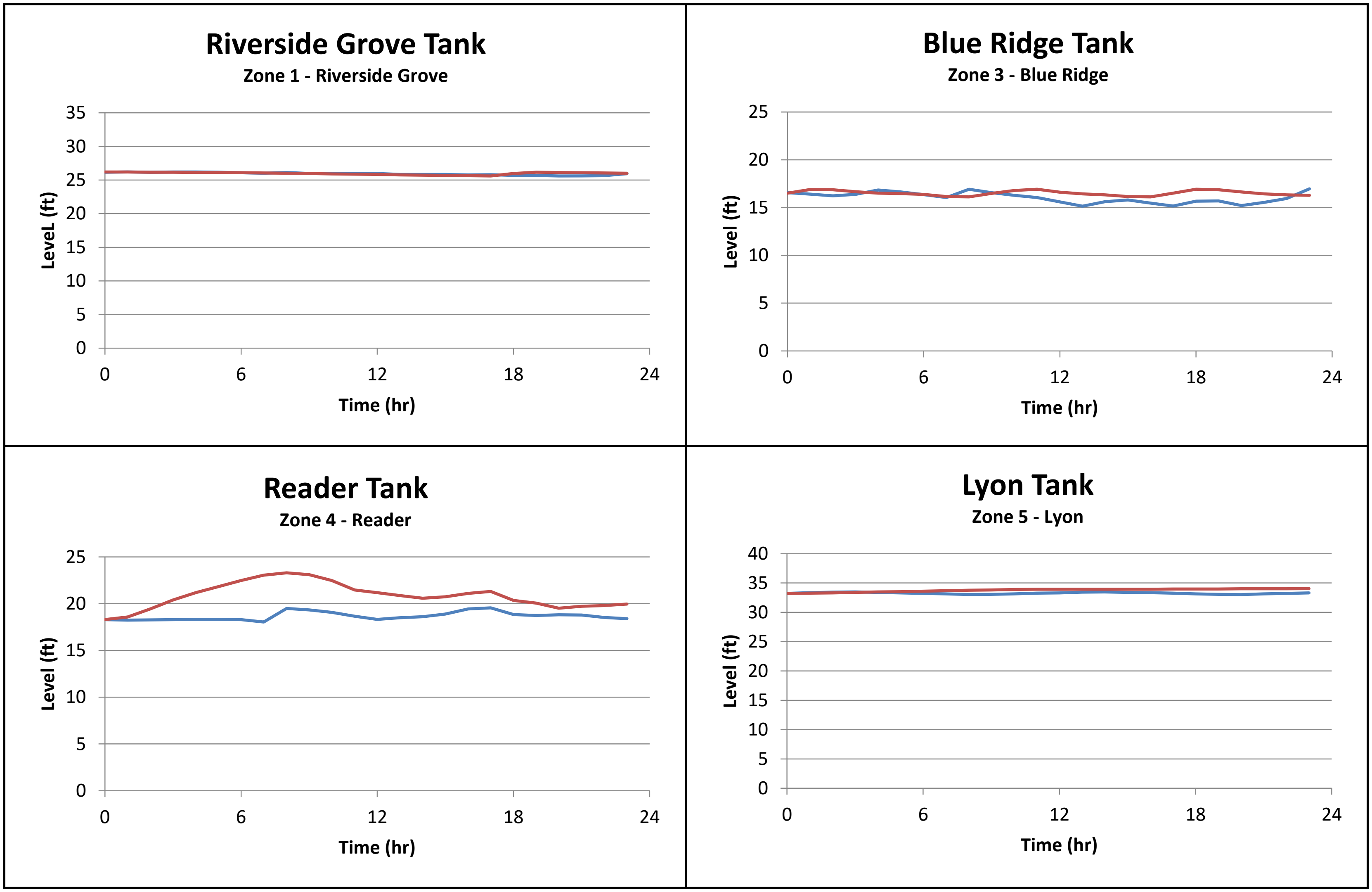
Telemetry Data
Model Data

AKEL ENGINEERING GROUP, INC.

April 14, 2021

Figure 6.3
Pressure Logger Calibration
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



LEGEND

Telemetry Data
Model Data

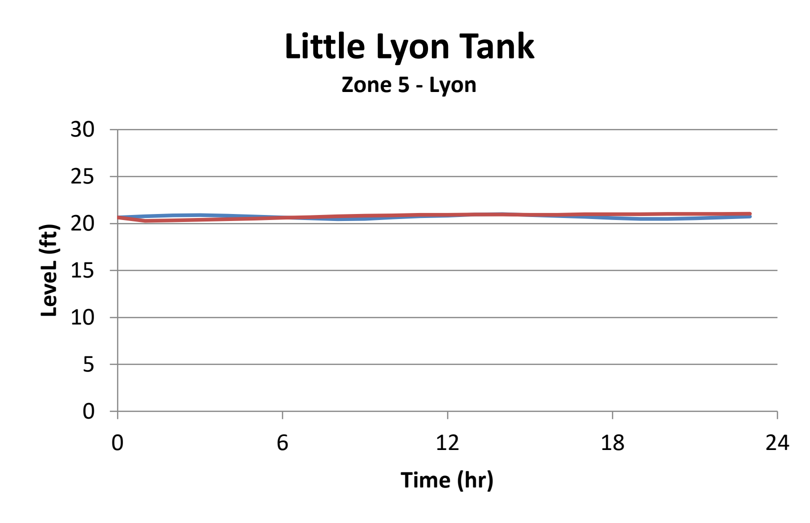
AKEL ENGINEERING GROUP, INC.

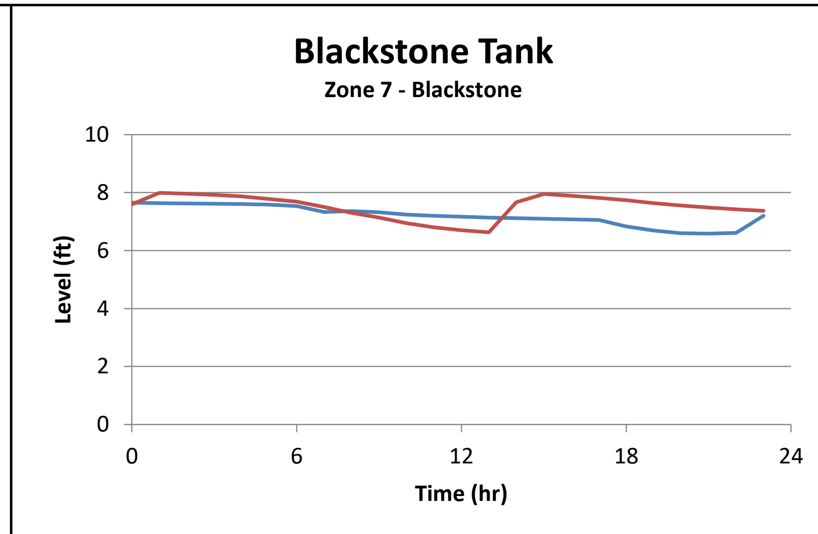
April 14, 2021

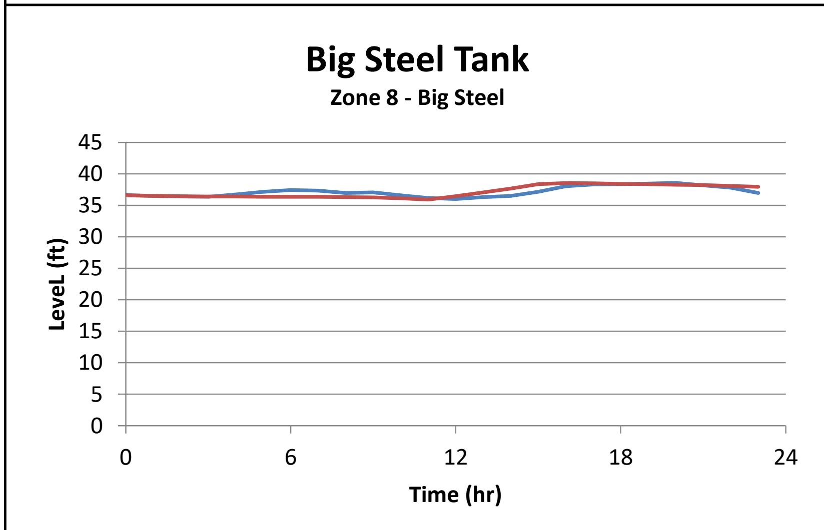
Figure 6.4
Tank Calibration

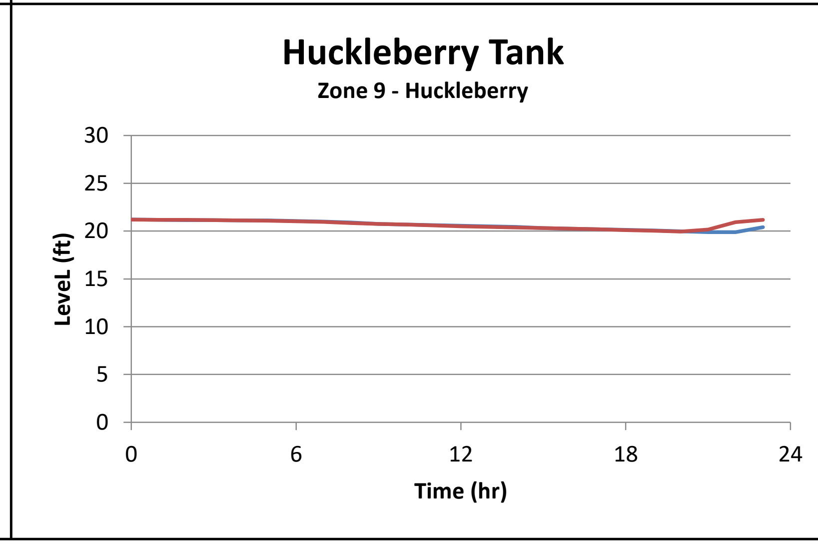
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley Water District









LEGEND

Telemetry Data
Model Data

AKEL ENGINEERING GROUP, INC.

