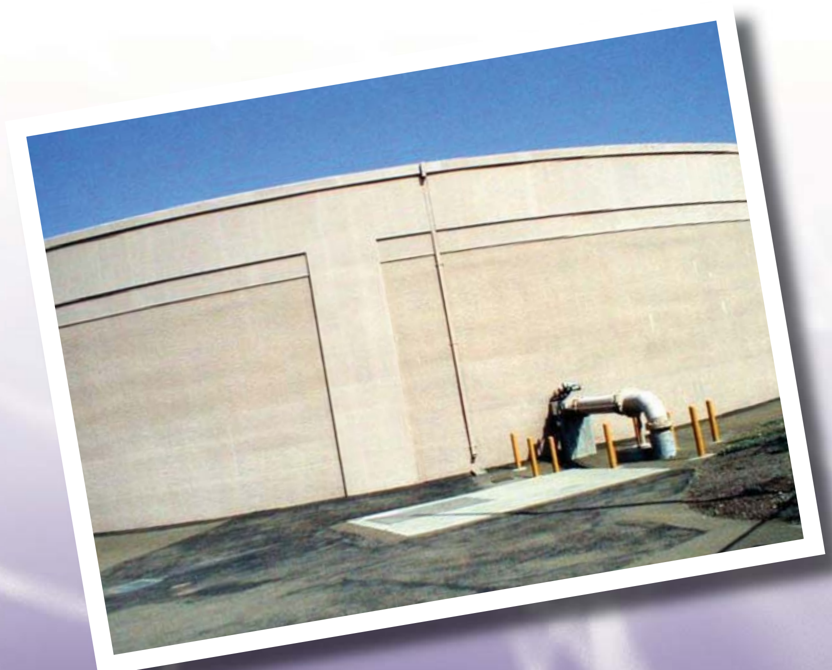
City of Milpitas

Water Master Plan Update



December 2009

RMC
Water and Environment

City of Milpitas

2009 Water Master Plan Update

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EXECUTIVE SUMMARY

This 2009 Water Master Plan Update (2009 Update) is an update of the City of Milpitas (City) 2002 Water Master Plan (2002 Master Plan). The 2002 Master Plan defined the water system improvements necessary to meet the City's 2002 water demand and future demand associated with future development plans for 2008, 2018 and build-out year of 2021. This 2009 Update is a reevaluation of the City's water system capacity based on updated land use information from several near- and long-term development projects currently in the planning process. This 2009 Update provides information required for the City's planning and financial efforts and defines the necessary water supply system improvements necessary to accommodate the City's buildout land use.

This 2009 Update analyzes the potential impact of three land use scenarios associated with different levels of development. The three scenarios are:

1. Nineteen (19) General Plan Amendments Only,
2. Proposed Transit Area Specific Plan Only, and
3. Combination of the Nineteen (19) General Plan Amendments, the proposed Transit Area Specific Plan land use, and the updated large water users (LWUs) information.

The goals of this planning document are to:

1. Update the land use information for the three potential development scenarios, and
2. Under each scenario, identify transmission and storage deficiencies caused by this change in water demand, and recommend projects to relieve these deficiencies

This 2009 Update uses baseline information, flow factors, and other information from the 2002 Master Plan and does not include any reevaluation of flow factors or model calibration steps. Revised water demands were developed based on new land use information and flow factors from the 2002 Master Plan. Each water supply area (i.e. SFPUC and SCVWD supply zones) was evaluated independently. The demand conditions analyzed were peak hour and maximum day with fire flow demands.

Overall, the water distribution system is a robust, well connected system designed for operational flexibility with redundant wholesale and emergency supply sources.

Capital Improvement Program

The recommended Capital Improvement Program (CIP) addresses system deficiencies that were determined to be either essential from a risk and liability perspectives or reasonable based on economics. The CIP consists of preferred projects to address specific deficiencies based on ease of construction, easements and right-of-way requirements, and cost. **Table ES-1** summarizes the near-term CIP projects.

In addition to the near-term CIP projects, potential long-term improvement projects were also identified and are shown in **Table ES-2**.

Table ES-1: Summary of Near-Term CIP Projects

Scenario[a]	Zone	Location	Issue	Improvements	2009 Cost[b]	Recommended CIP[e]
All	SF1	Dixon Rd. & I-680	Low Pressure	Install pressure reducing valves and open/close isolation valves.	$225,000[c]	FY 2010/2011
All	SC1	Railroad Avenue & Carlo Street	Low Pressure and Reliability	Construct 300 LF of 12-in pipe to three dead-end pipes, one on Abel and two on Carlo Street. Also parallel 260 LF of the existing 8-in pipe on Carlo with a 6-in pipe.	$412,000[d]	FY 2010/2011
All	SC2	Pecten Court	Low Pressure	Construct 150 LF of 12-in pipe connecting the dead-end point at Pecten Court to 10-inch pipe at Montague Expressway.	$292,000	FY 2010/2011
All	SF1	Hanson Court	Low Pressure	Construct 950 LF of 12-in pipe connecting the dead-end at Hanson Court to N. Milpitas Blvd.	$356,000	Not recommended at this time.
All	SC1	Hammond Way & Sinnott Lane	Low Pressure	Construct 300 LF of 8-in pipe connecting the dead-end on Hammond Way to Main Street.	$89,000	Not recommended at this time.

Footnotes:

a. Scenario 1: 19 General Plan Amendments
Scenario 2: Transit Area Specific Plan
Scenario 3: Combination of 19 General Plan Amendment, Transit Area Specific Plan, and updated LWU information

b. Based on $17/in/LF for pipes, $1.7/gal for tanks, and PRV quotes. SFENR CCI 9719 (November 2009)/20 Cities Average CCI 8592 (November 2009) and a contingency of 30% for construction and 30% for implementation were used. Contingency includes design, construction management, utility coordination, environmental assessments, administration costs and planning level estimating coverage. Some of the City's documents published prior to 2009 referenced the costs of these projects in August 2007 dollar, which used SFENR CCI 9072/20 Cities Average CCI 8007.

c. Construction costs are based on City of Milpitas *Sunnyhills Low Pressure Area Revision Study* dated January 2001 and escalated to 2009 Dollars.

d. Includes $100,000 for boring and jacking under the Railroad.

e. The Near-Term CIP in the 2002 Master Plan included a project to add an 8-inch PRV at Sunnyhills Turnout to mitigate reliability issue. This project is not included in this updated CIP but may still be desirable to enhance reliability.

Table ES-2: Summary of Long-Term CIP Projects

Zone	H2OMAP ID	Location	Issue	Improvements	2009 Cost[a]	Recommended CIP
Scenario 1 (19 General Plan Amendments)						
SC2	Turnout, pipes 227 and 212	Montague Expwy and Curtis Ave.	High Velocity & Excessive Headloss	Construct a new 20-inch Turnout, upsize pipes 227, 212 and PRV to 26 inch	$2,450,000	FY 2020/2021
SCVWD Zone	N/A	SCVWD Zone	Insufficient Storage	Construct a 5.4 MG Tank and Pump Station	$17,970,000	FY 2020/2021
				OR		
				Construct a 3,300-gpm Well	$8,160,000	
Scenario 2 (Transit Area Specific Plan)						
SC2	Turnout, pipes 213, 227 and 212	Montague Expwy, SCVWD Gibraltar Turnout and Curtis Ave.	High Velocity & Excessive Headloss	Construct a new 20-inch Turnout, construct 22-in pipe parallel to pipe 213, upsize pipes 227, 212 and PRV to 26 inch	$2,950,000	FY 2020/2021
SCVWD Zone	N/A	SCVWD Zone	Insufficient Storage	Construct a 6.3 MG Tank and Pump Station	$21,160,000	FY 2020/2021
				OR		
				Construct a 4,100-gpm Well	$10,130,000	
Scenario 3 (19 Gen Plan Amend., Transit Area Specific Plan, and updated Large Water Users Information)						
SC2	Turnout, pipes 213, 227 and 212	Montague Expwy, SCVWD Gibraltar Turnout and Curtis Ave.	High Velocity and Excessive Headloss	Construct a new 20-inch Turnout, construct 22-in pipe parallel to pipe 213, upsize pipes 227, 212 and PRV to 26 inch	$2,950,000	FY 2020/2021
SCVWD Zone	N/A	SCVWD Zone	Insufficient Storage	Construct a 6.6 MG Tank and Pump Station	$22,560,000	FY 2020/2021
				OR		
				Construct a 4,400-gpm Well	$10,870,000	

Footnotes:

a. Based on $17/in/LF for pipes, $1.7/gal for tanks, $1.01/gal/d for wells, and PRV quotes. SFENR CCI 9719 (November 2009)/20 Cities Average CCI 8592 (November 2009) and a contingency of 30% for construction and 30% for implementation were used. Contingency includes design, construction management, utility coordination, environmental assessments, administration costs and planning level estimating coverage. Some of the City's documents published prior to 2009 referenced the costs of these projects in August 2007 dollar, which used SFENR CCI 9072/20 Cities Average CCI 8007.

The specific timing and phasing needs of these improvements were not evaluated in this master plan update.

Recycled water improvements in the Transit Area include approximately 14,970 ft of 8-inch and 6-inch pipes and has an estimated implementation cost of $5,710,000 (November 2009 value).

Additional Recommendations

In addition to projects recommended in the CIP to mitigate for the deficiencies identified, the following are a few additional recommendations regarding "good practices" that would help address the deficiencies that were not included in the CIP.

Valves Maintenance

The analysis of the distribution system was made under the assumption that the pressure regulating valves and the emergency regulating valves are maintained annually and that they will respond as expected, especially in an emergency condition. Therefore, it is essential to keep the valves in good working condition and to continuously exercise them.

Fire Flows

There are six areas where the current fire flow residual pressure is less than the required 20 psi. With the exception of node 2509 at Montague Expressway and McCarthy Boulevard, the other five locations were previously identified as low-pressure areas in the 2002 Master Plan. Model analysis also shows that these areas are not impacted by the proposed development in the three land use scenarios. Based on discussion with City staff when the 2002 Master Plan was developed, it was determined that these areas do not require capital improvements at this time. However, the Fire Department should be made aware of the low residual fire flow pressures in these areas and consider them weak areas until a capital project could be built in the future to eliminate the problem.

Hanson Court

The Hanson Court area, which indicated low residual pressure in a fire flow simulation, was found to have a 70 psi residual pressure at the hydrant upstream of the dead end point. According to the 2002 Master Plan, City maintenance staffs have observed that there is flow in the pipeline even when all the valves are closed indicating that there could be unknown connections. These connections need to be further investigated prior to determining if this area needs a project to remedy the problem. If new connections are found then the hydraulic model need to be updated to reflect this.

Emergency Wells

The Pinewood and Curtis emergency wells were taken into account as part of the storage capacity. To be able to take the wells into account for storage two conditions need to be met. The first condition is having emergency power supply at the well pumps and second condition is having chlorination at the wells. The existing Pinewood well does have an emergency power supply source and the City is in the process of adding a chlorination system to the well. The Curtis well, a CIP project, is being constructed and does include a chlorination system and emergency power supply as part of the construction specification.

Pipelines with High Headlosses

There are a number of pipelines in the system that exceeded the criteria for maximum headlosses for the appropriate pipeline sizes. However, the velocities in these pipes stayed within the performance criteria and therefore no capital improvement is recommended. It is good practice to keep an eye on these pipelines and to upsize these pipes or parallel them with another pipeline if other circumstances such as low pressure or excessive velocity make it necessary to undertake a project in those areas.

Standard Pipe Size

The use of standard pipe sizes such as the 6, 8, and 12-inch pipelines is highly recommended. Pipes with these sizes tend to be cheaper in cost than the non-standard sizes such as the 10-inch pipe because the standard sizes are more available and sold off the shelf. Having standard sizes also helps in the maintenance and operation of the facilities. Therefore in this master plan where analysis showed the need of a non-standard size pipe, the next larger standard pipe size was recommended.

