November 2020

City of San Juan Bautista

Water Master Plan

AKEL
ENGINEERING GROUP, INC.

Final

CITY OF SAN JUAN BAUTISTA

2020

WATER MASTER PLAN

FINAL

November 2020

AKEL ENGINEERING GROUP, INC.

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ENGINEERING GROUP, INC.

Smart Planning Our Water Resources

November 5, 2020

City of San Juan Bautista
311 2nd St
San Juan Bautista, CA 95045

Attention: Don Reynolds
City Manager

Subject: 2020 Water Master Plan – Final Report

Dear Don:

We are pleased to submit the Final Report for the City of San Juan Bautista Water Master Plan. This master plan is a standalone document, though it was prepared as part of the integrated infrastructure master plans for the water and wastewater master plans. This master plan documents the following:

- Existing distribution system facilities, acceptable hydraulic performance criteria, and projected water demands consistent with the Urban Planning Area.
- Development and validation of the City'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, Don Reynolds, City Manager, and other City staff whose courtesy and cooperation were valuable components in completing this study.

Sincerely,

AKEL ENGINEERING GROUP, INC.

Tony Akel, P.E.
Principal

Enclosure: Report

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Acknowledgements

City Council

Mary Vasquez Edge, Mayor

Leslie Q. Jordan, Vice Mayor

Dan DeVries, Council Member

César E. Flores, Council Member

John Freeman, Council Member

Management Personnel

Don Reynolds, City Manager

Karl Bjarke, Project Manager

Julie Behzad, Contract City Engineer – CSG Consultants

Nicholas Bryan, Public Works Supervisor

Miles Farmer, WWTP Contract Operator - Cypress Water Services

Danny Gonzales, Water System Contract Operator - All Clear Water Services

Other City Engineering, Planning, and Operations Staff

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TABLE OF CONTENTS

PAGE NO.

TABLE OF CONTENTS

PAGE NO.

TABLE OF CONTENTS PAGE NO.

FIGURES

TABLE OF CONTENTS

PAGE NO.

TABLES

TABLE OF CONTENTS PAGE NO.

APPENDICES

EXECUTIVE SUMMARY

The purpose of this Water Master Plan is to document the planned land use for the City of San Juan Bautista (City), identify existing and future demands generated within the City, and to plan water infrastructure to provide adequate levels of service to the customers at the lowest lifecycle cost feasible.

This executive summary presents a brief background of the City'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 City'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 servicing future growth.

The highlights of this Water Master Plan are listed as follows:

1. The water demand projections used for ultimate build-out of the City are based on the latest General Plan Land Use information. Actual consumption data for the various land uses were extracted from City billing information to characterize existing consumption characteristics and to project future water demands.
2. The existing deficiencies and projected development within the City will require a large investment in new and replacement infrastructure. This study analyzes this future development and identifies the improvements needed to serve it.
3. Under existing conditions, Well 6 has been taken offline due to water quality concerns, resulting in an existing and future water supply deficit. An engineering report was prepared by Stantec Consulting Services to evaluate multiple groundwater supply alternatives, with the preferred option including importing water from San Benito County Water District West Hills Water Treatment Plant (WTP), south of the City of Hollister. This will require the City to construct a pipeline of approximately six miles in length to connect the City's existing water distribution system to the West Hills WTP, as well as a booster station to mitigate head loss in the pipeline.
4. To meet the ultimate needs of the system, additional sources of water supply will be required, and improvements necessary to mitigate existing capacity deficiencies and to accommodate future growth. The following summary of buildout Capital Improvement Projects are recommended to meet these needs:
    - Construct transmission pipelines and booster station necessary to connect the water distribution system to the existing West Hills WTP
    - Construct Reservoir T-1A.

- Construct new transmission pipelines and replace deficient pipelines.
- Acquire property for needed facilities.

ES.1 STUDY OBJECTIVES

The City recognizes the importance of planning, developing, and financing the City's water system infrastructure. As such, the City authorized Akel Engineering Group to prepare this 2020 Water Master Plan (WMP) and a concurrent Wastewater Master Plan in November of 2019. This master plan included the following tasks:

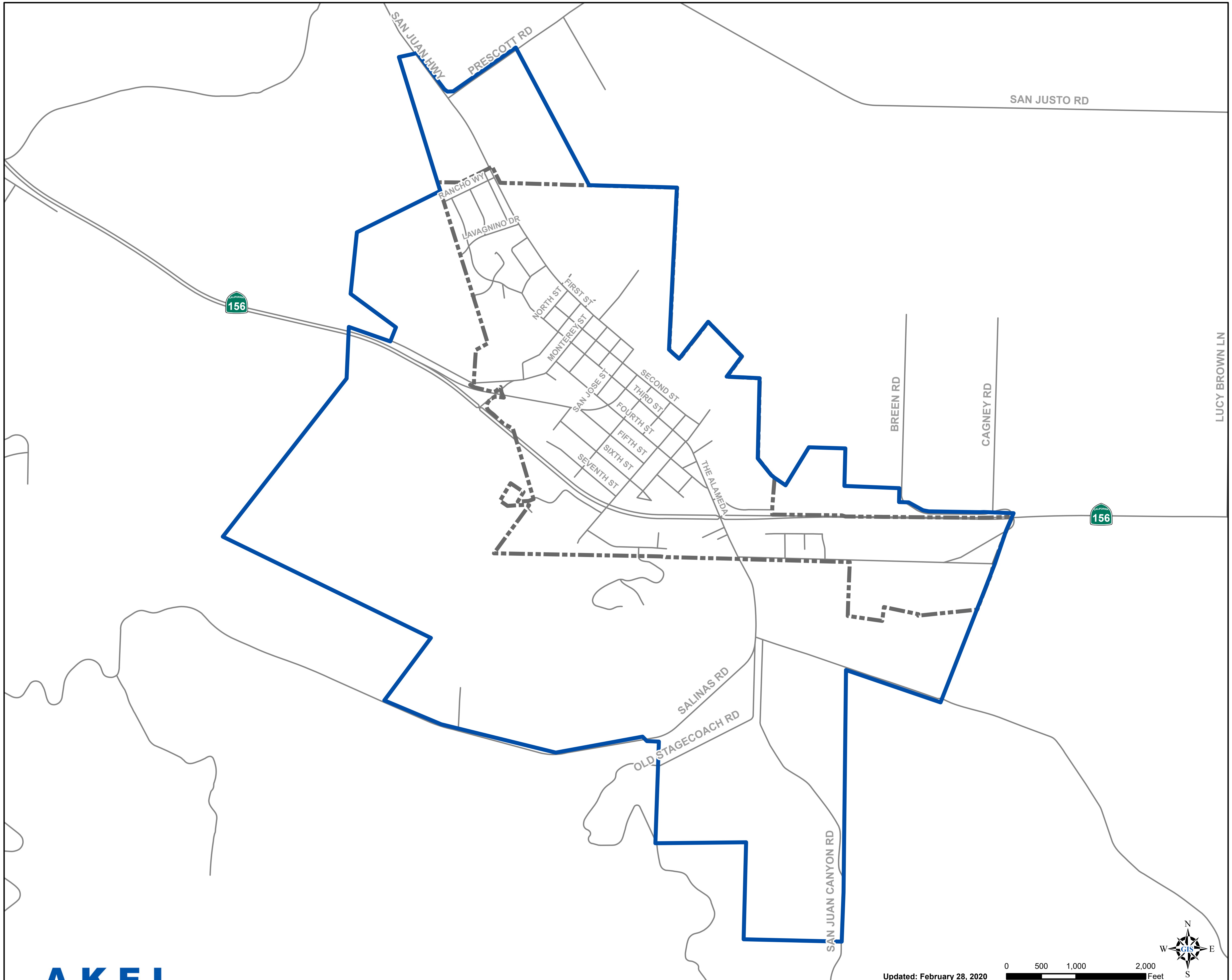
- Summarizing the City's existing domestic water system facilities
- Documenting growth planning assumptions and known future developments
- Developing domestic water system performance criteria
- Projecting future domestic water demands
- Developing and validating a new hydraulic model using received drawings and Geographic Information Systems (GIS) data
- Evaluating the domestic water facilities to meet existing and projected demand requirements and fire flows
- 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 2020 Water Master Plan report

ES.2 STUDY AREA

The City of San Juan Bautista provides domestic water service to over 2,000 residents, with a service area that encompasses 847 acres. The City's service area, approximately 11 miles south of Gilroy, is generally bound to the north by Prescott Road, to the east by Mission Vineyard Road, to the southwest by State Route 156, and to the south by Old San Juan Hollister Road (**Figure ES.1**).

ES.3 SYSTEM PERFORMANCE AND DESIGN CRITERIA

This report documents the City'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 Chapter 3 discusses the system performance and design criteria for the domestic water system.



Legend

- City Limits
- Sphere of Influence Boundary
- Streets

Figure ES.1
Planning Boundaries
Water Master Plan
City of San Juan Bautista

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File Path: P:\xGIS\GIS_Projects\San_Juan_Bautista\Water\191112-MP\Hardcopy\SJB_Fig2-1_PlanningBoundary_022820.mxd

ES.4 EXISTING WATER SYSTEM OVERVIEW

The City's municipal water system consists of 3 active groundwater wells, a total of 1.25 million gallons in storage, distribution mains, a booster station, pressure reducing station, and numerous fire hydrants. The City's topography is generally flat, sloping down from south to north; based on this topography, the water distribution system is comprised of a single pressure zone with a single storage tank regulating system operation.

The City'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.5 EXISTING AND FUTURE DOMESTIC WATER DEMANDS

The existing water demands used for this master plan were based on the City's water billing consumption records and adjusted to match the annual production records and account for system losses. Additionally, future demands were developed based on the General Plan Land Use expected to develop within the buildout period.

The City's existing average day domestic water demand was documented at 0.25 million gallons per day (mgd). **Table ES.1** documents the future land use categories, and their corresponding domestic water demands. The average day domestic water demands from existing and future developments is estimated at 0.57 mgd. 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.6 REGIONAL SUPPLY ALTERNATIVES

In order to meet the existing domestic water demands, the City relies on multiple groundwater wells. The City currently faces challenges to maintain its existing water supply, including high levels of nitrate and hardness in the existing groundwater sources. In order to meet the growing demand requirements of the City service area and provide additional water supply reliability, the existing water supply capacity will require expansion. Multiple solutions to mitigate these issues were evaluated by Stantec Consulting Services, including a preferred water supply option comprised of connecting the existing water distribution system to the San Benito County Water District West Hills WTP, south of the City of Hollister.

ES.7 HYDRAULIC MODEL DEVELOPMENT

Hydraulic network analysis has become an effective and 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. As a part of this master plan a new hydraulic model was developed for the City's water distribution system, combining information on the physical characteristics of the water system (pipelines, groundwater wells,

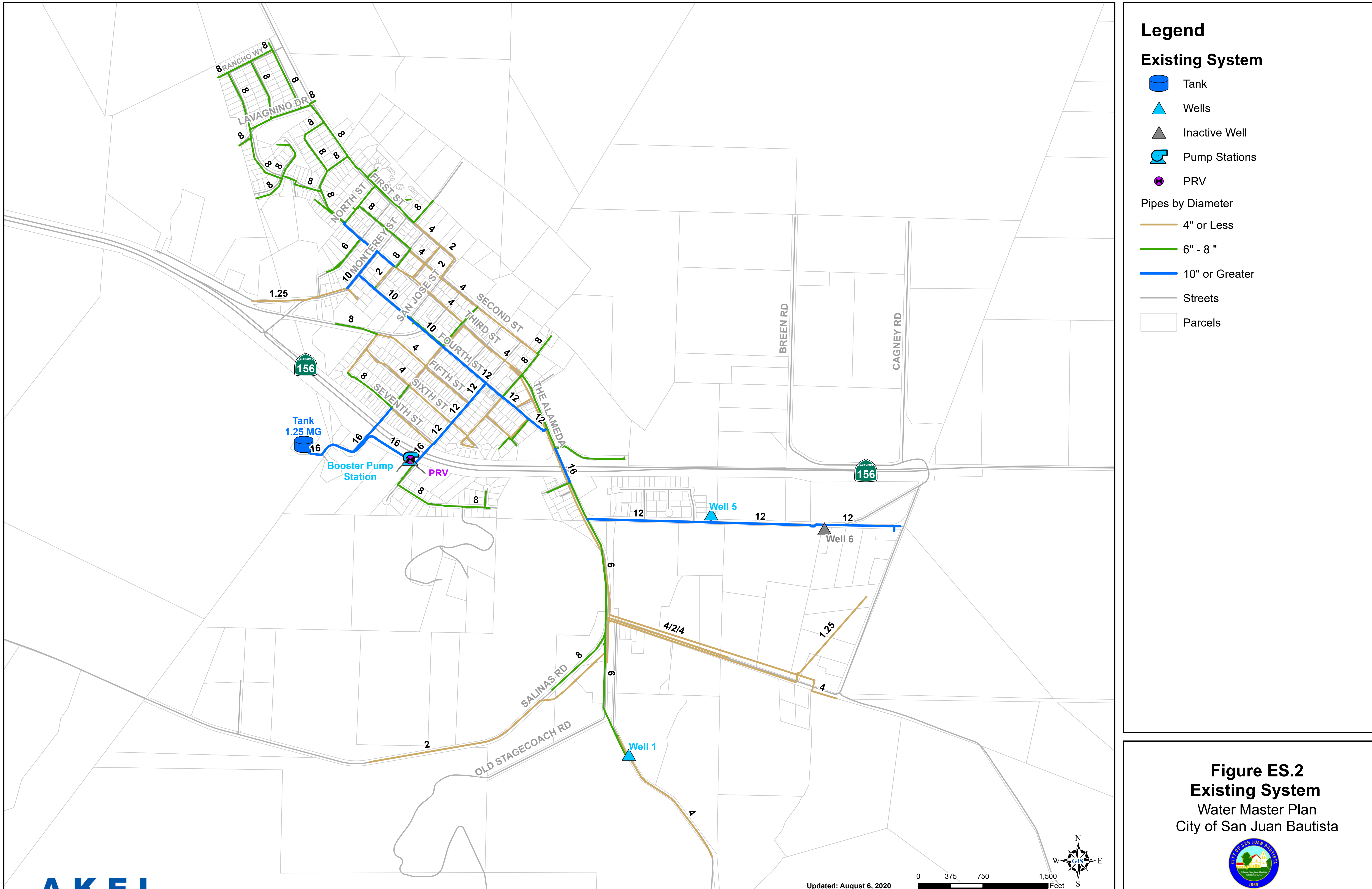


Figure ES.2
Existing System
Water Master Plan
City of San Juan Bautista

Table ES.1 Existing Land Use and Water Demands
Water Master Plan
City of San Juan Bautista

Land Use Classification	Existing Development within Service Area	Existing Average Daily Water Demand Unit factors									
		Consumption[1]			Production (Consumption + 11% losses)[2]		Production at 100% Occupancy			Recommended Water Unit Factor	
		Unadjusted Water Unit Factors	Annual Consumption		Unadjusted Water Unit Factors	Production (w/o Vacancy rate)	Vacancy Rate[3,4]	Projected Production at 100% Occupancy		Recommended Factor[5]	Balance Using Recommended Unit Factor
	(acres)	(gpd/acres)	(gpd)	(gpm)	(gpd/acres)	(gpd)	(%)	(gpd/acres)	(gpd)	(gpd/acres)	(gpd)
Residential											
Low Density Residential - Rural[6]	74	89	6,577	5	99	7,301	9.0%	108	7,958	110	8,127
Low Density Residential - Single Family[6]	161	691	111,215	77	767	123,448	9.0%	836	134,559	840	135,267
Medium Density Residential	8	836	6,717	5	928	7,455	9.0%	1,011	8,126	1,500	12,057
High Density Residential - Mission Farm RV Park[7]	12	169	2,064	1	187	2,291	9.0%	204	2,498	210	2,568
Subtotal - Residential	255		126,573	88		140,496			153,141		158,019
Non-Residential											
Agriculture	273	0	0	0	0	0	0.0%	0	0	0	0
Commercial	20	1,506	29,662	21	1,672	32,924	6.0%	1,772	34,900	1,780	35,054
Industrial[8,9]	45	382	17,121	12	425	19,004	6.0%	450	20,144	1,100	49,245
Mixed-Use[10]	0	0	0	0	0	0	0.0%	0	0	0	0
Public Facility[11]	43	85	3,679	3	95	4,083	0.0%	95	4,083	100	4,311
Non-Demand Generating Public Facility	15	0	0	0	-	-	-	-	-	-	-
Taylor/Earthbound Farms	60	371	22,414	16	-	-	-	-	-	-	-
True Leaf Farms	30	18	522	0	-	-	-	-	-	-	-
Subtotal - Non-Residential	486		73,397	51		56,012			59,128		88,610
Other											
Open Space	5	0	0	0	0	0	0.0%	0	0	0	0
Vacant	34	0	0	0	0	0	0.0%	0	0	0	0
Other	2	0	0	0	0	0	0.0%	0	0	0	0
Williamson Act Land	65	0	0	0	0	0	0.0%	0	0	0	0
Subtotal - Other	106		0	0		0			0		0
Totals											
	848		**199,970**	**139**		**196,508**			**212,268**		**246,629**

9/8/2020

Note:
1. 2019 Water Consumption provided by City staff on January 13, 2020.
2. In order to account for water system losses and other unmetered consumption, production was assumed to be equal to consumption increased by 11% based on Akel Engineering Group experience.
3. Residential vacancy rates sourced from San Benito County 2017-2022 Comprehensive Economic Development Strategy.
4. Commercial and Industrial vacancy rates sourced from San Benito County 2010 General Plan.
5. Recommended Medium Density Residential Water Demand factor based on General Plan development densities and Akel Engineering Group experience.
6. Existing acreage and consumption for low density residential land use was divided into two separate sub-types based on lot size; generally low density residential lots over 1.0 acres were considered Rural while lots under 1.0 acres were considered Single Family.
7. Unit factors for Mission Farm RV Park were calculated separately from medium / high density residential land use to account for higher population density than is typical.
8. Existing acreage of industrial land use excludes two users outside of the City's service area: Taylor/Earthbound Farms & True Leaf Farms. These users operate private facilities and are not serviced by the City's water system and are listed separately.
9. Unit factor for Industrial land use is recommended based on Akel Engineering Group experience.
10. Existing acreage of mixed-use land use was consolidated with it's predominant land use designation.
11. Existing acreage of public facility land use excludes parcels without an associated water billing record.

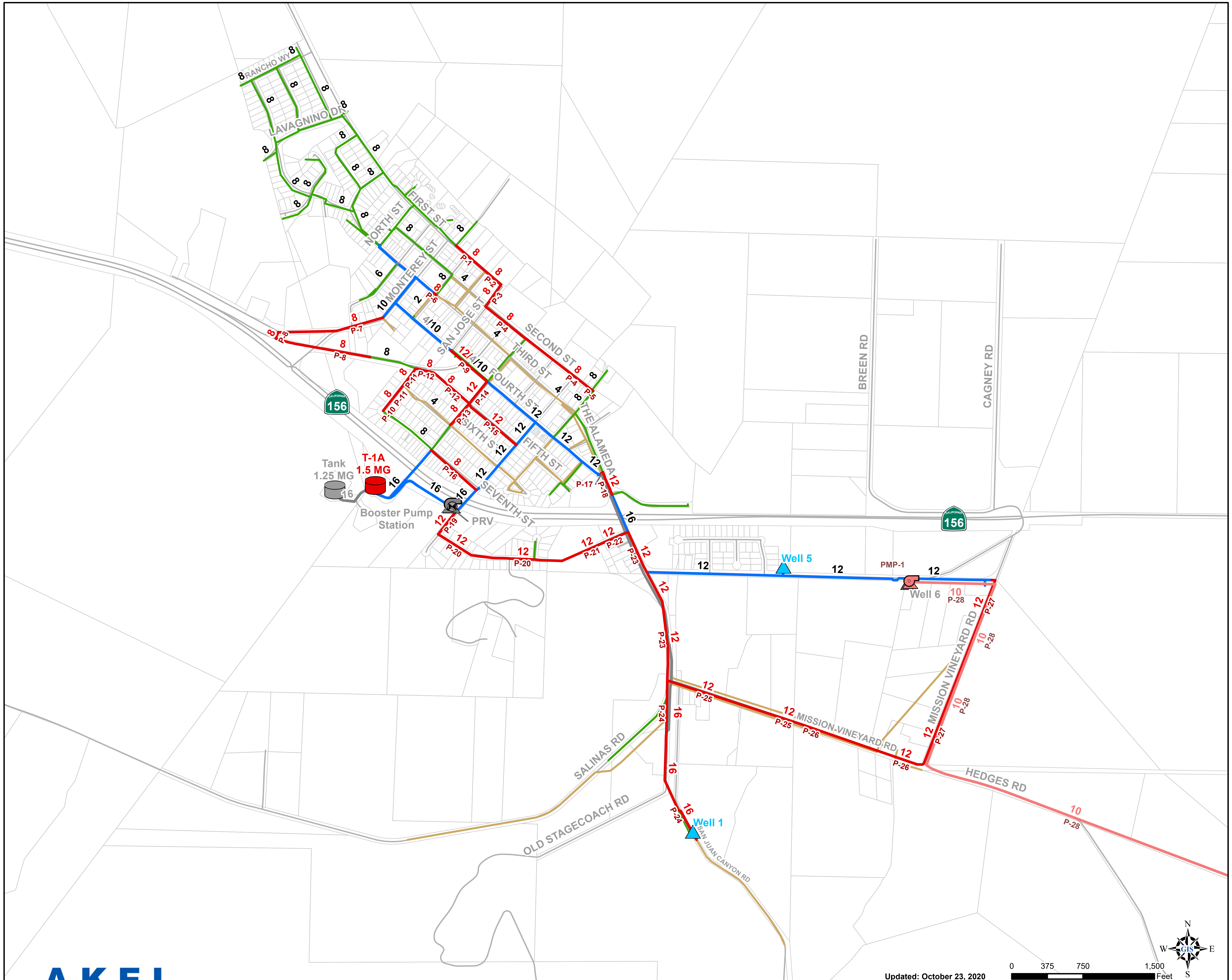
valves, booster stations, and storage reservoirs) and operational characteristics (how they operate). The hydraulic model development process included a thorough verification with City staff to ensure the water model was consistent with the existing water distribution system and provided results consistent with real-world conditions.

ES.8 EXISTING SYSTEM EVALUATION

This master plan included a hydraulic evaluation of the City's existing water distribution system. This hydraulic evaluation included analyzing the system-wide pressures under various demand conditions comparing the existing storage capacity, booster station capacity, and supply capacity to the required amounts based on the master plan performance criteria. The City's existing system is generally able to meet the system performance criteria under existing conditions. However, under fire flow conditions multiple areas of the City are unable to meet master plan criteria. Improvements are recommended to mitigate the deficiencies identified as part of the evaluation.

ES.9 CAPITAL IMPROVEMENT PROGRAM

The Capital Improvement Program includes improvements consistent with ongoing projects planned by the City as well as improvements recommended for mitigating existing system deficiencies and servicing future growth. **Figure ES.3** documents the recommended improvements. A detailed cost summary for the buildout improvements are documented in **Table ES.2**, as well as in Chapter 8. As shown on **Table ES.2**, the total cost over the buildout horizon is approximately 20.7 million dollars.



Legend

Future Improvements

- Tank
- West Hills WTP Connection Pump
- Pipes
- West Hills WTP Connection Pipeline

To be Abandoned

- Tank
- Pump Station
- Inactive Well
- PRV
- Pipes

Existing System

- Well

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

Figure ES.3
Future Improvements
Water Master Plan
City of San Juan Bautista

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Table ES.2 Buildout Capital Improvement Program
Water Master Plan
City of San Juan Bautista

Improv. No.	Improv. Type	Alignment	Limits	Improvement Details				Infrastructure Costs		Baseline Construction Cost	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
								Unit Cost ($/unit)	Infr. Cost [1] ($)	($)	($)	($)		Existing Users	Future Users	Existing Users ($)	Future Users ($)
Pipeline Improvements				Existing Diameter (in)	New/ Replace	Diameter (in)	Length (ft)										
P-1	Reliability	First St.	From Thomas Ln. to Jefferson St.	4	Replace	8	425	149	63,500	63,500	82,600	107,400	Existing Deficiency	100%	0%	107,400	0
P-2	Reliability	First St.	From Jefferson St. to San Jose St.	2	Replace	8	225	149	33,600	33,600	43,700	56,900	Existing Deficiency	100%	0%	56,900	0
P-3	Reliability	San Jose St.	From First St. to Second St.	2	Replace	8	300	149	44,800	44,800	58,300	75,800	Existing Deficiency	100%	0%	75,800	0
P-4	Reliability	Second St.	From San Jose St. to Franklin St.	4	Replace	8	1,425	149	212,600	212,600	276,400	359,400	Existing Deficiency	100%	0%	359,400	0
P-5	Reliability	Second St.	From Franklin St. to approx. 20' se/o Franklin St.	6	Replace	8	25	149	3,800	3,800	5,000	6,500	Existing Deficiency	100%	0%	6,500	0
P-6	Fire Flow	Third St.	From approx. 30' se/o Tahualamist St. to Tahualamist St.	4	Replace	8	50	149	7,500	7,500	9,800	12,800	Existing Deficiency	100%	0%	12,800	0
P-7	Development	Monterey St. / Larios Dr.	From approx. 200' sw/o Fourth St. to approx. 600' w/o Larios Dr.	1.25	Replace	8	1,125	149	167,900	167,900	218,300	283,800	With Development	0%	100%	0	283,800
P-8	Development	Muckelemi St.	From approx. 400' w/o Monterey St. to approx. 600' e/o Monterey St.	-	New	8	1,100	149	164,200	164,200	213,500	277,600	With Development	0%	100%	0	277,600
P-9	Fire Flow	Fourth St.	From San Jose St. to Polk St.	4,8,10	Replace	12	525	190	99,600	99,600	129,500	168,400	Existing Deficiency	100%	0%	168,400	0
P-10	Fire Flow	San Antonio St.	From Seventh St. to approx. 100' ne/o Seventh St.	0.75	Replace	8	100	149	15,000	15,000	19,500	25,400	Existing Deficiency	100%	0%	25,400	0
P-11	Fire Flow	San Antonio St.	From approx. 460' sw/o Muckelemi St. to Muckelemi St.	4	Replace	8	475	149	70,900	70,900	92,200	119,900	Existing Deficiency	100%	0%	119,900	0
P-12	Fire Flow	Muckelemi St. / Fifth St.	From San Antonio St. to Polk St.	4	Replace	8	700	149	104,500	104,500	135,900	176,700	Existing Deficiency	100%	0%	176,700	0
P-13	Fire Flow	Polk St.	From Fifth St. to Sixth St.	4	Replace	8	300	149	44,800	44,800	58,300	75,800	Existing Deficiency	100%	0%	75,800	0
P-14	Fire Flow	Polk St.	From Fourth St. to Fifth St.	4	Replace	12	325	190	61,700	61,700	80,300	104,400	Existing Deficiency	100%	0%	104,400	0
P-15	Fire Flow	Fifth St.	From Polk St. to Washington St.	4	Replace	12	675	190	128,100	128,100	166,600	216,600	Existing Deficiency	100%	0%	216,600	0
P-16	Fire Flow	Seventh St.	From Polk St. to Washington St.	4	Replace	8	650	149	97,000	97,000	126,100	164,000	Existing Deficiency	100%	0%	164,000	0
P-17	Reliability	The Alameda	From approx. 10' w/o The Alameda to approx. 10' e/o The Alameda	-	New	12	25	190	4,800	4,800	6,300	8,200	As Funding is Available	46%	54%	3,900	4,400
P-18	Capacity	The Alameda	From Fourth St. to Nyland Dr.	6	Replace	12	275	190	52,200	52,200	67,900	88,300	As Funding is Available	46%	54%	41,100	47,300
P-19	Reliability	Washington St.	From Lausen Dr. to Lang St.	6	Replace	12	350	190	66,400	66,400	86,400	112,400	As Funding is Available	46%	54%	52,300	60,200
P-20	Reliability	Lang St.	From Washington St. to Lang Ct.	8	Replace	12	1,150	190	218,100	218,100	283,600	368,700	As Funding is Available	46%	54%	171,400	197,400
P-21	Reliability	Lang St.	From Lang Ct. to approx. 290' w/o The Alameda	-	New	12	725	190	137,500	137,500	178,800	232,500	As Funding is Available	46%	54%	108,100	124,500
P-22	Reliability	Lang St.	From approx. 290' w/o The Alameda to The Alameda	8	Replace	12	300	190	56,900	56,900	74,000	96,200	As Funding is Available	46%	54%	44,800	51,500

Table ES.2 Buildout Capital Improvement Program
Water Master Plan
City of San Juan Bautista

Improv. No.	Improv. Type	Alignment	Limits	Improvement Details				Infrastructure Costs		Baseline Construction Cost	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
								Unit Cost ($/unit)	Infr. Cost[1] ($)	($)	($)	($)		Existing Users	Future Users	Existing Users ($)	Future Users ($)
Pipeline Improvements				Existing Diameter (in)	New/ Replace	Diameter (in)	Length (ft)										
P-23	Capacity	The Alameda / San Juan Canyon Rd.	From Lang St. to Mission Vineyard Rd.	6	Replace	12	1,675	190	317,700	317,700	413,100	537,100	As Funding is Available	46%	54%	249,600	287,600
P-24	Development	San Juan Canyon Rd.	From Mission Vineyard Rd. to approx. 620' s/o Old Stagecoach Rd.	4,6	Replace	16	1,775	229	406,200	406,200	528,100	686,600	With Development	0%	100%	0	686,600
P-25	Reliability	Mission Vineyard Rd	From San Juan Canyon Rd. to approx. 1,490' e/o San Juan Canyon Rd.	4	Replace	12	1,500	190	284,500	284,500	369,900	480,900	As Funding is Available	46%	54%	223,500	257,500
P-26	Reliability	Mission Vineyard Rd	From approx. 1,490' e/o San Juan Canyon Rd. to Hedges Rd.	-	New	12	1,375	190	260,800	260,800	339,100	440,900	As Funding is Available	46%	54%	204,900	236,100
P-27	Reliability	Mission Vineyard Rd	From Hedges Rd. to San Juan Hollister Rd.	-	New	12	2,125	190	403,000	403,000	523,900	681,100	As Funding is Available	46%	54%	316,600	364,600
P-28	Capacity	Mission Vineyard Rd / Hedges Rd / ROW	From Well 6 Site to West Hills WTP	-	New	10	33,420	172	5,001,000	5,001,000	6,501,300	8,451,700	Existing Deficiency	46%	54%	3,927,500	4,524,300
				Subtotal - Pipeline Improvements					**8,528,600**	**8,528,600**	**11,088,400**	**14,416,000**				**7,013,700**	**7,403,400**
Booster Station Improvements				Existing Capacity (gpm)	New/Replace	Capacity (gpm)											
PMP-1	Capacity	Well 6 Site		-	New	3 @ 450			895,300	895,300	1,163,900	1,513,100	Existing Deficiency	46%	54%	703,200	810,000
				Subtotal - Booster Station Improvements					**895,300**	**895,300**	**1,163,900**	**1,513,100**				**703,200**	**810,000**
Reservoir Improvements				Existing Capacity (MG)	New/Replace	Capacity (MG)											
T-1A	Capacity	Inactive Concrete Reservoir Site		1.25	Replace	1.5			2,794,800	2,794,800	3,633,300	4,723,300	517 EDUs	46%	54%	2,194,900	2,528,500
				Subtotal - Reservoir Improvements					**2,794,800**	**2,794,800**	**3,633,300**	**4,723,300**				**2,194,900**	**2,528,500**
Total Water System Improvement Costs																	
				Pipeline Improvements					**8,528,600**	**8,528,600**	**11,088,400**	**14,416,000**				**7,013,700**	**7,403,400**
				Booster Station Improvements					**895,300**	**895,300**	**1,163,900**	**1,513,100**				**703,200**	**810,000**
				Reservoir Improvements					**2,794,800**	**2,794,800**	**3,633,300**	**4,723,300**				**2,194,900**	**2,528,500**
				Total - Improvement Cost					**12,218,700**	**12,218,700**	**15,885,600**	**20,652,400**				**9,911,800**	**10,741,900**

AKEL ENGINEERING GROUP, INC.