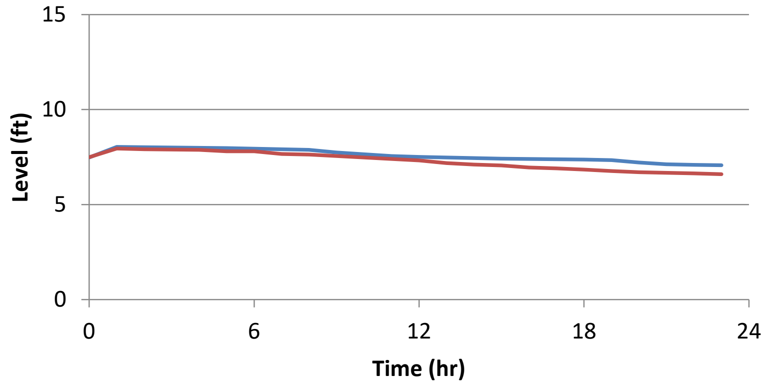
April 14, 2021

Figure 6.4
Tank Calibration
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley Water District

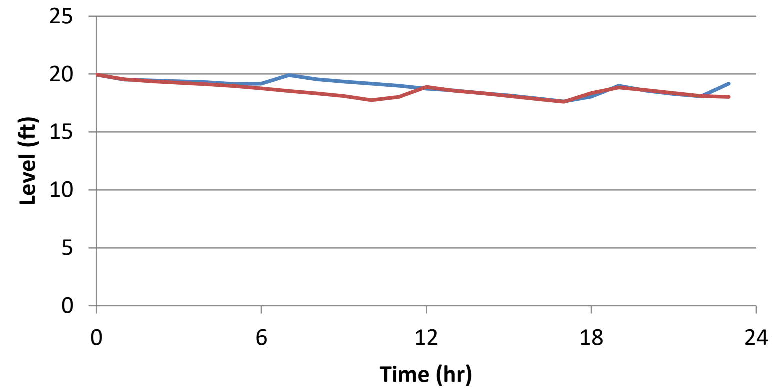
Ralston Tank

Zone 10 - Ralston



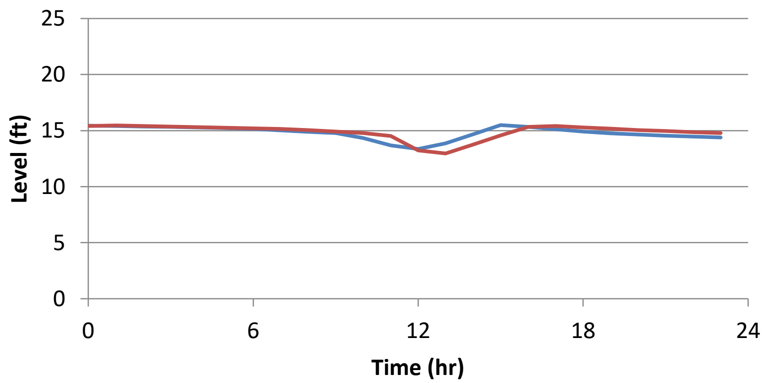
Bear Creek Tank

Zone 11 - Bear Creek



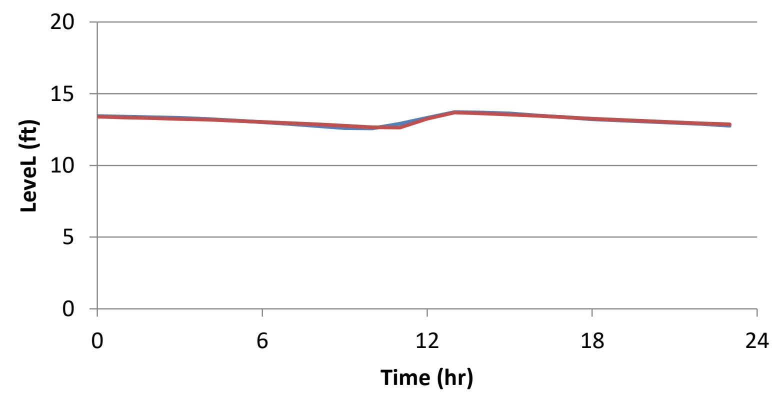
Highland Tank

Zone 13 - Highland



Nina Tank

Zone 14 - Nina



LEGEND

Telemetry Data

Model Data

AKEL ENGINEERING GROUP, INC.