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ABBREVIATIONS

ABAG	Association of Bay Area Government
ACWD	Alameda County Water District
AFY	acre-feet per year
avg	average
AWWA	American Water Works Association
CCI	Construction Cost Index
CIP	Capital Improvement Program
City	City of Milpitas
CVP	Central Valley Project
CDPH	California Department of Public Health
DU	dwelling unit
ENR	Engineering News Record
EPRV	emergency pressure regulating valves
FAR	floor area ratio
ft	feet
ft/kft	feet per 1,000 feet
ft/s	feet per second
FY	fiscal year
gal	gallon
GIS	Geographic Information System
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
HGL	hydraulic grade line
in	inch
ksf	1,000 square feet
IS	Information System
LF	linear feet
MG	million gallons
MGD	million gallons per day
N/A	not applicable
PRV	pressure regulating valves
psi	pounds per square inch
psig	pounds per square inch gage
SBWR	South Bay Water Recycling

SC	Santa Clara
SCADA	supervisory control and data acquisition
SCVWD	Santa Clara Valley Water District
SF	San Francisco
sf	square feet
SFENR CCI	Engineering News Record Construction Cost Index for San Francisco
SFPUC	San Francisco Public Utilities Commission
SJWC	San Jose Water Company
SWP	State Water Project
TM	Technical Memorandum
TOD	Transit Oriented Development
WTP	water treatment plant
WUF	Water Use Factors

CHAPTER 1 INTRODUCTION

Chapter Synopsis: *This chapter presents the purposes, objectives, and scope for the 2009 Water Master Plan Update. This 2009 Update is an update of the 2002 Master Plan (RMC 2002) that incorporates new land use information into the City's water model to identify potential impacts that the new development projects might have on the water system.*

The City of Milpitas (City) is located in the Santa Clara County, California, approximately 45 miles south of San Francisco, and is bordered by Fremont to the north and San Jose to the south. Since its inception in 1954, Milpitas has experienced steady growth and development. At the time of incorporation, Milpitas covered an area of 2.9 square miles with a population of 825. Rapid growth began with the Ford Motor Company assembly plant in 1955 and continued with the high technology industry in the 1970's. By 1992, the City had covered 13.6 square miles.

The City contains a strong complement of employment and retail uses as well as housing. The City can be divided into two distinct areas consisting of roughly 10.1 square miles on the relatively flat Valley Floor to the west and 3.5 square miles on the steep Hillside to the east. The Valley Floor areas, extending from Coyote Creek in the west to Piedmont Road, Evans Road and the northerly portion of North Park Victoria Drive in the east, are zoned for industrial, commercial, and residential uses. The Hillside areas are zoned for residential use only. Parks and recreational open spaces are distributed throughout the residential areas.

1.1 Project Purpose

This 2009 Update is a reevaluation of the City's water system capacity based on updated land use information from several near- and long-term development projects currently in the planning stage. It provides information required for the City planning and financial efforts and defines the necessary water supply system improvements necessary to accommodate the City's buildout land use. This 2009 Update evaluated the potential impacts of the development projects under three scenarios:

Scenario 1: Nineteen (19) General Plan Amendments (GPA), which are currently in the planning and approval stages throughout the City. These projects mainly include very high density multi-family housing developments that will require a significant water demand above current land use. Scenario 1 evaluates the incremental increase in water demand and infrastructure improvement necessary to accommodate this development assuming there has been no change in the existing water system since the last evaluation (i.e. 2002 Master Plan).

Scenario 2: The Milpitas Transit Area Specific Plan (TASP), which outlines a development vision for the area of the City including and just south of the Great Mall. The area is currently dominated by light industrial land use and will be converted to high density residential, commercial, and mixed use land uses over the next 20 years. The switch from light industrial to high density residential will increase the water demand in an area already identified for needing water main improvements in the near future. Scenario 2 evaluates the incremental increase in water demand and infrastructure improvement necessary to accommodate this development assuming there has been no change in the existing water system since last evaluation (i.e. 2002 Master Plan).

Scenario 3: This scenario comprised of three components: the GPA developments, the TASP development, and the updated water use information of the City's large water users (LWUs). GPA and TASP developments are as explained above. Updated LWUs refers to the water demand changes observed in many LWUs between 2002 and 2007. Many of the LWUs identified in the 2002 Master Plan have changed their water use, left the City, gone out of business, or relocated within the City. Scenario 3 evaluates the impact of new developments while also taking into consideration the changes observed in the current water system.

1.2 Objectives

There are two objectives of this 2009 Update:

1. Update the land use under the three scenarios, and
2. Under each scenario, identify pipe and storage deficiencies caused by this change in water demand, and recommend projects to relieve these deficiencies

1.3 Previous Studies

This Master Plan Update will build off of the work completed for the 2002 Master Plan. The objectives of the 2002 Water Master Plan was to:

1. Identify and present improvements needed to both upgrade the 2002 distribution system to meet the 2002 water demand and to expand the distribution system to accommodate future demand associated with future development plans.
2. Documents the conditions under which the City was operating in year 2001.
3. Examines future planning documents to estimate the water supply needs of the community in 2008, 2018, and at the project Midtown build-out year of 2021.

The final projects proposed for the 2002 Master Plan Revision are shown in **Table 1-1**.

Table 1-1: Summary of 2002 Master Plan Capital Improvement Program Projects

Zone	H_2OMAP ID	Location	Issue	Improvements	2002 Cost	Implementation Year
SF1	N/A	Sunnyhills Turnout	Reliability	Install an additional 8-in PRV for redundancy	$19,000	FY 03/04
SF1	Nodes 207 and 230	Dixon Rd. & Levin Street	Low Pressure	Install pressure reducing valves on all service connections and open/close isolation valves	$184,000	FY 03/04
SC1	Node 9914	Railroad Avenue & Carlo Street	Low Pressure & Reliability	Construct 300 LF of 12-in pipe to three dead-end pipes, one on Abel and two on Carlo Street. Also, parallel 260 LF of the existing 8-in pipe on Carlo with a 6-in pipe	$325,000	FY 03/04
SC2	N/A	Pipe 213 – SCVWD Turnout @ Gibraltar	High Velocity & Excessive Headloss	Construct 750 LF of 12-inch pipe parallel to existing pipe 213	$383,000	FY 15/16
SC1	N/A	SCVWD Zone Storage Tank	Insufficient Storage	Construct a 1.3 MG tank	$3,664,000	FY 20/21

For this Update, all the scenarios will be modified from the base Midtown Buildout land use developed in the 2002 Master Plan. Each scenario will be analyzed only under buildout conditions, and phasing will not be included in the analysis.

CHAPTER 2 LAND USE

Chapter Synopsis: *This chapter includes updates to the land use data from the 2002 Master Plan. This 2009 Update consists of the evaluation of three additional land use scenarios based on the buildout scenario from the 2002 Master Plan, and includes changes to both existing and future land use data.*

2.1 Land Use Database

The land use database used for this 2009 Master Plan is the City GIS parcel database used for the 2002 Master Plan. As part of the effort in developing the 2002 Master plan, linkage between the parcel database (i.e. the parcel centroids) and the water distribution system (i.e. nodes) has been established in the H2ONET hydraulic model (converted to H2OMAP for this update) by using the City's plats and record drawings information. Land use in the City since 2002 has remained mostly unchanged. There are some changes due to large water users and future land developments, as described in the following sections.

2.2 Existing Land Use

The existing land use designations for the City were largely unchanged; however, review of recent years' water use records suggested that there might have been some water use change among some of the City's large water used (LWU, users that exceed an annual average water use of 30,000 gpd) since 2002. As part of this 2009 Update effort, recent water use records collected from March 2006 through February 2007 were reviewed and 10 of the LWU were contacted to identify any expected trends in their future water use.

Some of the LWU identified in the 2002 Master Plan no longer meet the LWU criteria. Only 12 of the original 17 LWUs are still currently included, and new LWUs have been added based on the flow criteria. The updated list of large users is shown in **Table 2-1**.

Table 2-1: Large Water Users

No.	Street Name	H2OMAP Node ID	FY 2000/2001 Average Annual Water Use (gpd)[a]	FY 2006/2007 Average Annual Water Use (gpd)[b]
1	Abel St.	1855	297,000	340,785
2	Hillview Dr.	2010	163,500	161,000
3	Mccarthy Blvd.	2510	99,600	130,873
4	Ames Ave.	3009	149,700	124,242
5	Barber Ct./Ln.[d]	1613	95,125[e]	122,750
6	Hillview Dr.	2010	74,500	121,332
7	Milpitas Blvd.	2006	166,500	106,778
8	Main St.	2908	75,200	102,257
9	Hillview Dr.	2010	85,200	82,114
10	Milpitas Blvd.	2005	167,798	64,697
11	Barber Ln.	1604	52,552[c]	41,697
12	Alder Dr.	2518	9,725[c]	40,001
13	Yosemite Dr.	2003	46,500	38,828
14	Milpitas Blvd.	312	35,566	35,859
15	Calaveras Blvd.	9966	23,940[c]	35,642
16	Milpitas Blvd.	2007	236,900	30,121
		Total	**1,779,306**	**1,578,975**

Footnotes:

a. Source: FY 2000/2001 Water Records provided by the City
b. Average water use over the March 2006 to February 2007 period.
c. Actual water use unavailable. Values were assumed to be equal to the water use of adjacent parcels.
d. Includes all water users with even number service address located at 190 to 550 Barber Lane/Court
e. Estimated using FY00/01 and FY06/07 water billing data.

2.3 Future Land Use

Since the completion of the 2002 Water Master Plan, there has been several changes to future land use, including:

- General Plan Amendments (19 total)
- Transit Area Specific Plan
- Updated large water user information

From this updated information, three new land use scenarios were developed and analyzed in the H2OMap model:

- **Scenario 1:** This scenario includes the buildout land use for the City as well as the 19 General Plan Amendments pending with the City's planning department. These 19 projects are completing the approval process and should be assumed to be completed within the next 5 years. The breakdown of land use for the Scenario 1 projects is shown in **Table 2-2**.
- **Scenario 2:** This scenario includes the buildout land use for the City plus the current plans for the Milpitas Transit Area (MTA) Specific Plan. The MTA Specific Plan is currently being finalized. The Plan will not be completed for approximately 20 years, however some projects will begin the planning and approval process following approval of the MTA Specific Plan and EIR. The proposed development density for the MTA Specific Plan is shown in **Table 2-3**.
- **Scenario 3:** This scenario combines the projects from both Scenarios 1 and 2 with the buildout land use for the rest of the City, and also includes modifications to the Large Water User list. Refer to **Table 2-1, Table 2-2** and **Table 2-3** for the proposed land use changes.

The probability that these land use projections will change is high. For this update, the three scenarios investigated offer a range from near-term developments (Scenario 1 - 19 General Plan Amendments) to long-term, build out projects (Scenario 2 - Transit Area Specific Plan, and Scenario 3 - 19 General Plan Amendments, Transit Area Specific Plan and adjusted large water users information).

The parcels containing LWU were assumed to maintain their current land use through build-out, except when overlapping planned developments, such as the Milpitas Transit Area or other general plan amendments. In those cases, the build-out development plans were assumed to supersede existing land use.

Figure 2-1, Figure 2-2, Figure 2-3 and Figure 2-4 illustrate the land use projections for the three scenarios, highlighting the parcels that will change from the Master Plan Revision build out scenario.

Table 2-2: Scenario 1 Proposed Development (19 General Plan Amendments)

Project No.	Project Name	Current Zoning	Proposed Zoning	Office Area (SF)	Commercial Area (SF)	Residential Units
Outside of the Midtown Specific Plan Area Projects						
3206	S Main St - Matteson	Gen Comm-TOD	R4-TOD	--	2,700	126
3151	Californian - Barry Swenson	Highway Svc	R4	--	--	176
3205	Estrella - Warmington	Ind Park	R4	--	--	369
3170	Murphy Ranch - Fairfield	Ind Park	R4	--	--	659
3207	Calaveras Station (Trumark)	Highway Svc	R4-PUD	--	--	360
3196	Starlite (Dixon & Milpitas)	Neigh Comm	MXD	--	--	3
3211	Sinclair II	Ind Park	R4	--	--	79
3214	Landmark Towers (Billings Chev)	Gen Comm	R4-PUD	48,960	148,805	375
n/a	Menlo Equities (Abbott)	Ind Park	R4	--	--	275
3208	Town Center	Town Center	Town Center	--	16,891	65
Midtown Specific Plan Area Projects						
3152	South Main Manor - Sylvia Leung	MXD-TOD	MXD-TOD	--	--	22
3199	Aspen Village - Global Premier	R4	R4	--	--	101
3189	Baystone	R4-TOD	R4-TOD	--	--	391
3178	Centria - DR Horton	R4-TOD	R4-TOD	--	--	464
3204	Paragon - DR Horton	R4	R4	--	--	147
3169	Parc Place - DR Horton	R4	R4	--	--	285
2430	KB Homes	Gen Comm & R4	R3-PUD & R4	--	70,000	683
3144	Apton	MXD-TOD	MXD-TOD	--	--	93
3192	DeVries Place - Mid Pen	MXD-TOD	MXD-TOD	--	--	103

Table 2-3: Scenario 2 Proposed Development (Transit Area Specific Plan)

Land Use	Units	Value[a]
Residential	DU	7,109
Office (Commercial)	sq.ft.	993,843
Hotel	sq.ft.	175,500
Retail (Commercial)	sq.ft.	287,075

Footnotes:

a. Values are the "reasonable worst-case scenario" for development within the Milpitas Transit Area, which equals 90% of the average of the high-end and low-end estimates for development.