10/29/2020

Notes:
1. Portions of the alignment of pipeline P-28 exist in agricultural land with no paving, thus pipeline unit costs were reduced by 30% to account for the following: 25% reduction for pavement replacement, and 5% reduction for traffic control.
2. Baseline construction costs plus 30% to account for unforeseen events and unknown conditions.
3. 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.

CHAPTER 1 - INTRODUCTION

This chapter provides a brief background of the City of San Juan Bautista's (City) domestic water system, the need for this master plan, and the objectives of the study. Unit conversions, abbreviations, and definitions are also provided in this chapter.

1.1 BACKGROUND

The City of San Juan Bautista (City) is located approximately 8 miles west of Hollister, 11 miles south of Gilroy and 13 miles southeast of Watsonville (**Figure 1.1**). The City provides potable water service to 2,100 residents, as well as a number of commercial, industrial, and public establishments. The City owns and operates a domestic water distribution system that consists of 2 active groundwater wells, 1 storage tank with a volume of 1.25 million gallons, and more than 10 miles of distribution pipelines.

1.2 SCOPE OF WORK

The City authorized Akel Engineering Group to prepare this 2020 Water Master Plan (WMP) and a concurrent Wastewater Master Plan in November of 2019. The 2020 WMP evaluates the City's water system and recommends capacity improvements necessary to service the needs of existing users and for servicing the future growth of the City. This 2020 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 City's service area. The area and horizon for the master plan is based on the City'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 City's existing domestic water system facilities
- Documenting growth planning assumptions and known future developments
- Developing domestic water system performance criteria
- Projecting future domestic water demands
- Developing and validating a new hydraulic model using received drawings and Geographic Information Systems (GIS) data
- Evaluating the domestic water facilities to meet existing and projected demand requirements and fire flows
- Performing a capacity analysis for major distribution mains

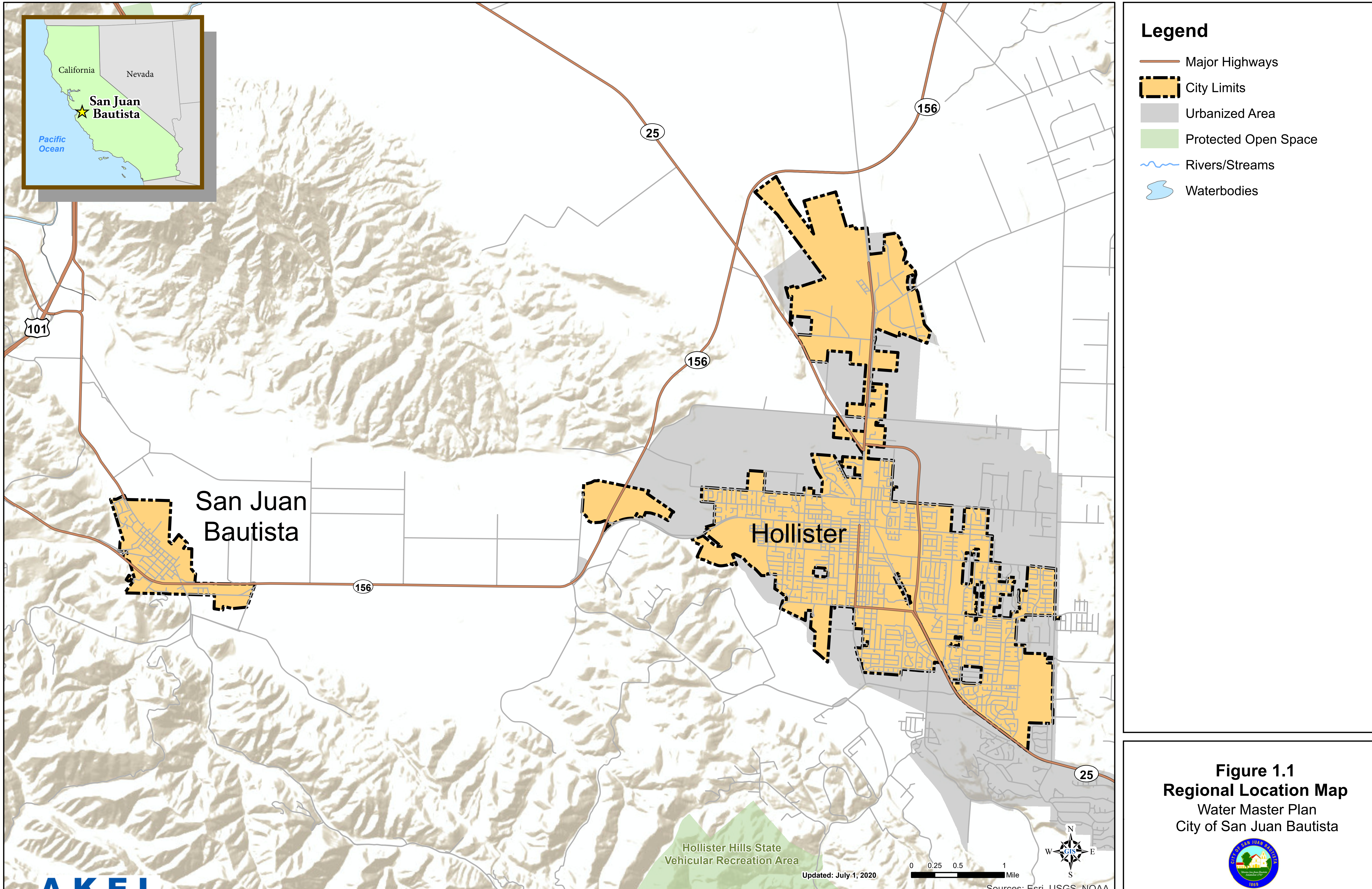

Figure 1.1
Regional Location Map
Water Master Plan
City of San Juan Bautista

AKEL
ENGINEERING GROUP, INC.

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- 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 2020 Water Master Plan report

1.3 INTEGRATED APPROACH TO MASTER PLANNING

The City implemented an integrated master planning approach and contracted the services of Akel Engineering Group to prepare the following documents:

- 2020 Water Master Plan
- 2020 Wastewater Master Plan

While each of these reports is published as a standalone document, they have been coordinated for consistency with the City's General Plan. Additionally, each document has been cross referenced to reflect relevant analysis results with the other documents.

1.4 RELEVANT REPORTS

The City 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:

- **City of San Juan Bautista 2035 General Plan, November 2015**. The 2035 General Plan represents the official adopted goals and policies of the City of San Juan Bautista, and addresses planning issues within the community such as historic preservation, economic development, and development of public facilities. This includes establishing a plan for municipal elements such as land use, housing, and economic development.

- **State Water Resources Control Board Sanitary Survey of Water System Facilities, March 2019**. This letter confirmed the findings of an inspection conducted in October 2018 by the State Water Resources Control Board on the water system facilities operated by the City.

- **State Water Resources Control Board Water Permit, June 2020**. This permit, issued to the City on June 12, 2020, approved the City's operation of the water system. IT also documents the City's existing system information, operations, and supply conditions as reported by an inspection conducted in September 2019.

- **City of San Juan Bautista - Source and Potable Water Improvements Preliminary Engineering Report, September 2020**. The Source and Potable Water Improvements Preliminary Engineering Report (PER) completed by Stantec Engineering Services, Inc.

(Stantec) investigates alternatives and recommends programs to reduce potable water hardness and provide a secure water source for the City in compliance with regulatory standards. The report is attached as **Appendix A**.

1.5 REPORT ORGANIZATION

The Water Master Plan report contains the following chapters:

Chapter 1 - Introduction. This chapter provides a brief background of the City's domestic water system, the need for this master plan, and the objectives of the study. Unit conversions, 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.

Chapter 3 - System Performance and Design Criteria. This chapter presents the City'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 City's existing domestic water system facilities including the existing wells, distribution mains, storage reservoir, and booster pump stations.

Chapter 5 - Water Demands and Supply Characteristics. This chapter summarizes existing domestic water demands and projects the future domestic water demands.

Chapter 6 - Hydraulic Model Development. This chapter describes the development and validation of the City'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 - 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.

1.6 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:

- Don Reynolds, City Manager
- Karl Bjarke, Project Manager
- Julie Behzad, Contract City Engineer – CSG Consultants
- Nicholas Bryan, Public Works Supervisor
- Miles Farmer, WWTP Contract Operator – Cypress Water Services
- Danny Gonazales, Water Systems Contact Operator – All Clear Water Services

As part of the preparation of this Water Master Plan, Stantec Inc. prepared reports evaluating treatment strategies for both water supply sources and collected wastewater flows.

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 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 and digital elevation models
- Generate maps and exhibits used in this master plan

Table 1.1 Unit Conversions

Water Master Plan
City of San Juan Bautista

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

Table 1.2 Abbreviations and Acronyms

Water Master Plan

City of San Juan Bautista

Abbreviation	Expansion	Abbreviation	Expansion
2020 WMP	2020 Water Master Plan	gpdc	Gallons per day per capita
AACE International	Association for the Advancement of Cost Engineering	gpm	Gallons per minute
AC	Acre	GSA	Groundwater Sustainability Agency
ACP	Asbestos Cement Pipe	HGL	Hydraulic grade line
ADD	Average Day Demand	hp	Horsepower
Akel	Akel Engineering Group, Inc.	HWL	High water level
CCI	Construction Cost Index	in	Inch
CDPH	California Department of Public Health	LAFCO	Local Agency Formation Commission
cfs	Cubic feet per second	LF	Linear feet
CI	Cast Iron Pipe	MDD	Maximum day demand
CIB	Capital Improvement Budget	MG	Million gallons
CIP	Capital Improvement Program	MGD	Million gallons per day
City/CoSB	City of San Juan Bautista	MMD	Maximum month demand
DDW	Division of Drinking Water	NFPA	National Fire Protection Association
DIP	Ductile Iron Pipe	PHD	Peak hour demand
DU	Dwelling Unit	PRV	Pressure reducing valve
EDU	Equivalent Dwelling Unit	psi	Pounds per square inch
ENR	Engineering News Record	ROW	Right of Way
EPA	Environmental Protection Agency	SCADA	Supervisory Control and Data Acquisition
EPS	Extended Period Simulation	SOI	Sphere of Influence
fps	Feet per second	SWRCB	State Water Resources Control Board
ft	Feet	TBD	To be determined
FY	Fiscal Year	ULL	Urban Limit Line
GIS	Geographic Information Systems	WMP	Water Master Plan
gpd	Gallons per day	WTP	Water Treatment Plant

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.

2.1 STUDY AREA DESCRIPTION

The City of San Juan Bautista is located in San Benito County, approximately 11 miles south of Gilroy and 13 miles southeast of Watsonville. The City's closest neighbor, the City of Hollister, is located 8 miles to the east. State Route 156 bisects the boundary of the City in the east-west direction. The City limits currently encompass 0.79 square miles, with an approximate population of 2,100 residents.

The City's service area is generally bound to the north by Prescott Road, to the east by Mission Vineyard Road, to the southwest by State Route 156, and to the south by Old San Juan Hollister Road. The topography is generally flat, with slopes increasing from north to south toward the Gabilan Mountain Range. **Figure 2.1** displays the assumed sphere of influence boundary as documented in the General Plan. This boundary has not yet been adopted by City staff but was used for planning purposes as part of this master plan.

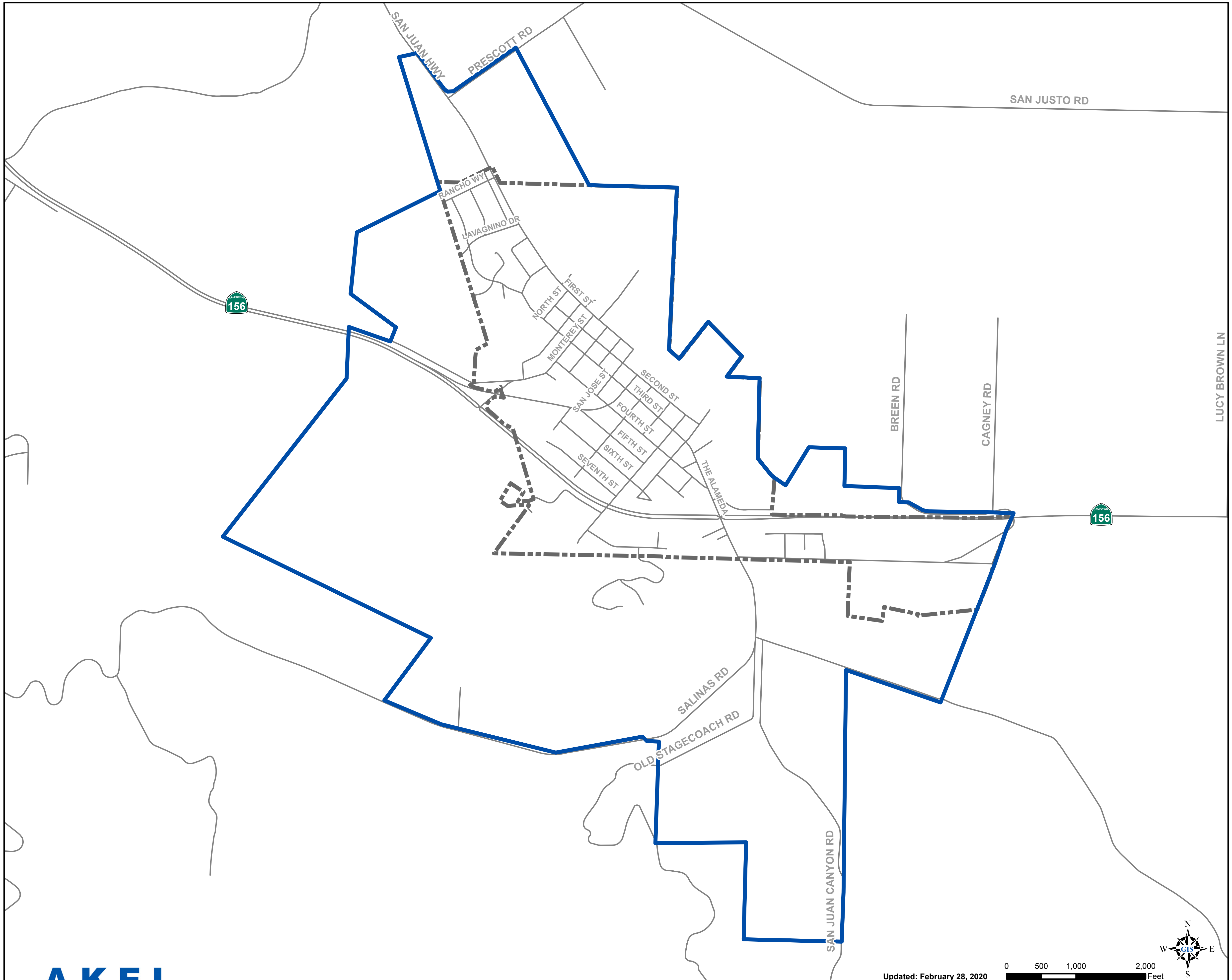
The City operates and maintains a domestic water system that covers the majority of the developable area within the Planning Boundary. Currently, the water demands are provided from groundwater wells located in the southeast portion of the service area.

2.2 WATER SERVICE AREA AND LAND USE

The City's water system services residential and non-residential lands primarily within the City limits, as summarized on **Table 2.1** and shown graphically on **Figure 2.2**. Areas within the City's potential water service area include:

- 741 acres of demand generating lands including residential and non-residential areas.
- 106 acres of undeveloped lands inside the service area.

The existing land use statistics were based on land use information received from City staff. Several existing residential and commercial areas were reclassified as "Mixed-Use" in the General Plan; however, for the purposes of estimating water demand, these acreages were assumed to retain their existing land use, such as residential or commercial. It should be noted that two industrial users, Taylor/Earthbound Farms and True Leaf Farms, operate private water and wastewater facilities; these users are not serviced by the City's water system but do convey wastewater flows to the wastewater treatment plant. For planning purposes, the acreage from these two developments are included in **Table 2.1**.



Legend

- City Limits
- Sphere of Influence Boundary
- Streets

Figure 2.1
Planning Boundaries
Water Master Plan
City of San Juan Bautista

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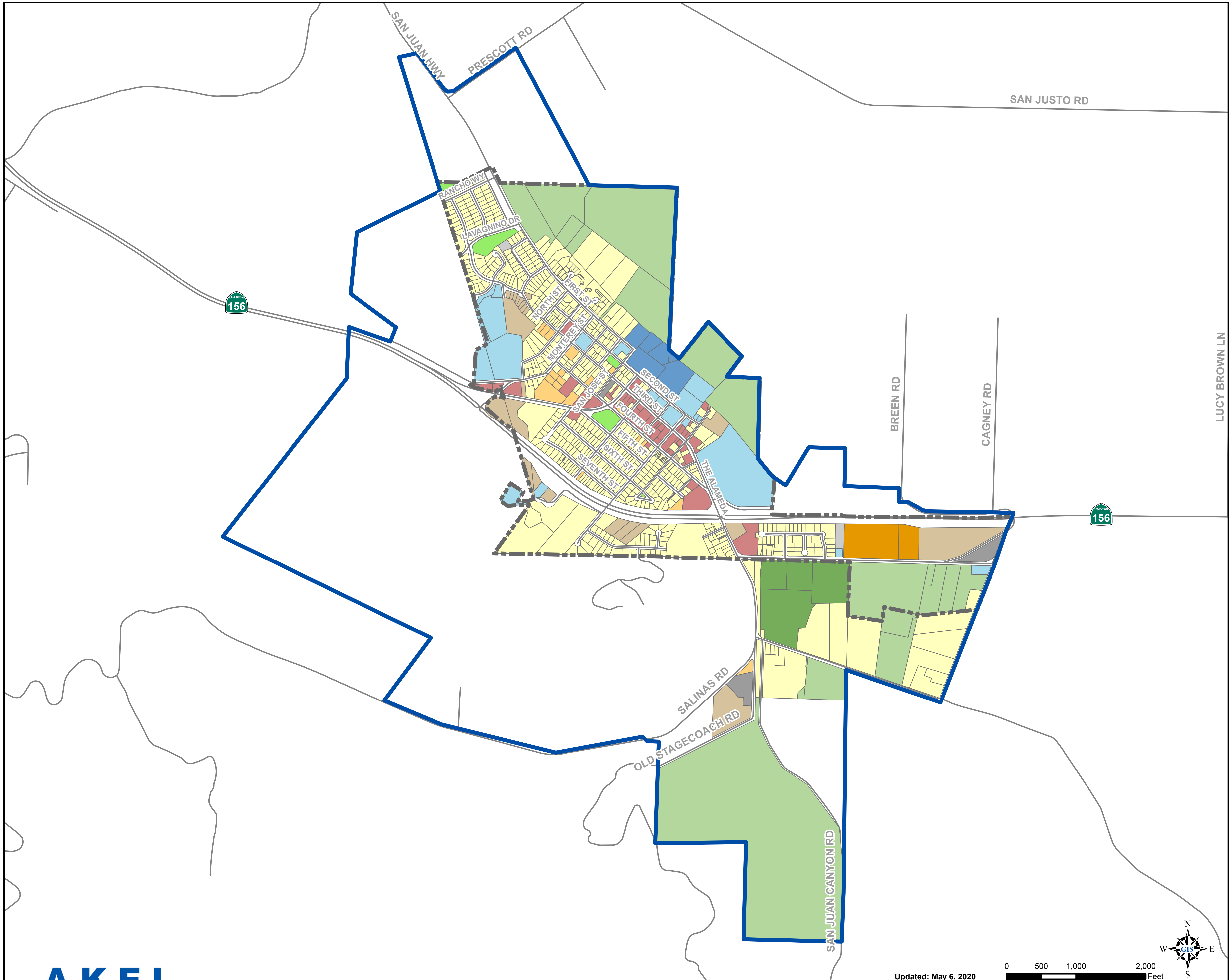

Legend

Existing Land Use

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Public Facility
- Mission
- Industrial
- Agriculture
- Open Space
- Williamson Act Land
- Vacant
- Other
- Streets
- City Limits
- Sphere of Influence Boundary

Figure 2.2
Existing Land Use
Water Master Plan
City of San Juan Bautista

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Table 2.1 Existing and Future Land Use

Water Master Plan

City of San Juan Bautista

Land Use Classification	Existing Development			Future Development				Total Development
	Existing Development (acres)	Existing Lands - Redeveloping (acres)	Subtotal Existing Development - Unchanged (acres)	New Lands - Redevelopment (acres)	New Development: Inside City Limits (acres)	New Development: Outside City Limits (acres)	New Development (acres)	(acres)
Residential								
Residential	255.2	-37.8	217.4	59.0	14.8	6.0	20.9	297.2
Subtotal Residential	**255.2**	**-37.8**	**217.4**	**59.0**	**14.8**	**6.0**	**20.9**	**297.2**
Non-Residential								
Agriculture	273.2	-178.1	95.1	0.0	1.5	0.0	1.5	96.7
Commercial	19.7	-1.3	18.4	117.0	6.1	0.0	6.1	141.5
Industrial	134.7	0.0	134.7	34.7	0.0	0.0	0.0	169.4
Mixed-Use	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public Facility	58.4	-0.9	57.5	10.5	2.4	0.0	2.4	70.3
Subtotal Non-Residential	**486.0**	**-180.3**	**305.7**	**162.2**	**10.0**	**0.0**	**10.0**	**477.9**
Other								
Open Space	5.3	-3.1	2.2	0.0	3.0	0.0	3.0	5.3
Vacant	34.1	-34.1	0.0	0.0	0.0	0.0	0.0	0.0
Williamson Act Land	65.3	0.0	65.3	0.0	0.0	0.0	0.0	65.3
Other	1.6	0.0	1.6	0.0	0.0	0.0	0.0	1.6
Subtotal- Other	**106.4**	**-37.2**	**69.1**	**0.0**	**3.0**	**0.0**	**3.0**	**72.2**
Total								
Subtotal- Residential & Non-Residential	741.2	-218.2	523.1	221.2	24.8	6.0	30.9	775.1
Subtotal- Other	106.4	-37.2	69.1	0.0	3.0	0.0	3.0	72.2
Total Area	**847.6**	**-255.4**	**592.2**	**221.2**	**27.9**	**6.0**	**33.9**	**847.3**

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9/9/2020

Notes:

1. Source: GIS information downloaded from San Benito County Website (11/05/2019).

The buildout of the City's Sphere of Influence includes approximately 300 acres of residential land use, 480 acres of non-residential land use, and 70 acres of other open space land uses as documented in **Table 2.1** and shown graphically in **Figure 2.3**. The land use designations utilized in this master plan are consistent with the Land Use Element of the City's General Plan, and as received from the City's planning division.

2.3 HISTORICAL POPULATION AND FUTURE GROWTH

The City of San Juan Bautista is a growing community, with over 8% of the San Benito County population residing within the City's service area limits. Records obtained from California Department of Finance estimate the 2019 population at approximately 2,081 people. From 2015 to present the City's service area has observed an average annual growth rate of approximately 1.9 percent.

The General Plan anticipates a 2035 population of 3,500 and this 2020 WMP is consistent with the General Plan projections. The current and projected service area population is summarized in **Table 2.2**.

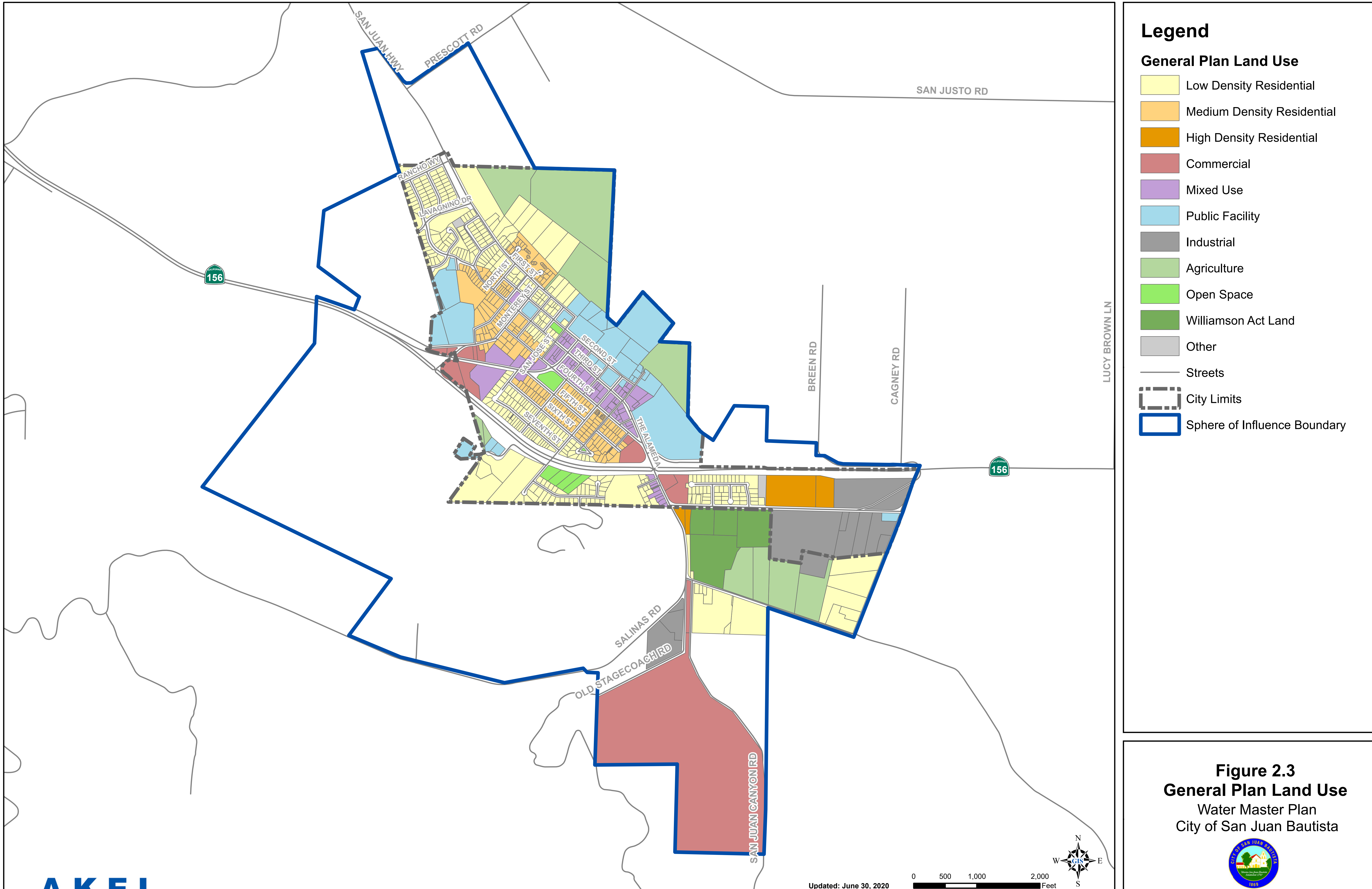

Figure 2.3
General Plan Land Use
Water Master Plan
City of San Juan Bautista

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Table 2.2 Historical and Projected Population

Water Master Plan

City of San Juan Bautista

Year	Population	Annual Growth(%)
Historical[1]		
2000	1,549	-
2001	1,566	1.1%
2002	1,579	0.8%
2003	1,594	0.9%
2004	1,690	6.0%
2005	1,688	-0.1%
2006	1,683	-0.3%
2007	1,779	5.7%
2008	1,835	3.1%
2009	1,852	0.9%
2010	1,862	0.5%
2011	1,873	0.6%
2012	1,881	0.4%
2013	1,895	0.7%
2014	1,914	1.0%
2015	1,930	0.8%
2016	1,943	0.7%
2017	1,981	2.0%
2018	1,986	0.3%
2019	2,081	4.8%
Projected[2]		
2020	2,158	3.7%
2021	2,239	3.7%
2022	2,322	3.7%
2023	2,409	3.7%
2024	2,499	3.7%
2025	2,593	3.7%
2026	2,671	3.0%
2027	2,751	3.0%
2028	2,834	3.0%
2029	2,919	3.0%
2030	3,007	3.0%
2031	3,097	3.0%
2032	3,190	3.0%
2033	3,285	3.0%
2034	3,384	3.0%
2035	3,485	3.0%
2036	3,591	3.0%
2037	3,700	3.0%
2038	3,812	3.0%
2039	3,928	3.0%
2040	4,047	3.0%
2041	4,170	3.0%
2042	4,296	3.0%
2043	4,426	3.0%
2044	4,561	3.0%
2045[3]	4,699	3.0%

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8/6/2020

Note :

1. Historical Populations per California Department of Finance estimates.
2. Unless noted otherwise, projected population extracted from San Juan Bautista 2035 General Plan and normalized to historical population:
   - Year 2021 - 2024: Exponential interpolation between 2020 and 2025.
   - Year 2026 - 2029: Exponential interpolation between 2025 and 2030.
   - Year 2031 - 2034: Exponential interpolation between 2030 and 2035.
3. 2045 population based on land use holding capacity of future residential development and maximum residential land use densities designated by the General Plan.

CHAPTER 3 - SYSTEM PERFORMANCE AND DESIGN CRITERIA

This chapter presents the City'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 historical domestic water consumption per capita was calculated to determine the average water use per capita per day. This was accomplished by dividing the City's historical water production from groundwater production records by the historical population for the respective year.

This master plan forecasts domestic water demands for residential and non-residential land uses based on net acreages. However, to generalize trends in the City's water use, per capita water use was documented.