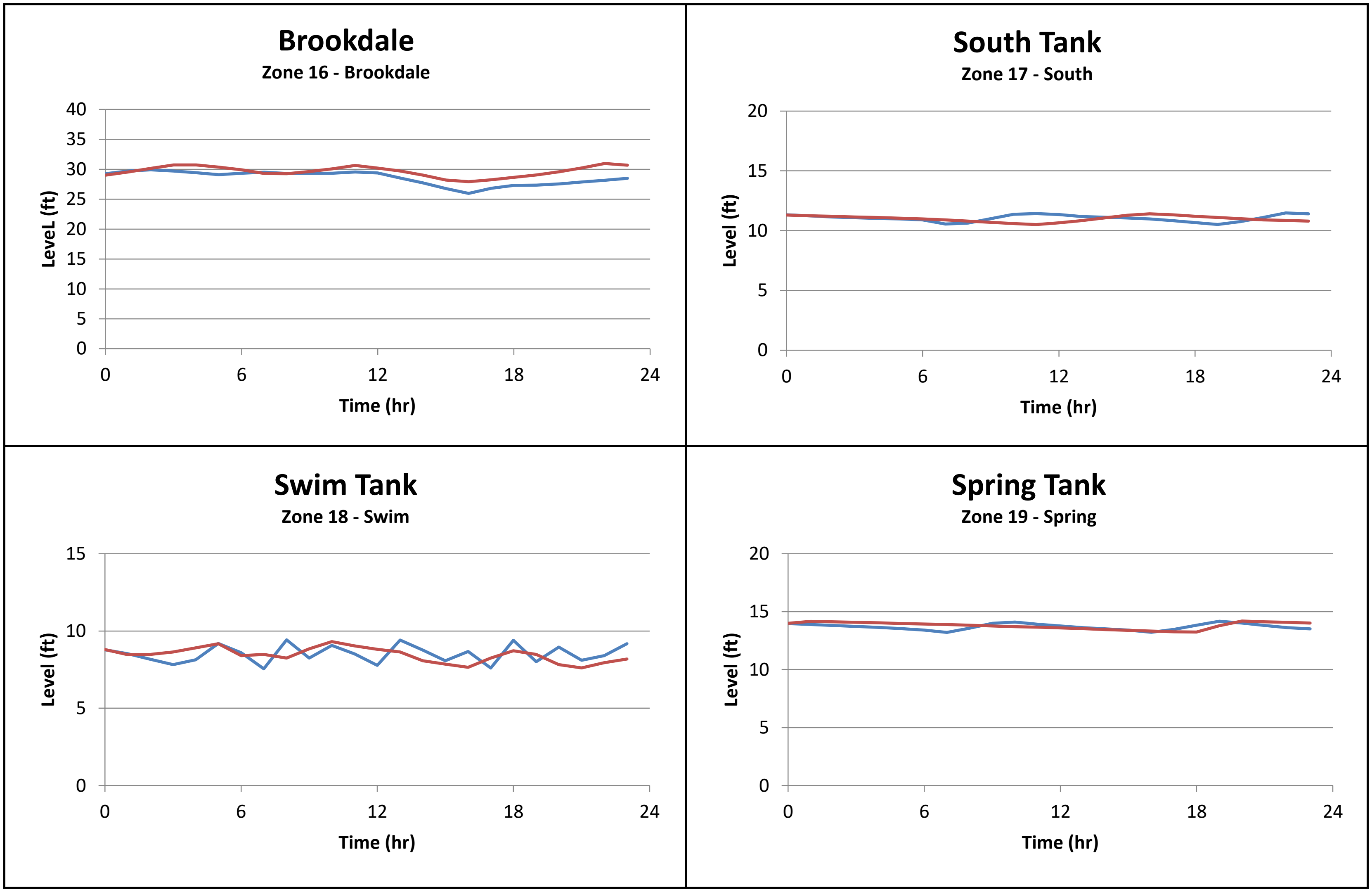
April 14, 2021

Figure 6.4

Tank Calibration

Water Master Plan

San Lorenzo Valley Water District



LEGEND

- Telemetry Data
- Model Data

April 14, 2021

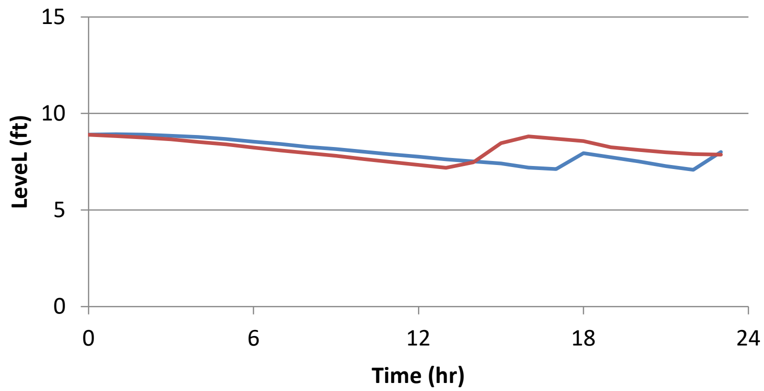
Figure 6.4

Tank Calibration

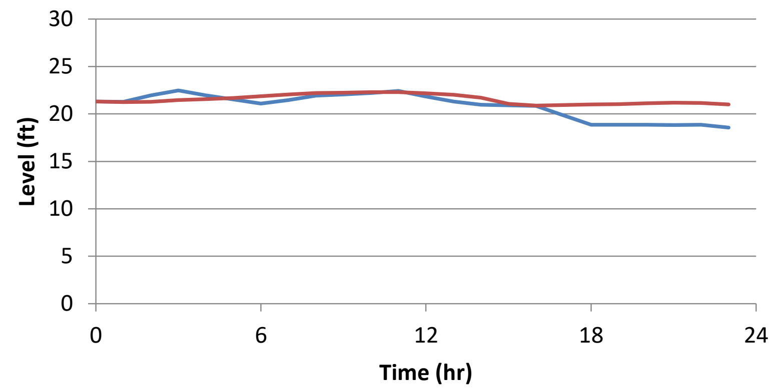
Water Master Plan

San Lorenzo Valley Water District

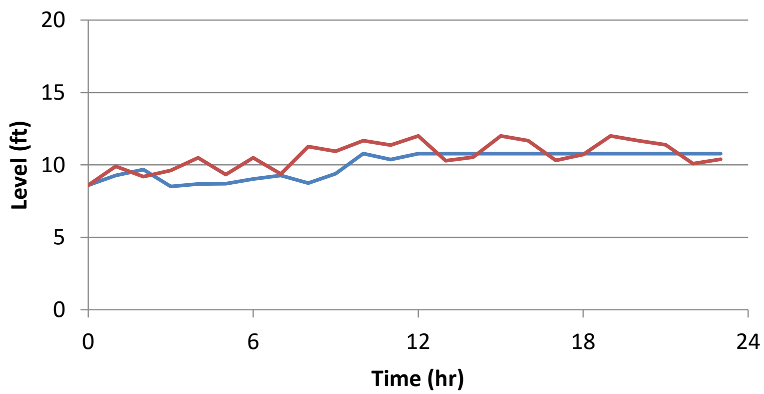
University Tank
Zone 20 - University



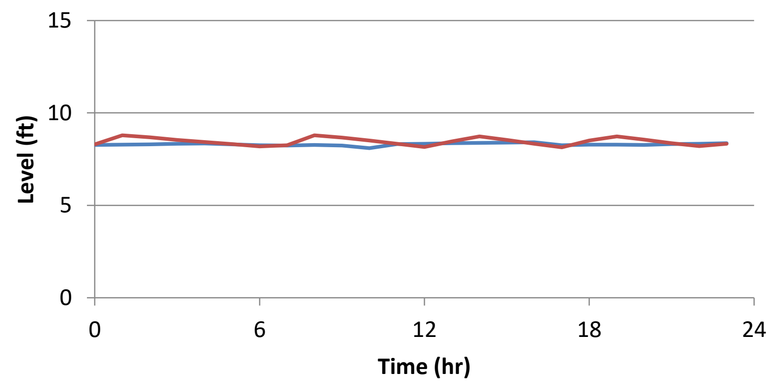
Quail Tank
Zone 21 - Quail



Probation Tank
Zone 22 - Probation



Upper Pasatiempo Tank
Zone 23 - Upper Pasatiempo



LEGEND

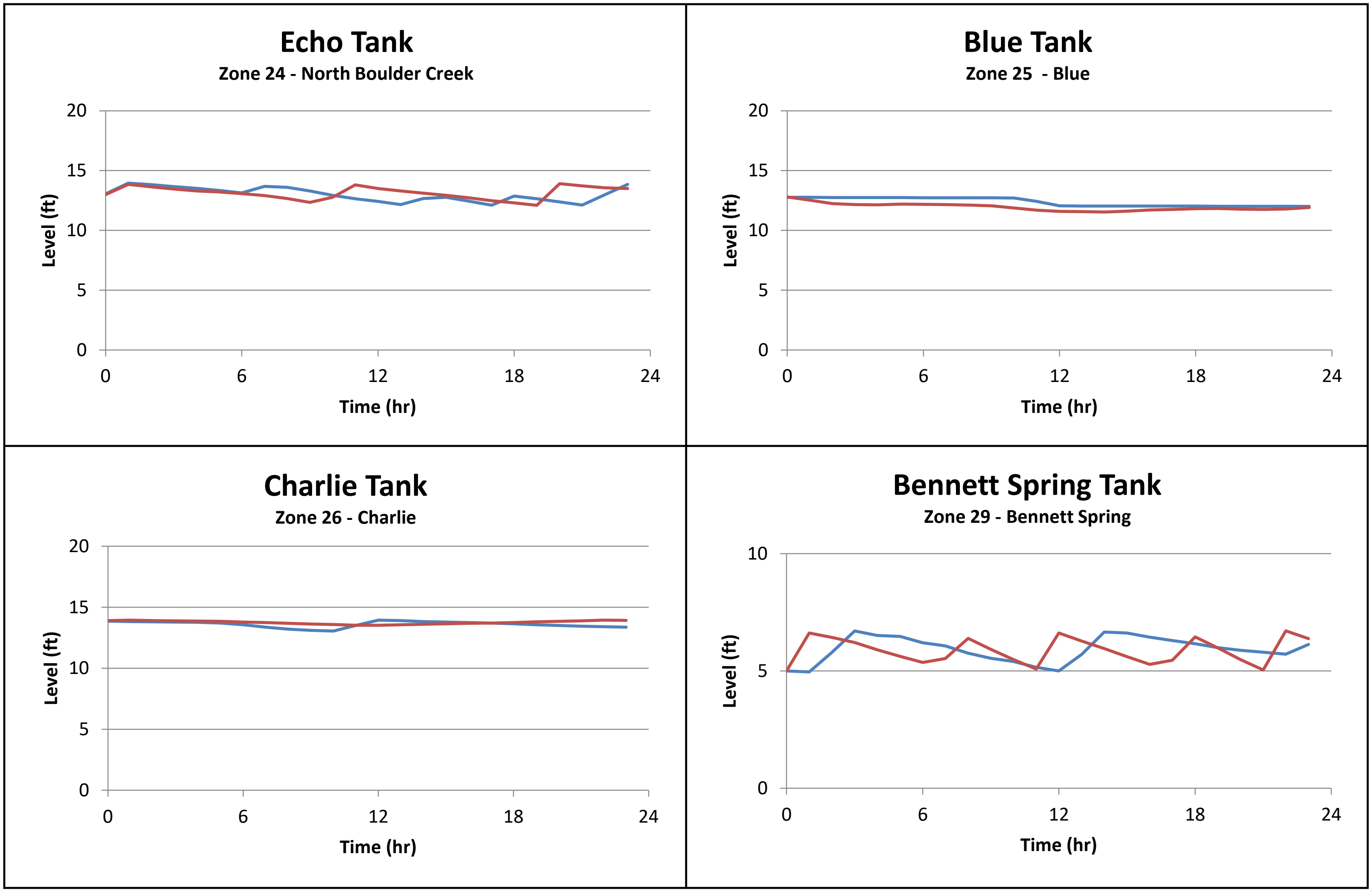
- Telemetry Data
- Model Data

AKEL ENGINEERING GROUP, INC.

April 14, 2021

Figure 6.4
Tank Calibration
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley Water District



LEGEND

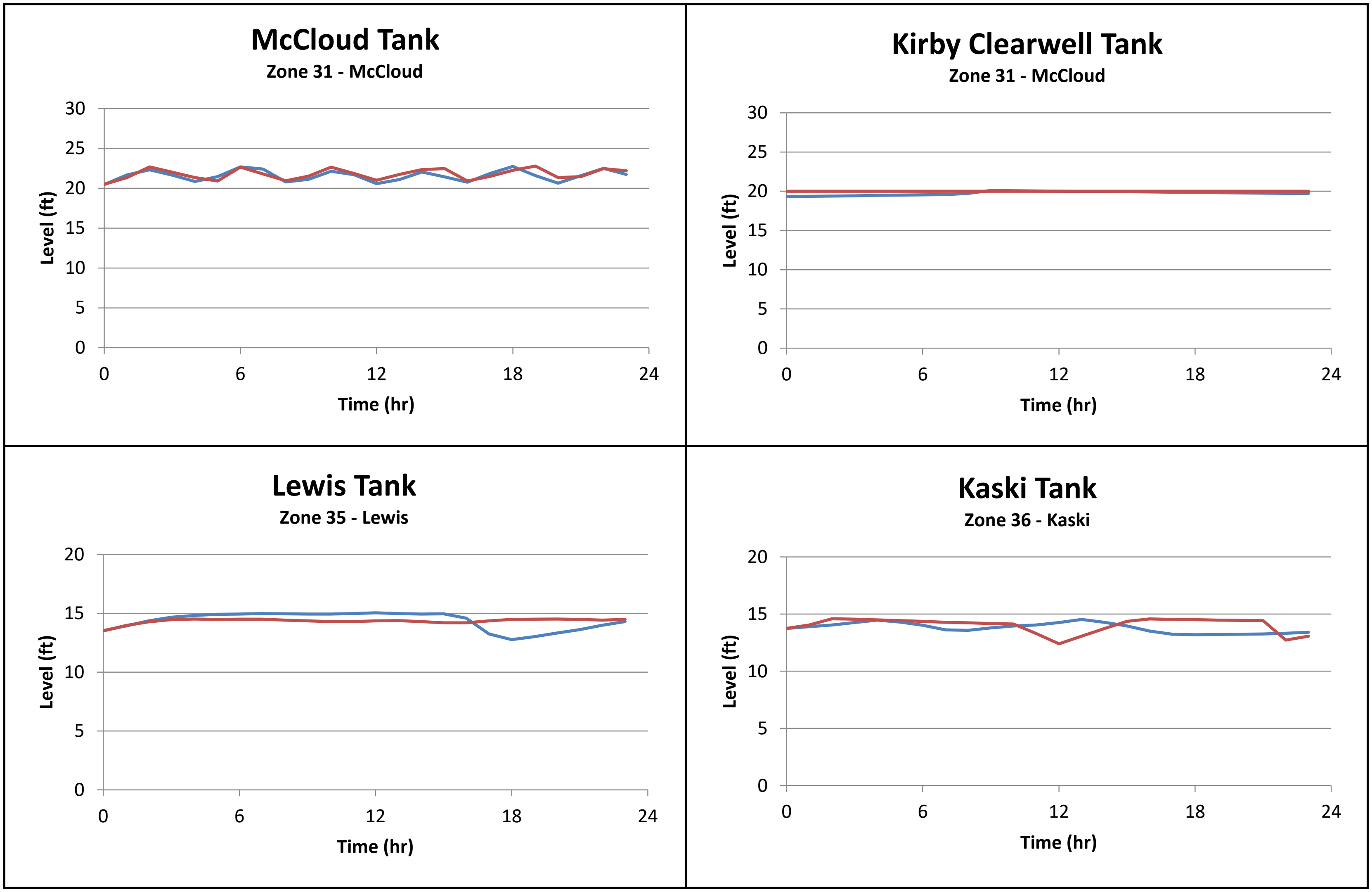
Telemetry Data
Model Data

AKEL ENGINEERING GROUP, INC.

April 14, 2021

Figure 6.4
Tank Calibration
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



LEGEND

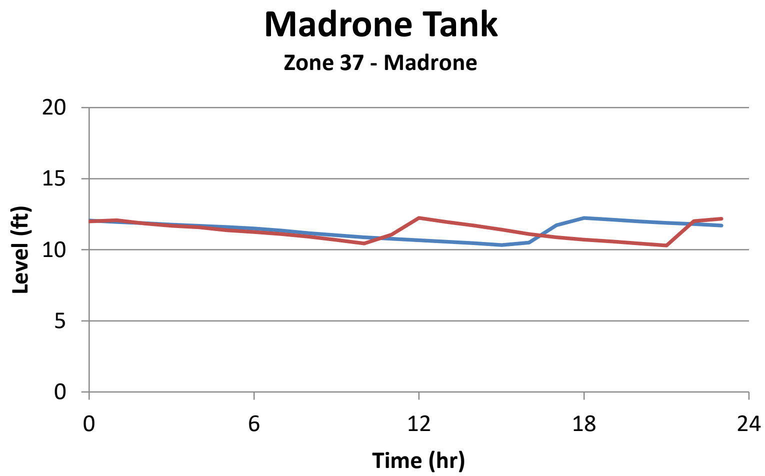
Telemetry Data
Model Data

AKEL ENGINEERING GROUP, INC.

April 14, 2021

Figure 6.4
Tank Calibration
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley Water District



LEGEND

Telemetry Data

Model Data

AKEL ENGINEERING GROUP, INC.