Table 2-4 summarizes the overall land use breakdown in the City for each of the scenarios.

Table 2-4: Future Land Use Acreage by Land Use Category

Land Use Category	Code	Estimated Acreages					
		Scenario 1 (19 Gen Plan Amend.)		Scenario 2 (Transit Area Specific Plan)		Scenario 3 (19 Gen Plan Amend., Transit Area & adjusted LWU info)	
		Acres	% Total	Acres	% Total	Acres	% Total
Valley Floor Residential							
Single Family Low	SFL	1,440	23.8%	1,440	23.8%	1,440	23.8%
Single Family Medium	SFM	170	2.8%	170	2.8%	170	2.8%
Multifamily Medium	MFM	215	3.6%	215	3.6%	215	3.6%
Multifamily High	MFH	203	3.4%	195	3.2%	194	3.4%
Multifamily Very High	MFVH	140	2.3%	75	1.2%	210	2.3%
Mobile Home Park	MHP	55	0.9%	55	0.9%	55	0.9%
	Sub-total	**2,223**	**36.8%**	**2,150**	**35.6%**	**2,285**	**37.8%**
Hillside Residential							
Single Family Very Low	HVL	15	0.2%	15	0.2%	15	0.2%
Single Family Low	HL	115	1.9%	115	1.9%	115	1.9%
Single Family Medium	HM	30	0.5%	30	0.5%	30	0.5%
	Sub-total	**160**	3%	**160**	3%	**160**	3%
Commercial							
Town Center	TC	10	0.2%	10	0.2%	10	0.2%
Retail Sub-Center	RSC	60	1.0%	63	1.0%	63	1.0%
General Commercial	CMRL	237	3.9%	240	4.0%	237	3.9%
Professional/Administrative Offices	PAO	45	0.7%	45	0.7%	45	0.7%
Mixed Use	MXD	95	1.6%	95	1.6%	95	1.6%
	Sub-total	**447**	**7.4%**	**453**	**7.5%**	**450**	**7.5%**
Overlay Districts							
Multifamily Very High with TOD	MFVH-TOD	90	1.5%	20	0.3%	20	0.3%
Mixed Use with TOD	MXD-TOD	35	0.6%	37	0.6%	37	0.6%
Manufacturing/Warehouse TOD	IND-TOD	105	1.7%	37	0.6%	37	0.6%
Gateway Office Overlay Zone	CMRL-OO	15	0.2%	15	0.2%	15	0.2%
	Sub-total	**245**	**4.1%**	**109**	**1.8%**	**109**	**1.8%**
Industrial							
Industrial Park	INDP	722	12.0%	785	13.0%	711	11.8%
Manufacturing/Warehouse	IND	702	11.6%	620	10.3%	570	9.4%
	Sub-total	**1,424**	**23.6%**	**1,405**	**23.3%**	**1,281**	**21.2%**
Other							
Large Water Use	LWU	240	4.0%	240	4.0%	259	4.3%
Large Hotel	Hotel	50	0.8%	50	0.8%	50	0.8%
Parks/Recreation Irrigated	PRKI	325	5.4%	325	5.4%	325	5.4%
Public/Semi-Public	CVC	40	0.7%	65	1.1%	40	0.7%
Schools	SCHL	205	3.4%	205	3.4%	205	3.4%
Open Space Non-Irrigated	PRK	365	6.0%	365	6.0%	365	6.0%
Undeveloped/Vacant Area	Vacant	315	5.2%	297	4.9%	315	5.2%
	Sub-Total	**1,540**	**25.5%**	**1,547**	**25.6%**	**1,559**	**25.8%**
New Milpitas Transit Area Categories							
Boulevard Very High Density Mixed Use	Blvd VH MXD	–	–	55	0.9%	55	0.9%
High Density Transit Oriented Residential	Hi TOD Res	–	–	81	1.3%	81	1.3%
Very High Density Transit Oriented Residential	VH TOD Res	–	–	48	0.8%	48	0.8%
High Density Mixed Use	Hi TOR Rtl	–	–	20	0.3%	20	0.3%
	Sub-total	**–**	**–**	**204**	**3.4%**	**204**	**3.4%**
	Total	**6,040**	**100%**	**6,040**	**100%**	**6,048**	**100%**