The City's historical per capita consumption factors, based on available data between 2009-2017, are listed in **Table 3.1**. It should be noted that there were data gaps in the records for 2010, 2011, and 2013. The City's per capita consumption has generally varied since 2009, with a maximum per capita consumption of 170 gallons per day per capita (gpdc) in 2009 and a minimum of 104 gpdc in 2015. **Table 3.2** lists three years (2015-2017) of monthly water production in the City for the years.

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), and the peak hour demand (PHD).The average day demand represents the annual water demand, divided by 365 days, since it is expressed in daily units.

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 City's MMD usually occurs during the summer months between May and July. The MMD is used primarily in the evaluation of supply capabilities.

Table 3.1 Historical Water Production and Maximum Day Peaking Factors

Water Master Plan

City of San Juan Bautista

Year	Population[1]	Annual Change	Historical Water Production[2]									Average Per Capita Water Use
			Annual Production			Maximum Month Production				Maximum Day Production		
						Maximum Monthly Production		Month of Occurrence	Max to Avg Ratio	Total	Max to Avg Ratio	
		(%)	(MG/year)	(mgd)	(gpm)	(MG/month)	(mgd)			(MGD)		(gpdc)
2009	1,852	0.9%	115	0.32	219	15.00	0.50	July	1.59	0.53	1.70	170
2010	1,862	0.5%										
2011	1,873	0.6%										
2012	1,881	0.4%	87	0.24	166	10.84	0.36	July	1.51	0.43	1.81	127
2013	1,895	0.7%										
2014	1,914	1.0%	96	0.26	183	10.84	0.35	May	1.33	0.58	2.19	137
2015	1,930	0.8%	73	0.20	139	8.54	0.28	July	1.42	0.57	2.83	104
2016	1,943	0.7%	76	0.21	145	8.31	0.28	July	1.32	0.57	2.73	108
2017	1,981	2.0%	89	0.24	169	10.83	0.36	July	1.48	0.58	2.39	123
2018	1,986	0.3%										
2019	2,081	4.8%										
Historical Maximum Peaking Factors												
5-year Maximum			96	0.26	183	10.84	0.36	July	1.48	0.58	2.83	137
3-year Maximum			89	0.24	169	10.83	0.36	July	1.48	0.58	2.83	123
2017			89	0.24	169	10.83	0.36	July	1.48	0.58	2.39	123
Recommended Criteria[3]												
Recommended Criteria											**2.25**	

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9/2/2020

Notes:

1. Historical Populations per California Department of Finance estimates.
2. Historical production per annual water readings received from City staff on May 5, 2020. Historical production data was not available for 2010, 2011, or 2013.
3. Peaking factors during drough conditions are higher than historical due to mandatory year-round watering reductions. Accordingly, it is not recommended to use such a peaking factor under average conditions, and thus this master plan recommends a peaking factor consistent with California Waterworks Methodology in the absence of additional supporting data.

Table 3.2 Historical Monthly Water Production (2015-2017)

Water Master Plan

City of San Juan Bautista

Month	2015 Daily Production Average Day (mgd)	2015 Monthly Production (MGM)	2015 Monthly Percent of Annual (%)	2015 Peaking Factor Month to Avg Factor	2016 Daily Production Average Day (mgd)	2016 Monthly Production (MGM)	2016 Monthly Percent of Annual (%)	2016 Peaking Factor Month to Avg Factor	2017 Daily Production Average Day (mgd)	2017 Monthly Production (MGM)	2017 Monthly Percent of Annual (%)	2017 Peaking Factor Month to Avg Factor
January	0.12	3.8	5%	0.61	0.15	4.6	6%	0.70	0.14	4.3	6%	0.57
February	0.17	4.7	6%	0.84	0.16	4.5	6%	0.77	0.17	4.7	6%	0.69
March	0.19	6.0	8%	0.97	0.17	5.3	7%	0.81	0.15	4.7	6%	0.63
April	0.21	6.2	8%	1.02	0.17	5.2	7%	0.83	0.17	5.1	7%	0.69
May	0.19	6.0	8%	0.96	0.21	6.7	9%	1.02	0.26	8.2	11%	1.08
June	0.21	6.2	8%	1.02	0.27	8.2	11%	1.31	0.34	10.2	13%	1.40
July	0.28	8.5	12%	**1.42**	0.28	8.3	11%	**1.32**	0.36	10.8	14%	**1.48**
August	0.25	7.6	10%	1.23	0.27	8.4	11%	1.28	0.33	10.3	14%	1.37
September	0.26	7.7	11%	1.28	0.27	8.1	11%	1.29	0.34	10.3	13%	1.40
October	0.21	6.4	9%	1.03	0.20	6.3	8%	0.96	0.25	7.7	10%	1.01
November	0.17	5.0	7%	0.83	0.20	5.9	8%	0.94	0.21	6.2	8%	0.85
December	0.16	4.9	7%	0.79	0.16	4.9	6%	0.76	0.20	6.3	8%	0.83
Total		**73.1**				**76.3**				**89.0**		
Average Value	**0.20**	**6.1**			**0.21**	**6.4**			**0.24**	**7.4**		
Maximum Value		**8.5**		**1.42**		**8.4**		**1.32**		**10.8**		**1.48**

AKEL ENGINEERING GROUP, INC.

9/2/2020

Notes:

1. Source: 2015, 2016, and 2017 Production Extracted from Groundwater Production records provided by District staff May 5, 2020.

Available historical monthly water production records, obtained for the period between 2009 and 2017 (**Table 3.1**), indicate the maximum month to average month ratio ranging between 1.32 and 1.48. Over the reviewed period, this ratio neither showed significant increasing or decreasing trends. Therefore, an MMD factor of 1.5 was deemed representative of City trends. The following equation is recommended for estimating the maximum month demand, given the average day demand:

Maximum Month Demand = **1.5** 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 City'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.

The maximum day demands were obtained from the City's water production records. Groundwater well production records indicate the date of occurrence and magnitude of the maximum day demand for each calendar year, as listed in **Table 3.1**. The maximum day to average day demand ratios for the period between 2009 and 2017 ranged from 1.70 to 2.83 and occurred in May or July.

It should be noted that the highest maximum day to average day demand ratios occurred as a result of mandatory year-round watering reductions during historical periods of drought. As these conditions are atypical, it is not recommended to use such ratios under average conditions. Thus it was determined that a ratio of 2.25 would be used in this master plan, which is consistent with California Waterworks Methodology in absence of supporting data. Therefore, the following equation is then used to estimate the maximum day demand, given the average day demand:

Maximum Day Demand = **2.25** 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.

A peak hour to maximum day ratio of 1.5 was applied to the maximum day demand to yield the peak hour demand ratio of 3.4. The peak hour demand can then be calculated using the average day demand and the following equation:

Peak Hour Demand = **3.4** 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.

As the City is currently using groundwater wells as the only source of supply, groundwater should be viewed as a sustainable resource. 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. 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 for operational equalization and fire protection. Operational or equalization storage provides the difference in quantity between the customer's peak hour demands and the system's available reliable supply.

3.4.1 Typical Storage Criteria

Typical storage criteria consist of three main elements: operational, emergency, and fire flow.

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 2 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 City criterion requires that 25 percent of the maximum day demand be reserved for operational storage.

Emergency Storage

Table 3.3 Recommended Planning and Design Criteria Summary
Water Master Plan
City of San Juan Bautista

Design Parameter	Criteria[1]	
Supply		
	Supply to meet Maximum Day Demand with largest unit out or service	
Storage		
Total Required Storage	Total Required Storage = Operational + Fire + Emergency	
Operational Storage	25% of Maximum Day Demand	
Emergency Storage	50% of Maximum Day Demand	
Fire Storage	Residential	0.18 MG (1,500 gpm for 2 hours)
	Commercial/Public Facility	0.30 MG (2,500 gpm for 2 hours)
	Industrial	0.54 MG (3,000 gpm for 3 hours)
Distribution Mains		
	Distribution mains should be designed to satisfy the following criteria:	
Maximum Pipeline Velocity	5 ft/s during Peak Hour Demand	
	10 ft/s during Maximum Day Demand + Fire Flow	
Minimum Pipeline Size:	8-inch	
Pump Stations		
	Pump stations shall meet Maximum Day Demand with largest unit out of service.	
PRVs		
	PRVs should be designed to meet the greater of:	
	Peak Hour Demand, or Maximum Day Demand + Fire Flow	
Service Pressures		
Maximum Pressure	100 psi	
Minimum Pressure		
Maximum Day Demand	40 psi	
Peak Hour Demand	40 psi	
Fire Flows	20 psi	
Demand Peaking Factors		
Maximum Month Demand	1.5 x Average Day Demand	
Maximum Day Demand[2]	2.25 x Average Day Demand	
Peak Hour Demand[2]	3.4 x Average Day Demand	
Fire Flows		
Residential	1,500 gpm for 2 hours	
Commercial/Public Facility	2,500 gpm for 2 hours	
Industrial	3,000 gpm for 3 hours	

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9/2/2020

Notes:
1. Unless noted otherwise, criteria shown are recommended based on Akel Engineering Group experience.
2. Peaking factor criteria is based on California Waterworks Standards.

Emergency storage is the volume of water stored to meet demand during emergency situations such as pipe failures, distribution main failures, pump failures, power outages, natural disasters, or other cases in which the supply sources are not able to meet the demand condition.

The amount of water reserved for emergencies is determined by policies adopted by the City and is based on an assessment of the costs and benefits including the desired degree of system reliability, risk during an emergency situation, economic considerations, and water quality concerns.

In California, the amount of emergency storage reserve in municipal water systems is usually between 50 percent and 100 percent of the maximum day demand. The City criterion requires that 50 percent of the maximum day demand be reserved for emergency 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 land use type, and is usually higher for commercial and industrial areas. Fire flow provisions were calculated based on the governing (highest) land use type within a reservoir service area as follows:

- Residential: 1,500 gpm for 2 hours = 0.18 MG
- Commercial/Public Facility: 2,500 gpm for 2 hours = 0.30 MG
- Industrial: 3,000 gpm for 3 hours = 0.54 MG

Total Storage Requirement

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

Qs = 25% MDD (equalization) + 50% MDD (emergency) + 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 city 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 fire flows and during the maximum day demand

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.

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 City's pressure criteria are summarized as follows:

- **Maximum Pressure:** 100 psi
- **Minimum Pressure:**
    - Maximum Day Demand: 40 psi
    - Peak Hour Demand: 40 psi
    - Maximum Day Demand + Fire Flow: 20 psi

3.6 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 2019 water consumption data. The demand was adjusted to balance with current production records, and to account for distribution main losses and vacancies in existing land uses. In the absence of 2019 production records, a system-wide distribution main loss of eleven percent was assumed based on Akel Engineering

Group experience in similar projects. The demand unit factor was then calculated using the total water production and total number of residential and non-residential land use acreages. The

existing unit factor analysis is shown on **Table 3.4**, with the determined unit factors listed on **Table 3.5**.

In order to account for variation in demand across different areas of the same land use classification, several land use types were divided into sub-classifications. It should be noted that the revised classifications resulted in adjusted acreages for each land use type when compared to **Table 2.1**, however total existing service area acreage remained the same. The determinations were decided on a case-by-case basis based on lot size, demands, or other development information as described below:

- **Low Density Residential.** Low density residential land use was separated based on lot size, with lots under 1.0 acres designated as single family residential and lots of 1.0 acres or more as rural residential.
- **Medium/High Density Residential.** The only land classified as high density residential is the Mission Farm RV Park. Thus, medium/high density residential land use was separated into medium density residential and Mission Farm RV Park to properly characterize demand unit factors for each.
- **Industrial.** Industrial land use excludes two users that are located outside of the City's service area: Taylor/Earthbound Farms and True Leaf Farms. These users operate private facilities and are not serviced by the City's water system, and have been listed separately.
- **Public Facility.** Several parcels designated as public facility land use do not typically have associated domestic water demands. As such, these "non-demand generating" parcels have been listed separately.

3.7 FIRE FLOWS

Fire flows are typically based on land use, with the potential for increased fire flow based on the building type. The following are the criteria for fire flows:

- **Category 1.** Fire flows for residential areas were calculated at 1,500 gpm for two hours.
- **Category 2.** Fire flows for commercial areas and public facilities were calculated at 2,500 gpm for two hours.
- **Category 3.** Fire flows for industrial areas were calculated at 3,000 gpm for three hours.

3.8 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

Table 3.4 Water Demand Unit Factor Analysis
Water Master Plan
City of San Juan Bautista

Land Use Classification	Existing Development within Service Area	Existing Average Daily Water Demand Unit factors									
		Consumption[1]			Production (Consumption + 11% losses)[2]		Production at 100% Occupancy			Recommended Water Unit Factor	
		Unadjusted Water Unit Factors	Annual Consumption		Unadjusted Water Unit Factors	Production (w/o Vacancy rate)	Vacancy Rate[3,4]	Projected Production at 100% Occupancy		Recommended Factor[5]	Balance Using Recommended Unit Factor
	(acres)	(gpd/acres)	(gpd)	(gpm)	(gpd/acres)	(gpd)	(%)	(gpd/acres)	(gpd)	(gpd/acres)	(gpd)
Residential											
Low Density Residential - Rural[6]	74	89	6,577	5	99	7,301	9.0%	108	7,958	110	8,127
Low Density Residential - Single Family[6]	161	691	111,215	77	767	123,448	9.0%	836	134,559	840	135,267
Medium Density Residential	8	836	6,717	5	928	7,455	9.0%	1,011	8,126	1,500	12,057
High Density Residential - Mission Farm RV Park[7]	12	169	2,064	1	187	2,291	9.0%	204	2,498	210	2,568
Subtotal - Residential	255		126,573	88		140,496			153,141		158,019
Non-Residential											
Agriculture	273	0	0	0	0	0	0.0%	0	0	0	0
Commercial	20	1,506	29,662	21	1,672	32,924	6.0%	1,772	34,900	1,780	35,054
Industrial[8,9]	45	382	17,121	12	425	19,004	6.0%	450	20,144	1,100	49,245
Mixed-Use[10]	0	0	0	0	0	0	0.0%	0	0	0	0
Public Facility[11]	43	85	3,679	3	95	4,083	0.0%	95	4,083	100	4,311
Non-Demand Generating Public Facility	15	0	0	0	-	-	-	-	-	-	-
Taylor/Earthbound Farms	60	371	22,414	16	-	-	-	-	-	-	-
True Leaf Farms	30	18	522	0	-	-	-	-	-	-	-
Subtotal - Non-Residential	486		73,397	51		56,012			59,128		88,610
Other											
Open Space	5	0	0	0	0	0	0.0%	0	0	0	0
Vacant	34	0	0	0	0	0	0.0%	0	0	0	0
Other	2	0	0	0	0	0	0.0%	0	0	0	0
Williamson Act Land	65	0	0	0	0	0	0.0%	0	0	0	0
Subtotal - Other	106		0	0		0			0		0
Totals											
	848		**199,970**	**139**		**196,508**			**212,268**		**246,629**

9/8/2020

Note:
1. 2019 Water Consumption provided by City staff on January 13, 2020.
2. In order to account for water system losses and other unmetered consumption, production was assumed to be equal to consumption increased by 11% based on Akel Engineering Group experience.
3. Residential vacancy rates sourced from San Benito County 2017-2022 Comprehensive Economic Development Strategy.
4. Commercial and Industrial vacancy rates sourced from San Benito County 2010 General Plan.
5. Recommended Medium Density Residential Water Demand factor based on General Plan development densities and Akel Engineering Group experience.
6. Existing acreage and consumption for low density residential land use was divided into two separate sub-types based on lot size; generally low density residential lots over 1.0 acres were considered Rural while lots under 1.0 acres were considered Single Family.
7. Unit factors for Mission Farm RV Park were calculated separately from medium / high density residential land use to account for higher population density than is typical.
8. Existing acreage of industrial land use excludes two users outside of the City's service area: Taylor/Earthbound Farms & True Leaf Farms. These users operate private facilities and are not serviced by the City's water system and are listed separately.
9. Unit factor for Industrial land use is recommended based on Akel Engineering Group experience.
10. Existing acreage of mixed-use land use was consolidated with it's predominant land use designation.
11. Existing acreage of public facility land use excludes parcels without an associated water billing record.

Table 3.5 Water Demand Unit Factors

Water Master Plan
City of San Juan Bautista

Land Use Type	Water Demand Unit Factor (gpd/acre)
Low Density Residential - Rural	110
Low Density Residential - Single Family	840
Medium Density Residential	1,500
High Density Residential - Mission Farm RV Park	210
Commercial	1,780
Industrial	1,100
Public Facility	100

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8/6/2020

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.

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 used in this master plan is 5 feet per second during peak hour demand, and 10 feet per second during maximum day demand and fire flow conditions. 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.

CHAPTER 4 - EXISTING DOMESTIC WATER FACILITIES

This chapter provides a description of the City's existing domestic water system facilities including the existing wells, distribution mains, storage reservoirs, and booster pump stations. The City's existing domestic water facilities are documented on **Table 4.1**, and described in the following sections.

4.1 EXISTING WATER SYSTEM OVERVIEW

The City's municipal water system consists of two active groundwater wells, one storage tank with a 1.25 million gallons storage volume, distribution mains, and fire hydrants. The City's topography is generally flat with slopes increasing from north to south; based on this topography, the water distribution system is comprised of a single pressure zone.

The City'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, as well as labeling the existing wells and the storage reservoir.

4.2 SOURCE OF SUPPLY

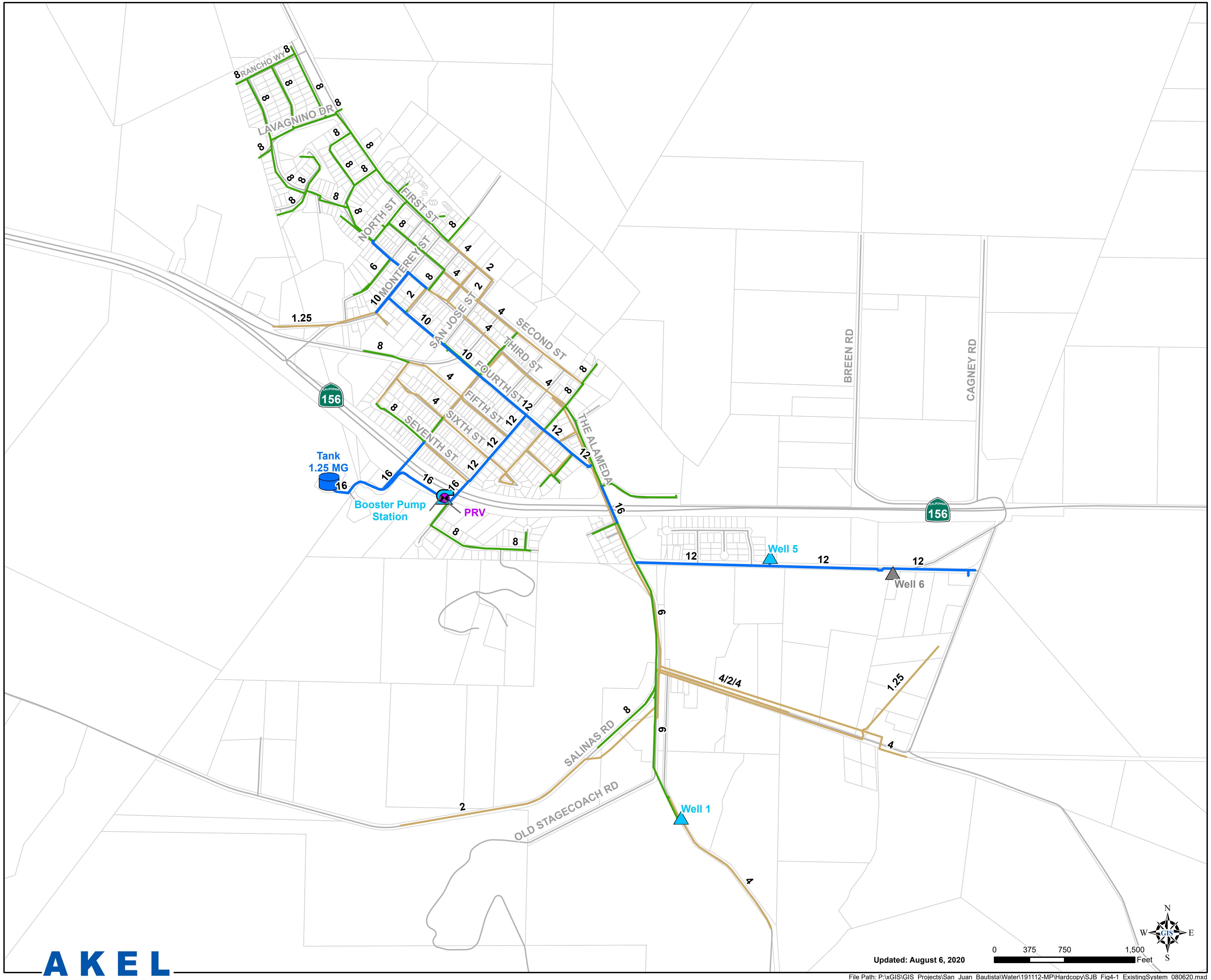
The City currently uses groundwater as the sole source of supply. There are two active groundwater wells in the City that are used for supply: Well 1 and Well 5 (**Figure 4.1**). During the preparation of this master plan, City operations staff provided well capacity ratings. It should be noted that, over time, well efficiencies may vary based on equipment conditions and groundwater levels. In periods of prolonged drought, well efficiency ratings may decrease due to a decline in groundwater levels. The opposite may occur in wet periods as well efficiencies may increase as the groundwater levels recover. As such, the City should monitor the well efficiencies on a frequent basis to adequately manage the groundwater supply. If periods of prolonged drought persist, it may be necessary to construct additional wells to maintain adequate supply capacity.

Based on the well capacities shown on **Table 4.1** the City's current total rated supply is approximately 0.86 mgd. Consistent with the system performance and design criteria the firm capacity is calculated as the capacity with the largest well out of service. The firm capacity of the well supply is estimated at 0.25 mgd.

4.3 WATER DISTRIBUTION PIPELINES

The City's distribution system consists of more than 9 miles of pipeline. The pipelines are generally 16-inches and smaller, and convey water to the consumers' service connections.

An inventory of existing modeled pipes, extracted from the GIS-based hydraulic model and used in this analysis, is included in **Table 4.1**. For each pipe diameter, the inventory lists the length in feet, as well as the total length in units of miles.



Legend

Existing System

- Tank
- Wells
- Inactive Well
- Pump Stations
- PRV

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

Figure 4.1
Existing System
Water Master Plan
City of San Juan Bautista

Table 4.1 Existing System Inventory
Water Master Plan
City of San Juan Bautista

Existing Water Facilities					
Facility Name	**Facility Information**				
	Groundwater Wells[1,2,3,4]				
	Elevation	**Well Depth**	**Head**	**Pump Flow**	**Status**
Well 1 (San Juan Canyon Rd)	249 ft	128 ft	105 ft	175 gpm	Active
Well 5 (Old San Juan Hollister Rd w/o Mission Farm RV Park)	206 ft	450 ft	149 ft	425 gpm	Active
	Storage Reservoirs[4]				
	Elevation	**Diameter**	**Height**	**High Set Point**	**Design Capacity**
Reservoir 1 (Lausen Dr)	395 ft	95 ft	26 ft	26 ft	1.25 MG
	Booster Stations[2]				
	Elevation	**No. of Pumps**	**Total Capacity**	**Firm Capacity**	**Horsepower**
Pump 1 (Lausen Dr)	245 ft	3	150 gpm	100 gpm	5 hp
	Pressure Reducing Valves[2]				
	Elevation	**Outlet Pipe Diameter**	**Setting**		
PRV 1 (Lausen Dr)	245 ft	16"	55		
	Existing Modeled Pipe, by Diameter[4,5,6,7]				
Diameter (in)	**Total Length** (LF)	(mi)	**% of Total System**		
Unknown Diameter	2,566	0.5	4%		
0.75"	97	0.0	0%		
2"	6,936	1.3	10%		
4"	22,238	4.2	33%		
6"	6,480	1.2	10%		
8"	17,643	3.3	26%		
10"	1,819	0.3	3%		
12"	7,261	1.4	11%		
16"	2,366	0.4	4%		
Total	67,405	12.8	100%		

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8/6/2020

Notes:
1. Source: 2017 San Juan Bautista Water Forum Water Source Handout
2. Source: State Water Resources Control Board Permit provided July 16, 2020.
3. Wells 2, 3, 4, and 6 were brought offline and are not displayed in this table.
4. Source: Construction drawings received from City April 6, 2020.
5. Source: Harris ArcGIS Web Map received from City September 26, 2019
6. Source: Water Distribution Map drawings received from City March 15, 2018
7. Source: 2017 San Juan Bautista Water Forum Water Delivery / Infrastructure Handout

4.4 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 City's planning criteria.

The City's sole existing storage reservoir is included in **Table 4.1**, along with its volume, height, diameter, and bottom elevation. Due to the storage reservoir's base elevation a pressure reducing valve is used to control the flow of water to the distribution system and reduce the delivery pressures. Additionally, there is a booster pump located near the storage reservoir that is used to fill the tank as necessary; information for the booster pump can be found in **Table 4.1**.

4.5 PRESSURE REDUCING VALVES

System pressures are regulated through use of a pressure reducing valve (PRV), which is shown on **Table 4.1**. Constructed PRVs allow for the conveyance of water across large elevation changes throughout City. Additionally, the PRV provides a source of emergency supply in the case of groundwater well pump failure or other operational issues. The City currently operates a single pressure reducing valve near the storage reservoir, which is used reduce the pressure of water discharged from the tank to maintain acceptable pressures throughout the system.

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 City's 2019 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 was obtained from the water billing records. Using GIS, each customer account was geocoded to its physical location within the system. The accounts were then sorted by land use type and the total demand in each zone was calculated.

The City'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 groundwater wells and customer service connections. The total domestic water demands were increased proportionally to 0.26 mgd to reflect the total 2014 production and account for transmission main losses.

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 Sphere of Influence. **Table 5.1** documents the future land use categories and their corresponding domestic water demands. It should be noted that the existing domestic water demands in **Table 5.1** 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 0.57 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.

5.3 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 City peaking factor criteria. The maximum day to average day ratio of 2.25, and peak hour to average day ratio of 3.4, were applied to the average day demands to obtain estimates of the higher demand conditions. The maximum day and peak hour demand estimates for the buildout of the Planning Area are 1.27 mgd and 1.91 mgd, respectively.

Table 5.1 Future Water Demand

Water Master Plan

City of San Juan Bautista

Land Use Classification	Water Unit Factor (gpd/acre)	Total Water Demand: Existing Unchanged[1,2] (acres)	Total Water Demand: Redeveloped Area[1,2] (acres)	Total Water Demand: New Development (acres)	Buildout of Service Area: Total Area (acres)	Buildout of Service Area: Average Water Demand (gpd)
Residential						
Low Density Residential - Rural	110	72.9	0.0	0.0	72.9	8,015
Low Density Residential - Single Family	840	125.1	22.6	16.0	163.6	137,411
Medium Density Residential	1,500	7.2	36.5	4.9	48.6	72,866
Mission Farm RV Park	210	12.2	0.0	0.0	12.2	2,568
Subtotal - Residential		**217.4**	**59.0**	**20.9**	**297.2**	**220,860**
Non-Residential						
Commercial	1,780	18.4	117.0	6.1	141.5	251,871
Industrial[3]	1,100	44.8	34.7	0.0	79.4	87,371
Public Facility[4]	100	42.2	10.5	2.4	55.1	5,507
Subtotal - Non-Residential		**105.3**	**162.2**	**8.5**	**276.0**	**344,748**
Total						
Future Demands		**322.7**	**221.2**	**29.3**	**573.2**	**565,608**

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Notes:

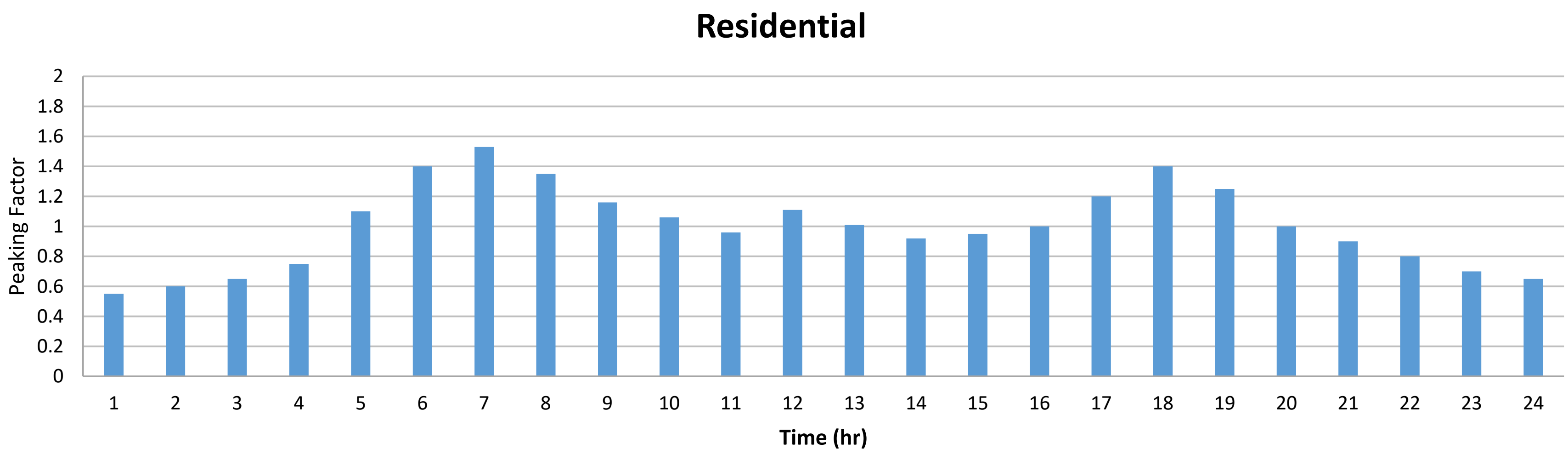
1. Land Use areas based on parcel shapefile downloaded from San Benito County Website (11/05/2019).
2. Developed and Undeveloped areas based on parcel shapefile received from City Staff January 16,2020.
3. Industrial acreages shown exclude Earthbound Farms and True Leaf Farm.
4. Public facility acreages shown exclude non-demand generating parcels.