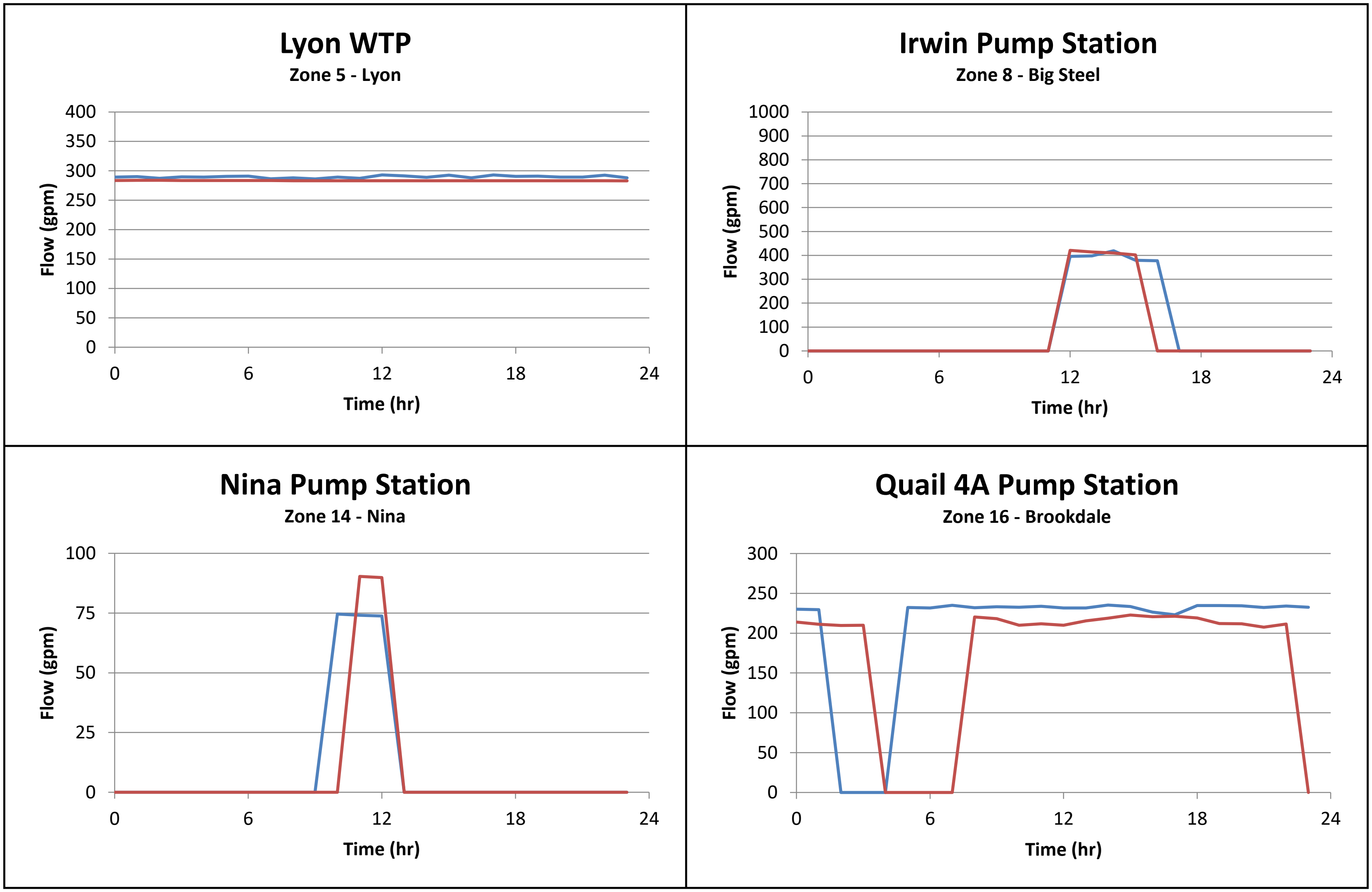
April 14, 2021

Figure 6.4

Tank Calibration

Water Master Plan

San Lorenzo Valley Water District



LEGEND

Telemetry Data

Model Data

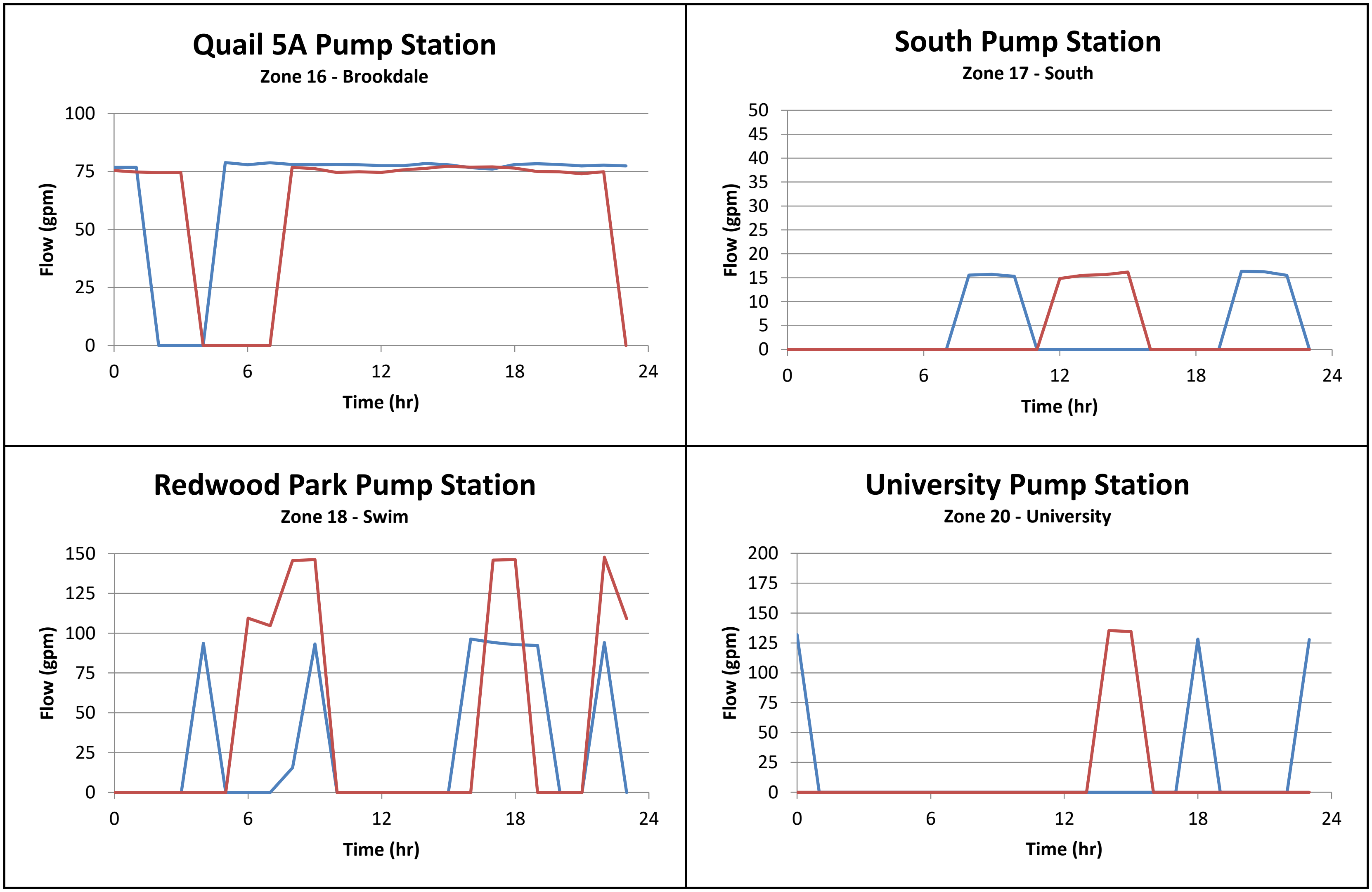
AKEL ENGINEERING GROUP, INC.

April 14, 2021

Figure 6.5
Pump Calibration

Water Master Plan

San Lorenzo Valley Water District



LEGEND

Teletry Data

Model Data

AKEL ENGINEERING GROUP, INC.

April 14, 2021

Figure 6.5

Pump Calibration

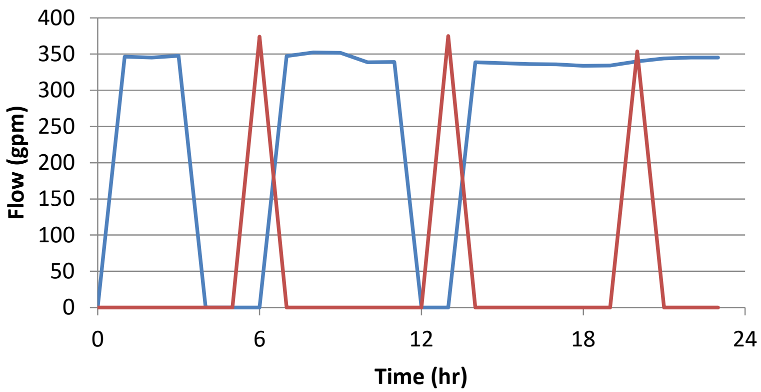
Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

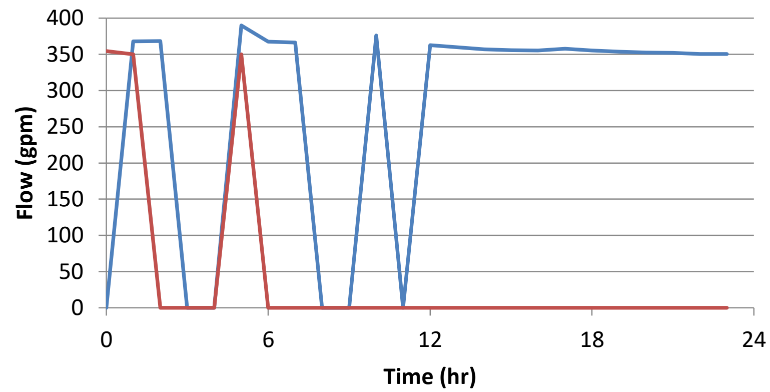
Olympia 2 Pump Station

Zone 21 - Quail



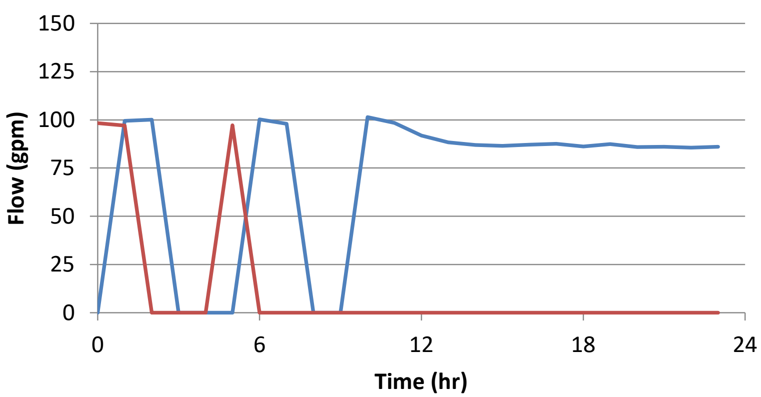
Pasatiempo 5 Pump Station

Zone 22 - Probation



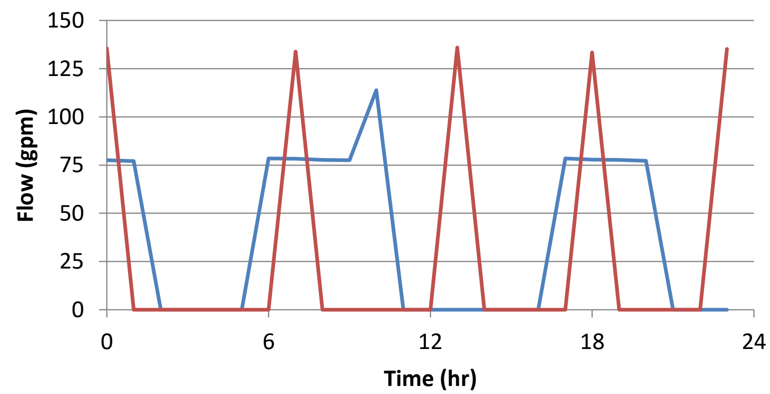
Pasatiempo 7 Pump Station

Zone 22 - Probation



Lower Pasatiempo Pump Station

Zone 23 - Upper Pasatiempo



LEGEND

Telemetry Data

Model Data

AKEL ENGINEERING GROUP, INC.

April 14, 2021

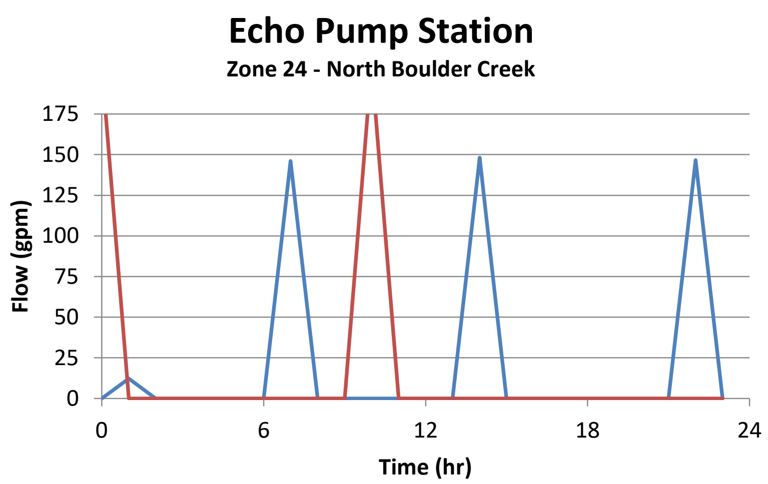
Figure 6.5

Pump Calibration

Water Master Plan

San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



LEGEND

Telemetry Data
Model Data

AKEL
ENGINEERING GROUP, INC.