Figure 2-1: Scenario 1 (19 General Plan Amendments) Land Use Map

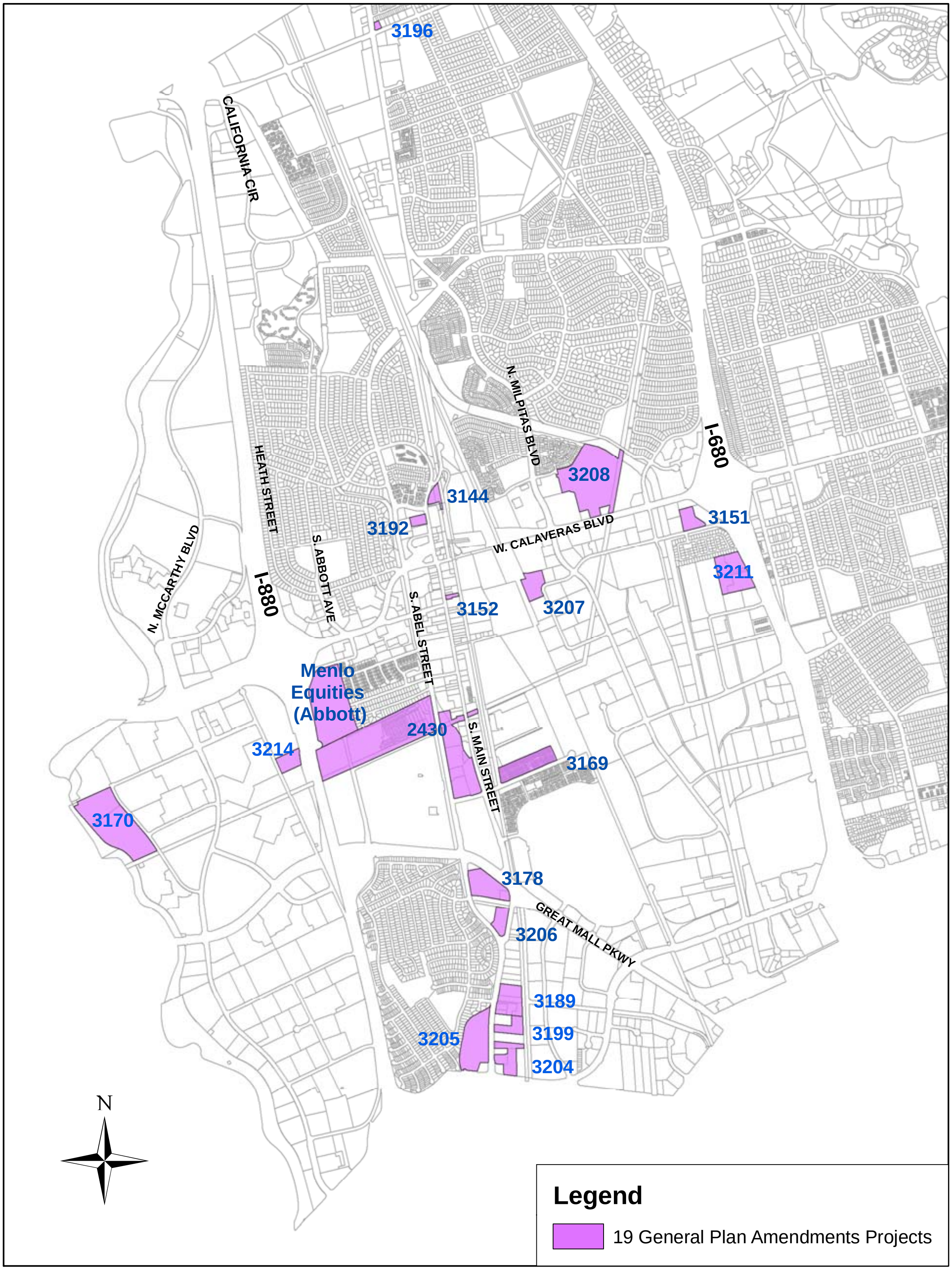


Figure 2-2: Scenario 2 (Transit Area Specific Plan) Land Use Map

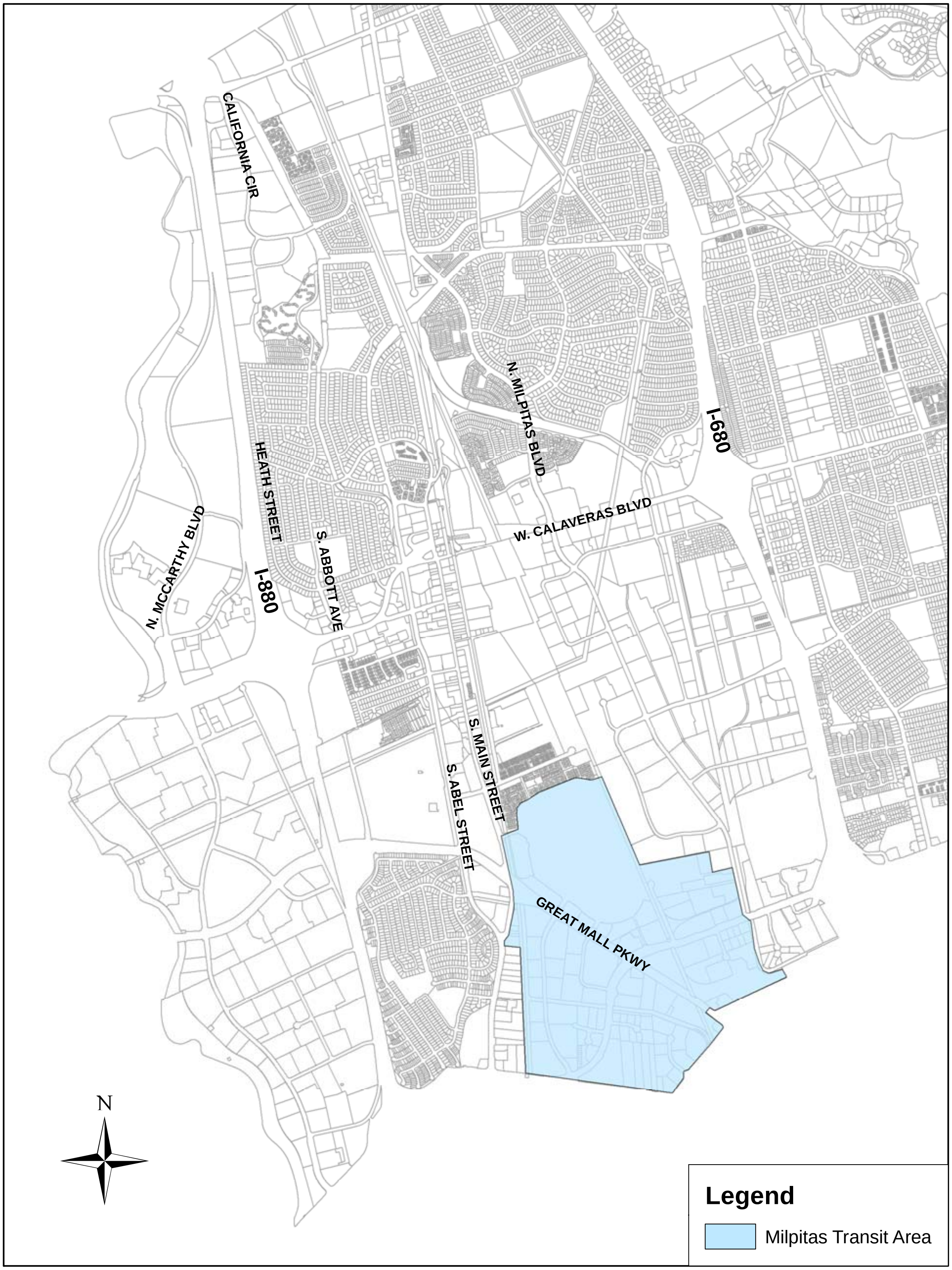


Figure 2-3: Milpitas Transit Area Preferred Plan

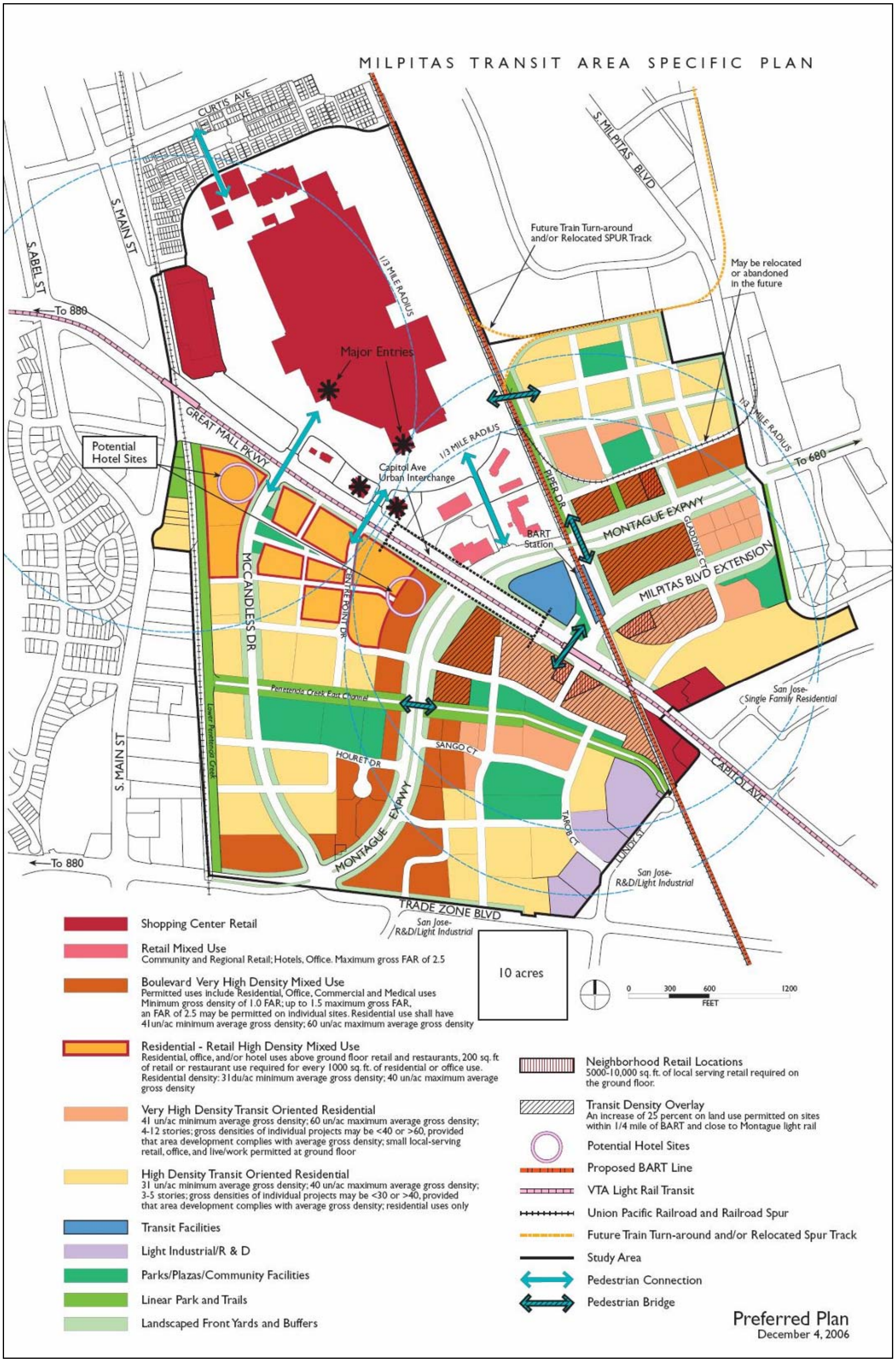
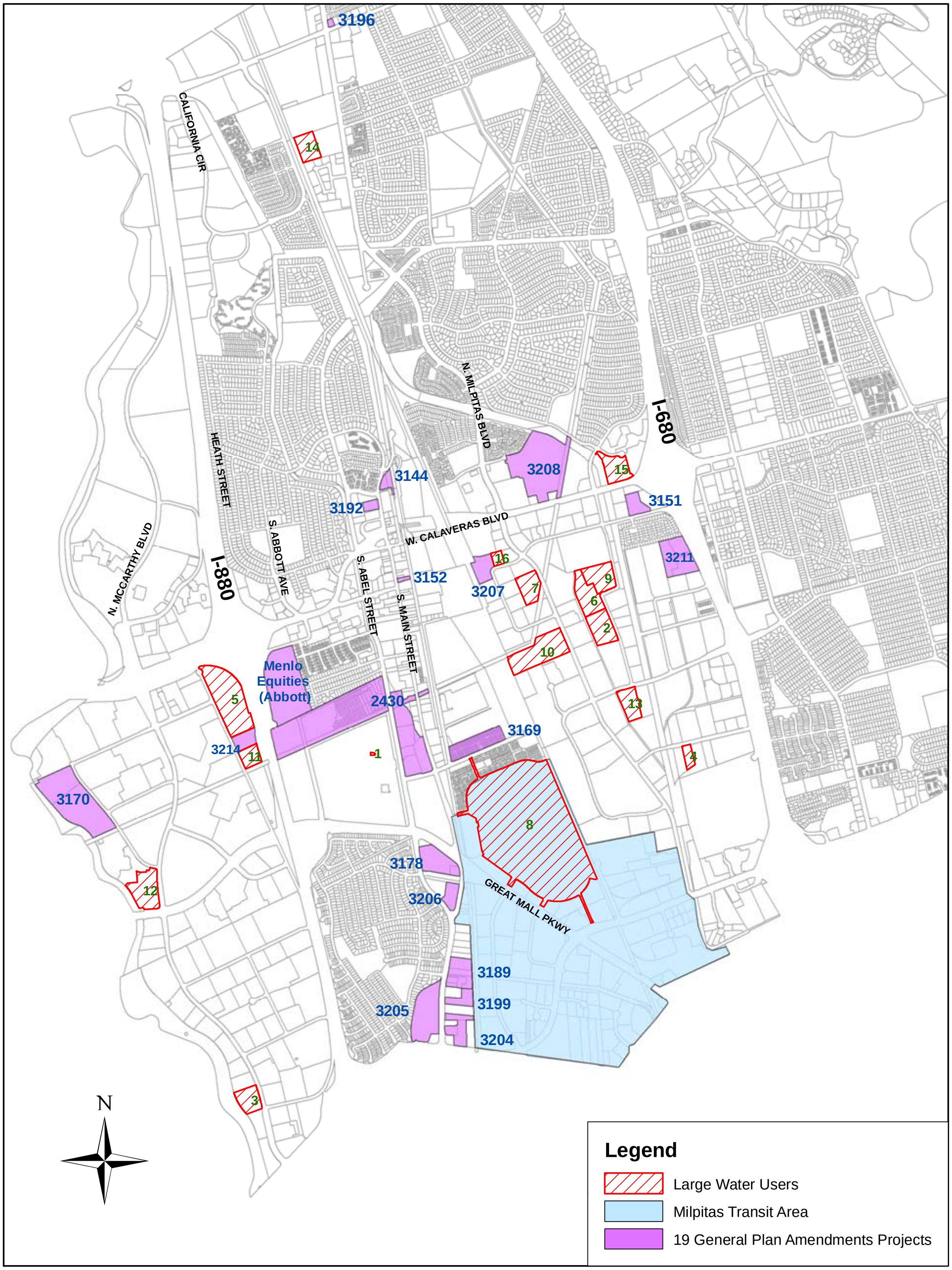


Figure 2-4 - Scenario 3 Land Use Map



CHAPTER 3 WATER SUPPLY AND DEMANDS

Chapter Synopsis: *This chapter discusses the City's water supply sources and the water demands in the future condition for the three scenarios. Most of the information has not changed since 2002 and can be referenced in the 2002 report. An updated table is provided for the future conditions of the water demand.*

3.1 Supply Overview

The City receives wholesale potable water directly from two supply sources, the SFPUC and the SCVWD. In addition to these two potable supply sources, the City has constructed a non-potable recycled water system (i.e. SBWR) for landscape irrigation uses in selected areas west of Highway 680. The City's emergency water supply consists of two local groundwater wells and three emergency interties, one with the San Jose Water Company and two with the Alameda County Water District.

The SFPUC and SCVWD potable water supply sources are not blended under normal operating conditions. The SFPUC water is unfiltered with a low hardness, alkalinity, and pH. Lime is added to increase the pH to about 8 to 10. The SCVWD water has a medium hardness and alkalinity with a pH generally between 7 and 8. Due to their different characteristics, the indiscriminate blending of these two supplies could lead to potential water quality problems such as generation of taste and odors. Hence, the City's water system is physically separated via 41 isolation valves in the distribution pipeline network. These isolation valves can be manually opened to allow emergency backup of SFPUC supply for the SCVWD zones. With minor exceptions, SFPUC water is provided to the residential areas of the City while the SCVWD water is distributed to the industrial areas.

3.1.1 San Francisco Public Utilities Commission (SFPUC)

The City purchases approximately 60 percent of its potable water from the SFPUC and 40 percent from the SCVWD. Water from the SFPUC is delivered to the City via Bay Division Pipelines no. 3 and no. 4. Water purchased from SFPUC is governed by a Contract between SFPUC and the City which expires in 2034, between SFPUC and suburban water agencies. The present "supply guarantee" for the City is for a minimum annual delivery of 9.2 MGD.

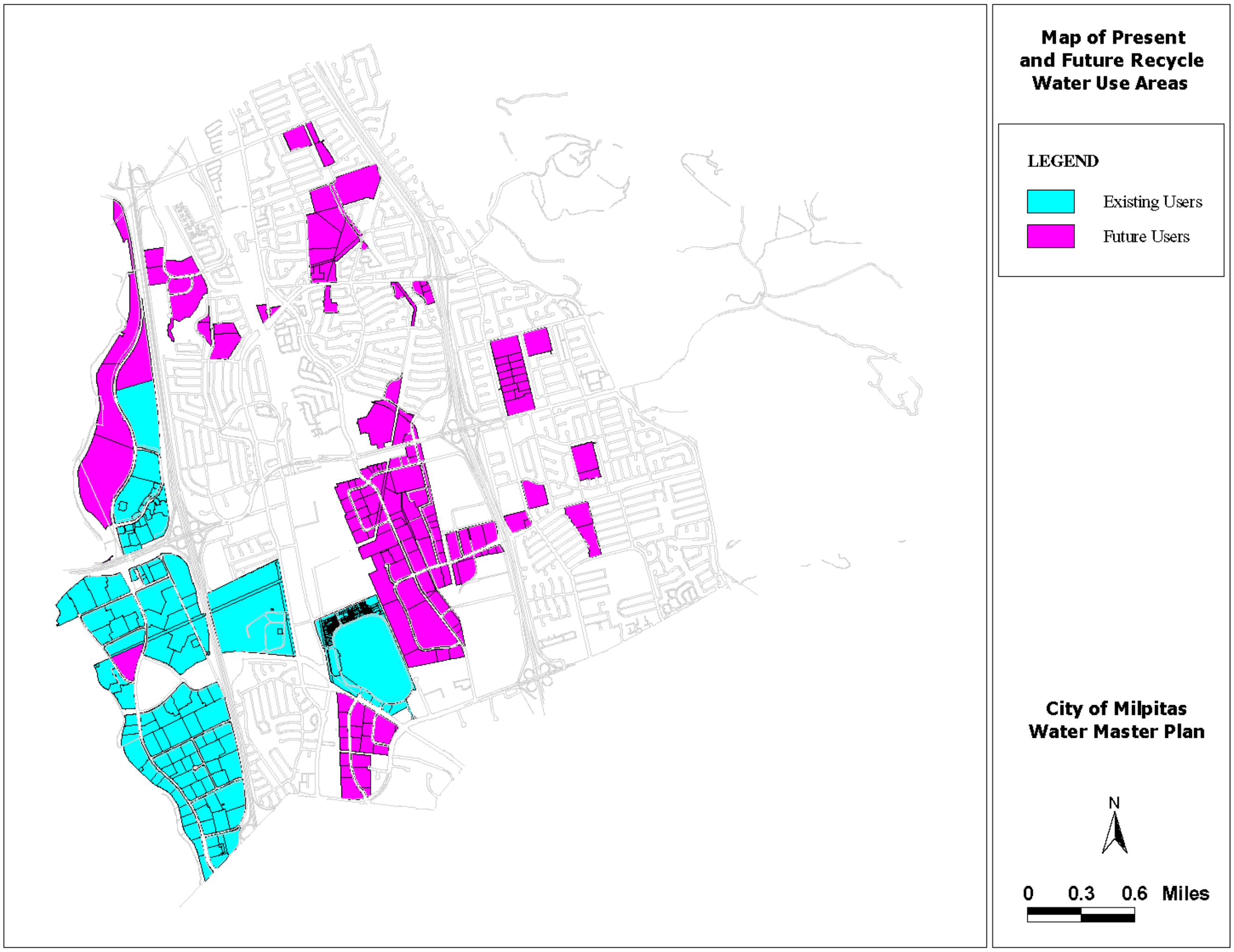
3.1.2 Santa Clara Valley Water District (SCVWD)