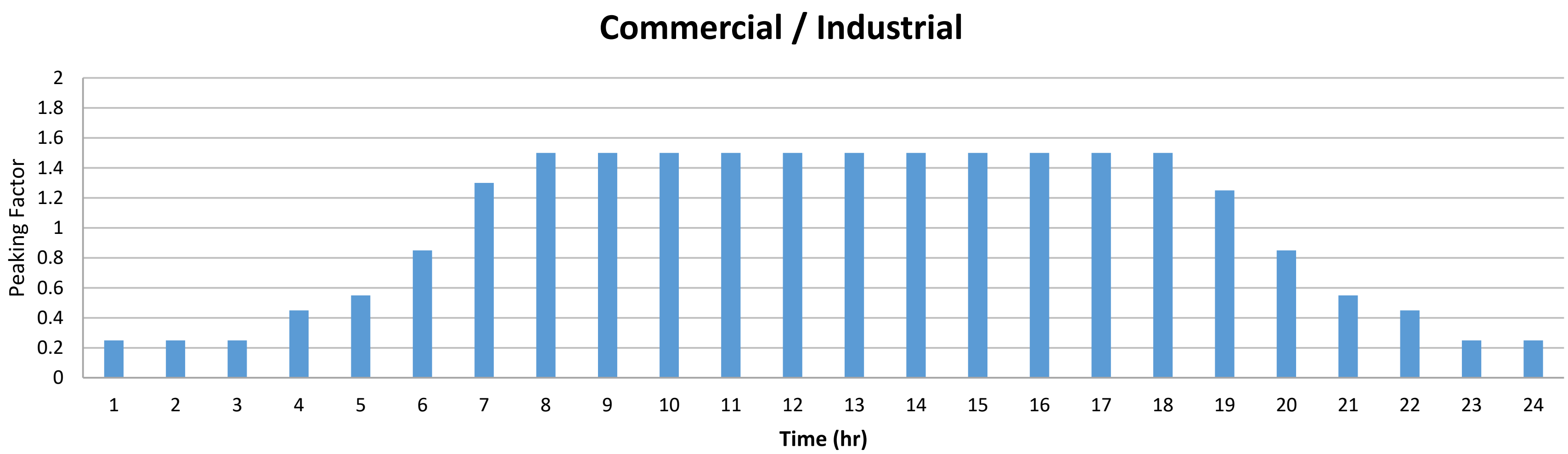
5.4 DIURNAL DEMAND PATTERNS

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.

Two different diurnal curves (**Figure 5.1**) were used to model the demand patterns of 1) residential, 2) commercial, public facility, and industrial use accounts. In the absence of data that can be used to develop these curves, they were based on industry standard demand patterns for these corresponding land use types, and which were originally developed by AWWA.

Each diurnal curve has a unique pattern that creates maximum and minimum flow conditions at different times of the day. Residential demands peak in the morning and evening and are at a minimum during the night hours. Non-residential demands, which include commercial, institutional, and industrial demands, are also at a minimum during the night; however, they remain at a constant maximum from the hours of 8 AM to 5 PM.





LEGEND

Water Demand

Notes:

1. Diurnal patterns are based on AEG experience and reflect typical water system operations.

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June 30, 2020

Figure 5.1

Diurnal Patterns

Water Master Plan

City of San Juan Bautista

CHAPTER 6 - HYDRAULIC MODEL DEVELOPMENT

This chapter describes the development and calibration of the City'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 City'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 City's hydraulic model combines information on the physical characteristics of the water system (pipelines, groundwater wells, and storage reservoir) and operational characteristics (how they operate). 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 that are 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 has been developed into the GIS-based hydraulic model InfoWater by Innovyze. The model has an intuitive graphical interface and is directly integrated with ESRI's ArcGIS (GIS).

6.3 HYDRAULIC MODEL DEVELOPMENT

Developing the hydraulic model included skeletonization, digitizing and quality control, developing pipe and node databases, and water demand allocation.

6.3.1 Digitizing and Quality Control

The City's existing domestic water distribution system was digitized in GIS using several sources of data and various levels of quality control. The data sources included the City's existing system as documented in GIS drawings and schematics provided by City staff.

After reviewing the available data sources, the hydraulic model was built and verified by City staff. Using the available water system data this master plan developed the domestic water system in

GIS. Resolving discrepancies in data sources was accomplished by graphically identifying discrepancies and submitting it to City staff for review and comments. City comments were incorporated in the verified model.

6.3.2 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.

6.3.3 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. The existing demand distribution was obtained from the water billing records. Using GIS, 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 greater Planning Area were allocated based on proposed land use and the land use acreages. As many of the areas were very large in size, demands were allocated evenly to the demand nodes within each area. Infill areas, redevelopment areas, and vacant lands were also included in the future demand allocation.

6.4 MODEL OPERATIONAL VALIDATION

The operational characteristics of the water system hydraulic model were documented and submitted to City staff for review. Well flow and operations, tank level fluctuations, and City-wide maximum and minimum pressures were documented and City staff provided feedback to ensure the model appropriately represents the operational characteristics of the existing water system. Due to a lack of SCADA implementation, the existing system is currently based on Operator control and the hydraulic model was setup to generally reflect the current operational strategy. In the future, if SCADA control is implemented, it is recommended that the hydraulic model be updated.

The validated 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 aid the City 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.

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 developed 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. 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

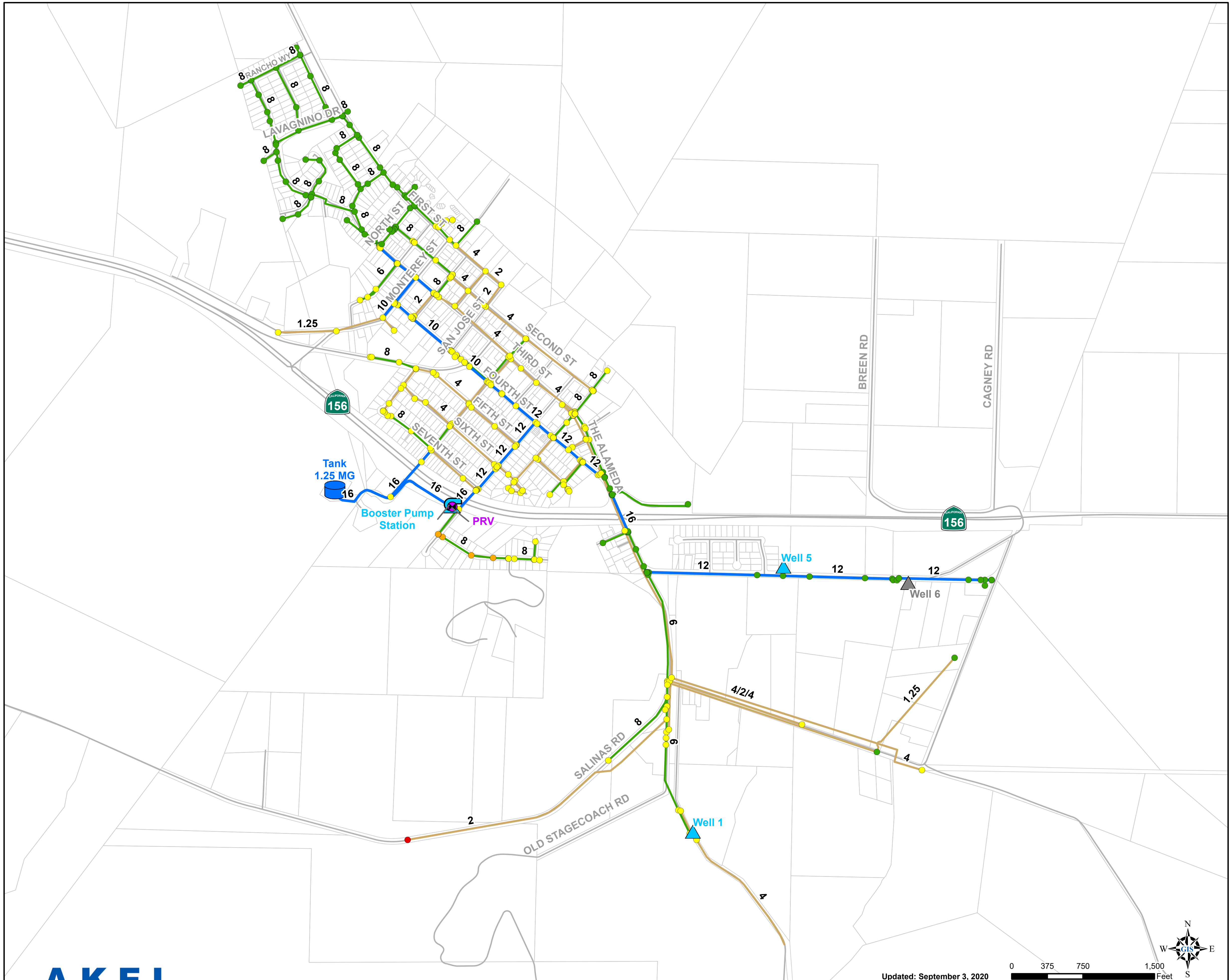
The hydraulic model was also used to determine if the existing domestic water distribution system meets the City's System Performance and Design Criteria for maximum day and peak hour pressures, as discussed in a previous chapter. During maximum day and peak hour demands, the minimum pressure requirement is 40 psi. The hydraulic analysis indicated the City's existing system performed reasonably well during under peak hour operating conditions, with some exceptions as shown on **Figure 7.1**.

7.3 HIGH PRESSURE ANALYSIS

The hydraulic model was also used to identify areas in the City's existing domestic water distribution system that experience high pressure under maximum day demand conditions. Areas of high pressure may be more susceptible to pipeline breaks and ruptures. The City's maximum desired pressure criterion is 100 psi. The hydraulic analysis indicated the City's existing system observes some periods of high pressures, primarily in the northern section of the city. The areas of high pressure are shown graphically on **Figure 7.2**.

7.4 FIRE FLOW ANALYSIS

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. The available fire flow at the City's residual pressure criteria of 20 psi is summarized on **Figure 7.3**.



Legend

Minimum Pressures

- Less than 20 psi
- 20 - 35 psi
- 35 - 55 psi
- 55 - 80 psi
- Greater than 80 psi

Existing System

- Tank
- Wells
- Inactive Well
- Pump Stations
- PRV

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

Figure 7.1
Minimum Pressures
Water Master Plan
City of San Juan Bautista

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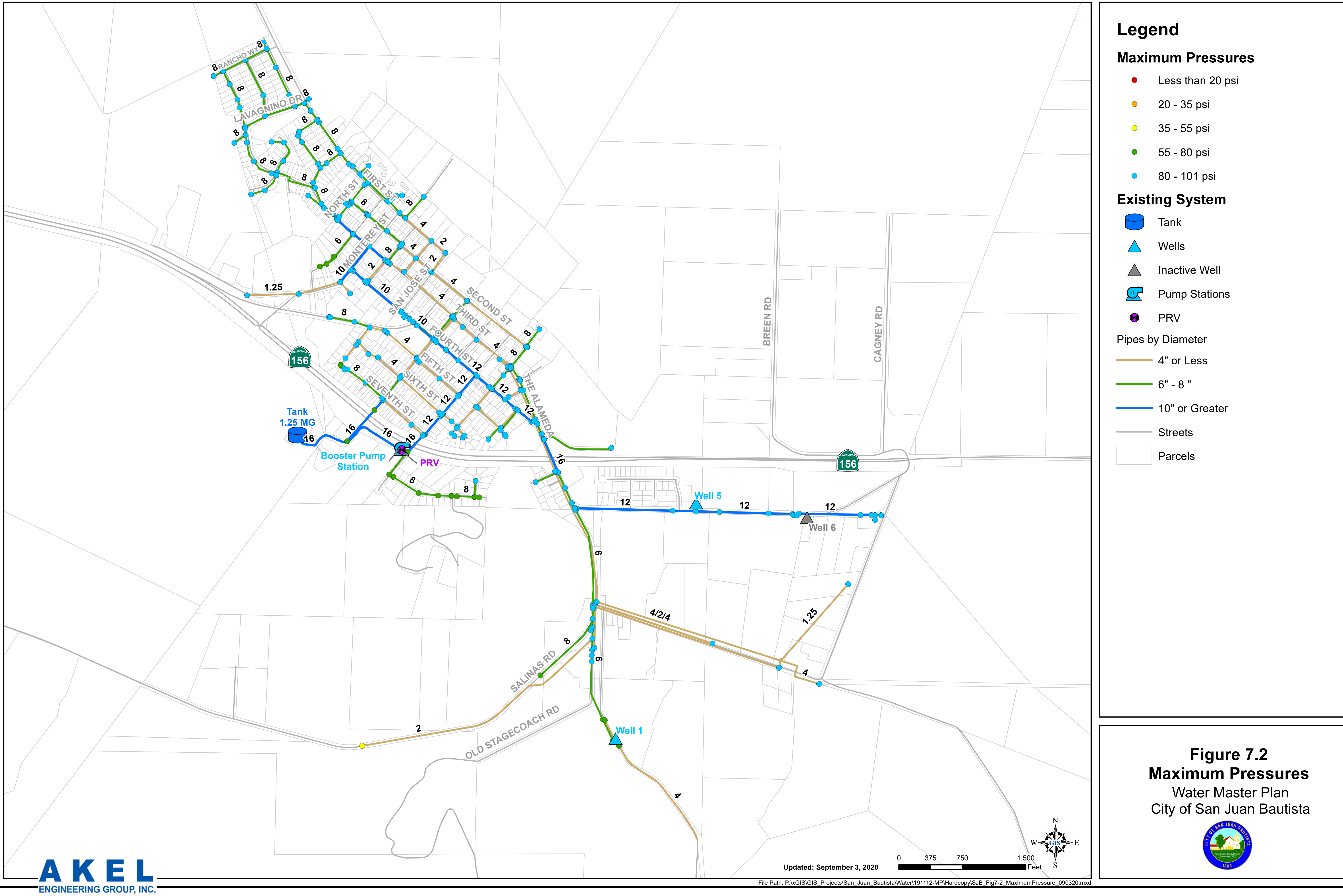

Figure 7.2
Maximum Pressures

Water Master Plan
City of San Juan Bautista

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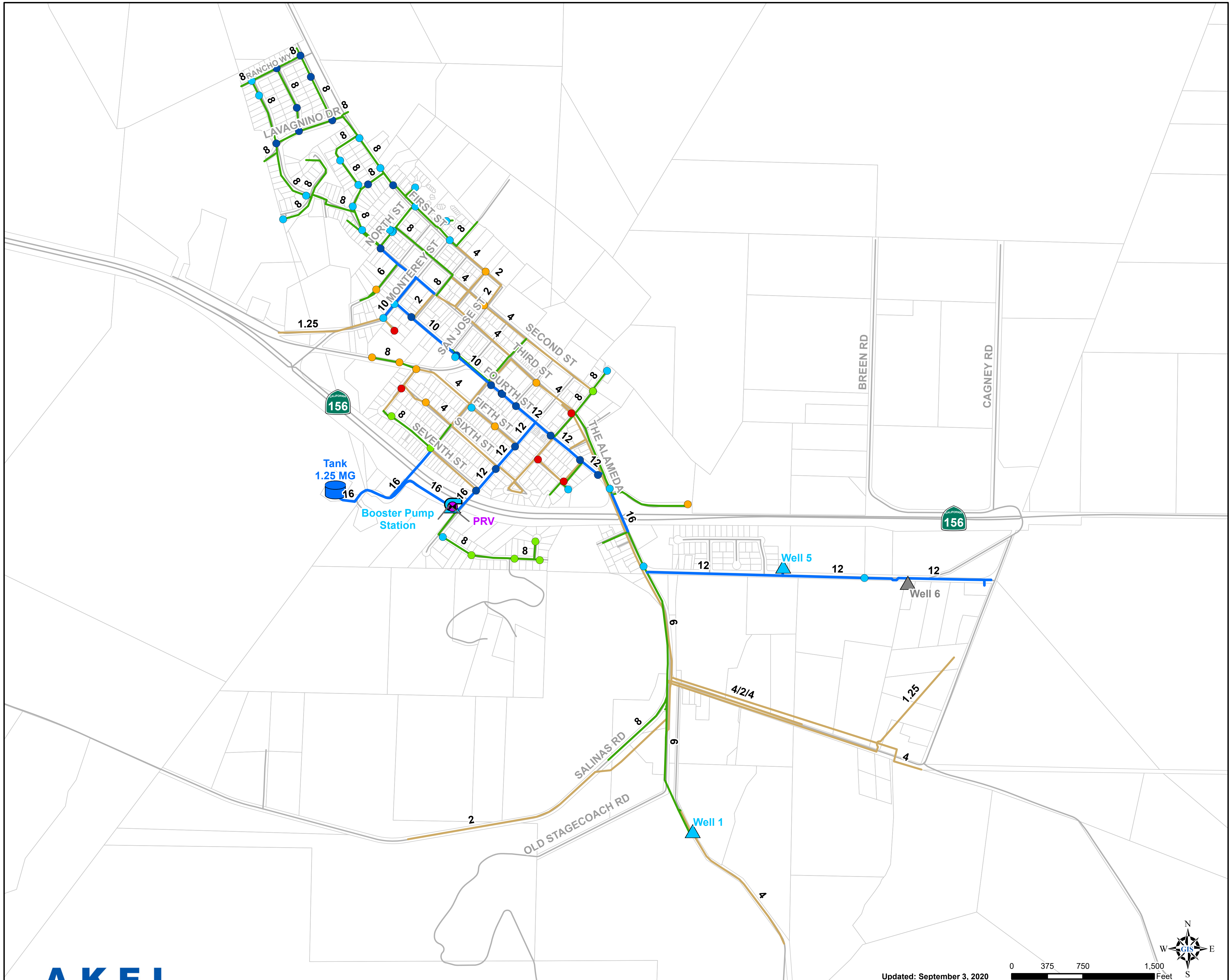

Legend

Available Flow (gpm)

- < 400
- 400 - 900
- 900 - 1,500
- 1,500 - 2,500
- > 2,500

Existing System

- Tank
- Wells
- Inactive Well
- Pump Stations
- PRV

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

Figure 7.3
Available Fire Flow
Water Master Plan
City of San Juan Bautista

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File Path: P:\xGIS\GIS_Projects\San_Juan_Bautista\Water\191112-MP\Hardcopy\SJB_Fig7-3_AvailableFF_090320.mxd

Due to a high number of small-diameter distribution mains, the hydraulic model predicted that many of the existing service connections are unable to meet the pressure requirements under fire flow conditions. A majority of the distribution system serving this area is comprised of water pipelines under 8-inches in diameter. It is recommended that as pipeline repairs and replacements occur, pipelines under 8-inches be replaced with an 8-inch pipeline at minimum and validated by the hydraulic model. Additionally, and where feasible, it is recommended that looped connections be constructed for reliability.

Improvements to mitigate specific fire flow deficiencies are discussed below. Each improvement includes a coded identifier to correlate to the schedule of improvements and Capital Improvement Program.

- **P-6**: Replace approximately 50 feet of existing 4-inch water main with 8-inch water main along Third Street from approximately 30 feet south east of Tahualamist Street to Tahualamist Street.
- **P-9**: Replace approximately 525 feet of existing parallel 4-inch, 8-inch, and 10-inch water main with 12-inch water main along Fourth Street from San Jose Street to Polk Street.
- **P-10**: Replace approximately 100 feet of existing 0.75-inch water main with 8-inch water main along San Antonio Street from Seventh Street to approximately 100 feet north east of Seventh Street.
- **P-11**: Replace approximately 475 feet of existing 4-inch water main with 8-inch water main along San Antonio Street from approximately 460 feet south west of Muckelemi Street to Muckelemi Street.
- **P-12**: Replace approximately 700 feet of existing 4-inch water main with 8-inch water main along Muckelemi Street and Fifth Street from San Antonio Street to Polk Street.
- **P-13**: Replace approximately 300 feet of existing 4-inch water main with 8-inch water main along Polk Street from Fifth Street to Sixth Street.
- **P-14**: Replace approximately 325 feet of existing 4-inch water main with 12-inch water main along Polk Street from Fourth Street to Fifth Street.
- **P-15**: Replace approximately 675 feet of existing 4-inch water main with 12-inch water main along Fifth Street from Polk Street to Washington Street.
- **P-16**: Replace approximately 650 feet of existing 4-inch water main with 8-inch water main along Seventh Street from Polk Street to Washington Street.

7.5 WATER STORAGE REQUIREMENTS

The City'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.

7.5.1 Existing Storage Requirements

Existing storage requirements were identified for each pressure zone and are summarized in **Table 7.1**. The table lists the existing domestic water demands and identifies the operational, emergency, and fire storage for the system. This table also lists the total required storage for existing domestic water demands at 0.98 MG.

7.5.2 Future Storage Requirements

Future storage requirements were identified based on the buildout of the 2035 General Plan and summarized on **Table 7.1**. The table lists the future domestic water demands and identifies the operational, emergency, and fire storage required for future development. The table also lists the total required storage for future domestic water demands at 1.05 MG. As the existing storage requirements already include 0.54 MG of fire storage, future growth will increase storage requirements by 0.51 MG, for a total existing and buildout storage requirement of 1.49 MG.

7.5.3 Recommended New Storage Facilities

The existing and future storage requirements were compared with existing City storage facilities in each pressure zone and the required storage facility improvements were identified, shown on **Tables 7.1**. The table lists existing storage requirements identifies existing storage capacity deficiencies, and identifies future storage capacity requirements to meet the needs from future growth.

The results of the storage analysis indicate that the existing storage volume is sufficient under existing conditions but is unable to meet the requirements for both existing and future customers at the buildout of the General Plan. Therefore, a new storage reservoir is recommended to mitigate this deficiency.

The proposed storage reservoirs, summarized on **Table 7.2** and graphically shown on **Figure 7.4**, are described as follows:

> **T-1A:** Construct a new 1.5 MG storage reservoir at the site of the inactive concrete reservoir.

7.6 WATER SUPPLY REQUIREMENTS

The City's existing domestic water system supply capacity is identified in this section. Additionally, this section identifies the additional supply capacity required to meet the supply requirement.

7.6.1 Existing Supply Requirements

Existing supply requirements were identified for the City and are summarized on **Table 7.3**. The City's existing water supply requirement, based on the existing land use and recommended water demand factors, is approximately 400 gpm. The existing firm supply capacity with the existing wells active is 600 gpm. However, under existing conditions Well 6 has been taken offline due to

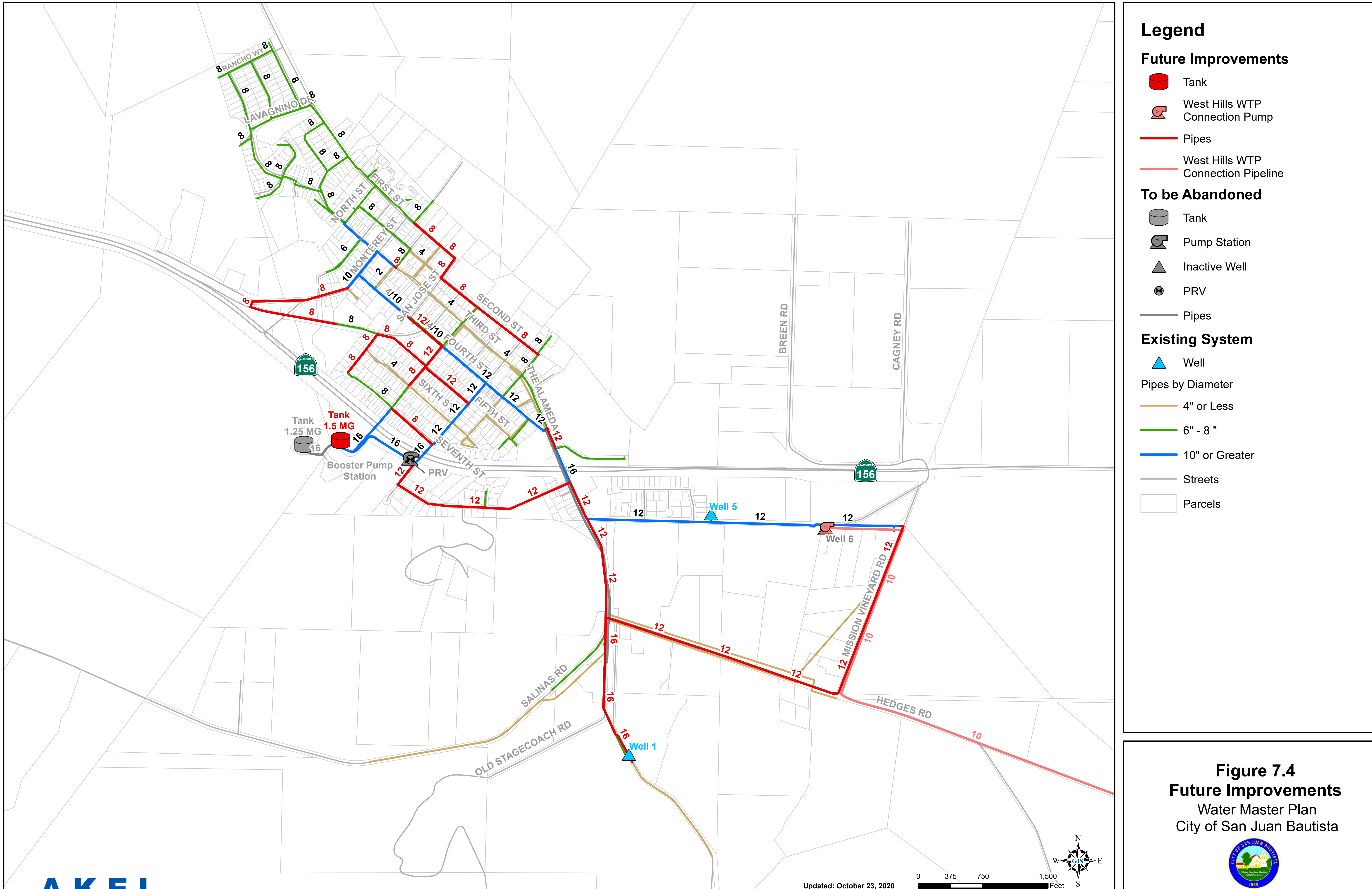

Figure 7.4
Future Improvements
Water Master Plan
City of San Juan Bautista

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Table 7.1 Buildout Storage Capacity Analysis

Water Master Plan

City of San Juan Bautista

Storage Capacity Analysis		
Existing Water Storage Requirements[1,2]		
Existing Average Day Demand	0.26	MGD
Existing Maximum Day Demand	0.59	MGD
Operational + Emergency	0.44	MG
Fire Protection	0.54	MG
Total	**0.98**	**MG**
Future Water Storage Requirements[1,2,3]		
Future Average Day Demand	0.30	MGD
Future Maximum Day Demand	0.68	MGD
Operational + Emergency	0.51	MG
Fire Protection	0.54	MG
Total	**1.05**	**MG**
Water Storage Balance		
Total Buildout Storage Requirement[4]	**1.49**	**MG**
Existing Storage	**1.25**	**MG**
Existing Storage Balance	**-0.24**	**MG**
Recommended Improvement	Replace existing 1.25 MG tank with **new 1.5 MG storage tank**	
Storage	**1.50**	**MG**
Buildout Storage Balance	**0.01**	**MG**

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9/3/2020

Notes:

1. Maximum Day Demand = 2.25 x Average Day Demand
2. Storage Requirements are derived as follows:
   - •Operational = 25% of MDD
   - •Emergency = 50% of MDD
   - •Fire Protection = 3,000 gpm for 3 hours = 0.54 MG
3. Demands and Storage Requirements shown do not include existing demands.
4. Total Buildout Storage Requirements include operational (existing and future), emergency (existing and future), and fire protection requirements (0.54 MG).

Table 7.2 Schedule of Improvements
Water Master Plan
City of San Juan Bautista

Improv. No.	Improv. Type	Alignment	Limits	Improvement Details			
Pipeline Improvements				Existing Diameter (in)	New/ Replace	Diameter (in)	Length (ft)
P-1	Reliability	First St.	From Thomas Ln. to Jefferson St.	4	Replace	8	425
P-2	Reliability	First St.	From Jefferson St. to San Jose St.	2	Replace	8	225
P-3	Reliability	San Jose St.	From First St. to Second St.	2	Replace	8	300
P-4	Reliability	Second St.	From San Jose St. to Franklin St.	4	Replace	8	1,425
P-5	Reliability	Second St.	From Franklin St. to approx. 20' se/o Franklin St.	6	Replace	8	25
P-6	Fire Flow	Third St.	From approx. 30' se/o Tahualamist St. to Tahualamist St.	4	Replace	8	50
P-7	Development	Monterey St. / Larios Dr.	From approx. 200' sw/o Fourth St. to approx. 600' w/o Larios Dr.	1.25	Replace	8	1,125
P-8	Development	Muckelemi St.	From approx. 400' w/o Monterey St. to approx. 600' e/o Monterey St.	-	New	8	1,100
P-9	Fire Flow	Fourth St.	From San Jose St. to Polk St.	4,8,10	Replace	12	525
P-10	Fire Flow	San Antonio St.	From Seventh St. to approx. 100' ne/o Seventh St.	0.75	Replace	8	100
P-11	Fire Flow	San Antonio St.	From approx. 460' sw/o Muckelemi St. to Muckelemi St.	4	Replace	8	475
P-12	Fire Flow	Muckelemi St. / Fifth St.	From San Antonio St. to Polk St.	4	Replace	8	700
P-13	Fire Flow	Polk St.	From Fifth St. to Sixth St.	4	Replace	8	300
P-14	Fire Flow	Polk St.	From Fourth St. to Fifth St.	4	Replace	12	325
P-15	Fire Flow	Fifth St.	From Polk St. to Washington St.	4	Replace	12	675
P-16	Fire Flow	Seventh St.	From Polk St. to Washington St.	4	Replace	8	650
P-17	Reliability	The Alameda	From approx. 10' w/o The Alameda to approx. 10' e/o The Alameda	-	New	12	25
P-18	Capacity	The Alameda	From Fourth St. to Nyland Dr.	6	Replace	12	275
P-19	Reliability	Washington St.	From Lausen Dr. to Lang St.	6	Replace	12	350
P-20	Reliability	Lang St.	From Washington St. to Lang Ct.	8	Replace	12	1,150
P-21	Reliability	Lang St.	From Lang Ct. to approx. 290' w/o The Alameda	-	New	12	725
P-22	Reliability	Lang St.	From approx. 290' w/o The Alameda to The Alameda	8	Replace	12	300
P-23	Capacity	The Alameda / San Juan Canyon Rd.	From Lang St. to Mission Vineyard Rd.	6	Replace	12	1,675
P-24	Development	San Juan Canyon Rd.	From Mission Vineyard Rd. to approx. 620' s/o Old Stagecoach Rd.	4,6	Replace	16	1,775

Table 7.2 Schedule of Improvements

Water Master Plan

City of San Juan Bautista

Improv. No.	Improv. Type	Alignment	Limits	Improvement Details			
P-25	Reliability	Mission Vineyard Rd	From San Juan Canyon Rd. to approx. 1,490' e/o San Juan Canyon Rd.	4	Replace	12	1,500
P-26	Reliability	Mission Vineyard Rd	From approx. 1,490' e/o San Juan Canyon Rd. to Hedges Rd.	-	New	12	1,375
P-27	Reliability	Mission Vineyard Rd	From Hedges Rd. to San Juan Hollister Rd.	-	New	12	2,125
P-28	Capacity	Mission Vineyard Rd / Hedges Rd / ROW	From Well 6 Site to West Hills WTP	-	New	10	33,420
Booster Station Improvements				**Existing Capacity** (MG)	**New/Replace**	**Capacity** (MG)	
PMP-1	Capacity	Well 6 Site		-	New	3 @ 450	
Reservoir Improvements				**Existing Capacity** (MG)	**New/Replace**	**Capacity** (MG)	
T-1A	Capacity	Inactive Concrete Reservoir Site		1.25	Replace	1.5	

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10/29/2020

Table 7.3 Supply Capacity Evaluation
Water Master Plan
City of San Juan Bautista

Well No.	Supply Capacity Analysis	
	Existing Wells (gpm)	Assuming Well 6 Offline (gpm)
Supply Capacity Criteria		
Supply to meet Maximum Day Demand with largest unit out of service		
Existing Supply Capacity[1]		
Well 1	175	175
Well 5	425 - Standby	425 - Standby
Well 6	450	**Offline**
Total Capacity	1,050	600
Firm Capacity	600	175
Existing and Buildout Maximum Day Demands		
Existing[2,3,5]	**411**	**411**
Buildout[2,4,5]	**884**	**884**
Supply vs Demand Evaluation		
Available Firm Capacity	**600**	**175**
Capacity Surplus/Deficiency		
Existing Conditions	**189**	**-236**
Buildout Conditions	**-284**	**-709**
Recommended Additional Firm Supply		
New Firm Supply	**290**	**710**

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9/25/2020

Notes:
1. Well capacities based on email provided by Stantec June 18, 2020.
2. Maximum Day Demand = 2.25 x Average Day Demand
3. Existing demand based on Metered Water Deliveries documented in 2019 Water Consumption Reports provided by City staff January 13, 2020.
4. Buildout demand based on land use parcels and developed unit factors, as shown in Table 5.1.

water quality concerns. Therefore, the firm supply capacity of the City's active groundwater wells is 175 gpm. Based on this firm supply capacity and the existing supply requirements there is an existing supply deficit of more than 200 gpm.