April 14, 2021

Figure 6.5
Pump Calibration
Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley
WATER DISTRICT

APPENDIX B

Disadvantage Community Cost Analysis

October 19, 2021

San Lorenzo Valley Water District
13060 Highway 9
Boulder Creek, CA 95006

Attention: Rick Rogers
District Manager

Subject: Disadvantage Communities Master Plan Improvements Technical Memorandum

Dear Rick,

We are pleased to submit this technical memorandum documenting the recommended Master Plan improvements for the Disadvantage Communities (DAC) serviced by San Lorenzo Valley Water District (District).

1.1 BACKGROUND

The San Lorenzo Valley Water District provides potable water service to 23,000 residents, as well as numerous commercial, industrial, and institutional establishments. The District operates a domestic water distribution center that consists of 2 water treatment plants, 7 groundwater wells, 55 storage tanks equating to 9.3 million gallons in storage, and over 183 miles of distribution pipelines.

As part of the 2021 Water System Master Plan, a capacity evaluation of the existing and future water system was performed, improvements were recommended, and a capital improvement plan was developed. This technical memorandum will address the improvements for (or directly servicing) the disadvantaged communities within San Lorenzo Valley Water District. Within the San Lorenzo Valley Water District service area boundary there are approximately 762 acres of disadvantaged communities as identified on **Figure 1**.

A “disadvantaged community” is defined in the California Water Code (§79505.5(a)) as “a community with an annual median household income [MHI] that is less than 80 percent of the statewide annual median household income.” Communities are geographically defined based upon U.S. Census designations (i.e., Census Designated Place, Block Group, and Tract). MHI is determined based upon the U.S. Census Bureau’s American Community Survey (ACS) which collects information annually on social, economic, demographic, and housing characteristics of the U.S. population. The 5-year ACS estimates represent data collected over a period of time.

The Department of Water Resources (DWR) provides an interactive, internet-based mapping tool to aid in identifying disadvantaged communities. The DAC mapping tool utilizes the ACS 5-year data sets. For the purpose of this report, the communities identified as disadvantaged are based upon the 2012-2016 ACS data – which was the most recent dataset available at the outset of the San Lorenzo Valley Water District's efforts to update the Water Master Plan update. The statewide MHI in 2016, based on the five-year ACS data, was $63,783. Therefore, communities with an MHI below $51,026 were considered DAC (80% of statewide MHI), and an MHI below $38,270 were considered a "severely disadvantaged" (60% of statewide MHI).

It is important to note that the DAC communities identified based upon ACS data represent a snap-shot in time. The disadvantaged community status of any given community may change as new ACS 5-year data becomes available. Changes occurred between the 2012 - 2016 and the 2014 - 2018 period and are anticipated to change again with the 2016 – 2020 5-year ACS data that will be released in December 2021.

1.2 HYDRAULIC MODEL DEVELOPMENT AND CALIBRATION

Hydraulic network analysis has become an effectively powerful tool in many aspects of water distribution planning, design, operation, management, emergency response planning, system reliability analysis, fire flow analysis, and water quality evaluations. The District's hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth.

The calibration process for the hydraulic model was extensive, and involved an iterative process which resulted with satisfactory comparisons between the field measurements and the hydraulic model predictions at each well site, the water tanks, and booster stations.

The calibrated hydraulic model was used as an established benchmark in the capacity evaluation of the existing water distribution system. The model was also used to identify improvements necessary for mitigating existing system deficiencies and for accommodating future growth.

1.3 EVALUATION AND PROPOSED IMPROVEMENTS FOR THE DISADVANTAGED COMMUNITIES

The calibrated hydraulic model was used for evaluating the distribution system for capacity deficiencies during peak hour demand and during maximum day demands in conjunction with fire flows. Since the hydraulic model was calibrated for extended period simulations, the analysis duration was established at 24 hours for analysis.

The criteria used for evaluating the capacity adequacy of the domestic water distribution system facilities (transmission mains, storage reservoirs, and booster stations) is summarized on **Table 1**. The recommended improvements are identified on **Figure 2** and summarized in this section.

1.3.1 Fire Flow Analysis and Recommended Improvements

- **P4-2**: Replace approximately 7,920 feet of existing 8-inch water main with new 10-inch water main along Highway 9 from approximately 700 feet southeast of Douglas Avenue to approximately 250 feet south of Big Basin Way. This improvement is also intended to address an existing deficiency.

- **P4-6**: Replace approximately 1,410 feet of existing 6-inch water main with new 10-inch water main along Dolores Drive and Douglas Avenue from Reader Reservoir to Highway 9. This improvement is also intended to address an existing deficiency.

- **P16-22**: Replace approximately 7,070 feet of existing 6-inch water main with new 8-inch water main along Glen Arbor Road and Hihn Road from Pine Street to Eleana Drive.

1.3.2 Pipeline Improvements to Fix Existing Deficiencies

- **P4-10**: Replace approximately 510 feet of existing 1-inch, 1.25-inch, and 2-inch main with new 8-inch main along Hiawatha Road from Keller Drive to approximately 400 feet northeast of Keller Drive.

- **P4-15**: Replace approximately 10 feet of existing 1.5-inch main with new 8-inch main within the right-of-way from Irene Avenue to approximately 10 feet west of Irene Avenue.

- **P16-10**: Replace approximately 760 feet of existing 1.25-inch main with new 8-inch main along Love Creek Road from Roberts Road to approximately 350 feet south of Berts Road.

- **P16-11**: Replace approximately 2,470 feet of existing 1.5-inch and 2-inch main with new 8-inch main along Kipling Avenue, Live Oak Avenue, and Pine Street from Longfellow Avenue to Manzanita Avenue.

- **P16-12**: Replace approximately 2,280 feet of existing 1.5-inch and 2-inch main with new 8-inch main along Whittier Avenue and Manzanita Avenue from Brookside Avenue to approximately 300 feet south of Locust Street.

- **P16-13**: Replace approximately 2,410 feet of existing 1-inch and 2-inch main with new 8-inch main along Pine Street, Glen Arbor Road, and Madrone Avenue from Manzanita Avenue to Railroad Avenue.

- **P16-14:** Replace approximately 640 feet of existing 1-inch main with new 8-inch main along Hillcrest Avenue from Highway 9 to Manzanita Avenue.

- **P16-15:** Replace approximately 790 feet of existing 1-inch main with new 8-inch main along Circle Drive and Urbana Lane from Hillcrest Avenue to approximately 50 feet east of Manzanita Avenue

1.3.3 Valve Improvements

- **PRV4-1:** Install a new pressure reducing valve from Lyon Zone near the intersection of Highway 9 and Lorenzo Street. This improvement is intended to provide supply to Reader Zone and dependent zones from Lyon Zone instead of Big Steel Zone. The Firehouse pump station can be abandoned but is recommended to stay online if condition permits to be used as an emergency supply backup for the North System. This valve improvement will also mitigate a portion of the deficiency at the Irwin Pump Station

1.3.4 Booster Improvements

- **PS13-1:** Upgrade the existing Fairview Pump Station with larger capacity pumps, PS-Z13. This pump station will have two new 110 gpm pumps for a total pump station capacity of 220 gpm and a firm capacity of 110 gpm

1.3.5 Reservoir Improvements

- **T4-1**: Construct a new 420,000 gallon storage reservoir at the existing Reader Tank Site.
- **T11-1**: Construct a new 310,000 gallon storage reservoir at the existing Bear Creek Tank Site.
- **T13-1**: Replace the existing Highland storage reservoir (60,000 gallons) with a new 130,000 gallon storage reservoir. This improvement is intended to replace the existing reservoir, which is an aging wood tank

1.4 DISADVANTAGED COMMUNITY CAPITAL IMPROVEMENT PROGRAM

This chapter provides a summary of the recommended domestic water system improvements to mitigate existing capacity deficiencies and to accommodate anticipated future growth for the disadvantage communities. The chapter also presents the cost criteria and methodologies for developing the capital improvement program.

1.4.1 Cost Estimate Accuracy and Unit Costs

Costs developed for this technical memorandum should be considered “Order of Magnitude” and have an expected accuracy range of **-30 percent** and **+50 percent**.

- **Order of Magnitude Estimate.** This classification is also known as an “original estimate”, “study estimate”, or “preliminary estimate”, and is generally intended for master plans and studies.

This estimate is not supported with detailed engineering data about the specific project, and its accuracy is dependent on historical data and cost indexes.

The unit cost estimates used in developing the Capital Improvement Program are summarized on **Table 2** and are intended for developing the Order of Magnitude estimate and do not account for site specific conditions, labor and material costs during the time of construction, final project scope, implementation schedule, detailed utility and topography surveys for reservoir sites, investigation of alternative routings for pipes, and other various factors. Domestic water pipeline unit costs are based on length of pipes, in feet. Storage reservoir unit costs are based on capacity, per million gallons (MG). Pump Station costs are based on an equation that replaces the pump curve. Valve improvements are a flat cost based on previous projects constructed by the District.

1.4.2 Capital Improvement Program and Cost Allocation

The Capital Improvement Program costs for the projects identified in this technical memorandum for mitigating existing system deficiencies and for serving anticipated future growth within the disadvantage communities are summarized on **Table 3**.

Each improvement was assigned a unique coded identifier associated with the improvement type and is summarized graphically on **Figure 2**. The estimated construction costs include the baseline costs plus **30 percent** contingency allowance to account for unforeseen events and unknown field conditions, as described in a previous section. Capital improvement costs include the estimated construction costs plus **30 percent** project-related costs (engineering design, project administration, construction management and inspection, and legal costs).