Water from the SCVWD is delivered to the City from the Penitencia or Santa Teresa WTP via the Milpitas Pipeline. Water purchase from the SCVWD is governed by contract between SCVWD and the City. Actual contract amount is adjusted periodically based on an annual delivery schedule request that the City submits every 3 years. This schedule is binding for the subsequent 3-year period, and the City's annual purchase must be at least 95% of the maximum year contained in the schedule. The City's monthly "supply guarantee" is at least 15% of the total estimated yearly amount.

3.1.3 Recycled Water

The South Bay Water Recycling (SBWR) Program is an on-going, multi-year effort to use high quality recycled water from the San Jose/Santa Clara Water Pollution Control Plant (WPCP) for irrigation, industrial, and other purposes. Construction on the Milpitas Recycled Water Pipeline and segment began in winter of 1997 under Phase I and provides recycled water to business/retail areas surrounding McCarthy Ranch and Oak Creek Industrial Park. The City's current non-potable or recycled water distribution system consists of 7.5 miles of water mains delivering water to approximately 80 service connections. Design of Phase 2 portions is underway to expand the system by approximately nine more miles into central Milpitas. **Figure 3-1** shows the location of the current and future recycle water users in the City.

Figure 3-1: Map of Current and Future Recycle Water Use Areas



3.1.4 EMERGENCY WELLS AND INTERTIES

During a supply emergency where one wholesale supply source fails, the City has the ability to provide water from the other wholesale supply to the entire City by opening isolation valves between the two supply zones. The City also operates two wells (Pinewood and Curtis) that are designated as an emergency water supply source. Lastly, in addition to the isolation valves and emergency wells, the City also has emergency intertie contracts with Alameda County Water District (2 interties) to the north and San Jose Water Company (1 intertie) to the south.

The San Jose Water Company (SJWC) intertie typically functions only when the City's water distribution system pressures experience a significant drop. The agreement, dated March 1973, allows the City to receive water from the SJWC on a 2-hour notice if the SJWC are not also experiencing a water supply emergency. The water source is from the SCVWD's Penitencia WTP.

The primary supply for the two Alameda County Water District (ACWD) interties is the South Bay Aqueduct. Other sources include the SFPUC and local wells. The agreement between the City and the ACWD, dated December 1995, allows two-way supply as needed on a 2-hour notice.

In the fall of 2001, operation was commenced on the new SFPUC/SCVWD transmission lines intertie. This intertie is an agreement between the City's two water wholesalers, SFPUC and SCVWD, and hence functions to supply water in either direction. The City, as a retailer, has not signed any agreement and does not have any direct authority to trigger the intertie activation. However, this new intertie is connected to the City's water distribution system and could therefore provide backup wholesale water supply to the City.

3.2 Water Demands

3.2.1 Unaccounted-for-Water Usage

Unaccounted-for-water usage in a distribution system is defined as the difference between the amount of water entering a system (supplied or purchased) and the amount of water used (metered and billing data). Expressed as a percentage, unaccounted-for-water usage is always present in a water system and can result from many factors such as unidentified leaks in a pipe network, periodic fire-hydrant flushing, fire-fighting events, unauthorized use, inaccurate and nonfunctioning meter, etc. In modeling, unaccounted-for-water usage must be added to the system demands so that total water supplied will equal total water demand. According to the City 2000 Urban Water Management Plan, the average unaccounted-for-water usage over the last 10-year period is 6.4%. This percentage was added to the total demand at each node during the analysis since current demand and future water use factor were developed based on billing information.

3.2.2 Water Recycling and Conservation

According to the 2002 Master Plan, the current annual recycled water use in the City's service area is 312,000 hundred cubic feet (HCF). This amount has been accounted for as the water demands were based on water billing data. In the build-out condition, the estimated additional recycled water use is 275,000 HCF, or 0.56 MGD. This amount was subtracted from the maximum day demand for Scenario 1 (19 General Plan Amendments).

In Scenario 2 (Transit Area Specific Plan) and Scenario 3 (19 General Plan Amendments, Transit Area Specific Plan and updated large water users information), 0.16 MGD recycled water is anticipated to be used in the Transit Area developments. This amount is part of the estimated future recycled water use of 0.56 MGD and has been accounted for in the water demand estimation of the Transit Area parcels. Therefore, a water demand reduction of 0.40 MGD, instead of 0.56 MGD, was used for the supply and storage analysis for these two scenarios.

In analyzing the City's distribution system, a conservative approach was taken, which assumed that the peaking factors and water use factors would be unaffected by the increase in recycled water usage in the future. The recycled water usage was not subtracted from the model input, ensuring that future facilities are adequately sized to meet all future demands.

3.2.3 Water Use Factor

The WUFs used for this 2009 Update are presented in **Table 3-1**, which is the same was that used for the 2002 Water Master Plan. WUFs in gallons per day per acre (gpd/acre) were multiplied by the parcel acreage to estimate the water demand in the parcels outside of the project areas in the three scenarios. For the 19 General Plan Amendments and the proposed Transit Area Specific Plan projects, a slightly different methodology was used to estimate the future water demand. Since the proposed number of residential units and office and commercial square footage have been specified for these projects, water demand was estimated by multiplying the WUFs in gallons per day per thousand square feet (gpd/ksf) or in gallons per day per dwelling unit (gpd/DU) by the amount of planned development in the parcels.

Table 3-1: Water Use Factor (WUF)

EXISTING LAND USE CATEGORIES	CODE	2007 WUF gpd/ksf or gpd/DU		2007 WUF (gpd/acre)[a]
General Commercial	CMRL	110 gpd/ksf		**2,400**
Public/Semi Public	CVC	--		**1,000**
Large Hotel	Hotel	--		**4,500**
Single-Family Low Hillside	HL	800 gpd/DU		**800**
Manufacturing/Warehousing	IND	91.5 gpd/ksf		**2,000**
Industrial Park	INDP	71.5 gpd/ksf		**1,250**
Professional/Administrative Offices	PAO	146.5 gpd/ksf		**3,200**
Parks/Recreation Irrigated	PRKI	--		**1,300**
Retail Sub-center	RSC	281 gpd/ksf		**4,290**
Single-Family Low	SFL	320 gpd/DU		**2,240**
FUTURE LAND USE CATEGORITES	**CODE**	**DU/acre**	**Commercial Use FAR[c]**	**FUTURE WUF (gpd/acre)**
Gateway Office Overlay Zone	CMRL-OO	--	1.5	**7,200**
Multifamily High[b]	MFH	22	--	**5,310**
Multifamily Very High[b]	MFVH	40	--	**9,720**
Multifamily Very High with TOD[b] Overlay Zone[b]	MFVH-TOD	60	--	**14,580**
Mixed Use[b]	MXD	30	0.75	**10,890**
Mixed Use with TOD Overlay Zone[b]	MXD-TOD	40	1	**14,520**
Manufacturing/Warehousing with TOD Overlay Zone	IND-TOD	--	0.4	**1,600**

Notes:
1. Does not include 6.4 percent unaccounted-for-water
2. Refer to Abbreviations for definitions for acronyms

Footnotes:
a. gpd/acre = (gpd/ksf) * FAR x * (43.56 ksf/acre) or (gpd/DU)*(DU/acre); the values for FAR and DU/acre can be found in Table 2-1 and Table 2-4 in the 2002 Master Plan Report
b. Assumes a population density of 2.7 persons/DU and a flow factor of 90 gpd/person
c. A WUF of 110gpd/ksf is used in conjunction with the FAR

3.2.4 Peaking Factor

The peaking factors are summarized in **Table 3-2**. The peaking factors used for this 2009 Master Plan Update are the same as the 2002 Master plan. Please refer to Section 3.2.4 of the 2002 Water Master Plan for the detailed content regarding the determination of the peaking factors.

Table 3-2: Summary of Peaking Factors

Peaking Factors [a]	Maximum Day	Peak Hour
Residential	1.9 [b]	3.8 [c]
Industrial/Commercial	1.5	2.4

Notes:
a. Peaking factors presented as a ratio to average day demand
b. Based on water meter records between 1990 and 2001. The maximum day demand was recorded in 1993
c. Peak Hour = Max Day Factor x 2.0. Per AWWA M32 Manual, typical range for peak hour to maximum day demand is 1.3 to 2.0

3.2.5 Water Demand Projection

Water demands were developed for each of the three scenarios established in Chapter 2**.** **Table 3-3** shows the updated demands for Scenario 1. **Table 3-4** shows the incremental demand change for Scenario 2. **Table 3-5** shows the incremental demand change for Scenario 3. **Table 3-6** shows the three potential build-out scenarios included in this Master Plan update.

Table 3-3: Scenario 1 (19 General Plan Amendments) Incremental Water Demand Change