7.6.2 Future Supply Requirements

A supply verses demand comparison was completed to document the well capacity needs from existing conditions to buildout. Buildout average day demands are estimated based on future land use conditions and water demand unit factors discussed in a previous chapter. Assuming Well 6 remains offline the existing supply deficit will increase to approximately 700 gpm under buildout conditions. If Well 6 is brought back online the increase in available firm supply capacity will result in a future supply deficit of 280 gpm. Due to this supply deficiency a new water supply is recommended to meet the requirements of the existing and future customers.

7.7 REGIONAL CONNECTION ALTERNATIVES

The City currently faces multiple challenges to maintain its existing water supply. These challenges include high levels of nitrate and hardness in the existing groundwater sources. The high nitrate levels directly impact the operations of the City's existing wells; currently, Well 6 is offline due to high nitrate levels. Additionally, the high hardness has led to a significant number of residents installing point of delivery water softening systems. The salts produced as a byproduct of the softening process have a negative impact on the City's Wastewater Treatment Plant.

As part of this master plan, various solutions to mitigate these two water quality issues were evaluated. These solutions would require either the installation of a new potable water well (Betabel Road Well) or the construction of a transmission main and booster station to connect the West Hills Water Treatment Plant to the existing system, as documented on **Figure 7.5**. Stantec Consulting evaluated three source control options, which are described below and summarized in the following pages:

- **Option A:** Source Control via Pellet Water Softening Plant Rehabilitation
- **Option B:** Source Control via Domestic Cartridge Water Softeners
- **Option C:** Source Control by Importing Water from West Hills Water Treatment Plant (WTP)

The preliminary engineering report evaluated the different solutions and identified the West Hills WTP connection as the preferred alternative. The following sections summarize the Preliminary Engineering Report (PER) prepared by Stantec Consulting documenting the Source and Potable Water Improvements. The PER is included in **Appendix A**.

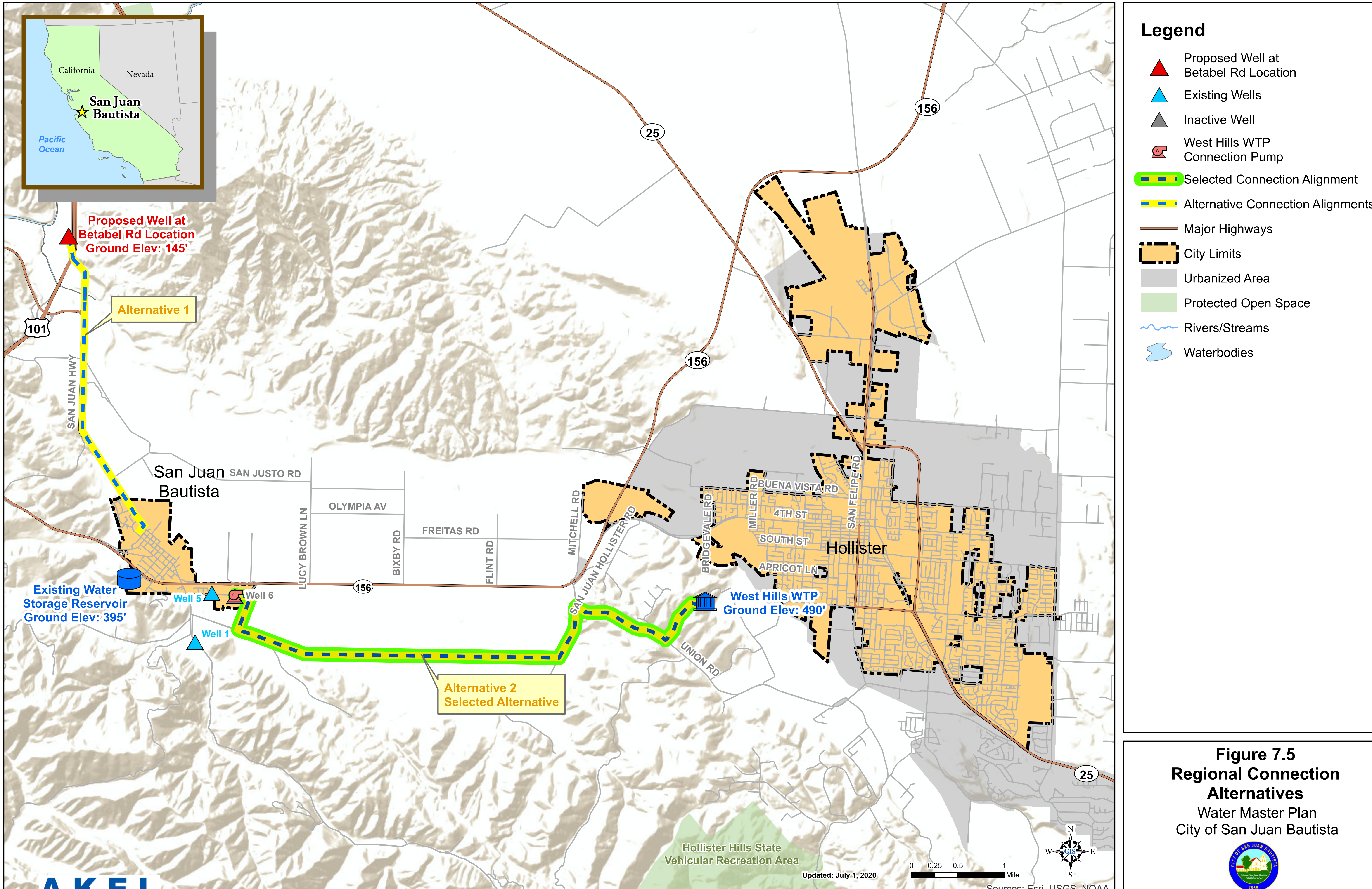

Figure 7.5
Regional Connection Alternatives
Water Master Plan
City of San Juan Bautista

7.7.1 Option A: Pellet Water Softening Plant Rehabilitation

In 2011, the City purchased a pellet water softening system, which was delivered in 2011 but never installed. This system was intended to mitigate the water hardness at the supply source and remove the need for the point of delivery softening systems currently used by many customers.

As part of this master plan, staff from Stantec prepared a preliminary evaluation of the softening system, which included a review of the original system and design constraints, estimated costs to rehabilitate and install the system, and estimated costs to operate the system on an ongoing basis. The total cost to rehabilitate and install the pellet water softening system is approximately $1,800,000. The operation of the pellet water softening system would also necessitate the removal of the point of deliver water softening system installed by customers. A buyback program is recommended to incentivize removal, which has an estimated cost of up to $280,000.

To provide additional water security this option also requires connection to a new Betabel Road Well. This new water source would have water chemistry similar to the City's existing wells, with high hardness and elevated levels of iron and manganese that would necessitate well head treatment, the additional well would provide supply reliability. The well would require a new transmission main to connect to the City and has an estimated project cost of $4,010,000. The total life cycle cost of the entire water supply option is $9,840,000.

7.7.2 Option B: Source Control via Domestic Cartridge Water Softeners

This water supply option replaces the existing point of delivery self-regenerating water softening systems with cartridge water softeners. The existing self-regenerating water softening units drain the effluent brine solution to the sewer system, which contributes to the salinity issues at the WWTP. The cartridge water softening units store the brine solution in a connected tank. On a monthly basis the softening cartridges are replaced and the harvested brine solution is collected and disposed of. A buyback program is recommended to incentivize removal, which has an estimated cost of up to $280,000.

To provide additional water security this option also requires connection to a new Betabel Road Well. This new water source would have water chemistry similar to the City's existing wells, with high hardness and elevated levels of iron and manganese that would necessitate well head treatment, the additional well would provide supply reliability. The well would require a new transmission main to connect to the City and has an estimated project cost of $4,010,000. The total life cycle cost of the entire water supply option is $8,690,000.

7.7.3 Option C: Source Control by Importing Water from West Hills WTP

This water supply option includes a connection to the San Benito County Water District (SBCWD) West Hills WTP. The water provided from the West Hills WTP is only moderately hard and has less total dissolved solids than the City's current supplies. To connect the City's existing water distribution system to the West Hills WTP a pipeline of approximately six miles in length will be constructed. The City has considered multiple pipeline sizes and selected a transmission main of

10-inches in diameter. In order to adequately convey maximum day demands in the buildout of the system, a booster station must be constructed in order to overcome head loss within the pipe between the WTP and the connection to the City's water distribution system. The improved water quality would remove the need for the current point of delivery water softening systems and a buyback program is recommended to incentivize removal, which has an estimated cost of up to $280,000.

The proposed transmission main and booster station, summarized on **Table 7.2** and graphically shown on **Figure 7.4**, are described as follows:

> **P-28:** Construct approximately 33,420 feet of new 10-inch water main along Mission Vineyard Road, Hedges Road, and ROW from the Well 6 site to the West Hills Water Treatment Plant. This improvement will cost approximately $8,452,000.
>
> **PMP-1:** Construct a new booster pump station at the intersection of San Juan Hollister Road and Mission Vineyard Road. This pump station will include 3 pumps with a capacity of 450 gpm each, two duty and one standby, for a total capacity of 1,350 gpm. This improvement will cost approximately $1,513,000.

The total life cycle cost of the entire water supply option is $10,068,000.

7.7.4 Preferred Water Supply Option

The PER used a scoring matrix to evaluate the multiple water supply options that were evaluated. The criteria included in the matrix were as follows: life cycle costs, footprint, ease of operation and maintenance, reliability, upstream and downstream effect, water security, and flexibility with future regulations. Based on the criteria evaluated the recommended water supply option is Option C West Hills WTP connection.

7.8 PIPELINE IMPROVEMENTS TO SERVE FUTURE GROWTH

The buildout of the 2035 General Plan includes development outside of 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 sequence in the improvement schedule. The pipeline improvements, summarized on **Table 7.3** and shown graphically in **Figure 7.4**, are described in detail below.

- **P-1**: Replace approximately 425 feet of existing 4-inch water main with 8-inch water main along First Street from Thomas Lane to Jefferson Street. This improvement aims to increase the reliability of the domestic water system.
- **P-2**: Replace approximately 225 feet of existing 2-inch water main with 8-inch water main along First Street from Jefferson Street to San Jose Street. This improvement aims to increase the reliability of the domestic water system.

- **P-3**: Replace approximately 300 feet of existing 2-inch water main with 8-inch water main along San Jose Street from First Street to Second Street. This improvement aims to increase the reliability of the domestic water system.
- **P-4**: Replace approximately 1,425 feet of existing 4-inch water main with 8-inch water main along Second Street from San Jose Street to Franklin Street. This improvement aims to increase the reliability of the domestic water system.
- **P-5**: Replace approximately 25 feet of existing 6-inch water main with 8-inch water main along Second Street from Franklin Street to approximately 20 feet south east of Franklin Street. This improvement aims to increase the reliability of the domestic water system.
- **P-7**: Replace approximately 1,125 feet of existing 1.25-inch water main with 8-inch water main along Monterey Street and Larios Drive from approximately 200 feet south west of Fourth Street to approximately 600 feet west of Larios Drive. This improvement is intended to service future development.
- **P-8**: Construct approximately 1,100 feet of new 8-inch water main along Muckelemi Street from approximately 400 feet west of Monterey Street to approximately 600 feet east of Monterey Street. This improvement is intended to service future development.
- **P-17**: Construct approximately 25 feet of new 12-inch water main along within Right-Of-Way from approximately 10 feet west of The Alameda to approximately 10 feet east of The Alameda. This improvement aims to increase the reliability of the domestic water system.
- **P-18**: Replace approximately 275 feet of existing 6-inch water main with 12-inch water main along The Alameda from Fourth Street to Nyland Drive. This improvement is intended to mitigate a capacity deficiency as a result of future growth.
- **P-19**: Replace approximately 350 feet of existing 6-inch water main with 12-inch water main along Washington Street from Lausen Drive to Lang Street. This improvement aims to increase the reliability of the domestic water system.
- **P-20**: Replace approximately 1,150 feet of existing 8-inch water main with 12-inch water main along Lang Street from Washington Street to Lang Court. This improvement aims to increase the reliability of the domestic water system.
- **P-21**: Construct approximately 725 feet of new 12-inch water main along within Right-Of-Way from Lang Court to approximately 290 feet west of The Alameda. This improvement aims to increase the reliability of the domestic water system.
- **P-22**: Replace approximately 300 feet of existing 8-inch water main with 12-inch water main along Lang Street from approximately 290 feet west of The Alameda to The Alameda. This improvement aims to increase the reliability of the domestic water system.
- **P-23**: Replace approximately 1,675 feet of existing 6-inch water main with 12-inch water main along The Alameda and San Juan Canyon Road from Lang Street to Mission

Vineyard Road. This improvement is intended to mitigate a capacity deficiency as a result of future growth.

- **P-24**: Replace approximately 1,775 feet of existing 4-inch and 6-inch water main with 16-inch water main along San Juan Canyon Road from Mission Vineyard Road to approximately 620 feet south of Old Stagecoach Road. This improvement is intended to service future development.
- **P-25**: Replace approximately 1,500 feet of existing 4-inch water main with 12-inch water main along Mission Vineyard Road from San Juan Canyon Road to approximately 1,490 feet east of San Juan Canyon Road. This improvement aims to increase the reliability of the domestic water system.
- **P-26**: Construct approximately 1,375 feet of new 12-inch water main along Mission Vineyard Road from approximately 1,490 feet east of San Juan Canyon Road to Hedges Road. This improvement aims to increase the reliability of the domestic water system.
- **P-27**: Construct approximately 2,125 feet of new 12-inch water main along Mission Vineyard Road from Hedges Road to San Juan Hollister Road. This improvement aims to increase the reliability of the domestic water system.

CHAPTER 8 – 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.

8.1 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**.

8.2 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 City 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.

8.2.1 Unit Costs

The unit cost estimates used in developing the Capital Improvement Program are summarized on **Table 8.1**. Domestic water pipeline unit costs are based on length of pipes, in feet. Booster station and storage reservoir unit costs are based on capacity, per flowrate in gallons per minute (gpm) and per million gallons (MG) respectively.

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.

8.2.2 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 Master Plan were benchmarked using a 20-City national average ENR CCI of 11,412, reflecting a date of April 2020.

8.2.3 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.

8.2.4 Project Related Costs

The capital improvement costs also account for project-related costs, comprising of engineering design, project administration (developer and City staff), construction management and

Table 8.1 Unit Costs

Water Master Plan

City of San Juan Bautista

Pipelines	
Pipe Size (in)	**Cost**[1] ($/lineal foot)
8	$149
10	$172
12	$190
16	$229
18	$247
20	$282
24	$308
30	$341
36	$402

Pump Stations	
Estimated Pumping Station Unit Cost ($/gpm), where Q is equal to the total station capacity in gpm	
Construct New Pump Station	$2.416*10^{(0.7583*\log(Q)+3.1951)}$

Storage Reservoirs	
	Cost[1] ($/gal stored)
≤1.0 MG	$2.33
1.1 MG-3.0 MG	$1.86
3.1 MG - 5.0 MG	$1.34
> 5 MG	$1.00

AKEL ENGINEERING GROUP, INC.

10/28/2020

Notes:

1. Construction costs were based on Akel Engineering Group experience adjusted to an ENR CCI of 11,412 (April 2020).

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.

8.3 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.

8.3.1 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 City are summarized on **Table 8.2**.

Each improvement was assigned a unique coded identifier associated with the improvement type and is summarized graphically on **Figure 8.1**. 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).

8.3.2 Regional Connection Alternatives

The Capital Improvement Program costs include costs for the preferred regional connection alternative, as identified in the preliminary engineering report (PER) assembled by Stantec Engineering. It should be noted that these costs include baseline infrastructure costs, as well as the aforementioned construction and capital improvement contingency costs. The final costs for each alternative, including costs related to O&M and domestic softener buyback, can be found in the PER in **Appendix A**.

8.3.3 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 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 8.2** lists each improvement, and separates the cost by responsibility between existing and future users.

8.3.4 Construction Triggers

As a 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 City. Other improvements replace existing infrastructure that is not currently deficient but will violate master plan criteria with future development. The construction triggers quantify the amount of additional development that may occur before the improvement becomes necessary.

8.4 15-YEAR PIPELINE REPLACEMENT PLAN

This section discusses the suggested expenditure budget for the replacing all pipes below 8 inches in diameters as well as the recommended phasing of construction for the pipeline replacements.

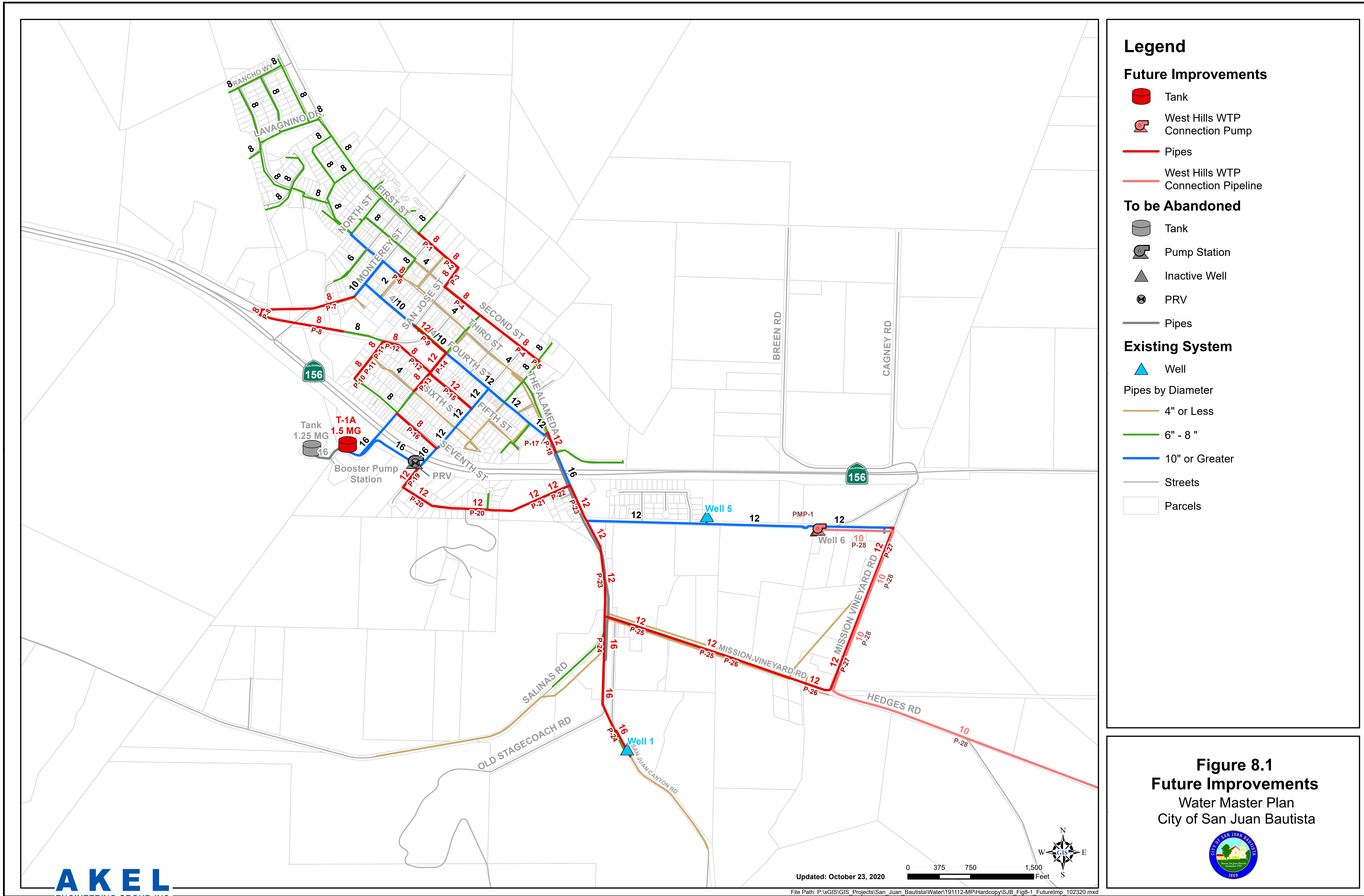

Figure 8.1
Future Improvements
Water Master Plan
City of San Juan Bautista

Table 8.2 Capital Improvement Program
Water Master Plan
City of San Juan Bautista

Improv. No.	Improv. Type	Alignment	Limits	Improvement Details: Existing Diameter (in)	Improvement Details: New/ Replace	Improvement Details: Diameter (in)	Improvement Details: Length (ft)	Infrastructure Costs: Unit Cost ($/unit)	Infrastructure Costs: Infr. Cost [1] ($)	Baseline Construction Cost ($)	Estimated Construction Cost[2] ($)	Capital Improvement Cost[3] ($)	Construction Trigger	Suggested Cost Allocation: Existing Users	Suggested Cost Allocation: Future Users	Cost Sharing: Existing Users ($)	Cost Sharing: Future Users ($)
Pipeline Improvements																	
P-1	Reliability	First St.	From Thomas Ln. to Jefferson St.	4	Replace	8	425	149	63,500	63,500	82,600	107,400	Existing Deficiency	100%	0%	107,400	0
P-2	Reliability	First St.	From Jefferson St. to San Jose St.	2	Replace	8	225	149	33,600	33,600	43,700	56,900	Existing Deficiency	100%	0%	56,900	0
P-3	Reliability	San Jose St.	From First St. to Second St.	2	Replace	8	300	149	44,800	44,800	58,300	75,800	Existing Deficiency	100%	0%	75,800	0
P-4	Reliability	Second St.	From San Jose St. to Franklin St.	4	Replace	8	1,425	149	212,600	212,600	276,400	359,400	Existing Deficiency	100%	0%	359,400	0
P-5	Reliability	Second St.	From Franklin St. to approx. 20' se/o Franklin St.	6	Replace	8	25	149	3,800	3,800	5,000	6,500	Existing Deficiency	100%	0%	6,500	0
P-6	Fire Flow	Third St.	From approx. 30' se/o Tahualamist St. to Tahualamist St.	4	Replace	8	50	149	7,500	7,500	9,800	12,800	Existing Deficiency	100%	0%	12,800	0
P-7	Development	Monterey St. / Larios Dr.	From approx. 200' sw/o Fourth St. to approx. 600' w/o Larios Dr.	1.25	Replace	8	1,125	149	167,900	167,900	218,300	283,800	With Development	0%	100%	0	283,800
P-8	Development	Muckelemi St.	From approx. 400' w/o Monterey St. to approx. 600' e/o Monterey St.	-	New	8	1,100	149	164,200	164,200	213,500	277,600	With Development	0%	100%	0	277,600
P-9	Fire Flow	Fourth St.	From San Jose St. to Polk St.	4,8,10	Replace	12	525	190	99,600	99,600	129,500	168,400	Existing Deficiency	100%	0%	168,400	0
P-10	Fire Flow	San Antonio St.	From Seventh St. to approx. 100' ne/o Seventh St.	0.75	Replace	8	100	149	15,000	15,000	19,500	25,400	Existing Deficiency	100%	0%	25,400	0
P-11	Fire Flow	San Antonio St.	From approx. 460' sw/o Muckelemi St. to Muckelemi St.	4	Replace	8	475	149	70,900	70,900	92,200	119,900	Existing Deficiency	100%	0%	119,900	0
P-12	Fire Flow	Muckelemi St. / Fifth St.	From San Antonio St. to Polk St.	4	Replace	8	700	149	104,500	104,500	135,900	176,700	Existing Deficiency	100%	0%	176,700	0
P-13	Fire Flow	Polk St.	From Fifth St. to Sixth St.	4	Replace	8	300	149	44,800	44,800	58,300	75,800	Existing Deficiency	100%	0%	75,800	0
P-14	Fire Flow	Polk St.	From Fourth St. to Fifth St.	4	Replace	12	325	190	61,700	61,700	80,300	104,400	Existing Deficiency	100%	0%	104,400	0
P-15	Fire Flow	Fifth St.	From Polk St. to Washington St.	4	Replace	12	675	190	128,100	128,100	166,600	216,600	Existing Deficiency	100%	0%	216,600	0
P-16	Fire Flow	Seventh St.	From Polk St. to Washington St.	4	Replace	8	650	149	97,000	97,000	126,100	164,000	Existing Deficiency	100%	0%	164,000	0
P-17	Reliability	The Alameda	From approx. 10' w/o The Alameda to approx. 10' e/o The Alameda	-	New	12	25	190	4,800	4,800	6,300	8,200	As Funding is Available	46%	54%	3,900	4,400
P-18	Capacity	The Alameda	From Fourth St. to Nyland Dr.	6	Replace	12	275	190	52,200	52,200	67,900	88,300	As Funding is Available	46%	54%	41,100	47,300
P-19	Reliability	Washington St.	From Lausen Dr. to Lang St.	6	Replace	12	350	190	66,400	66,400	86,400	112,400	As Funding is Available	46%	54%	52,300	60,200
P-20	Reliability	Lang St.	From Washington St. to Lang Ct.	8	Replace	12	1,150	190	218,100	218,100	283,600	368,700	As Funding is Available	46%	54%	171,400	197,400
P-21	Reliability	Lang St.	From Lang Ct. to approx. 290' w/o The Alameda	-	New	12	725	190	137,500	137,500	178,800	232,500	As Funding is Available	46%	54%	108,100	124,500
P-22	Reliability	Lang St.	From approx. 290' w/o The Alameda to The Alameda	8	Replace	12	300	190	56,900	56,900	74,000	96,200	As Funding is Available	46%	54%	44,800	51,500

Table 8.2 Capital Improvement Program

Water Master Plan

City of San Juan Bautista

Improv. No.	Improv. Type	Alignment	Limits	Improvement Details				Infrastructure Costs		Baseline Construction Cost	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
								Unit Cost ($/unit)	Infr. Cost[1] ($)	($)	($)	($)		Existing Users	Future Users	Existing Users ($)	Future Users ($)
Pipeline Improvements				Existing Diameter (in)	New/ Replace	Diameter (in)	Length (ft)										
P-23	Capacity	The Alameda / San Juan Canyon Rd.	From Lang St. to Mission Vineyard Rd.	6	Replace	12	1,675	190	317,700	317,700	413,100	537,100	As Funding is Available	46%	54%	249,600	287,600
P-24	Development	San Juan Canyon Rd.	From Mission Vineyard Rd. to approx. 620' s/o Old Stagecoach Rd.	4,6	Replace	16	1,775	229	406,200	406,200	528,100	686,600	With Development	0%	100%	0	686,600
P-25	Reliability	Mission Vineyard Rd	From San Juan Canyon Rd. to approx. 1,490' e/o San Juan Canyon Rd.	4	Replace	12	1,500	190	284,500	284,500	369,900	480,900	As Funding is Available	46%	54%	223,500	257,500
P-26	Reliability	Mission Vineyard Rd	From approx. 1,490' e/o San Juan Canyon Rd. to Hedges Rd.	-	New	12	1,375	190	260,800	260,800	339,100	440,900	As Funding is Available	46%	54%	204,900	236,100
P-27	Reliability	Mission Vineyard Rd	From Hedges Rd. to San Juan Hollister Rd.	-	New	12	2,125	190	403,000	403,000	523,900	681,100	As Funding is Available	46%	54%	316,600	364,600
P-28	Capacity	Mission Vineyard Rd / Hedges Rd / ROW	From Well 6 Site to West Hills WTP	-	New	10	33,420	172	5,001,000	5,001,000	6,501,300	8,451,700	Existing Deficiency	46%	54%	3,927,500	4,524,300
				Subtotal - Pipeline Improvements					**8,528,600**	**8,528,600**	**11,088,400**	**14,416,000**				**7,013,700**	**7,403,400**
Booster Station Improvements				Existing Capacity (gpm)	New/Replace	Capacity (gpm)											
PMP-1	Capacity	Well 6 Site		-	New	3 @ 450			895,300	895,300	1,163,900	1,513,100	Existing Deficiency	46%	54%	703,200	810,000
				Subtotal - Booster Station Improvements					**895,300**	**895,300**	**1,163,900**	**1,513,100**				**703,200**	**810,000**
Reservoir Improvements				Existing Capacity (MG)	New/Replace	Capacity (MG)											
T-1A	Capacity	Inactive Concrete Reservoir Site		1.25	Replace	1.5			2,794,800	2,794,800	3,633,300	4,723,300	517 EDUs	46%	54%	2,194,900	2,528,500
				Subtotal - Reservoir Improvements					**2,794,800**	**2,794,800**	**3,633,300**	**4,723,300**				**2,194,900**	**2,528,500**
Total Water System Improvement Costs																	
				Pipeline Improvements					**8,528,600**	**8,528,600**	**11,088,400**	**14,416,000**				**7,013,700**	**7,403,400**
				Booster Station Improvements					**895,300**	**895,300**	**1,163,900**	**1,513,100**				**703,200**	**810,000**
				Reservoir Improvements					**2,794,800**	**2,794,800**	**3,633,300**	**4,723,300**				**2,194,900**	**2,528,500**
				Total - Improvement Cost					**12,218,700**	**12,218,700**	**15,885,600**	**20,652,400**				**9,911,800**	**10,741,900**

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10/29/2020

Notes:
1. Portions of the alignment of pipeline P-28 exist in agricultural land with no paving, thus pipeline unit costs were reduced by 30% to account for the following: 25% reduction for pavement replacement, and 5% reduction for traffic control.
2. Baseline construction costs plus 30% to account for unforeseen events and unknown conditions.
3. 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.