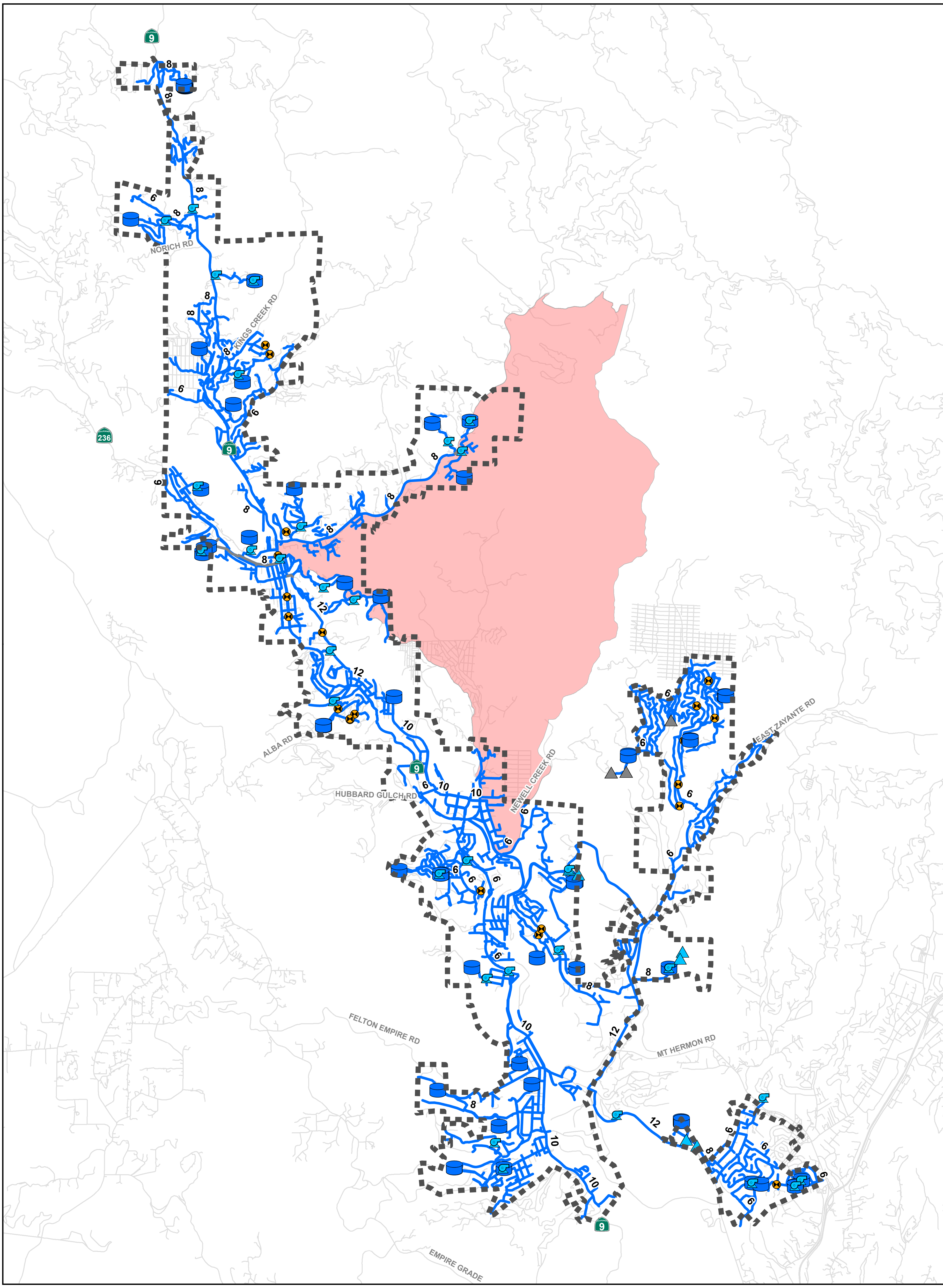
Also included in **Table 3** is the cost allocation for improvements that only partially serve these disadvantage communities such as transmission mains or booster stations that also serve other users. The total cost for improvements within or partially servicing the DAC areas is approximately $7.3 million.

We are extending our thanks to District staff whose courtesy and cooperation were valuable components in completing this analysis and producing this technical memorandum.

Sincerely,

AKEL ENGINEERING GROUP, INC.

Tony Akel, P.E.
Principal



Legend

Existing System

- Pump Station
- Abandoned Pump Station
- Wells
- Wells (Inactive)
- Tank
- Valve
- Existing Pipelines
- Abandoned Pipelines
- Disadvantaged Communities
- Planning Area

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Update: July 19, 2021

0 0.25 0.5 1 Mile

N E S W

Figure 1 Disadvantaged Communities

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

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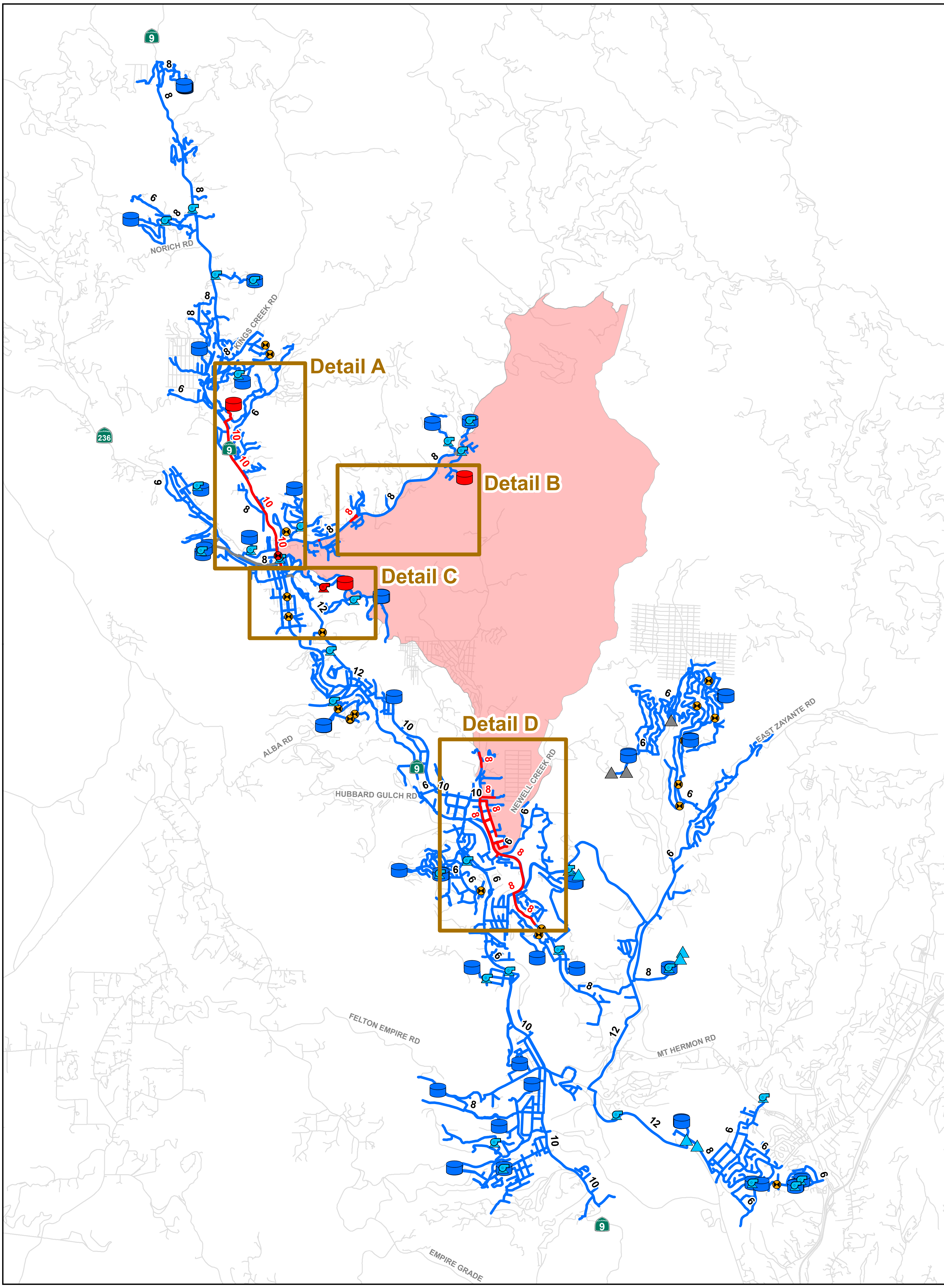


Legend

Recommended Improvements	Existing System	
Pump Station	Pump Station	Existing Pipelines
Tank	Abandoned Pump Station	Abandoned Pipelines
PRV	Wells	Disadvantaged Communities
Pipelines	Wells (Inactive)	
	Tank	
	Valve	

Update: August 4, 2021

0 0.25 0.5 1 Mile

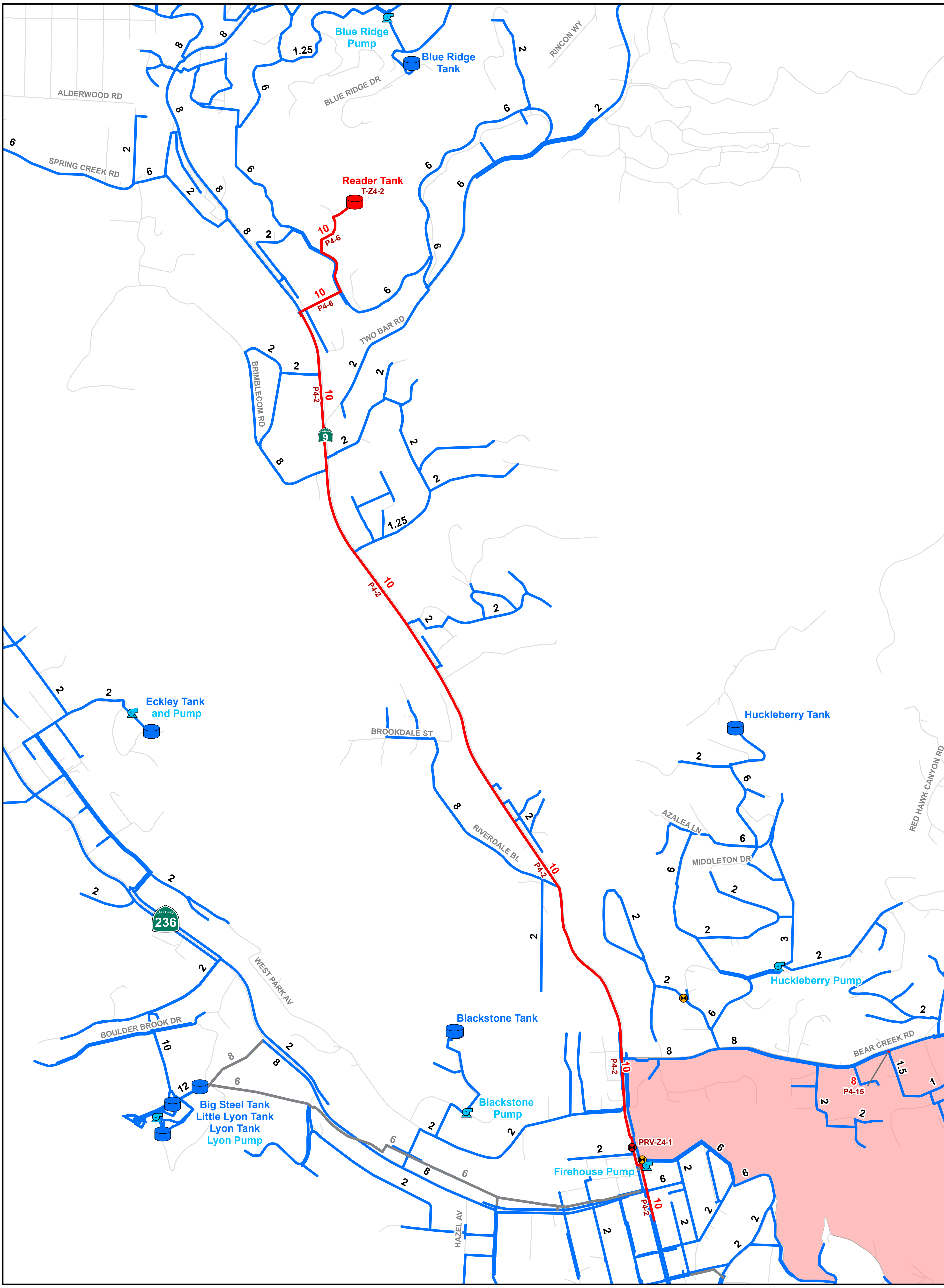
Figure 2
Capital Improvement Program Disadvantaged Communities

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_Fig2_ReclImp_080421.mxd



Legend

Recommended Improvements	Existing System	
Pump Station	Pump Station	Existing Pipelines
Tank	Abandoned Pump Station	Abandoned Pipelines
PRV	Wells	Disadvantaged Communities
Pipelines	Wells (Inactive)	
	Tank	
	Valve	