Project Number	Project Name	Average Demand (gpd)			Maximum Day Demand (gpd)			Peak Hour Demand (gpd)		
		2002 Buildout Demand	New Demand w/ Proposed Development	Change in Demand	2002 Buildout Demand	New Demand w/Proposed Development	Change in Demand	2002 Buildout Demand	New Demand w/ Proposed Development	Change in Demand
Outside of the Midtown Specific Area										
3206	S. Main Street – Matteson	19,440	30,942	11,502	36,936	58,790	21,854	73,872	117,580	43,708
3151	Californian – Barry Swenson	15,771	42,768	26,997	23,657	81,259	57,603	37,850	162,518	124,668
3205	Estrella – Warmington	13,925	89,667	75,742	20,888	170,367	149,480	33,420	340,735	307,315
3170	Murphy Ranch – Fairfield	27,100	160,137	133,037	40,650	304,260	263,610	65,040	608,521	543,481
3207	Trumark – Read Rite Site	15,220	87,480	72,260	28,918	166,212	137,294	57,836	332,424	274,588
3196	Starlite (at Dixon & Milpitas)	1,630	729	-901	3,097	1,385	-1,712	6,194	2,770	-3,424
1	Sinclair II	17,900	19,197	1,297	26,850	36,474	9,624	42,960	72,949	29,989
2	Landmark Towers (Billings Chev)	7,200	116,815	109,615	10,800	221,949	211,149	17,280	443,898	426,618
3	Menlo Equities (Abbott)	41,840	66,825	24,985	62,760	126,968	64,208	100,416	253,935	153,519
3208	Town Center	240,016	17,822	-222,194	456,030	26,733	-429,298	912,061	42,773	-869,288
	Subtotal of Projects Outside of the Midtown Specific Area	**400,042**	**632,382**	**232,340**	**710,585**	**1,201,526**	**483,812**	**1,346,929**	**2,378,101**	**1,031,172**
Within the Midtown Specific Area										
3152	South Main Manor – Sylvia Leung	6,098	5,346	-752	9,147	10,157	1,010	14,635	20,315	5,680
3199	Aspen Village – Global Premier	26,050	24,543	-1,507	39,075	46,632	7,557	62,520	93,263	30,743
3189	Baystone	86,605	95,013	8,408	129,908	180,525	50,617	207,852	361,049	153,197
3178	Centria – DR Horton	98,998	112,752	13,754	148,497	214,229	65,732	237,595	428,458	190,862
3204	Paragon – DR Horton	44,712	35,721	-8,991	67,068	67,870	802	107,309	135,740	28,431
3169	Parc Place – DR Horton	70,276	69,255	-1,021	133,524	131,585	-1,940	267,049	263,169	-3,880
2430	KB Homes	225,691	174,369	-51,322	338,537	331,301	-7,235	541,658	662,602	120,944
3144	Apton	21,925	22,599	674	41,658	42,938	1,281	83,315	85,876	2,561
3192	DeVries Place – Mid Pen	18,150	25,029	6,879	34,485	47,555	13,070	68,970	95,110	26,140
	Subtotal of projects within the Midtown Specific Area	**598,505**	**564,627**	**-33,878**	**941,898**	**1,072,791**	**130,893**	**1,590,903**	**2,145,583**	**554,679**
	Subtotal (All Projects)	**998,547**	**1,197,009**	**198,462**	**1,652,483**	**2,274,317**	**614,705**	**2,937,833**	**4,523,684**	**1,585,851**
	Unaccounted-for Water (6.4%)	63,907	76,609	12,702	105,759	145,556	39,341	188,021	289,516	101,494
	Total[a]	**1,063,000**	**1,274,000**	**212,000**	**1,759,000**	**2,420,000**	**655,000**	**3,126,000**	**4,814,000**	**1,688,000**

Notes:
1. Projected water demands are based on the following water use factors from the 2002 Water Master Plan:
Residential = 243 gpd/DU (90 gpd/person * 2.7 people/DU), Office = 160 gpd/ksf, Commercial = 120 gpd/ksf
2. A peaking factor of 1.9 was applied to the average demand to obtain maximum daily flow for all projects with the exception of no. 3208 for which a factor of 1.5 was used.
3. A peaking factor of 3.8 was applied to the average demand to obtain maximum hour flow for all projects with the exception of no. 3208 for which a factor of 2.4 was used

Footnotes:
a. Total demand is rounded to the nearest 1,000 gpd

Table 3-4: Scenario 2 (Transit Area Specific Plan) Incremental Water Demand Change

Type of Development	Normal Day (gpd)	Max. Day (gpd)	Peak Hour (gpd)
Residential & Mixed Use	1,832,000	3,481,000	6,961,000
Commercial	11,000	16,000	25,000
Hotel	71,000	134,000	267,000
Unchanged Base Flow	444,000 [b]	788,000 [c]	1,491,000 [c]
Subtotal	**2,358,000**	**4,419,000**	**8,744,000**
Unaccounted For Flows [a]	151,000	283,000	560,000
Total Transit Area Demand	**2,509,000**	**4,702,000**	**9,304,000**
2002 Master Plan Demand for Transit Area	1,553,000 [d]	2,753,000 [d]	5,209,000 [d]
Change in Demand	**960,000**	**1,949,000**	**4,095,000**

Notes:
1. Values are rounded to the nearest 1,000 gpd
2. School was not included in the Transit Area demand because there are no identified sites for the developments and the anticipated water demand is less than 1% of the total demand of the Transit Area.

Footnotes:
a. Unaccounted-for flows are assumed to be 6.4% of the total demand.
b. Value determined by the City.
c. Values estimated using the peaking factors of 1.8 for maximum day and 3.4 for peak hour for the entire transit area.
d. Values from the revised 2002 Water Master Plan parcel demand file.

Table 3-5 shows the combined incremental water demand change of Scenario 3.

Table 3-5: Scenario 3 Incremental Water Demand Change

Type of Development	Normal Day (gpd)	Max. Day (gpd)	Peak Hour (gpd)
Scenario 1 Incremental Demand Change	212,000	655,000	1,688,000
Scenario 2 Incremental Demand Change	960,000	1,949,000	4,095,000
Large Water Users Incremental Demand Change	-765,000	-1,248,000	-2,189,000
Total Incremental Demand Change	**407,000**	**1,356,000**	**3,594,000**

Notes:
1. Unaccounted-for flows of 6.4% of the total demand are included in these values.
2. Values are rounded to the nearest 1,000 gpd

Projected peak hour demand was estimated by multiplying the normal day demand by the appropriate peaking factors as defined in the 2002 Master Plan. The summary of the projected peak hour by zones for Scenario 1, 2, and 3 are shown in **Table 3-6**. Normal day and maximum day demands are also listed for reference. The peak hour demand for Scenario 1 is estimated to be 55.0 MGD. The peak hour demand for Scenario 2 was projected to be 58.5 MGD. The peak hour demand for Scenario 3 is estimated to be 58.6 MGD.

Table 3-6: Summary of Projected Future Demand for the 3 Scenarios

Zone	Scenario 1 (19 General Plan Amendments)			Scenario 2 (Transit Area Specific Plan)			Scenario 3 (19 Gen Plan Amend., Transit Area Specific Plan & adjusted LWU info)		
	Normal Day (MGD)	Max. Day (MGD)	Peak Hour (MGD)	Normal Day (MGD)	Max. Day (MGD)	Peak Hour (MGD)	Normal Day (MGD)	Max. Day (MGD)	Peak Hour (MGD)
SC1	5.22	8.94	16.43	5.26	9.16	16.78	5.38	9.59	17.93
SC2	2.74	4.37	7.49	3.22	5.29	9.35	3.22	5.35	9.54
SF1	4.36	7.97	15.48	4.47	8.18	15.88	4.38	8.01	15.55
SF2	4.11	7.62	14.97	4.34	8.08	15.90	4.12	7.63	14.97
SF3	0.14	0.26	0.53	0.14	0.26	0.53	0.14	0.26	0.53
SF4	0.14	0.26	0.52	0.14	0.26	0.52	0.14	0.26	0.52
Total [a]	**16.7**	**29.4**	**55.4**	**17.6**	**31.2**	**58.9**	**17.4**	**31.1**	**59.0**
Total less recycled water [b]	**16.1**	**28.9**	**54.9**	**17.2**	**30.8**	**58.5**	**17.0**	**30.7**	**58.6**

Footnotes:

a. An uncounted-for-water usage rate of 6.4% was included in these water demand figures.

b. A recycled water supply of 0.56 MGD has been subtracted from the total water demand in Scenario 1. For Scenarios 2 and 3, an amount of 0.40 MGD was subtracted from the total water demand.

CHAPTER 4 MODEL UPDATE AND CALIBRATION

***Chapter Synopsis**: The model used for the 2009 Update is the same as the model developed in 2002. There is no update to this chapter. The following sections are excerpts from the 2002 Master Plan.*

4.1 Distribution System

The City purchases its wholesale water supply from the SFPUC and SCVWD. Having two different supply sources helps the City to lower the likelihood of losing water supply entirely since it is highly unlikely that both the SFPUC and the SCVWD system would experience a loss of supply at the same time. The City also has two emergency intertie connections with Alameda County Water District and San Jose Water Company. The City's distribution system has the built-in flexibility to interconnect all zones, allowing the system to have operational flexibility. Therefore, the City's distribution system has both supply source redundancy and operational flexibility.

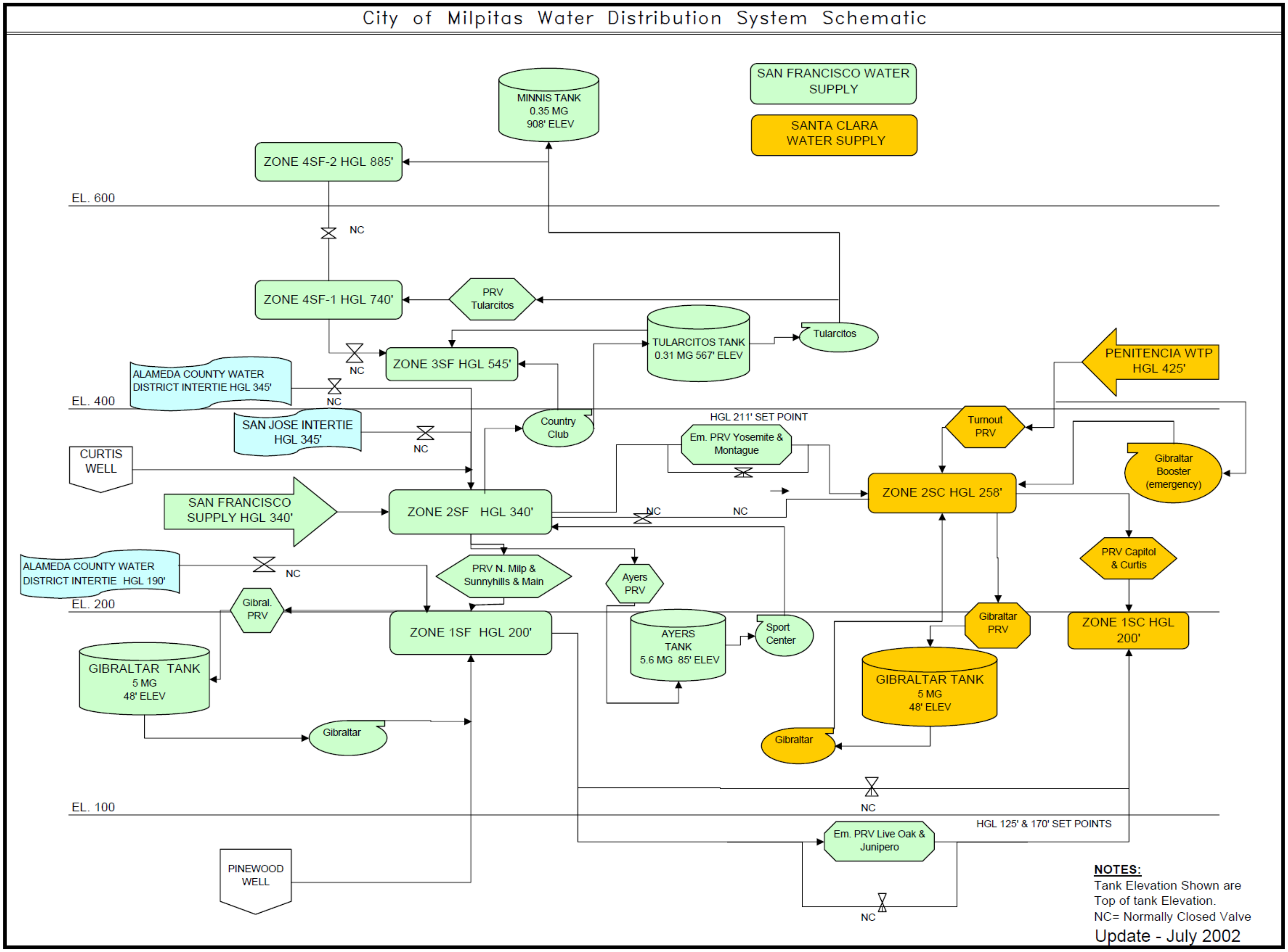
4.1.1 Existing Distribution System Descriptions

Wholesale potable water enters the City via four turnouts and is delivered to approximately 15,000 service connections throughout the City via 193 miles of water mains. An updated schematic of the distribution system is shown in **Figure 4-1**. The City's potable water distribution facilities consist of the following components:

- 4 Turnouts;
- 5 Reservoirs;
- 2 Emergency Wells (1 existing and 1 under construction);
- 3 Emergency Interties;
- 5 Pump Stations;
- 41 Isolation Valves;
- 15 Pressure Regulating Valves

Elevations in the distribution system range from sea level at the Valley Floor to 2,600 feet near Monument Peak. Because of the City's topography, the water pressure varies at various locations. The distribution network is divided by elevation with six pressure zones created to allow water to flow from their perspective turnout stations and storage reservoirs to their zone of services. The SFPUC supply is distributed to four pressure zones and the SCVWD supply is distributed to two pressure zones in the Valley Floor area using pumps and pressure reducing systems with booster pumps providing water to the higher hillside elevations.