The costs and phasing for the next fifteen fiscal years (FY) are summarized on **Table 8.3**; this plan includes the total costs for pipelines to be constructed, as well as cost escalation to account for inflation over time. The improvements listed are ordered by existing pipeline diameter, as smaller pipelines are assumed to be a greater risk to existing system reliability and are recommended for priority replacement.

Table 8.3 15-Year Pipeline Replacement Schedule

Water Master Plan

City of San Juan Bautista

Year	Projected ENR CCI[1]	Improvement Details: Existing Diameter (in)	Improvement Details: Total Length[2] (LF)	Improvement Details: Total Length[2] (mi)	Infrastructure Costs: Unit Cost[3] ($/unit)	Infrastructure Costs: Infr. Cost ($)	Baseline Construction Cost ($)	Estimated Construction Cost[4] ($)	Capital Improvement Cost[5] ($)
2021	**11,731**	1.25	1,325	0.25	153	203,300	203,300	264,300	343,600
2022	**12,060**	2	1,300	0.25	158	205,000	205,000	266,500	346,500
2023	**12,397**	2	1,300	0.25	162	210,700	210,700	274,000	356,200
2024	**12,744**	2	1,300	0.25	167	216,600	216,600	281,600	366,100
2025	**13,100**	2	1,300	0.25	171	222,700	222,700	289,600	376,500
2026	**13,467**	2	1,300	0.25	176	228,900	228,900	297,600	386,900
2027	**13,844**	4	1,150	0.22	181	208,200	208,200	270,700	352,000
2028	**14,231**	4	1,150	0.22	186	214,000	214,000	278,200	361,700
2029	**14,629**	4	1,150	0.22	191	220,000	220,000	286,000	371,800
2030	**15,039**	4	1,150	0.22	197	226,100	226,100	294,000	382,200
2031	**15,459**	4	1,150	0.22	202	232,500	232,500	302,300	393,000
2032	**15,892**	4	1,150	0.22	208	239,000	239,000	310,700	404,000
2033	**16,337**	4	1,150	0.22	214	245,700	245,700	319,500	415,400
2034	**16,794**	6	1,425	0.27	220	312,900	312,900	406,800	528,900
2035	**17,264**	6	1,425	0.27	226	321,700	321,700	418,300	543,800
		Total - 15-Year Replacement Improvements				**3,507,300**	**3,507,300**	**4,560,100**	**5,928,600**

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8/6/2020

Notes:
1. Costs account for inflation consistent with previous 10 years of historical ENR CCI (2010 - 2020). ENR CCI values shown for documentation purposes only and are subject to review annually by City staff.
2. Pipe lengths shown do not include pipelines recommended for replacement in the Capital Improvement Program.
3. Unit costs are based on 8-inch diameter pipelines, the minimum required size per design criteria.
4. Baseline construction costs plus 30% to account for unforeseen events and unknown conditions.
5. 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.

APPENDICES

APPENDIX A

Source and Potable Water Improvements
Preliminary Engineering Report

San Juan Bautista, Source and Potable Water Improvements

Preliminary Engineering Report

November 3, 2020

Submitted to:

Akel Engineering Group, Inc.

Prepared for:

The City of San Juan Bautista

Prepared by:

Stantec Consulting Services Inc.

Prepared by ______________________________
(signature)

Beth Cohen, P.E.

Reviewed by ______________________________
(signature)

Steven L. Beck, P.E.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

The City of San Juan Bautista provides potable water service to approximately 2,100 residents and commercial/industrial users. The City currently operates a domestic water distribution system that consists of two groundwater wells (Well No. 1 and Well No. 5), associated well-head treatment systems (chlorination and iron/manganese filters), a 1.25-million gallon storage tank, and over 10-miles of distribution pipelines. As discussed in the 2020 Water Master Plan, the City's existing customers have a maximum daily demand of 343 gallons per minute (gpm), but only has a firm reliable capacity of 175 gpm (using Well No. 1 as the primary source of water when the higher production Well No. 5 is removed from service for routine maintenance or possible nitrate contamination). Further, the City is at risk of having a water shortage because their high capacity well (Well No. 5) draws from the same groundwater source as a recently decommissioned well (Well No. 6) that was taken out of service due to increased nitrate levels that have not yet been isolated or controlled. Well No. 5 is vulnerable to the same fate as the adjacent well and, if nitrates contaminate the City's main water production well, they will not have the ability to serve their existing users. Finding a backup water source for water security is a high priority for the City.

Additionally, the City operates a local wastewater treatment plant (WWTP) that is in violation of discharge limits for chloride, sodium, and total dissolved solids (TDS) and has been violating these constituents for many years. The elevated chloride, sodium, and TDS levels observed in the City's wastewater are partially from source water (groundwater) hardness and associated self-regenerating water softeners used for potable water treatment throughout the community. The existing groundwater wells produce very hard water (greater than 300 mg/L as $CaCO_3$) and, as a result, many of the City's residents have installed domestic self-regenerating water softeners to provide local treatment. Water softeners exchange calcium and magnesium (the main constituents contributing to hardness) for sodium or common salt (sodium chloride, NaCl). This process results in elevated chloride, sodium, and TDS concentrations that are discharged into the City's sanitary sewer collection system and then pass through the wastewater treatment plant untreated, causing effluent discharge permit violations.

The purpose of this report is to investigate alternatives and develop a recommended program to reduce the potable water hardness (mitigating the salinity loading from self-regenerating water softeners) and provide a secure water source. The alternative projects considered herein include the following:

A. Option A, Source Control via Pellet Water Softening Plant Rehabilitation: Salinity control will be accomplished by rehabilitating the City owned pellet water softening system and installing it on the potable water distribution network. After lowering source water hardness, the City will implement a buy-back program to eliminate domestic self-regenerating water softeners, in order to reduce the wastewater influent salinity concentrations to permittable levels. This option will connect to the Batebel Road Well for water security.

B. Option B, Source Control via Domestic Cartridge Water Softeners: Salinity control will be accomplished by replacing all domestic self-regenerating water softeners with cartridge water softeners. Salt being discharged from household water softeners will no longer drain to the sewers (lowering influent wastewater salinity concentrations to permittable levels) and instead the salt will be collected in canisters and safely disposed of off-site. This option will connect to the Batebel Road Well for water security.

C. Option C, Source Control by Importing Water from West Hills WTP: Salinity control will be accomplished by replacing well water (very hard water) with treated surface water (moderately hard) and remove self-regenerating water softeners in order to reduce the wastewater influent salinity concentrations to permittable levels. Connecting to West Hills WTP also provides water security and no additional water source connections are needed.

Options A and B both require new City water softening systems in order to reduce wastewater influent salinity concentrations to permittable levels (i.e. providing soft water to the community and eliminating self-regenerating water softeners that dump high levels of chloride, sodium, and TDS into the sewers). Further, Options A and B require installation of a new potable water well (Betable Road Well) to provide water security to the City's potable water portfolio. Option C will reduce the hardness without installation of new water softening systems and provide water security (without connecting to other wells).

This Preliminary Engineering Report documents the alternative analysis and provides additional information related to the Best Apparent Project with the intent of complying with the requirements of the United States Department of Agriculture – Rural Development (USDA-RD) funding program.

1.0 PROJECT PLANNING

The purpose of this section is to describe the project area, including the location, environmental resources, population and community. This section is divided into the following sub sections.

- Project Location
- Environmental Resources Present
- Population Trends
- Community Engagement

1.1 LOCATION

The City of San Juan Bautista (City) provides water distribution for the community and is located in San Benito County, California. A vicinity map showing the location of the water system is shown in **Figure 1**.

Figure 1 San Juan Bautista Water System Map

1.2 ENVIRONMENTAL RESOURCES PRESENT

A separate CEQA Initial Study and Mitigated Negative Declaration (IS/MND) checklist will be provided to document environmental resources present in the Project area and impacts from this Project are generally anticipated to be as follows:

- **Aesthetics**. Less than significant with mitigation incorporated. The selected project is considered to have less than significant impact.
- **Agricultural Resources**. No Impact. The selected project is not anticipated to impact any existing farmland (as the entire project falls under the rehabilitation of existing facilities and regional pipeline alignments along existing roads within the public-right-of way) and could be

used to improve those resources by providing high quality effluent discharged to downstream agricultural resources.

- **Air Quality**. Less than significant with mitigation incorporated. The selected project will have a similar amount of equipment as the existing facilities, with the opportunity to provide more efficient motors and control algorithms within the rehabilitated facility.
- **Biological Resources**. No Impact. The selected project does not have any impacts to known habitat as it involves replacing existing infrastructure. However, habitat is known to exist in the project vicinity and will require careful biological surveys.
- **Cultural Resources**. No Impact. The site has been extensively modified and no archeological or historic resources were noted during the construction and operation of the facility. Further, if human remains are unearthed during construction, the project will be halted until a qualified archeologist can assess its significance and until the County Coroner has made necessary findings as to the origin.
- **Geology and Soils**. Less Than Significant Impact. The selected project is expected to have an equal or lesser risk related to expansive soils.
- **Hazardous Material**. Less than significant. The selected project does not anticipate encountering any hazardous materials and all process chemicals will be double contained.
- **Hydrology and Water Quality**. No Impact. The selected project is anticipated to have a positive impact on water quality.
- **Land Use and Planning**. No Impact. The selected project would not change or alter any existing land use planning.
- **Mineral Resources**. No Impact. The selected project is not anticipated to impact mineral resources.
- **Noise**. No Impact. The selected project is not anticipated to create more noise than the existing water wells and treatment facilities and, in fact, will have modern drives and controllers that reduce noise from potential receptors.
- **Population and Housing**. No Impact. The selected project will serve the same community plan and have a positive impact on the surrounding community by providing reliable water services.
- **Public Services**. No Impact. The selected project will not impact public services.
- **Recreation**. No Impact. The selected project will not impact recreation opportunities in the community.
- **Transportation/Traffic**. No Impact. The selected project will not impact traffic except during construction, but there will be no long-term transportation or traffic impacts.
- **Utilities or Services**. No Impact. The selected project will not impact utilities except to provide a reliable potable water source.

1.2.1 Engineered Environmental Mitigation

The proposed Project is located within the existing well site fence line and a regional pipeline along road alignments within the public right-of-way, in previously disturbed areas. As such, the Project does not have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community or reduce the number or restrict the range of a rare or endangered plant or animal. The amount of disturbance within the Project area (existing well sites and roadways) indicates a low likelihood that cultural resources would be encountered during Project construction activities. Therefore, the potential array of impacts is considered less than significant and assumed to require the following Best Management Practices (to be verified in the IS/MND):

Erosion Control and Stormwater Pollution Prevention Plan: The construction contractor will prepare an erosion control plan and a stormwater pollution prevention plan prior to construction for all grading activities that exceed one acre of disturbance (as required by the Regional Board). The plans shall provide, at a minimum, measures to trap sediment, stabilize excavated soil piles, stabilize and revegetate disturbed areas, and any special stabilization measures required by the design engineer or the City. The plan shall be implemented and inspected accordingly in compliance with the permit throughout the construction process.

Noise Control: The construction contractor will be responsible for keeping construction noise levels within an acceptable range according to applicable County standards and ordinances.

Dust and Emission Control Plan: The construction contractor will prepare a dust and emission control plan prior to construction. The plans shall provide, at a minimum, measures to reduce dust and emissions (by minimizing idling time of diesel-powered equipment, apply water to disturbed areas, restrict grading and earth moving operations when wind speeds exceed 20 mph, etc.)

1.3 POPULATION TRENDS

Since the 1990’s the City of San Juan Bautista has experienced a slow, but steady, rate of growth. According to census data, the City has grown from a population of 1,390 (in 1990) to a population of 1,862 (in 2010), as shown in **Table 1**. This equates to an approximate annual growth rate of 1.5%.

In accordance with the 2014-2018 American Community Survey (ACS) 5-year estimates, the population in 2018 was 1,965. This intermediate measurement shows a slowing in the growth for the rural community.

Table 1 San Juan Bautista Population Data

Year	Population
1990	1,390
2000	1,548
2010	1,862
2018 (ACS)	1,965
2020*	2,030
2030*	2,247

*Projections based on least regression model.

1.4 COMMUNITY ENGAGEMENT

In the City's efforts to achieve the project objectives, public involvement is an important aspect of the overall plan, so that the City residents and businesses know what the City is doing with their water resources (potable water and wastewater), why, and how the City intends to 1) protect public health and enhance the environment, 2) comply with pertinent laws and regulations, 3) protect the value of properties served by the water and wastewater utilities, and 4) fund the improvements. Primary outreach efforts include:

- Community Workshops
- Community Survey
- Utility Bill Inserts
- Board Meetings

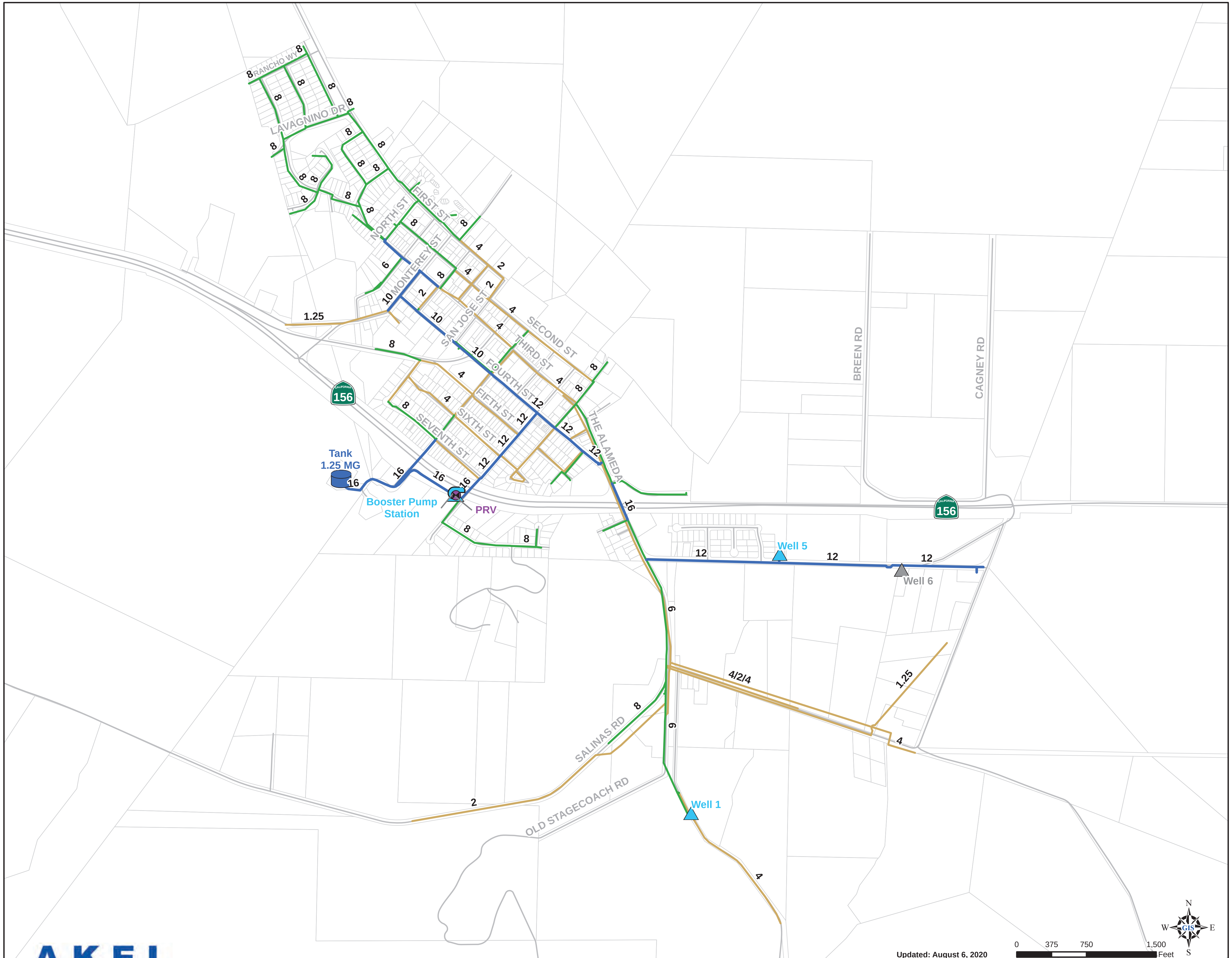
The need for wastewater treatment improvements has been known by the City for many years, as the plant has been out of compliance since the 2009 NPDES permit was adopted, and has been discussed over the years at many City Council meetings with public discussion and discourse. The source control measures have been recently incorporated into the conversations in the Master Plans and City Council meetings. Most recently, there was a City Council and community workshop held on February 15, 2020, to set goals for the City (including water and wastewater treatment). Further, the City initiated a community survey to identify what is important to ratepayers. The survey was mailed to every resident in the March 2020 water utility bill. Additionally, presentations have been made by City Staff to the Council related to the project, including (most recently) on April 21, 2020. These presentations included opportunity for public involvement during the public comment period.

2.0 EXISTING WATER FACILITIES

The existing San Juan Bautista water pumping, storage, and distribution system and is described herein.

2.1 LOCATION MAP

The existing water system layout is shown in **Figure 2**.



Legend

Existing System

- Tank
- Wells
- Inactive Well
- Pump Stations
- PRV

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

PRELIMINARY

Figure 2

Existing System

Water Master Plan

City of San Juan Bautista

AKEL

ENGINEERING GROUP, INC.

2.2 HISTORY

The original water distribution system was operated under Permit No. 73-048, issued by the Department of Health Services in 1973, and was recently renewed under Permit No. 02-05-20P-351002. The City historically met their water demands by using Well No. 1, No. 2, and No. 3. In October 2016, the Division of Drinking Water (Division) issued a moratorium on new service connections because Well No. 2 and No. 3 had high nitrates exceeding the maximum contaminate level (MCL) for nitrate as N of 10 milligrams per liter (mg/L) and Well No. 1 could not meet maximum water demands. In 2018, the Division lifted the moratorium on development because the City destroyed Well No. 2, sold Well No. 3 (to agricultural users), and added Well No. 5 and Well No. 6 to their portfolio. Since that time, Well No. 6 was placed on inactive status due to high nitrate levels, leaving Well No. 1 and Well No. 5 as the only permitted source water wells for the City of San Juan Bautista.

Well No. 1 was drilled in 1946 and rehabilitated in 2002. Well No. 5 was drilled in 2017 and has an on-site filtration system to reduce iron and manganese concentrations before discharging into the water distribution piping network.

2.2.1 Flows and Load Characterization

Historical Flows

Well production data for the period from January 2015 to January 2018 were obtained and analyzed. Data shown herein is in gallons per day (gpd) or million gallons per day (Mgal/d). Monthly and annual average flows are shown in **Figure 3**. The monthly flow was calculated as the rolling 30-day centered average based on the period from 14 days before to 15 days after the day in question. The annual average flow was calculated as the rolling 365-day centered average based on 182 days before to 182 days after the date in question. As shown, summer months require the highest demands on the system.

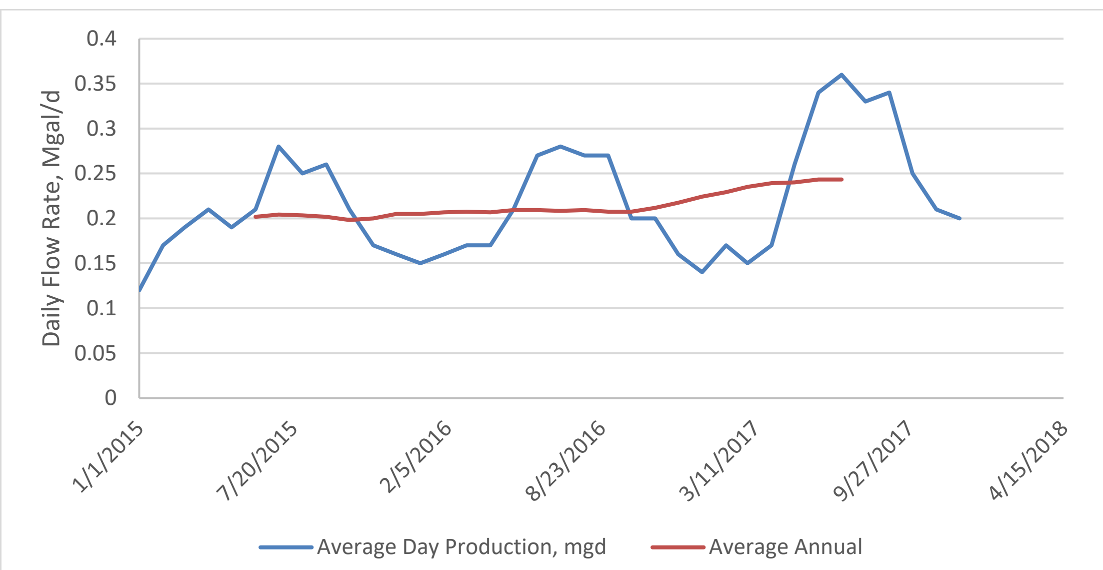


Figure 3 Historical Water Demand Flow Rates

The ratio of the monthly flow to the annual average flow is plotted in **Figure 4** and is 1.48 with a recommended peaking factor of 1.5. The maximum daily demand (MDD) was calculated as the peak daily flow from June 1st through August 31st each year. The data shows that the peaking factor for MDD to ADD between 2.2 and 2.9, see **Table 2**. However, the data shown in Table 2 are from drought years when mandatory year-round water restrictions were being enforced, whereas data from pre-drought years show peaking factors less than 2.0. Accordingly, the Water Master Plan (Appendix A) recommends using a peaking factor consistent with the California Waterworks Methodology, of 2.25.

The peak hour flow is an important parameter for water distribution design because it provides adequate service for the fire demands on top of the peak day demands. A peak hour ratio of 1.5 was applied to the MDD, resulting in a peak hour flow ratio is assumed to be 3.4.

Based on the above data analysis, the recommended flow peaking factors are as follows:

Max Month Demand / Annual Average Daily Demand (MMD / ADD) = 1.50 (Figure 4)

Max Day Demand / Annual Average Daily Demand (MMD / ADD) = 2.25 (California Waterworks)

Peak Hour Demand / Annual Average Daily Demand (PHD / ADD) = 3.4 (assumed)

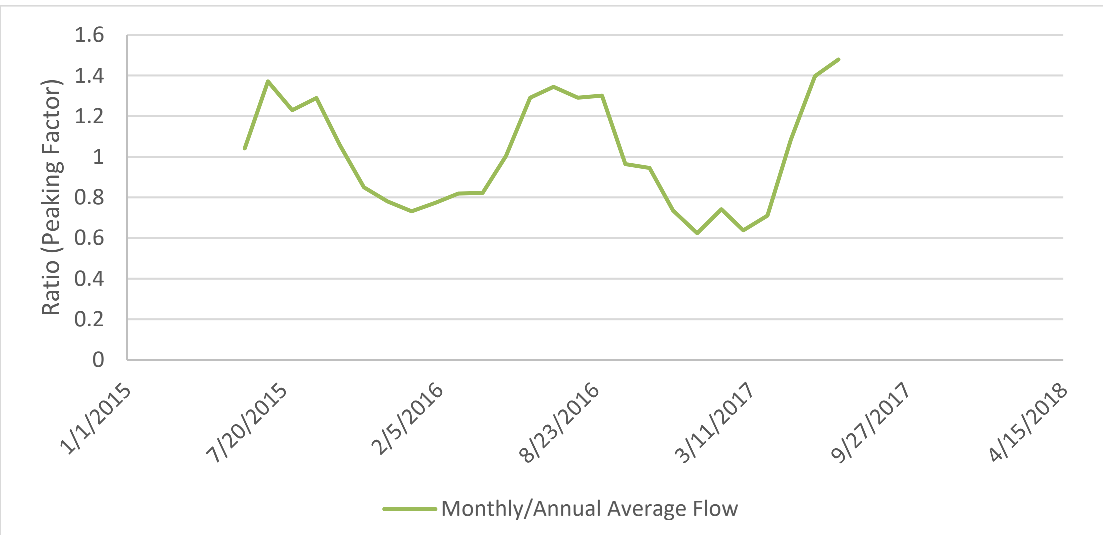


Figure 4 Flow Peaking Factors (Ratio of Daily and Monthly Flow to AAF)

Table 2 Relationship Between MDD and ADD

Year	MDD Mgal/d	ADD, Mgal/d	MDD/ADD Ratio
2014	0.58	0.26	2.23
2015	0.57	0.20	2.85
2016	0.57	0.21	2.71
2017	0.57	0.24	2.38

Production Wells Water Chemistry

The production wells supplying potable water for the City of San Juan Bautista have multiple constituents that are being monitored, including nitrates, iron, manganese, hardness, and salinity. The elevated chloride, sodium, and TDS levels observed in the City's sewers are thought to be driven, in part, by source water (groundwater) hardness and associated self-regenerating water softeners used for potable water treatment throughout the community. The existing groundwater wells produce very hard water (greater than 300 mg/L as CaCO3) and, as a result, many of the City's residents have installed domestic self-regenerating water softeners to provide local treatment. Water softeners exchange calcium and magnesium (the main constituents contributing to hardness) for sodium or common salt (sodium chloride, NaCl). This process results in elevated chloride, sodium, and TDS that is inevitably discharged to the City's wastewater collection system and negatively impacts the WWTP. For comparison, the relative hardness scale is provided as follows:

- **Soft:** 0 to 75 mg/L as $CaCO_3$
- **Moderate:** 75 to 150 mg/L as $CaCO_3$
- **Hard:** 150 to 300 mg/L as $CaCO_3$
- **Very Hard:** Above 300 mg/L as $CaCO_3$

Water quality data for the existing potable water supply wells (Well No. 1, Well No. 5, and Well No. 6) are show in **Table 3**, below. For an analysis on the overall impact of the source water on the wastewater salinity budget, refer to **Section 2.5**, which documents the likely contributors of salt loading on the plant.

Table 3 Source Water Chemistry & Max Flow Rate for Existing City Wells

Constituent	MCL	City Well 1 (Raw)	City Well 5 (Raw)	City Well 6 (Inactive)
pH (std. units)	6.5-8.5	6.7 – 8.0	7.5	7.7 – 8.1
Hardness as $CaCO_3$ (mg/L)	--	353 – 485	321	334 – 371
Alkalinity as $CaCO_3$ (mg/L)	--	278 – 360	320	380
TDS (mg/L)	500-1000	499 – 760	550	640 – 750
Chloride (mg/L)	250-500	61 – 100	81	89 – 110
Sodium (mg/L)	--	47 – 100	72	130 – 140
Iron (mg/L)	0.3	<0.1 – 0.1	**1.2** – **2.9**	<0.1
Manganese (mg/L)	0.05	<0.02 – 0.03	**0.17** – **0.23**	**0.16** – **0.32**
Nitrate – N (mg/L	10	1.4 – 4.3	<0.4 – 0.8	0.4 – **11.2**
Max Flow Rate (gpm)	--	175	425	450

As documented in the 2020 Water Master Plan (Appendix A), the City currently uses Well No. 1 as their primary water source for much of the year. As demands increase, Well No. 1 cannot keep up with high flow rates and requires Well No. 5 to provide additional flow. Well No. 5 includes iron and manganese treatment prior to distribution, as the raw water concentrations exceed the secondary maximum contaminant levels (MCLs). Well No. 6 is the preferred primary producer but has been taken off-line due to high nitrate contamination, which has not yet been isolated or controlled.

The remainder of this report, including the salinity balance in Section 2.5, is based on use of Well No. 1 as the current primary source water.

Projected Design Flows

The current water demand flow rates and water chemistry presented above are used for projecting future demands. Future increases are based on land use data presented in the 2020 Water Master Plan (**Appendix A**) and are expected to be proportional to increases in number of connections and/or population growth as determined by the land use zoning maps. Water demands for the San Juan Bautista Water Improvement Project are included in **Table 4**.

Table 4 Water Demands

Parameter	Unit	Current Condition ADD = 0.26 Mgal/d	Phase 1 Condition ADD = 0.35 Mgal/d	Buildout Condition ADD = 0.56 Mgal/d
Flow				
Annual Avg. Day Demand (ADD)	Mgal/d	0.26	0.35	0.56
Max Monthly Demand (MMD)	Mgal/d	0.39	0.53	0.84
Max Day Demand (MDD)	Mgal/d	0.59	0.79	1.26
Peak Hour Demand (PHD)	Mgal/d	0.88	1.19	1.90

2.3 CONDITION OF EXISTING FACILITIES

The San Juan Bautista water system includes two active wells (Well No. 1 and Well No. 5), an inactive and currently unpermitted well (Well No. 6), well-head treatment systems (iron/ manganese filters and chlorination), a 1.25-million gallon storage tank, and over 10-miles of distribution pipelines.

2.3.1 Water System Description and Summary of Condition

Groundwater is pumped by Well No. 1 and/or Well No.5 and disinfected by well-head chlorination systems. Well No. 1 was drilled in 1946 and rehabilitated in 2002. Well No. 5 was drilled in 2017 and has an on-site filtration system to reduce iron and manganese concentrations before discharging into the water distribution piping network.

Table 5 identifies the design capacity established for the existing water wells, as defined in the permit. When comparing the existing capacity to the current water demands shown in **Table 4**, the City does not have reliable capacity to handle the existing users (i.e. when Well No. 5 is out of service for emergencies or maintenance, Well No. 1 cannot keep up with demands). Further, Well No. 5 is at risk for nitrate contamination because it is drawing from the same groundwater source as Well No. 6, which had to be removed from service due to nitrate contamination.

Table 5 Existing Well Design Capacity

Parameter	Unit	Existing Design Criteria [1]
Well No. 1 Capacity	gpm	175
Well No. 5 Capacity	gpm	425

1. Existing Design Criteria, as defined in the permit.

Based on California Waterworks Standards Chapter 16 Section 64554(a)(2), all public water systems with less than 1,000 service connections should have a storage capacity greater than the maximum daily demands. The City's water system currently has a 1.25 Million Gallon (MG) storage tank, which is enough capacity to supply the existing peak daily flows of 0.59 Mgal/d.

2.3.2 Water Softening System

As noted previously, the existing groundwater wells produce very hard water (greater than 300 mg/L as $CaCO_3$). The City purchased a pellet water softening system to reduce hardness at the source, prior to delivering potable water, to eliminate use of domestic water softeners. The water softening system was designed to include three main treatment processes: a pellet reactor system (crystallization on sand media), lime system (pH adjustment), and filtration system (polishing stage). Although the pellet water softening system was delivered to the site in 2011, it was never installed or operated.