0 250 500 1,000 Feet

Update: August 4, 2021

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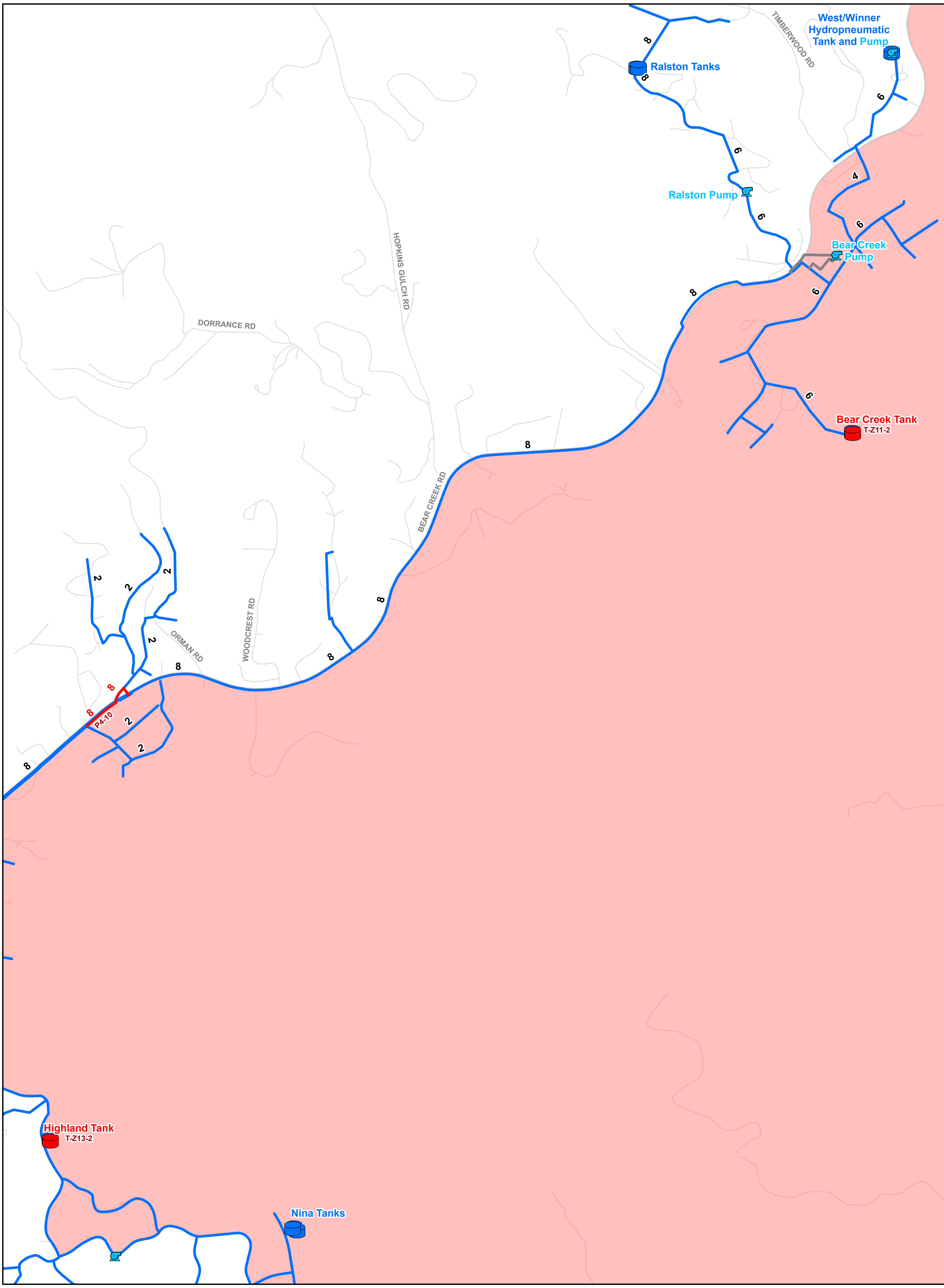
File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_DetailA_ReclImp_080421.mxd

Figure 2 - Detail A
Capital Improvement Program Disadvantaged Communities

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT



Legend

Recommended Improvements	Existing System	
Pump Station	Pump Station	Existing Pipelines
Tank	Abandoned Pump Station	Abandoned Pipelines
PRV	Wells	Disadvantaged Communities
Pipelines	Wells (Inactive)	
	Tank	
	Valve	

Update: August 4, 2021

0 245 490 980 Feet

N W E S

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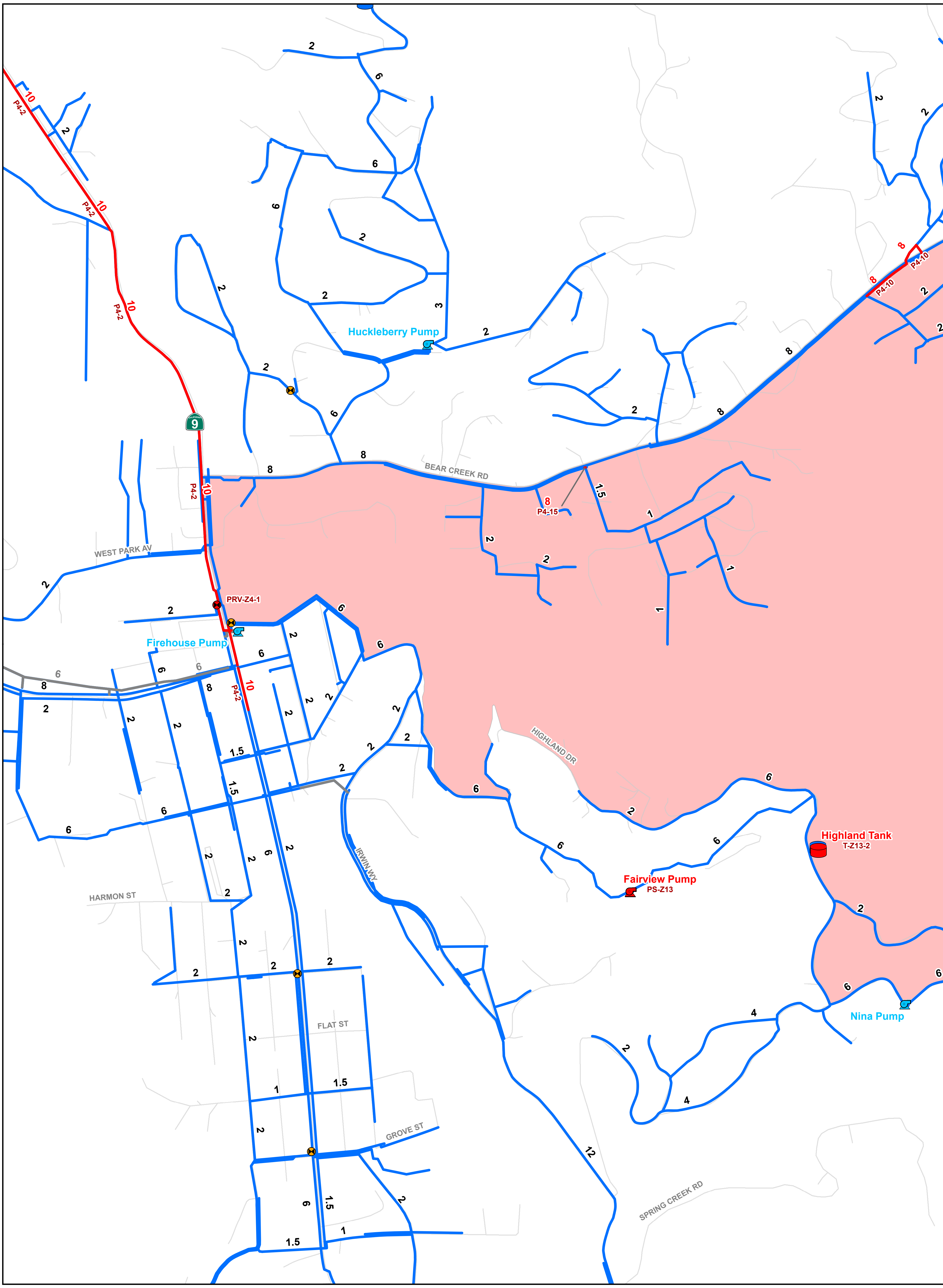
Figure 2 - Detail B
Capital Improvement Program
Disadvantaged Communities

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_DetailB_RecImp_080421.mxd



Legend

Recommended Improvements
- Pump Station
- Tank
- PRV
- Pipelines

Existing System
- Pump Station
- Abandoned Pump Station
- Wells
- Wells (Inactive)
- Tank
- Valve

- Existing Pipelines
- Abandoned Pipelines
- Disadvantaged Communities

Update: August 4, 2021

0 210 420 840 Feet

N W E S

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Figure 2 - Detail C
Capital Improvement Program
Disadvantaged Communities

Water Master Plan
San Lorenzo Valley Water District

San Lorenzo Valley WATER DISTRICT

File Path: P:\xGIS\GIS_Projects\San_Lorenzo_Valley_WD\Final\Appendix\SLVWD_DetailC_ReclImp_080421.mxd

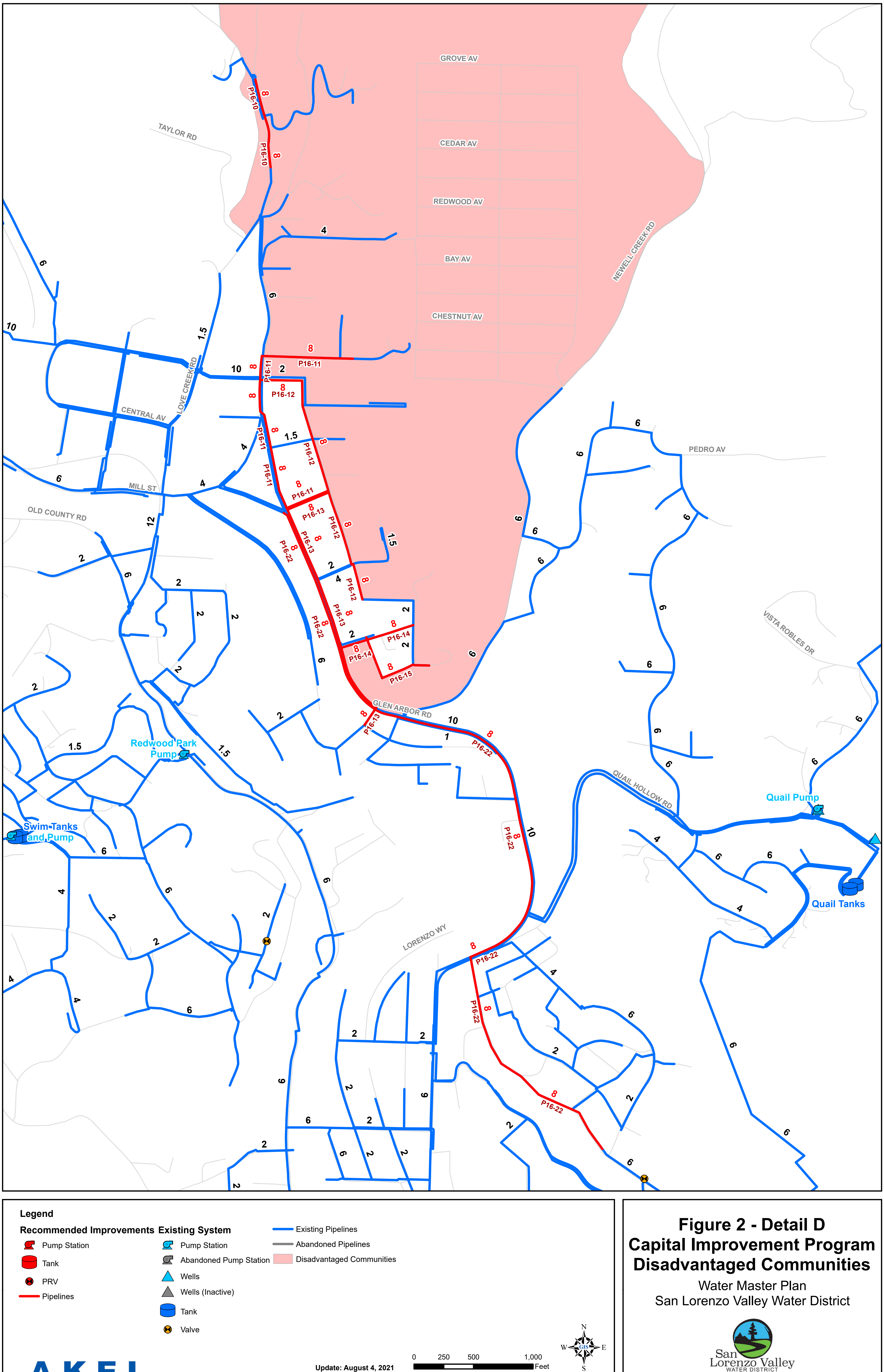

Figure 2 - Detail D
Capital Improvement Program
Disadvantaged Communities

Water Master Plan
San Lorenzo Valley Water District

Table 1 Design and System Performance Criteria
Water Master Plan
San Lorenzo Valley Water District