Figure 4-1: Water Distribution System Schematic



4.1.1.1 Turnouts

The SFPUC water supply currently enters the City through three turnouts at a 340 feet hydraulic grade line. The three SFPUC turnouts are located at Sunnyhills, Calaveras Boulevard, and Main Street. Each turnout has two pipelines and meters to monitor the flow quantity. The total capacity at the turnouts was previously rated at 31.0 MGD.

The SCVWD water supply enters the City through one turnout at Gibraltar with a total capacity of 14.4 MGD. In fiscal year 2000/2001, these four turnouts (three from SFPUC and one from SCVWD) provided an average of 12.4 MGD to Milpitas' homes, businesses, industries, and institutions.

Table 4-1: Normal Supply Sources

SUPPLY SOURCE	LOCATION	ZONE SERVED	CAPACITY (MGD)[a]
SFPUC	Sunnyhills (Washington/Escuela)	SF2	10.1
	Calaveras Valve Lot	SF2	13.0
	Main St. (Hammond Way)	SF2	7.9
		SFPUC TOTAL	**31.0**
SCVWD	Gibraltar	SC2	14.4
		NORMAL OPERATION TOTAL	**45.4**

[a] From City of Milpitas Water Emergency Management Plan, July 2001.

A new SFPUC/SCVWD turnout was recently installed north of the Gibraltar pump station as part of the SFPUC/SCVWD transmission pipeline intertie project to eliminate dead-end on the transmission lines when the intertie is not opened. The new turnout feeds the City's Gibraltar SF reservoir via a 12-inch pipeline and can also be reconfigured manually to feed SFPUC water directly to zone SC2 at the Gibraltar SCVWD pump 18-inch discharge line.

4.1.1.2 Reservoirs

The City has five reservoirs with a total maximum storage capacity of 16.2 MG. The SFPUC supply zone has four reservoirs while the SCVWD supply zone has one. In the SFPUC service area, two reservoirs at Tularcitos and Minnis (0.31 MG and 0.35 MG) serve the pressure zones in the hillside while the other two remaining reservoirs at Gibraltar and Ayer Sports Center (5.0 MG and 5.6 MG) serve the pressure zones on the valley floor. There is one 5.0 MG reservoir in the SCVWD supply zone providing water to both pressure zones in the valley floor. Table 4-2 shows the total reservoir capacity for the entire City and for each individual reservoir. The reservoirs are typically filled to 70% of capacity (equivalent to about one average day of storage).

Table 4-2: Reservoirs

SUPPLY SOURCE	RESERVOIR	PRESSURE ZONE	MAXIMUM CAPACITY (MG)
SFPUC	Gibraltar	SF1	5.0
	Ayer Sports Center	SF2	5.6
	Tularcitos	SF3	0.31
	Minnis	SF4	0.35
		TOTAL FOR SFPUC SERVICE AREAS	11.26
SCVWD	Gibraltar	SC1	5.0
		TOTAL FOR MILPITAS	16.26

4.1.1.3 Emergency Wells and Interties

Table 4-3 lists the emergency supply sources, consisting of City wells and interties. The Pinewood Well is located in the southern portion of the City and is connected to the City's lowest water pressure zone, SF1. The groundwater basin supplying the well is managed by the SCVWD and there is a fee associated for any water withdrawn from the basin. Previous tests showed that the Pinewood Well can reliably supply 1.7 MGD (equivalent to about 50% of Zone SF1 average daily water demand). The well is maintained by routine monthly operation and discharges to a nearby storm drain. The Pinewood Well is currently undergoing upgrades to include chlorination facilities for emergency uses. The Pinewood Well is designated as an active well by the Department of Public Health (DPH) even though it is reserved for emergencies only by the City. By DPH definition, emergency or standby sources/wells are those that are not operated more than 15 calendar days per year, and not more than five consecutive days each year.

The City is currently constructing the Curtis Well as part of a CIP to provide 1.5 MGD, or 50% of the daily average demand, for the City's zone SF2. Construction of the well is estimated to be complete during the fall of 2002. The water supply from this well is also reserved for emergency usage only and chlorination facility will be installed during the construction period.

Table 4-3: Emergency Supply Sources

SUPPLY SOURCE	LOCATION	ZONE SERVED	CAPACITY (MGD)[a]
City of Milpitas Wells	Pinewood Well	SF1	1.7
	Curtis Well	SF2	1.5
Interties	San Jose Water Company	SF2, SF3, SF4	2.6
	Alameda County WD	SF1, SF2	4.5
	SFPUC/SCVWD	SF1, SC2	40
		Total	48.6

[a] From City of Milpitas Water Emergency Management Plan, July 2001.

The San Jose Water Company (SJWC) intertie is located at Landess Avenue and Corktree Lane to the south of the City. The intertie is a 6-inch line and the valves are operated manually. The intertie has a capacity of 2.6 MGD and could supply approximately 59% of the City's Zones SF2, SF3, and SF4 average day demand at Midtown build-out.

The two Alameda County Water District (ACWD) interties are located at Milmont Drive and Park Victoria/Green Valley Road to the north of the City. The intertie at Milmont Drive is an 8-inch line and connects to zone SF1. The intertie at Park Victoria/Green Valley Road is also an 8-inch line but connects to zone SF2. During an average day projected demand at Midtown build-out, these two interties from the ACWD have the capacity to deliver approximately 50% of the demand for all SF zones.

Even though the City does not have any direct authority to trigger the activation of the new SFPUC/SCVWD transmission intertie near Gibraltar Court, this intertie could potentially also be used as an emergency supply source. The intertie is located within the City to the north of the Gibraltar Pump Station with a capacity of 40 MGD. It consists of a 42-inch interconnect pipe with a pump station to boost SFPUC pressure when water is supplied to the SCVWD transmission line, and a chemical feed system to adjust water chemistry in either direction. During normal operation, an isolation valve prevents exchange of water between the wholesalers. The City has a turnout on each side of the isolation valve, allowing for continuous turnover of water supply in the transmission pipeline. The Gibraltar SF turnout feeds the City's Gibraltar SF reservoir via a 12-inch line and can also be reconfigured manually to feed SFPUC water directly to zone SC2 at the SCVWD Gibraltar pump 18-inch discharge line.

4.1.1.4 Pump Stations

The City has five pump stations, shown in Table 4-4, that can be operated automatically or manually. The reservoirs supply water in conjunction with the pumps. In addition to these pumps, the City has an additional booster pump at Gibraltar, if needed, to increase the delivery pressure of the SCVWD water. Low pressure may occur during peak summer periods when deliveries are from the SCVWD's Santa Teresa WTP or during water emergencies.

The SFPUC pressure zones have four pump stations located at Gibraltar, Ayer, Country Club, and Tularcitos. The Gibraltar SF pump station delivers water from the Gibraltar SF reservoir to zone SF1. Similarly, the Ayer pump station provides water to zone SF2 from the Ayer Reservoir. The Country Club pump station provides water to the Tularcitos reservoir and zone SF3 on the hillside from zone SF2. Finally, the Tularcitos pump station provides water to the Minnis reservoir and zone SF4 from the Tularcitos reservoir.

Since the SCVWD service areas have only one reservoir and are located in the valley floor, it has only one pump station located at Gibraltar. The Gibraltar SC pump station delivers water from the Gibraltar SC reservoir to zone SC2.

Table 4-4: Pump Stations Summary

PUMP STATION	PRESSURE ZONE	CAPACITY (gpm)	POWER SOURCE
Gibraltar	SF1	2 pumps @ 5500[a]	Diesel
Ayer	SF2	3 pumps @ 2000	Electrical w/ generator backup
Country Club	SF3	2 pumps @ 300	Electrical w/ future generator backup
Tularcitos	SF4	2 pumps @ 250	Electrical w/ future generator backup
Gibraltar	SC2	2 pumps @ 5500[a,b]	Diesel
	SC2 Booster	3 pumps @ 5000 1 pump @ 2000	2 electric, 1 diesel Electric

[a] Variable Speed pumps
[b] Pump #2 also serves as a backup for SF1

4.1.1.5 Isolation and Pressure Regulating Valves

Before the addition of the SCVWD supply for industrial/commercial customers in 1993, the City of Milpitas received all of its supply from the SFPUC. When the SCVWD supply was put in use, isolation valves were installed to separate the SCVWD service zones from the SFPUC service zones due to water quality concerns discussed in Section 3.1. The City currently has 41 isolation valves separating the SFPUC zones from the SCVWD supply zones. Except for isolation valve numbers 79 and 99A, these valves can be opened to provide uninterrupted water service to the entire city should delivery from one of the water supplies fail. Isolation valve number 79 and 99A are located between pressure zone 1 and 2. Therefore, opening these two valves would require the installation of pressure reducing valves if flow will go from pressure zone 2 to zone 1 or booster pump stations if flow will go from pressure zone 1 to zone 2.

The valves are to be opened in the event of a long-term water supply shortage from either SCVWD or SFPUC. During short-term water outages (i.e. one or two days), the preferred backup supply would be from the City's reservoirs and wells. Table 4-5 describes the 41 isolation valves. The City has previously identified four key isolation valves to be opened first during emergency. Modeling had shown that by opening these four key isolation valves, enough water can be provided from one supply to serve the needs of both the SFPUC and SCVWD service areas. All of the key isolation valves are located in pressure zone 2 and are shown in bold and italicized in **Table 4-5.**

Table 4-5: Isolation Valves

ISOLATION VAVLE NO.	VALVE SIZE (in.)	LOCATION	PRESSURE ZONE
1	14	End of Live Oak Court	1
2	12	Starlite Drive & Capitol Avenue	
2A	10	150’ East of Evening Star Court	
3	8	S. Main Street & South Abel Street	
4	12	South Abel Street & Capitol Avenue	
5	12	South Abel Street & Capitol Avenue	
5A	6	South Main Street & Cedar Way	
6	8	South Main Street & Montague Expressway	
7	10	South Main Street & Montague Expressway	
12X	14	South end of Rio Verde Place	
13	12	South Abbott Avenue Near Economy Inn	
13A	8	North End of Rio Verde Place	
14	8	South Abel Street & Corning Avenue	
14A	6	Corning Avenue & Palmer Avenue	
15	8	South Abel Street & Junipero Drive	
18	12	South Abel Street & Serra Way	
18A	12	South Abel Street just south of Calaveras Boulevard	
20	8	South Main Street & Carlo Street	
20A	6	Carlo Street & Calaveras Boulevard	
20B	12	Carlo Street & Calaveras Boulevard	
24	6	End of East Carlo Street	
25	8	South End of Railroad Avenue	
26	6	South Abel Street & Sylvia Avenue	
27	8	Hammond Way near SFPUC Pipeline	
28	8	Hammond Way near SFPUC Pipeline	
30	12	South Main Street near SFPUC Pipeline	
31	24	South Main Street near SFPUC Pipeline	
35	8	End of Corning Avenue	
8	8	Montague Expressway & Southbound 680 off-ramp	2
8A	10	Montague Expressway & Southbound 680 off-ramp	
9 [a]	***24***	***Sinclair Frontage Road & Yosemite Drive***	
10	12	Sinclair Frontage Road – South of Wrigley Way	
23C [a]	***16***	***South Milpitas Boulevard North of Los Coches Street***	
32 [a]	***24***	***South Hillview Drive & Calaveras Boulevard***	
126	12	1000’ West of Gibraltar Drive &Yosemite Drive	
127	12	1000’ West of Gibraltar Drive &Yosemite Drive	
137 [a]	***16***	***650’ West of Gibraltar Drive & Yosemite Drive***	
171	12	Sinclair Frontage Road	
174	12	650’ West of Gibraltar Drive & Yosemite Drive	
79	12	Near Main PRV	1&2
99A	18	Curtis Avenue near Curtis PRV	1&2

[a] Denotes key isolation valves to be opened first during an emergency.

In addition to the 41 isolation valves, the City also has six emergency pressure regulating valves (EPRVs) listed in Table 4-6**.** These valves are set to be automatically triggered open to supplement flows from the SFPUC supply area to the SCVWD area should water pressure in the SCVWD area drop below 125 feet of HGL in Zone SC1 or 175 feet of HGL in Zone SC2. With a set point of 69 psi, the Junipero is the main EPRV for zone SC1 followed by the Live Oak EPRV. The California and Cadillac EPRVs were recently constructed in anticipation of new commercial developments at the northern end extension of the McCarthy Ranch area west of Interstate 880.