After being stored on-site for the past nine years (without use or maintenance), the equipment is in various states of disrepair, as shown in **Figure 5**. In order to place the system into service, the equipment requires rehabilitation and surrounding infrastructure needs to be installed (including concrete foundations and seismic supports, interconnecting electrical and piping, etc.)

Pellet Reactor Column

Lime Storage Silo

CO2 pH Adjustment Tank

Multimedia Filters

Figure 5 Existing Water Softening Treatment System

2.4 FINANCIAL STATUS OF EXISTING FACILITES

The median household income (MHI) for the City of San Juan Bautista is $53,077, which is 74.5% of State average, and has a population of approximately 2,030. A comprehensive operating budget for the City is attached to the project application (see **Appendix B**) and includes detailed expenses and assets associated with the City's budget. The City prepared a Rate Study in 2015 and adopted new water rates with Ordinance 2015-20, which is summarized as:

- the base rate of $55.76/month (inside City residents)
    - plus $6.35 per 1,000-gallons (uniform water rate), and
- the base rate of $66.29/month (outside City residents)
    - plus $6.35 per 1,000-gallons (uniform water rate),

There are currently 743 residential water accounts, and 41 commercial accounts, and 18 other accounts (government, schools, etc) for a total of 802 water connections.

The 2020 Water and Wastewater Masterplan (in **Appendix A**) includes a capital improvement program for major upcoming projects, including the recommendations from this report. **Table 6** shows the water operating revenue and expenses from June 2019 Auditor's Report and Financial Statement.

Table 6 Financial Status, 2019 Auditor's Report

Assets	Water
Operating Revenue	**1,312,018**
Operating Expense	
Contractual Services and Utilities	106,597
Personnel	127,639
Supplies, Materials, and Repairs	101,206
Depreciation	326,616
Total Operating Expense	**662,057**
Non-Operating Revenue / (Expense)	
Development Impact Fees	44,525
Interest Income	26,039
Interest Expense	(271,308)
Total Non-Operating Revenue / (Expense)	**(200,774)**

2.5 WATER AUDITS

The City is in the middle of updating their water masterplan, as shown in **Appendix A**. The results of which have been incorporated into this report. In addition to the water audits from the masterplan, the following salinity information is important to document.

2.5.1 Salinity Balance

Salinity (salt) is measured by the total concentration of dissolved minerals, such as magnesium, potassium, sodium, and chlorides. Once salinity is in wastewater, it is difficult to remove. All potable water contains naturally occurring salt, but water users (industrial, agricultural, and residential) also add salt to the water before discharging into the sewers. For example, households add salt to their drains from excess salt in their diet, and use of detergents, cleaning products, soaps, and shampoos. Salt is further added to sewers when it is exchanged for hardness in the self-regenerating water softeners.

As stated previously, many of the City's residents have installed domestic self-regenerating water softeners to provide local treatment to potable water. Water softeners exchange calcium and magnesium (the main constituents contributing to hardness) for sodium or common salt (sodium chloride, NaCl). This process results in elevated chloride, sodium, and TDS that is inevitably discharged to the City's wastewater collection system.

Further, the City receives sewer flow from an industrial user (Taylor Farms, formally Earthbound Farms). The agricultural processing facility washes produce with what is believed to be a mixture of sodium hypochlorite and a proprietary substance called SmartWash Solution (T128). While the disinfection and washing procedures of the facility are not known, it is assumed that sodium hypochlorite is used on site based on the sampling data provided in the wastewater evaluation found in **Appendix A.1**. This disinfection method adds substantial salinity loading to the industrial discharge. As such, the City is preparing an industrial pre-treatment program and limiting the amount of discharge from Taylor Farms (and all industrial users) to help limit the controllable sources of salt.

In addition to industrial discharge mitigation, the City needs to reduce salinity loading from the source water, to ensure the WWTP remains compliant with the NPDES permit, as detailed in **Appendix A.1**. The analysis presented herein will describe ways to limit raw water salinity and domestic water softener contributions.

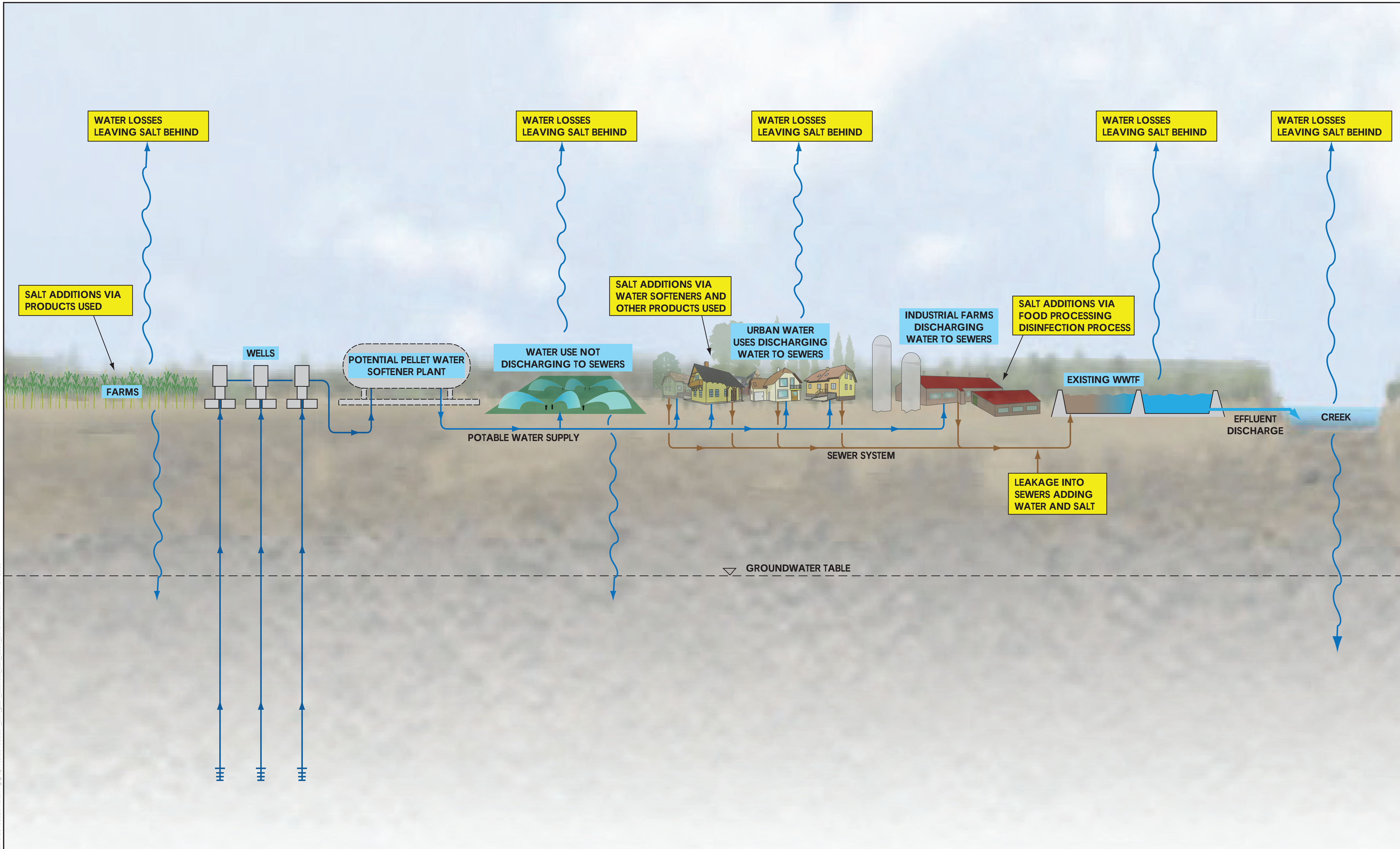
Table 7 shows an estimated salt balance for the City of San Juan Bautista wastewater influent.

As shown in **Figure 6**, salt comes from many sources (including potable water sources) and requires careful consideration as to the best option for removal.

Table 7 Salinity Balance (Average Daily Loads)

Salt Contributors to Total WWTP Influent	TDS	Chloride	Sodium
SALINITY LOADING, lb/d			
Well No. 1 (Raw Water)[1]	948	116	91
Diet and Personal Care Products[2]	400	27	19
Self-Regenerating Water Softeners[3]	545	327	218
Industrial User[4]	878	373	219
Inflow and Infiltration[5]	0	60	0
TOTAL WWTP INFLUENT, lb/d	2,772	904	546
SALINITY CONCENTRATION, mg/L			
Well No. 1 (Raw Water)[1]	628	77	60
Diet and Personal Care Products[2]	265	18	12
Self-Regenerating Water Softeners[3]	361	217	144
Industrial User[4]	582	247	145
Inflow and Infiltration[5]	0	40	0
TOTAL WWTP INFLUENT, mg/L	1836	600	362

1. Based on average well data shown in Table 3: 0.18 Mgal/d and TDS 628 mg/L, Chloride 77 mg/L, and Sodium 60 mg/L.
2. Dietary and Personal Care Products: TDS concentration of 265 mg/L based on Central Valley Clean Water Association "Salinity Management Practices for POTWs" 2012. Chloride and sodium concentrations based on "Chloride Contributions from Water Softeners and Other Domestic Sources" University of Minnesota 2019 and "Characterizing and Managing Salinity Loading in Reclaimed Water Systems" by AWWA & Thompson 2006.
3. Water softener efficiency based on 3300 grains hardness per pound NaCl (and average hardness 425 mg/L $CaCO_3$) in accordance with historical and current California efficiency standards and half the influent flow rate is being treated by ion exchange water softeners. Calculation assumes 40% of households have water softeners (approximately 350 softeners in use).
4. Industrial sampling from June 2020 on Taylor Farms wash water discharge (27,600 gal/d and average concentrations of 3816 mg/L TDS, 1623 mg/L chloride, and 950 mg/L sodium). To corelate these values to total wastewater influent flow concentration, the sample concentrations were multiplied by 15% (27,600gpd ÷ 180,000gpd = 15%)
5. To account for missing salinity, inflow and infiltration (I/I) based loading (salinity from agricultural runoff and natural erosion/weathering of rock minerals) was calculated by taking the difference between historical influent loads (from Appendix A.1) and total other loads contributors identified herein. The missing chloride concentration may also be linked to the historical changes in the primary source water, as various wells were placed online or taken offline (i.e. Well No. 1 has chloride concentrations that are 25 mg/L lower than Well No. 6, etc).



Stantec

Figure 6
Sources for Salt Balance

3.0 NEED FOR PROJECT

3.1 HEALTH, SANITATION, AND SECURITY

Below are descriptions of the current regulatory compliance issues for the City's water system.

3.1.1 Water Security Project Needs

Out of the five wells that the City has historically relied on for source water, three of those wells (Well No. 2, 3, and 6) have been removed from service after monitoring data showed nitrates over the MCL. In 2014, the Division of Drinking Water (Division) required the City to provide public notification for nitrates over the MCL, as a condition of using Well No. 2. In May of 2014, Well No. 2 sampling found nitrates between 85- and 95-mg/L (well over the nitrate MCL of 10-mg/L). The Division issued a Compliance Order (02-05-14R-001) on May 30, 2014, that required the City to find a solution to their nitrate problem by 2015. Citation 02-05-15-R-007 was issued in June 2015 for non-compliance with the 2014 Order. Compliance Order 02_05_16R-004 was issued in 2016 and placed a moratorium on new service connections due to the high nitrate contamination and lack of adequate water supply to support peak daily demands (see **Appendix C**). After the destruction of Well No. 2 and sale of Well No. 3, the City drilled Well No. 5 and purchased Well No. 6 to increase the available source water. On December 21, 2018, the Division issued a cancellation of the service connection moratorium. In May 2020, Well No. 6 was placed on inactive status due to high nitrate levels.

The City is currently permitted to operate Well No. 1 (175 gpm capacity) and Well No. 5 (425 gpm capacity) under Permit No. 02-05-20P-3510002. Well No. 5 is at risk for nitrate contamination because it draws water from the same groundwater source as the inactive Well No. 6. Further, when Well No. 5 is out of service for emergencies or maintenance, the City must solely rely on Well No. 1 to provide water to the daily demands. As noted previously, Well No. 1 cannot keep up with the current maximum month demands (270 gpm) and therefore a reliable water source is needed to ensure the capacity of the water system meets the demands.

3.1.2 Salinity Control Project Needs

Salinity includes nonionic substances (like silica) and ionic substances (like chloride, sodium, calcium, magnesium, sulfate, and nitrates). Salinity is transported with water and, as such, salt that originates in one location may be carried downstream to another. Significant problems ensue when the receiving water basin has no reliable way of disposing of salt. Increased levels of salinity can accelerate corrosion in plumbing, become toxic to aquatic life, and (most notably) negatively impact crop production.

California is one of the most productive agricultural areas on Earth. However, a downside of intensive irrigated agriculture is that it concentrates salt (both naturally occurring and added by agriculture as fertilizers and processing facilities) in residual water. The problem of salt accumulation in residual water has been recognized for decades, but potential remedies are expensive, which contributes to the ever-increasing problem of salt accumulation in the Central Coast. In an effort to control the salt accumulation problem and ultimately stabilize it, and possibly reverse it (to some extent), the Regional Water Quality Control Board developed a salinity control plan that is incorporated into the 2016 Basin Plan and further disseminated such requirements to local municipalities within their wastewater NDPES discharge permits.

As described in the wastewater reports (**Appendix A.1**), the City is currently in violation of chlorides, sodium, and TDS effluent limits and has received multiple violation notices and fines from the Regional Board for these effluent exceedance events (as documented in **Appendix C**). Further, the existing treatment facilities are not designed to remove salinity from the wastewater stream. In order to ensure long-term compliance with salinity limitations, the City will need to either implement source control measures (industrial pre-treatment programs, lowering potable water hardness and removing associated self-regenerating water softener use) or provide additional treatment facilities to remove salinity from the wastewater. As described in **Appendix A.1**, the option to treat salt at the wastewater plant is too expensive, environmentally complicated, and requires purchase of additional property. As such, potable water source control measures must be taken (to lower water hardness and remove self-regenerating water softener use from homes).

3.2 AGING INFRASTRUCTURE

Well No. 1 was drilled in 1946 and rehabilitated in 2002. Well No. 5 was drilled in 2017. The community water softener (pellet plant) was purchased in 2011 and was never installed or operated. After being stored on-site for the past nine years (without use or maintenance), the equipment is in various states of disrepair. In order to place the system into service, the equipment requires rehabilitation and surrounding infrastructure needs to be installed (including concrete foundations and seismic supports, interconnecting electrical and piping, etc.)

3.3 REASONABLE GROWTH

The planning period used for the project is 20 years. This allows for an appropriate timeline accommodating a limited amount of population growth (1.5%) in accordance with the City's planning horizons and roughly matches industry standards for the useful life of treatment works.

The current MMD is approximately 0.39 Mgal/d and the reliable pumping capacity is 175 gpm. The water system should be improved in phased increments (Existing, Phase 1- near term growth, Phase 2- buildout capacity) and future users will have to fund the future capacity.

- Current: During the interim phase, the existing water system will continue to be used to provide water to existing users. This includes ongoing maintenance and repairs at the existing facilities, but does not provide upgrades to the infrastructure to ensure long-term compliance with permits.

- Phase 1: The Phase 1 Project will provide water security and salinity reduction for the existing users (well pumps, and treatment systems will be sized for current users) and piping will be sized to accommodate 1.5% annual growth. The Phase 1 Project is described in the below evaluation.

- Phase 2: The Phase 2 Project will expand the water facilities to serve additional users, to accommodate "build out" conditions based on the City's Master Plan. The Phase 2 Project is not considered herein and is mentioned for long-term planning purposes only.

4.0 WATER SYSTEM UPGRADE ALTERNATIVES CONSIDERED

The purpose of this report is to investigate alternatives and develop a recommended program to reduce the potable water hardness (mitigating the salinity loading from self-regenerating water softeners) and provide a secure water source. The alternative projects considered herein include the following:

A. Option A, Source Control via Pellet Water Softening Plant Rehabilitation: Salinity control will be accomplished by rehabilitating the City owned pellet water softening system and installing it on the potable water distribution network. After lowering source water hardness, the City will implement a buy-back program to eliminate domestic self-regenerating water softeners, in order to reduce the wastewater influent salinity concentrations to permittable levels. This option will connect to the Batebel Road Well for water security.

B. Option B, Source Control via Domestic Cartridge Water Softeners: Salinity control will be accomplished by replacing all domestic self-regenerating water softeners with cartridge water softeners. Salt being discharged from household water softeners will no longer drain to the sewers (lowering influent wastewater salinity concentrations to permittable levels) and instead the salt will be collected in canisters and safely disposed of off-site. This option will connect to the Batebel Road Well for water security.

C. Option C, Source Control by Importing Water from West Hills WTP: Salinity control will be accomplished by replacing well water (very hard water) with treated surface water (moderately hard) and remove self-regenerating water softeners in order to reduce the wastewater influent salinity concentrations to permittable levels. Connecting to West Hills WTP also provides water security and no additional water source connections are needed.

Options A and B both require City owned water softeners in order to reduce wastewater influent salinity concentrations to permittable levels (i.e. providing soft water to the community and eliminating self-regenerating water softeners that dump high levels of chloride, sodium, and TDS into the sewers). Further, Options A and B require installation of a new potable water well (Betable Road Well) to provide water security to the City's potable water portfolio. Option C will reduce the hardness without installation of new water softening systems and provide water security (without connecting to other wells).

4.1 ALTERNATIVE DESCRIPTIONS AND COST ESTIMATES

Options A through C are described herein.

4.1.1 Option A Source Control via Pellet Water Softening Plant Rehabilitation

The City purchased a pellet water softening system to reduce hardness at the source, prior to delivering potable water, in order to eliminate use of domestic water softeners. The water softening system was designed to include three main treatment processes: a pellet reactor system (crystallization on sand media), lime system (pH adjustment), and filtration system (polishing stage). Although the pellet water softening system was delivered to the site in 2011 (manufactured by Procorp Enterprises LLC), it was never installed or operated.

The main component of the water softening system is the pellet reactor column, illustrated in **Figure 7**. Raw water is pumped into the bottom of the column to create a fluidized seed/pellet bed (seed material is sand). To raise the pH of the water, reagent (lime and/or sodium hydroxide) is mixed into the bottom of the column. The driving force of the high pH water (pH of approximately 10.0) allows the calcium ions to precipitate out of solution and crystallize on the seed material, forming pellets. As the pellets grow, they fall to the bottom of the column and are periodically removed using automatic isolation valves. The removed pellets are put into a dumpster and hauled off site for disposal. Softened water flows over a weir, out of the top of the reactor, where the pH is lowered using carbon dioxide to prevent further precipitation.

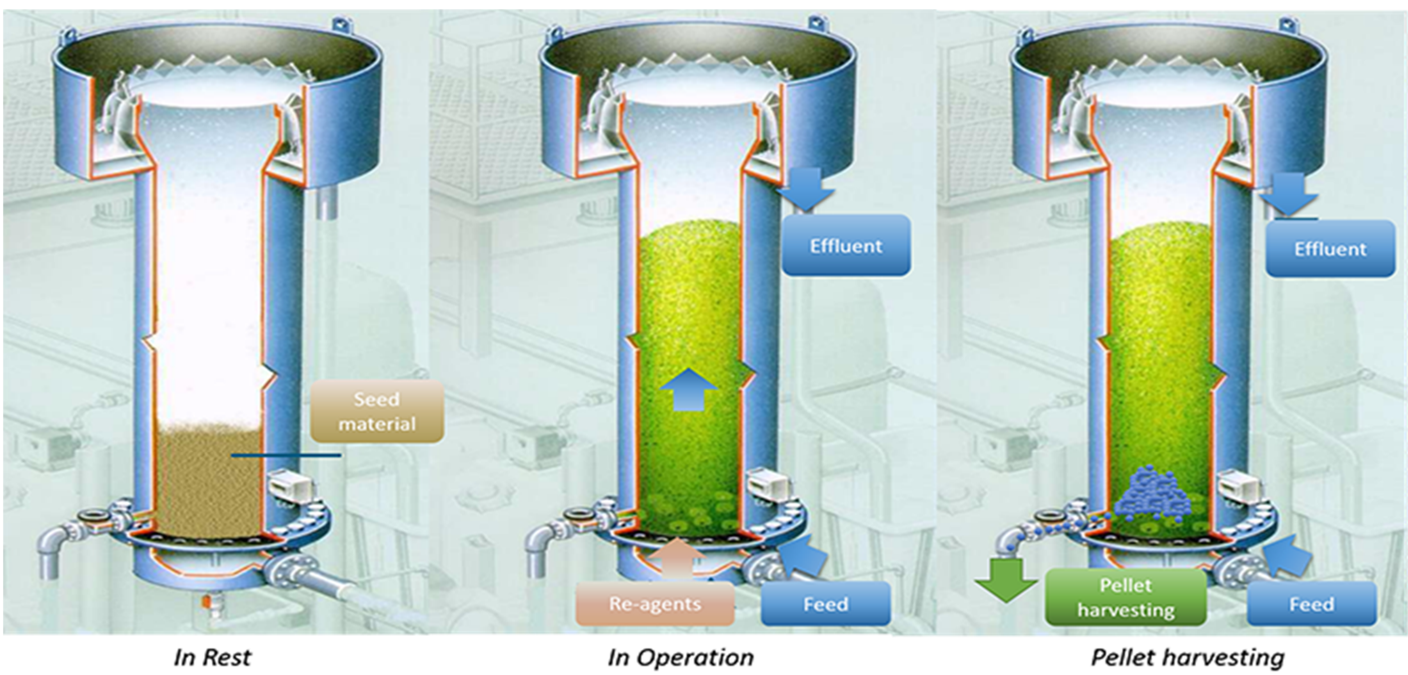


Figure 7 Pellet Reactor Column Schematic (Procorp® Crystalactor)

The softened water, discharged from the pellet reactor column, flows through six multimedia filters to remove residual turbidity (caused by excess lime) and any remaining calcium carbonate particles. Chlorine is added to the filtered effluent and sent to the City's water distribution system. The entire water softening system is controlled by a main control panel and motor control center.

This system was designed to remove 325 mg/L hardness as $CaCO_3$, which is estimated to eliminate 338 mg/L TDS, 203 mg/L chloride and 135 mg/L sodium from water softener discharge into the sewer (75% of salt contributed from the water softener source, as the shown in the salinity balance, **Table 7**).

As described in **Appendix D**, “Preliminary Evaluation of the Pellet Water Softening System”, the softening system has operational costs that must be considered when evaluating the lifecycle costs of the system. Lime is fed at a rate of 1,100 lb/d to raise the pH of the raw water (and precipitate calcium out of solution), while 15 mg/L of carbon dioxide is added downstream of the softener to lower pH and prevent scaling. Further, sand is fed at a rate of 140 lb/d (to make up for seed/sand loss during pellet extraction) and pellets are removed at a rate of 2,400 lb/d.

The cost to rehabilitate and install the water softening system is approximately $1,800,000. The cost to operate the system (based on an average daily demand of 0.4 Mgal/d) is $9,600/month. After the Pellet Plant source control system is installed and operational, the City will need to implement a buy-back program to remove domestic water softeners from homes. Depending on the community, the rebate may cost between $300 to $800 per unit ($105,000 to $280,000- using cash payments and credits on sewer bills).

This option also requires connection to the Betabel Road Well to provide water security, see **Figure 8**. The well water chemistry (detailed in **Table 8)** is similar to the other City wells, with very hard water (requiring use of the Pellet Plant water softener) and elevated levels of iron and manganese (requiring well-head iron/manganese filtration treatment), but it has the benefit of providing additional water source for the City’s portfolio. With the addition of the Betable Road Well, the City will have a firm reliable capacity of 600 gpm, which is sufficient to supply the max daily flow.

Table 8 Source Water Chemistry and Max Flow Rate for Betable Rd Well

Constituent	MCL	Betable Rd Well
pH (std. units)	6.5-8.5	8.2
Hardness as $CaCO_3$ (mg/L)	--	300
Alkalinity as $CaCO_3$ (mg/L)	--	270
TDS (mg/L)	500-1000	490
Chloride (mg/L)	250-500	42
Sodium (mg/L)	--	70
Iron (mg/L)	0.3	**0.33**
Manganese (mg/L)	0.05	**0.2**
Nitrate – N (mg/L	10	0.5
Max Flow Rate (gpm)	--	425

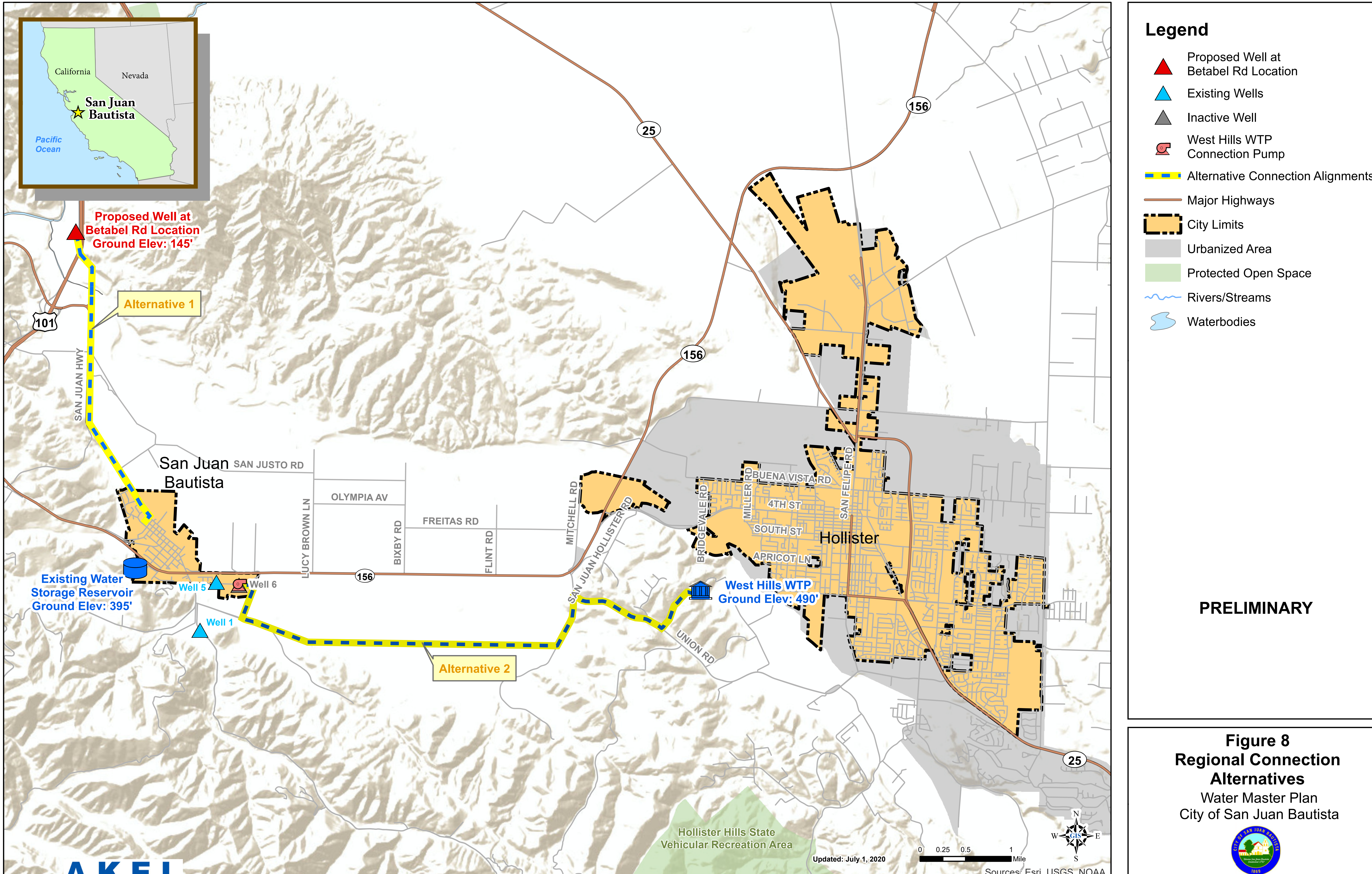


Figure 8
Regional Connection Alternatives
Water Master Plan
City of San Juan Bautista

AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\San_Juan_Bautista\Water\191112-MP\SJB_Fig7-6_Water-RCA_070120.mxd

In order to connect the Betabel Road Well water source to the City's distribution system, a new 12-inch diameter pipe will need to be constructed in a 3.5-mile long alignment (along the San Juan Highway), as shown in **Figure 8**. The total life cycle cost for the pellet plant and Betable Road Well connection is $9.84 million, as shown in **Table 9**.

Table 9 Pellet Plant and Betable Road Well Life Cycle Costs

Description	Cost
Construction Costs, Pellet Plant	$1,800,000
Construction Costs, Betable Road Well[1]	$4,010,000
Engineering/CM Costs (25%)	$1,450,000
Annual O&M, Pellet Plant	$115,200
Annual O&M, Betable Rd Well[2]	44,800
Present Worth O&M, 20-years @ 3%	$2,380,000
Domestic Softener Buyback	$193,000
Total Life Cycle Cost	**$9,840,000**

1. Based on a 12-inch diameter pipe in a 3.5-mile long alignment and cost of iron/manganese filter
2. Based on $200/acre-feet, purchasing 200,000 gpd

4.1.2 Option B: Source Control via Domestic Cartridge Water Softeners

Option B replaces domestic self-regenerating water softeners with cartridge water softeners. Both types of domestic water softeners exchange calcium and magnesium (the main constituents contributing to hardness) for sodium or common salt (sodium chloride, NaCl). However, the cartridge softeners do not have a drain that dumps the salty brine solution into the sewers (as the self-regenerating softeners do). Rather, the cartage softeners are sized to remove hardness and store all the waste within a tank.

The cartridge water softener systems will be designed to remove 425 mg/L hardness as $CaCO_3$, which is estimated to eliminate 452 mg/L TDS, 271 mg/L chloride and 181 mg/L sodium from the sewer (as shown in the salinity balance, **Table 7**) if 350 self-regenerating water softeners are replaced with cartridge systems (removing all softeners assumed to be in the system).

On a monthly basis, the brine solution needs to be removed (hauled off-site and disposed of in a landfill) and the exchange ions (salt) need to be replaced. Culligan Water Company provided a proposal to deliver and install the systems, as well as provide a monthly service to removal brine and recharge the canisters with new salt. The costs for all the cartridge water softeners (assumed to be 350 softeners) is detailed in **Table 10**. In order to encourage users to replace their softeners, the City will need to implement a buy-back program to remove domestic water softeners from homes. Depending on the community, the rebate may cost between $300 to $800 per unit ($105,000 to $280,000- using cash payments and credits on sewer bills).

As presented in Option A, this option also requires connection to the Betabel Road Well to provide water security. The costs for the Betabel Road Well connection are incorporated into the total lifecycle costs in **Table 10**.