PRELIMINARY

Design Parameter	Preliminary Criteria
DESIGN CRITERIA	
Demand Peaking Factors	
Maximum Day Demand	*1.5 x Average Day Demand*
Peak Hour Demand	*1.5 x Maximum Day Demand*
Supply Capacity Requirement	
Total Supply Requirement	Firm Supply Capacity = Maximum Day Demand
Storage Capacity Requirement	
Total Storage Requirement	Total Required Storage = Operational + Fire
Operational	**50%** of Maximum Day Demand
Fire Flow	Varies
Pump Stations Capacity Requirement[1]	
Booster Pump Stations	Firm Capacity to provide maximum day demand over 8 hours
Hydropneumatic Pump Stations	Firm Capacity = Peak Hour Demand
Transmission and Distribution Pipelines Capacity Requirements	
Maximum Velocity	
Maximum Day Demand + Fire Flow	**10** ft/s
Maximum Headloss	
Peak Hour Demand	**10** ft/k-ft
Minimum Pipeline Sizes	
New Pipelines	**8** inch
Pressure Reducing Valves Capacity Requirements	
Valve Size	Maximum Flow based on the greater of Peak Hour Demand and Maximum Day Demand + Fire Flow
PERFORMANCE CRITERIA	
Fire Flow Requirements	
Single Family Residential	**1,000 gpm** for **2 hours**
Multi-Family Residential	**1,500 gpm** for **2 hours**
Commercial/Institutional	**2,000 gpm** for **3 hours**
Distribution System Service Pressures	
Maximum Pressures	
At Service Connections	**80 psi**
In Pipelines	**130 psi**
Minimum Pressures	
Peak Hour Demand	**40 psi**
Maximum Day Demand + Fire Flow	**20 psi**

Table 2 Unit Costs

Water Master Plan
San Lorenzo Valley Water District

PRELIMINARY

Pipelines	
Pipe Size (in)	**Cost** ($/Lineal Foot)
6	188
8	202
10	217
12	233
16	280
18	301
20	345
24	378
30	418
36	493

Valves [2]

New Valve	$32,000 per Valve

Booster Pump Station

Estimated Pumping Station Unit Cost ($/gpm), where Q is equal to the total station capacity in gpm

Construct New Pump	Unit Cost = 209.70 x $e^{-0.0001 \times Q}$
Upgrade Existing Pump	Unit Cost = 175.82 x $e^{-0.00008 \times Q}$

Storage [2]

$3.11 / gallon

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9/7/2021

Notes :

1. Construction costs estimated using June 2021 ENR CCI of 12,112.
2. Unit costs based on comparable projects shown in SLVWD Capital Improvement Projects.

Table 3 Capital Improvement Program - Disadvantaged Communities
Water Master Plan
San Lorenzo Valley Water District

PRELIMINARY

Improv. No.	Pressure Zone	Improv. Type	Alignment	Limits	Priority	Improvement Details				Infrastructure Costs Unit Cost ($/unit)	Infrastructure Costs Infr. Cost ($)	Baseline Construction Cost ($)	Estimated Construction Cost[1] ($)	Capital Improvement Cost[2] ($)	Direct Service to Disadvantaged Communities (%)	Direct Service to Disadvantaged Communities ($)	Construction Trigger	Suggested Cost Allocation Existing Users	Suggested Cost Allocation Future Users	Cost Sharing Existing Users ($)	Cost Sharing Future Users ($)
Pipeline Improvements						Existing Diameter Communities	New/ Replace	Diameter (in)	Length (ft)												
P4-2	Reader	Existing Deficiency / Fire Flow Reliability	Hwy 9	From approx. 700' se/o Douglas Ave to approx. 250' s/o Big Basin Wy	1	8	Replace	10	7,920	217	1,717,100	1,717,100	2,232,300	2,902,000	9%	267,155	Existing Deficiency	100%	0%	2,902,000	0
P4-6	Reader	Existing Deficiency / Fire Flow Reliability	Dolores Dr / Douglas Ave	From Reader Reservoir to Hwy 9	1	6	Replace	10	1,410	217	305,700	305,700	397,500	516,800	22%	111,495	Existing Deficiency	100%	0%	516,800	0
P4-10	Reader	Existing Deficiency	Hiawatha Rd	From Keller Dr to approx. 400' ne/o Keller Dr	1	1 / 1.25 / 2	Replace	8	510	202	103,100	103,100	134,100	174,400	100%	174,400	Existing Deficiency	100%	0%	174,400	0
P4-15	Reader	Existing Deficiency	ROW	From Irene Ave to approx. 10' w/o Irene Ave	1	1.5	Replace	8	10	202	2,100	2,100	2,800	3,700	100%	3,700	Existing Deficiency	100%	0%	3,700	0
P16-10	Brookdale	Existing Deficiency	Love Creek Rd	From Roberts Rd to approx. 350' s/o Berts Rd	1	1.25	Replace	8	760	202	153,600	153,600	199,700	259,700	100%	259,700	Existing Deficiency	100%	0%	259,700	0
P16-11	Brookdale	Existing Deficiency	Kipling Ave / Live Oak Ave / Pine St	From Longfellow Ave to Manzanita Ave	1	1.5 / 2	Replace	8	2,470	202	499,100	499,100	648,900	843,600	100%	843,600	Existing Deficiency	100%	0%	843,600	0
P16-12	Brookdale	Existing Deficiency	Whittier Ave / Manzanita Ave	From Brookside Ave to approx. 300' s/o Locust St	1	1.5 / 2	Replace	8	2,280	202	460,700	460,700	599,000	778,700	100%	778,700	Existing Deficiency	100%	0%	778,700	0
P16-13	Brookdale	Existing Deficiency	Pine St / Glen Arbor Rd / Madrone Ave	From Manzanita Ave to Railroad Ave	1	1 / 2	Replace	8	2,410	202	486,900	486,900	633,000	822,900	100%	822,900	Existing Deficiency	100%	0%	822,900	0
P16-14	Brookdale	Existing Deficiency	Hillcrest Ave	From Hwy 9 to Manzanita Ave	3	1	Replace	8	640	202	129,300	129,300	168,100	218,600	100%	218,600	Existing Deficiency	100%	0%	218,600	0
P16-15	Brookdale	Existing Deficiency	Circle Dr / Urbana Ln	From Hillcrest Ave to approx. 50' e/o Manzanita Ave	1	1	Replace	8	790	202	159,600	159,600	207,500	269,800	100%	269,800	Existing Deficiency	100%	0%	269,800	0
P16-22	Brookdale	Fire Flow Reliability	Glen Arbor Rd / Hihn Rd	From Pine St to Eleana Dr	4	6	Replace	8	7,070	202	1,428,400	1,428,400	1,857,000	2,414,100	41%	979,571	As Funding is Available	100%	0%	2,414,100	0
						Subtotal - Pipeline Improvements					**5,445,600**	**5,445,600**	**7,079,900**	**9,204,300**		**4,729,621**				**9,204,300**	**0**
Valve Improvements						Existing Capacity (MG)	New/Replace	Capacity (gpm)	Valve Size (in)												
PRV4-1	Reader	PRV	Hwy 9 & Lorenzo St		1	-	New	2,403	8		32,000	32,000	41,600	54,100	11%	5,869	As Funding is Available	100%	0%	54,100	0
						Subtotal - Valve Improvements					**32,000**	**32,000**	**41,600**	**54,100**		**5,869**				**54,100**	**0**
Booster Station Improvements						Existing Capacity (gpm)	New/Replace	Capacity (gpm)	No. of Pumps												
PS13-1	Highland	Booster Pump	Existing Fairview Pump Station		1	50	Replace	220	2	205	45,130	45,130	58,700	76,400	27%	20,251	Existing Deficiency	100%	0%	76,400	0
						Subtotal - Booster Station Improvements					**45,130**	**45,130**	**58,700**	**76,400**		**20,251**				**76,400**	**0**
Reservoir Improvements						Existing Capacity (gal)	New/Replace	Capacity (gal)													
T4-1	Reader	Storage Reservoir	Existing Reader Tank Site		3	-	New	420,000			1,306,200	1,306,200	1,698,100	2,207,600	11%	239,501	Existing Deficiency	100%	0%	2,207,600	0
T11-1	Bear Creek	Storage Reservoir	Existing Bear Creek Tank Site		3	-	New	310,000			964,100	964,100	1,253,400	1,629,500	100%	1,629,500	Existing Deficiency	100%	0%	1,629,500	0
T13-1	Highland	Storage Reservoir	Existing Highland Tank Site		1	60,000	Replace	130,000			404,300	404,300	525,600	683,300	100%	683,300	Existing Deficiency	100%	0%	683,300	0
						Subtotal - Reservoir Improvements					**2,674,600**	**2,674,600**	**3,477,100**	**4,520,400**		**2,552,301**				**4,520,400**	**0**
Total Water System Improvement Costs																					
						Pipeline Improvements					**5,445,600**	**5,445,600**	**7,079,900**	**9,204,300**		**4,729,621**				**9,204,300**	**0**
						Valve Improvements					**32,000**	**32,000**	**41,600**	**54,100**		**5,869**				**54,100**	**0**
						Booster Station Improvements					**45,130**	**45,130**	**58,700**	**76,400**		**20,251**				**76,400**	**0**
						Reservoir Improvements					**2,674,600**	**2,674,600**	**3,477,100**	**4,520,400**		**2,552,301**				**4,520,400**	**0**
						Total - Improvement Cost					**8,197,330**	**8,197,330**	**10,657,300**	**13,855,200**		**7,308,042**				**13,855,200**	**0**

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9/9/2021

Notes:
1. Baseline construction costs plus 30% to account for unforeseen events and unknown conditions.
2. Estimated construction costs plus 30% to cover other costs including: engineering design, project administration (developer and City staff), construction management and inspection, and legal costs.