Table 10 Cartridge Water Softener and Betable Road Well Life Cycle Costs

Description	Cost[1]
Construction Costs, Cartridge Softeners	$455,000
Construction Costs, Betable Road Well[2]	$4,010,000
Engineering/CM Costs	$1,070,000
Annual O&M, Cartridge Softeners	$154,300
Annual O&M, Betable Rd Well[3]	44,800
Present Worth O&M, 20-years @ 3%	$2,957,000
Domestic Softener Buyback	$193,000
Total Life Cycle Cost[2]	**$8,690,000**

1. Based on replacing 350 water softeners (half the homes).
2. Based on a 12-inch diameter pipe in a 3.5-mile long alignment and cost of iron/manganese filter
3. Based on $200/acre-feet, purchasing 200,000 gpd

4.1.3 Option C: Source Control by Importing Water from West Hills WTP

The potable water provided by the San Benito County Water District's West Hills Water Treatment Plant (WTP) is only moderately hard (97 mg/L) and has less total dissolved solids (260 mg/L) than the water provided by the City of San Juan Bautista's wells. **Table 11** shows a comparison of Well No. 1 (current main potable water source) and West Hills WTP water.

Table 11 Water Chemistry for West Hills WTP

Constituent	West Hills WTP	City Well 1 (Raw)
pH (std. units)	7.8	7.0
Hardness as $CaCO_3$ (mg/L)	97	425
TDS (mg/L)	260	628
Chloride (mg/L)	79	77
Sodium (mg/L)	56	66

Similar to the pellet plant option, the West Hills WTP water source would eliminate up to 325 mg/L hardness as $CaCO_3$, which is estimated to remove 338 mg/L TDS, 203 mg/L chloride and 135 mg/L sodium from water softener discharge into the sewer (75% of salt contributed from the water softener source, as the shown in the salinity balance, **Table 7**). Further, the source water will also remove 325 mg/L of TDS from the water, making a total reduction of 663 mg/L TDS (338 + 325 =663).

In order to connect the West Hills WTP water source to the City's distribution system, a new 10-inch diameter pipe will need to be constructed in a 6.3-mile long alignment (between the City of Hollister and the City of San Juan Bautista) and booster pump station at Well No. 6 site (to provide adequate pressure during peak demands), as shown in **Figure 8**. After the West Hills WTP water source is installed, the City will need to implement a buy-back program to remove domestic water softeners from homes. Depending on the community, the rebate may cost between $300 to $800 per unit ($105,000 to $280,000- using cash payments and credits on sewer bills). The total life cycle cost for this option is $10.1 million, as shown in **Table 12**.

Table 12 West Hills WTP Life Cycle Costs

Description	Cost
Construction Costs	$5,900,000
Engineering/CM Costs (25%)	$1,480,000
Annual O&M[1]	$168,000
Present Worth O&M, 20-years @ 3%	$2,500,000
Domestic Softener Buyback	$193,000
Total Life Cycle Cost	**$10,068,000**

1. Based on $1500/acre-feet (West Hills wholesale fee schedule), purchasing 0.2 MGD, & saving $168,000/yr in existing water system operating costs (by not running/maintaining the wells as frequently).

4.2 COMMON DESIGN CRITERIA

In order to develop a fair comparison of alternatives, it is important to establish common design criteria on which to base the evaluation. Key design parameters are discussed below:

- **Design Water Demands**: The design criteria of the Water System Improvements Project indicate that the design maximum month demands for current users and Phase 1 users are 0.39 and 0.53 Mgal/d, respectively.
- **Design Salinity Loads**: The design criteria of the WWTP Improvements Project (Appendix A.1) indicate that the average annual influent TDS, Chloride, and Sodium concentrations are 1800, 600, and 300 mg/L, without industrial pretreatment or source control.
- **Industrial Pre-Treatment Salinity Reduction:** It is assumed that, once implemented, the industrial pre-treatment program will remove at least 562 mg/L TDS, 196 mg/L chloride, and 143 mg/L sodium. <u>As such, the source control measures may require an additional 205 mg/L chloride, 0 mg/L sodium, and 38 mg/L TDS removal</u>
  - The extent of industrial based salt reduction will not be fully known until a pre-treatment program is implemented and additional samples are collected (the preliminary numbers presented herein are based on a two-week sampling event from Taylor Farms). Once the pre-treatment program is adopted and frequent representative samples are analyzed,

the remaining salinity removal needed to comply with the NPDES permit will be better quantified.

  - For the purposes of this analysis, it is assumed that each source control option will provide sufficient salinity reduction, in combination with the pre-treatment program, to achieve compliance with the wastewater permit.

- **Potable Water Reliability:** The City only has a firm capacity of 175 gpm using Well No. 1 as the primary source of water (when the higher production Well No. 5 is removed from service for routine maintenance or possible nitrate contamination). As such, the City needs a backup water source to ensure a viable water portfolio, which can be achieved by a new well (the Betable Road Well) or connecting to West Hills WTP.

- **Cost Index, Interest Rate and Useful Lives:** The cost index used for the project cost estimates is based on the ENR Construction Cost Index at start of construction (CCI) of 11,000 (June 2020). The interest rate adjusted for inflation used in the life cycle analyses is 3.0% per year and the useful life of most of the project alternatives is estimated to be approximately 20 years to match the planning horizon (although structural components will last much longer, equipment will not).

- **Planning Period:** The planning period used for the project is 20 years. This allows for an appropriate timeline accommodating community service and a limited amount of growth in accordance with City planning horizons and roughly matches industry standards for the useful life of treatment works.

- **Contingency:** For the level of project development, all costs will be escalated by 30% contingency factor, to account for unknown project details.

4.3 POTENTIAL ENVIRONMENTAL IMPACTS OF PROJECT ALTERNATIVES

4.3.1 Option A, Source Control via Pellet Water Softening Plant Rehabilitation

The source water pipe alignment will be installed within previously disturbed areas, along the side of roadways (in the public utilities right-of-way) and the water softening upgrades will be done at the well site (within the existing fence line). Environmental impacts are considered less than significant and, if selected, will be confirmed during the CEQA Initial Study and Mitigated Negative Declaration (IS/MND) phase.

4.3.2 Option B: Source Control via Domestic Cartridge Water Softeners

The source water pipe alignment will be installed within previously disturbed areas, along the side of roadways (in the public utilities right-of-way) and the water softening upgrades will be done within existing customer homes (within existing fence lines). Environmental impacts are considered less than significant and, if selected, will be confirmed during the CEQA Initial Study and Mitigated Negative Declaration (IS/MND) phase.

4.3.3 Option C: Source Control by Importing Water from West Hills WTP

The source water pipe alignment will be installed within previously disturbed areas, along the side of roadways (in the public utilities right-of-way) and no water softener improvements are necessary (other than initiating a buy-back program for self regenerating water softeners). Environmental impacts are considered less than significant and, if selected, will be confirmed during the CEQA Initial Study and Mitigated Negative Declaration (IS/MND) phase.

4.4 LAND REQUIREMENTS

The proposed Project components are all located in City owned property (within existing well sites) or along existing roadways within the City's right-of-way in regional alignments and are within previously disturbed areas. Other than the Regional Alignments, the properties are currently owned by the City and does not require any additional acquisitions or lease of land. For any regional pipeline, the City will need to ensure they stay within the public utility right-of-way.

4.5 POTENTIAL CONSTRUCTION PROBLEMS

Construction of each alternative project is expected to be routine. However, potential construction problems could include keeping the existing Water System in operation during construction. The construction activities will also require temporary shutdowns of portions of the water system, though these are common for this type of project. Ingress/egress to the well sites must also be maintained throughout construction.

4.6 SUSTAINABILITY CONSIDERATIONS

4.6.1 Water and Energy Efficiency

The improvement project will include Title 24 compliance equipment, including premium efficiency motors. It will include upgraded instrumentation to optimize treatment performance, minimizing energy demands associated with pumping. All options will provide better water quality that achieves water quality goals set by the Regional Board.

4.6.2 Other, California Priorities

The California state planning priorities identified in Government Code 65041.1 are intended to promote equity, strengthen the economy, protect the environment, and promote public health and safety in the State, including in urban, suburban, and rural communities. These priorities are described as follows:

- **Promoting infill development** and equity by rehabilitating, maintaining, and improving existing infrastructure that supports infill development and appropriate reuse and redevelopment of previously developed, underutilized land that is presently served by transit, streets, water, sewer, and other essential services, particularly in underserved areas, and to preserving cultural and historic resources.

- **Protecting environmental and agricultural resources** by protecting, preserving, and enhancing the state's most valuable natural resources, including working landscapes such as farm, range, and forest lands, natural lands such as wetlands, watersheds, wildlife habitats, and other wildlands, recreation lands such as parks, trails, greenbelts, and other open space, and landscapes with locally unique features and areas identified by the state as deserving special protection.

- **Encouraging efficient development** patterns by ensuring that any infrastructure associated with development, other than infill development, supports new development that does all of the following:

  - Uses land efficiently.
  - Is built adjacent to existing developed areas to the extent consistent with the priorities specified pursuant to subdivision.
  - Is located in an area appropriately planned for growth.
  - Is served by adequate transportation and other essential utilities and services.
  - Minimizes ongoing costs to taxpayers

The following bullets describe how the City will promote project alternatives that address each of the planning practices as defined in Section 65041.1 of the California Government Code and sustainable water resources management priorities.

- **Infill Development.** The City promotes infill development and equity by rehabilitating, maintaining, and improving existing infrastructure that supports infill development and appropriate reuse and redevelopment of previously developed, underutilized land that is presently served by water and sewer infrastructure, particularly in underserved areas, and to preserving cultural and historic resources. Planning activities for this and prior plant upgrades have been limited to providing capacity for anticipated infill growth within the City. Growth outside the City or in excess of capacity planned to serve anticipated infill must be planned, designed and constructed by those private parties which will benefit from those improvements.

- **Environmental Resources.** The City protects, preserves, and enhances the state's most valuable natural resources, including forest lands, natural lands such as wetlands, watersheds, wildlife habitats, and other wildlands, recreation lands such as parks, trails and other open space, and landscapes with locally unique features and areas identified by the state as deserving special protection. They accomplish this by: optimizing the footprint of their facilities, keeping those to a minimum, thereby preserving nearby forested and grassland open spaces and wetlands; water quality is protected and enhanced by the operation of their treatment and disposal facilities which produce effluent which meets (other than identified herein) and in some cases exceeds established water quality objectives. Taken together these activities enhance the overall environmental quality within the watershed.

- **Efficient Development Patterns.** The City encourages efficient development patterns by ensuring that any infrastructure associated with development that is not infill supports new development, uses land efficiently, is built adjacent to existing developed areas to the extent possible and is placed in areas appropriately planned for growth, is served by adequate infrastructure and other essential utilities and services, and minimizes ongoing costs to taxpayers. Planning activities for this and prior plant upgrades have been limited to providing capacity for anticipated infill growth within the City. Growth outside the City or in excess of capacity planned to serve anticipated infill must be planned, designed and constructed by those private parties which will benefit from those improvements.

- **Water Resources Management.** The City encourages sustainable water resources management by ensuring that sustainable water resources measures are implemented, such as conserving water, conserving energy, and applying Low Impact Development Best Management Practices to the maximum extent practicable. Taken together with the above noted activities these enhance the overall environmental quality within the watershed.

4.7 COST ESTIMATES

See Section 5.1.

5.0 SELECTION OF AN ALTERNATIVE

5.1 LIFE CYCLE COST ANALYSIS

The life cycle cost estimates for Options A, B, and C are summarized in **Table 13**.

Table 13 Alternative Options Life Cycle Costs Summary

Description	Option A: Pellet Plant	Option B: Cartridge Softener	Option C: West Hills WTP
Source Control Costs			
Construction Costs	$1,800,000	$455,000 [1]	$5,900,000 [2]
Engineering/CM Costs [3]	$450,000	$68,000	$1,480,000
Annual O&M	$115,200	$154,300	$168,000 [4]
Present Worth O&M, 20-years @ 3%	$1,710,000	$2,290,000	$2,500,000
Domestic Softener Buyback	$193,000	$193,000	$193,000
Source Control, Total Life Cycle Cost	**$4,153,000**	**$3,006,000**	**$10,068,000**
Water Security Costs[5]			
Construction/Engineering/CM Costs	$5,010,000	$5,010,000	---
Annual O&M[6]	$44,800	$44,800	---
Present Worth O&M, 20-years @ 3%	$670,000	$670,000	---
Water Security, Total Life Cycle Cost	**$5,680,000**	**$5,680,000**	---
TOTAL LIFE CYCLE COST (Source control & Water Security)	**$9,840,000**	**$8,690,000**	**$10,068,000**
Salinity Reduction			
Removal Rate, mg/L (Chloride, Sodium, TDS)	203, 135, 338	271, 181, 452	203, 135, 663

1. Based on replacing 350 water softeners (half the sewer connections assumed to have softeners).
2. Based on a 10-inch diameter pipe in a 6.3-mile long alignment and a booster pump station
3. Engineering/CM fees are estimated to be 25% of construction costs, except for Option B (assumed to be 15%).
4. Based on $1500/acre-feet (West Hills wholesale fee schedule), purchasing 200,000 gpd, and saving $168,000/yr in existing water system operating costs (by not running/maintaining the wells as frequently).
5. Water security costs are for developing the Betable Rd Well (for Options A & B) or connecting to West Hills WTP (Option C).
6. Based on $200/acre-feet, purchasing 200,000 gpd

Option B (cartridge softener installation) has the lowest life cycle costs (approximately $3.0M), but requires installing domestic cartridge softeners in every household that currently uses self-regenerating water softeners (assumed to be 350 separate locations). The coordination efforts to make that happen is difficult. The proposal from Culligan assumes that each cartridge will be installed right at the point of entry into the house. However, many homes may need the pipe to be routed to the back or around the side (to be visually pleasing), which will increase the construction costs. Further, Culligan has never removed such high levels of hardness ($CaCO_3$) and recommends installing a small number of softeners (initially operating five softeners) to ensure the system is set up correctly and results are positive. Additionally, for Option B to be implemented, the City will need to invest $5.7M in the Betable Road Well development in order to achieve water security (making the total cost for this option $8.7M). The benefit to this option is that both the installation and maintenance of the system will be outsourced to Culligan.

Option A (Pellet Plant) has the second lowest life cycle cost (approximately $4.2M), but requires a new treatment process to be implemented in the City. This will likely require additional staff to operate and maintain the facility, which will increase the annual O&M costs, but will be in full control of the City (not relying on residents to properly maintain/protect their individual systems). It will eliminate the concern of very hard water scaling distribution pipelines and put good use of equipment the City already owns. However, in order to achieve water security, the City will need to invest $5.7M in the Betable Road Well development (making the total cost for this option $9.8M).

Option C (West Hills WTP) is the most expensive option (approximately $10.1M), but it provides a reliable water source to add to the City's portfolio, providing backup to primary wells and eliminates the need for the City to invest an additional $5.7M in the Betable Road Well. Further, this option provides limited concerns of future operational complexities, as all the source water treatment O&M will be handled by the San Benito County Water District. The West Hills WTP does receive some of its water from the Federal United States Bureau of Reclamation Central Valley Project and that portion of the monthly service fees ($540 out of the $1500/AF wholesale rate) is expected to increase in the future (to an unknown extent), thereby increasing the total O&M costs.

5.2 NON-MONETARY FACTORS

The source water options considered must be evaluated not only for their benefits to the removal of salinity and ability to provide reliable backup water source, but also for their ranking against the other options. To compare the options, a list of criteria is developed by which the alternatives will be ranked. **Table 14** provides a list of criteria and a brief explanation why it is important in the evaluation process.

Table 14 Improvements Project Selection Criteria

Criterion	Description
Life Cycle Costs (Capital and O&M)	Cost to design new processes, purchase equipment and construct facilities. Including the cost to operate new facilities – such as power costs, chemical costs, periodic replacement costs, maintenance costs, etc.
Footprint	The amount of land area needed to physically house the new process facilities
Ease of Maintenance/Operation	A measure of operator time required to operate and perform routine maintenance on equipment. It is expected that the fewer moving parts in the process, the less operator time will be needed to maintain the equipment
Reliability	A measure of how dependable and robust the system is and how well it will react to changing raw water quality and ability to remove downstream salinity
Upstream/Downstream Effect	Potential beneficial impacts that the new process will have on the upstream and downstream facilities. Such as the ability to prevent scaling on downstream pipes.
Water Security	Provide backup water source for potable water users, in case City's production well is taken out of service due to nitrate issues (or otherwise)
Flexibility (Future Regulations)	Ability for new equipment to fit into existing processes

The criteria themselves are given a score from one to five based their importance to the project. A score of five carries the highest level of relative importance while a score of one has a relatively lower level of importance. The value entered in the blue squares compares the criterion in the row to the criterion in the column for relative importance in the selection process. Each score entered in the blue squares will have a paired score in the white squares and the two paired scores will equal six. The relative weight of each criterion is calculated and ranked in the two columns on the right.

Table 15 provides a matrix assigning a score for each of the alternatives and its relative weight in determining the preliminary treatment process selected.

Table 15 Source Control Options Criteria Weight

	Life Cycle Costs (Capital and O&M)	Footprint	Ease of O&M	Reliability	Upstream/ Downstream Effect	Water Security	Flexibility (Future Regulations)	Relative Weight
Life Cycle Costs (Capital and O&M)		**5**	**4**	**3**	**4**	**2**	**3**	***21***
Footprint	**1**		**2**	**2**	**2**	**1**	**2**	***10***
Ease of O&M	**2**	**4**		**2**	**3**	**2**	**2**	***15***
Reliability	**3**	**4**	**4**		**4**	**3**	**3**	***21***
Upstream/ Downstream Effect	**2**	**4**	**3**	**2**		**3**	**3**	***17***
Water Security	**4**	**5**	**4**	**3**	**3**		**4**	***23***
Flexibility (Future Regulations)	**3**	**4**	**4**	**3**	**3**	**2**		***19***

Evaluation Criterion	**Entered Score**	**Paired Score**
Substantially More Important	5	1
Somewhat More Important	4	2
Equal Importance	3	3
Somewhat Less Important	2	4
Substantially Less Important	1	5

1. Blue cells are scored using evaluation criteria (score 1-5). White cells are the paired score (score 5-1). Relative weight is the total of the entire row.

Table 16 presents a comparative score (with the total of the scores equal to exactly ten) for the three options evaluated. This matrix also takes the relative weight determined in Table 15 for each of the evaluation criteria and multiplies that number by the comparative score for each of the criteria. This calculation returns a weighted score for each of the evaluation criteria and each of the alternative source control measures. The sums of these weighted scores for the seven evaluation criteria is presented as a total score on the bottom row. The higher the total score, the better the option for this application.

Table 16 Source Control Options Selection Matrix

		Comparative Score (Score Total Must Equal 10)			Criterion Score (Relative Weight Times Comparative Score)		
Criteria	***Relative Weight***	**Pellet Plant**	**Cartridge Softener**	**West Hills WTP**	**Pellet Plant**	**Cartridge Softener**	**West Hills WTP**
Life Cycle Costs (Capital and O&M)	*21*	3.3	3.5	3.2	69	74	67
Footprint	*10*	3	4	3	30	40	30
Ease of O&M	*15*	2	4	4	30	60	60
Reliability	*21*	3.5	3	3.5	74	63	74
Upstream/Downstream Effect	*17*	4	3	3	68	51	51
Water Security	*23*	3.3	3.3	3.3	77	77	77
Flexibility (Future Regulations)	*19*	4	2	4	76	38	76
				TOTAL SCORE	**423**	**402**	**434**

Source Control Recommendation

As shown in **Table 16**, connecting to the West Hills WTP scores highest compared to the other options evaluated in the analysis and is therefore the recommended source control options.

6.0 PROPOSED PROJECT, RECOMMENDED ALTERNATIVE

As shown in **Table 16**, connecting to the West Hills WTP scores highest compared to the other options evaluated in the analysis and is therefore the recommended source control alternative.

6.1 PRELIMINARY PROJECT DESIGN DESCRIPTION

The Apparent Best Project includes connecting the drinking water system to the West Hills WTP through a 10-inch diameter pipe constructed in a 6.3-mile long alignment (between the City of Hollister and the City of San Juan Bautista) and a booster pump station (to provide adequate pressure during peak demands), as shown in **Figure 8**. Further, after the West Hills WTP water source is installed, the City will need to implement a buy-back program to remove domestic water softeners from homes.

6.2 PROPOSED PROJECT SCHEDULE

Implementation of the project will follow the timeline required to secure funding and to complete the environmental CEQA and permitting process, establish user rates, complete the Proposition 218 process for those rates, and complete design and construction. An estimate of the timeline, subject to change, is presented in **Table 17**.

Table 17 Preliminary Project Schedule

Task	Completion Data
Preliminary Engineering Report	August 2020
Submit Construction Funding Application	August 2020
Implement Pre-Treatment Program	October 2020
Design & Project Management Consultant Selection	October 2020
Collect Samples at Industrial Discharge	April 2021
NEPA and CEQA permitting process	February 2022
Final Design (Drawings and Specifications)	March 2022
Bidding Process	May 2022
Construction NTP	June 2022
Construction Substantially Complete	July 2023
Final Startup, Testing, and Operations	November 2023

6.3 PERMIT REQUIREMENTS

As stated previously, the San Juan Bautista Wastewater Treatment Plant (WWTP) operates under Order No. R3-2009-0019 NPDES permit No. CA0047902. Based on the current permit, the average monthly discharge limits for chloride, sodium, and total dissolved solids (TDS) are 200 mg/L, 250 mg/L, and 1400 mg/L, respectively. The anticipated salinity balance, after the project is complete, is shown in **Table 18**. As detailed, the salinity concentrations are anticipated to be in compliance with the current permit once the project is complete (including limiting industrial users to only discharging municipal wastewater into the City's sewer collection system, procuring source water from West Hills WTP that is blended with the City's well water at 60-percent ratio, and implementing a water softener buy-back program that is expected to reduce half the domestic softener use). These numbers are also incorporated into the wastewater evaluation (Appendix A.1) for reference. Future permit restrictions that decrease the salinity concentrations beyond the existing limits (presumed to be 150, 200, and 1200 mg/L, respectively) will need to be accommodated through additional water softener buy-back or higher blended ratios from West Hills WTP.

The design of the improvements will be in compliance with the latest building codes (2019 California Building Code, CBC), design and placement of structural concrete will conform to American Concrete Institute Code Requirements (ACI 318) and for liquid containing structures ACI 350. All drinking water improvements will be done in accordance with NSF 61 standards and comply with CCR Title 17, 22, and 40.

During construction, the General Contractor will be required to obtain an encroachment permit from the County of San Benito, an air permit from the Monterey Bay Air Resources District, and a General Permit for storm water discharges associated with construction (and SWPPP compliance) from the Regional Board.

Table 18 Future WWTP Influent Salinity Balance (Average Daily Loads)

Salt Contributors to Total WWTP Influent	TDS	Chloride	Sodium
SALINITY LOADING, lb/d			
Well No. 1 & West Hills Blend (Raw Water)[1]	615	118	87
Diet and Personal Care Products[2]	400	27	19
Self-Regenerating Water Softeners[3]	146	88	59
Industrial User[4]	30	4	3
Inflow and Infiltration[5]	0	60	0
TOTAL WWTP INFLUENT, lb/d	1,191	296	167
SALINITY CONCENTRATION, mg/L			
Well No. 1 (Raw Water)[1]	407	78	58
Diet and Personal Care Products[2]	265	18	12
Self-Regenerating Water Softeners[3]	97	58	39
Industrial User[4]	20	2	2
Inflow and Infiltration[5]	0	40	0
TOTAL WWTP INFLUENT, mg/L	789	196	111

1. Based on average well & West Hills WTP data shown in Tables 3 & 11 with a blended ratio of 40% well water and 60% surface water.
2. Dietary and Personal Care Products: TDS concentration of 265 mg/L based on Central Valley Clean Water Association "Salinity Management Practices for POTWs" 2012. Chloride and sodium concentrations based on "Chloride Contributions from Water Softeners and Other Domestic Sources" University of Minnesota 2019 and "Characterizing and Managing Salinity Loading in Reclaimed Water Systems" by AWWA & Thompson 2006.
3. Water softener efficiency based on 3300 grains hardness per pound NaCl (and average blended source water hardness of 228 mg/L $CaCO_3$) in accordance with historical and current California efficiency standards and half the influent flow rate is being treated by ion exchange water softeners. Calculation assumes 20% of households will still have water softeners after buyback program takes effect (approximately 175 softeners remaining).
4. Based on industrial pre-treatment limiting drains to only municipal wastewater flow from facility at 4,000 gpd average and salinity concentrations of 885 mg/L TDS, 110 mg/L chloride, and 80 mg/L sodium). To corelate these values to total wastewater influent flow concentration, the sample concentrations were multiplied by 2.2% (4,000 gpd ÷ 180,000gpd = 2.2%)
5. To account for missing salinity, inflow and infiltration (I/I) based loading (salinity from agricultural runoff and natural erosion/weathering of rock minerals) was calculated by taking the difference between historical influent loads (from Appendix A.1) and total other loads contributors identified herein. The missing chloride concentration may also be linked to the historical changes in the primary source water, as various wells were placed online or taken offline (i.e. Well No. 1 has chloride concentrations that are 25 mg/L lower than Well No. 6, etc).

6.4 SUSTAINABLITY CONSIDERATIONS

In agreement with the State planning priorities of Government Code 65041.1 and sustainable water resource management priorities, all new improvements completed with this project will utilize premium efficient motors where feasible. New PLC controls and SCADA alarming will help the new facilities to operate efficiently.

6.5 ENGINEER'S OPINION OF PROBABLE COSTS

The total capital cost for this project is estimated to be $8,233,000 and is detailed in **Table 19**.

Table 19 Total Project Cost Estimate

ITEM	Subtotal	Total
Property Purchase / Lease Agreements		--
Easement Acquisition / Right of Way / Water Rights		$15,000
Bond Counsel		--
Legal Counsel		--
Interest/Refinancing Expense		--
Other (Water Softener Buy-Back Program)		$193,000
Environmental Services		
- CEQA Environmental Report	$40,000	
- NEPA Environmental Report	$10,000	
- Environmental Mitigation Contract Services	$10,000	
Total - Environmental Services:		$60,000
Engineering Services		
Basic Services:		
- Preliminary Engineering Report (PER)	$112,000	
- Preliminary and Final Design Phase Services	$508,000	
- Bidding/Contract Award Phase Services	$35,000	
- Construction and Post-Construction Phase Services (w/o inspection)	$230,000	
- Resident Project Representative Services (resident inspector)	$495,000	
Additional Services:		
- Permitting	$10,000	
- Regulatory Compliance Reports	$5,000	
- Environmental Mitigation Services (Construction Phase)	$10,000	
- Easement Acquisition/ROW's Services (Construction Phase)	--	
- Surveying Services (Construction Phase)	$10,000	
- Operation & Maintenance Manual(s)	$15,000	
- Geotechnical Services	$20,000	
- Hydrogeologist Services	--	
- Materials Testing Services (Construction Phase)	$25,000	
- Other Services (describe)	---	
Total – Engineering Services:		$ 1,475,000
Equipment/Materials (Direct purchase using approved methods, separate from construction bid/cost)		--
Construction Cost Estimate (escalated to mid-point of construction)		$ 5,900,000
Contingency (10% of construction cost estimate)		$ 590,000
TOTAL PROJECT COST ESTIMATE:		**$ 8,233,000**

6.6 ANNUAL OPERATING BUDGET

6.6.1 Income

The City currently charges residential and commercial customers the rates summarized below, as detailed in **Section 2.4**:

- the base rate of $55.76/month (inside City residents)
    - plus $6.35 per 1,000-gallons (uniform water rate), and
- the base rate of $66.29/month (outside City residents)
    - plus $6.35 per 1,000-gallons (uniform water rate),

Based on the 2019 Auditor's Report and Financial Statement, the City's annual operating revenue collected from water fees was $1,312,018.

6.6.2 Annual O&M Costs

The primary production of potable water will be changed from groundwater wells to West Hills WTP. Operation and maintenance costs for the existing wells, as a result of the proposed Project, are anticipated to decrease and the amount of contract labor needed for operations will also be less. However, the regional service fees will be added to the annual cost of operation. **Table 20** below, includes an estimate of the approximate annual operations and maintenance costs of the new facility.

Table 20 Projected Operations and Maintenance Costs

Annual O&M Cost Estimate	Water
Operating Expense	
Contractual Services and Utilities	53,000
Regional Service Fees (WHWTP)	336,000
Personnel	64,000
Supplies, Materials, and Repairs	50,500
Depreciation	326,616
Total Operating Expense	**830,116**

1. Based on 2019 O&M costs minus approximately half the cost of water utilities, supplies and personnel, plus additional regional service fees (West Hills WTP service fees).

6.6.3 Debt Repayments

Based on the June 2019 Auditor's Report and Financial Statement (as detailed in **Appendix B**), the City issued an Enterprise Revenue Bond for the principal amount of $11,640,000. The bond paid for the 2008 Water and Sewer COP and Pavex Note. The cash basis debt service paid during the fiscal year ending on June 30, 2020, totals $687,064. The bonds bear interest ranging from 3 to 5-percent and are payable semi-annually, ending on October 2043.

Based on a total Project Cost of $8,233,000 (as shown in Table 19) and an estimated 45% grant from USDA, the City will need to borrow $4,528,150 to pay for the project. Based on an assumed interest rate of 1.375% (current USDA poverty interest rate) and a 40-year term loan, the annual debt service will be $147,900.

The City has limited revenues available to support another loan obligation while keeping user fees manageable for the small city of San Juan Bautista. The City is hoping they will be eligible for additional grant assistance from other sources.

6.6.4 Reserves

Based on the June 2019 Auditor's Report and Financial Statement (as detailed in **Appendix B**), the current "restricted" reserves for the water are $863,071. The City's net asset positions are summarized in **Table 21**.

Table 21 Statement of Net Asset Positions

Item	Water
Current Assets	
Cash and Investments	$895,507
Restricted Cash and Investments	$863,071
Accounts Receivable, Net	$91,990
Total Current Assets	$1,850,568
Non-Current Assets	
Property, Plant, and Equipment	$7,413,720
Total Assets	
Total Assets	$9,264,288

7.0 CONCLUSION AND RECOMMENDATIONS

The Apparent Best Project for the City of San Juan Bautista includes the following components:

- Implement an industrial pre-treatment program for salinity control
- Construct a 10-inch potable water line from the West Hills WTP to the City of San Juan Bautista
- Booster pump station at Well No. 6 site
- Execute self-regenerating water softener buy-back program

APPENDIX A

2020 Water and Wastewater Masterplan

APPENDIX B

Current City Budget and Financial Audits

APPENDIX C

Violation Notices and Regional Board Comments

APPENDIX D

Pellet Plant Report