Table 4-6: Emergency Pressure Regulating Valves (EPRVs)

EPRV STATION	LOCATION	SET POINT (psig)	HYDRAULIC GRADE LINE (ft.)	FROM ZONE	TO ZONE
Junipero	Junipero & South Abel Street	69	169	SF1	SC1
Live Oak	Live Oak Court	42	125	SF1	SC1
Montague	Montague and I-680	62	216	SF2	SC2
Yosemite	Yosemite and I-680	67	211	SF2	SC2
California	California Circle and I-880	30	71	SF1	SC1
Cadillac	Cadillac Court and I-880	30	73	SF1	SC1

Wholesale water delivery to the City from the SFPUC and the SCVWD enters the interties at a HGL of 340 feet and 425 feet, respectively. Hence, nine PRVs are utilized at various points in the City to reduce pressures to a normal operating range. **Table 4-7** presents the location of these nine PRVs, their pressure settings, and the pressure zones that they serve. There are three PRVs serving zone SF1, two PRVs serving zone SC1, and three PRVs serving a small sub-zone (SF4-1) within zone SF4 in the hillsides. Since the water from the SCVWD enters the Gibraltar turnout from the Penitencia WTP at a HGL of 425 feet, a PRV is needed at the turnout to reduce the HGL to 340 feet for zone SC2.

Table 4-7: Pressure Reducing Valves (PRVs)

PRV STATION	LOCATION	LEAD SET POINT (psig)	LAG SET POINT (psig)	HGL (ft.)	FROM ZONE	TO ZONE
Calera Creek Heights	Near 163 Calera Creek Heights Drive	60	50	787	SF4-2	SF4-1
Capitol	N. Capitol Ave. btn. Montague & City limits	68	65	201	SC2	SC1
Curtis	W. Curtis Avenue btn. Main & Abel Street	77	67	202	SC2	SC1
Gibraltar	641 Gibraltar Court	145	120	325	SCVWD	SC2
Main	Hammond Way	80	72	207	SF2	SF1
North Milpitas	N. Milpitas & Calaveras Boulevard	79	76	207	SF2	SF1
Sunnyhills	Washington and Escuela	65	58	199	SF2	SF1
Tularcitos N. Vault	Near 1475 Pinehurst Court	57	50	707	SF4-2	SF4-1
Tularcitos S. Vault	Near 1486 Tularcitos Drive	58	50	762	SF4-2	SF4-1

4.1.2 Distribution System Operation

During normal operation, zone SF2 of the distribution system is supplied directly by the three turnouts at Sunnyhills, Calaveras, and Main because the HGL for this zone is approximately equal to the HGL of the turnouts at 340 feet. Zone SC2 is also supplied directly from the SCVWD turnout at Gibraltar after the water passes through a PRV to reduce the HGL from 425 feet to approximately 340 feet. Zone SC1 is supplied from zone SC2 through two PRVs, Curtis and Capitol. Similarly, zone SF1 is supplied from zone SF2 via three

PRVs: 1) North Milpitas, 2) Sunnyhills, and 3) Main. The Sunnyhills and Main PRVs are located right at the turnout. The hillside zones SF3 and SF4 are primarily supplied by gravity flow from the Tularcitos and Minnis reservoirs.

The three reservoirs on the valley floor mainly function to provide for supplemental use and emergency back-up. To ensure an adequate turnover and to address water quality concerns in these 5 MG plus reservoirs, water from the reservoirs is distributed to the system on a daily basis during peak hour demands in the morning.

The Country Club and Tularcitos pump stations are normally activated by the Tularcitos and Minnis reservoir levels. The Gibraltar pump station consists of a diesel peak shaving pump for zone SF1, a diesel peak shaving pump for zone SC2, and an emergency pressure boosting pump for the SCVWD turnout supply. The booster pump for the SCVWD turnout supply was designed to operate during low turnout delivery pressure events, but has not been run for eight years. This booster pump cannot re-circulate water to exercise the pump.

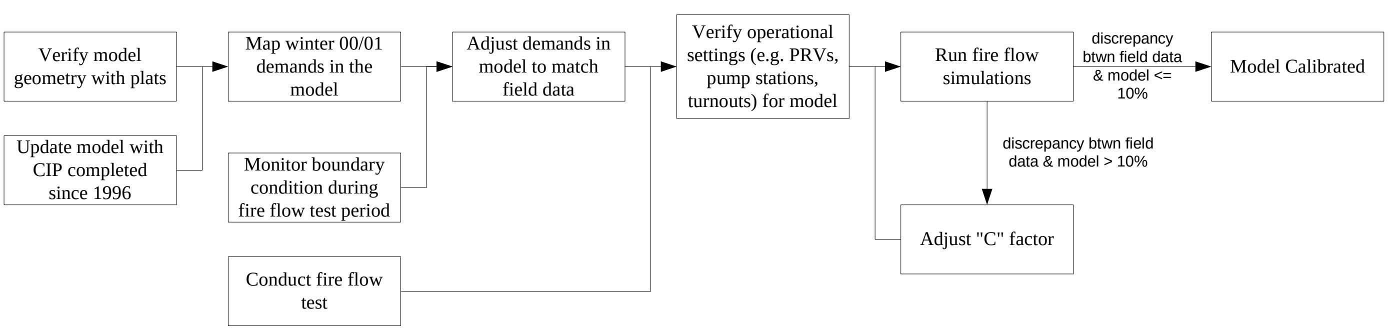
Under stressed conditions (i.e. fire or other emergency events), the system is supplied directly by both the turnouts and the reservoirs. In addition, if there is a sudden loss of pressure in zone SC1 or SC2, the EPRVs are set to open automatically to supplement SFPUC water to these zones; therefore stabilizing the pressure. For planned emergency events, such as the shutdown of the SCVWD supply line, the key isolation valves can be opened to link the two distribution systems together, making it unnecessary to activate the EPRVs.

There were two low pressure areas within the City identified by the Maintenance Department. The first area is located to the west of Interstate 680, east of Conway Street, South of Levin Street, and north of Coelho Street. Pressures between 20 to 30 psi have been observed for this area. The second area is located in the Lee's Orchard area in the southeastern region of Milpitas near Landess Avenue and Piedmont Road.

4.2 H_2ONET Model Update and Calibration

Figure 4-2 presents the methodology used to update and calibrate the H_2ONET model.

Figure 4-2: Methodology for Updating and Calibrating the H_2ONET Model



There are two types of hydraulic models used to simulate a water distribution system: steady-state and extended period. Simulations from a steady-state model represent a snapshot of the system performance at a given point in time under specific demand conditions (i.e. maximum day and fire flow, peak hour, etc.). The extended period model is analogous to a movie of the system performance and is typically used to analyze the dynamic performance of the system over a 24-hour period. Hence, dynamic modeling requires more extensive data such as various 24-hour demand curves within the system. These demand curves are created based on a ratio of demand at any point in a given day to the average demand for that day.

Dynamic modeling is typically used to evaluate water quality and operational studies whereas planning or design studies may be performed using a steady state model.[1] Therefore, it was decided that a steady-state (static) model would be used to analyze the water distribution system for the 2002 Water Master Plan.

4.2.1 H_2ONET Model History

Carollo Engineers used as-built information from the City's water distribution system 1"=100' plats to develop a hydraulic model for the City in 1992 using the Watsys hydraulic modeling software. The City had no previous hydraulic model prior to the development of the Watsys model. The Watsys model was initially developed to include pipelines that are 8-inch diameter or greater. The model was calibrated against fire flow data. During the calibration process, Carollo Engineers also included a number of 6-inch pipelines that were deemed significant to the operation of the system.

At the time of the original model development, the SFPUC was the only water supply source for the City. In August 1993, a permanent second supply source (SCVWD) was put into service and isolation valves were closed, creating two completely separate distribution systems. At this point, two more models (i.e. "Build-out a" and "Build-out b") were developed by Carollo Engineers in addition to the "Existing" model. The "Existing" model only had SFPUC as the sole water supplier. The "Build-out a" model reflected the piping configuration for the SFPUC service area only, with proposed CIP incorporated. Similar to the "Build-out a" model, the "Build-out b" model reflected the piping configuration for the SCVWD service area only, with proposed CIP also incorporated.

Using the three models as a basis, the City developed two more models between 1995 and 1996. The build-out "a" and "b" models were combined into one model with isolation valves closed to separate the two distribution systems. A second model was developed based on the combined model with the proposed CIP removed to represent the actual distribution system. The models were updated to include capital improvement projects constructed since 1994. The accuracy of the combined models was verified through comparison of fire flow data between the Carollo separate models and the City's combined version. The combined model was utilized by the City for emergency planning. By using the combined model, the City was able to identify the four key isolation valves shown in Table 4-5 to be open first during an emergency in which water needs to be delivered from the SFPUC supply zones to the SCVWD supply zones.

In the spring of 2000, West Yost Associates was contracted to take the two combined models and convert them from Watsys to H_2ONET. This was a simple conversion without calibrating and updating the model geometry to include new developments since 1996.

4.2.2 H_2ONET Model Update

The H_2ONET model update included linking 2001 land use polygons developed by the City to the model and updating model geometry through July 2001. The geometry of the H_2ONET model was updated by adding new improvements to the system since 1996. Based on plan sheets provided by the City, the following new developments as of July 2001 were incorporated into the H_2ONET model:

- Project No. 3069: 1,150 ft of 12-inch diameter pipeline (Preston Pipeline at Railroad & Bothelo Ave.)
- Project No. 3088: 3,500 feet of 8-inch diameter pipeline (Crossing at Montague Apartments)
- Project No. 3006: 725 feet of 10-inch diameter, 2,565 feet of 8-inch diameter, and 115 feet of 12-inch diameter pipelines (Beresford Village Tracts 8792 & 8793)
- Project No. 3076: Two new EPRVs between zone SF1 and SC1 crossing Interstate 880 at California Circle and Cadillac Court

[1] Ormsbee, Lindell E. and Lingireddy, Srinivasa, ***Calibration of Hydraulic Networks***

Before the model was calibrated, a physical system model acceptability review (i.e. verifying the accuracy of distribution network data) was performed to check for the following areas:

- Pipelines (Size Inaccuracies & Missing Pipes)
- Pump Stations
- Reservoirs & PRVs
- Isolation Valves
- Interties & Emergency Wells

4.2.2.1 Pipelines

The objective of the pipelines acceptability review is to resolve inconsistencies of pipeline sizing and locations found between the City's plat sheets and the H_2ONET model. Pipeline properties (e.g. location, diameters, length, connectivity) in the model that were not consistent with what was shown on the water distribution system plats were identified during the review. There were generally two types of inconsistencies identified: pipe size inaccuracies and missing pipes.

Pipeline size inaccuracies typically arise when a modeled pipeline was digitized as one diameter and the plats indicated that there were actually two different pipelines. During the acceptability review, it was assumed that the pipeline sizes shown on the plats were more accurate than in the model and inconsistencies were resolved in the model accordingly. Furthermore, pipelines 8-inch diameter and larger shown on the plats that were not included in the H_2ONET model were identified and added to the model. For pipelines in the model that were not shown on the plats, verification was made with the City before changes were made in the model. All changes were verified with the City.

In the H_2ONET model, junction nodes are points placed at the intersection of two or more links, at points of water consumption or inflow, at points where specific analysis values (e.g. pressure, concentration) are desired, and at points where pipe attributes (e.g. diameter, material) change. Each junction node can contain information such as elevation, demand, pressure zone, description, etc. The existing H_2ONET model did not separate the nodes by zones. During this review and update, all nodes were labeled by their appropriate zones (i.e. SF1, SF2, SC1, etc.) so that analysis results can be viewed in an organized manner. In the same way, pipelines were labeled according to street names and separated into zones.

4.2.2.2 Pump Stations

A pump stations review was performed to ensure that the pumps were supplying flows at the correct pressure and corresponding pressure setting. The review indicated that two of the five pump stations were missing from the model: Ayer and Gibraltar SCVWD. The Ayer pump station supplies water to zone SF2 from the Ayer reservoir while the Gibraltar SCVWD pump station delivers water to zone SC2 from the Gibraltar SCVWD reservoir. These two pump stations were added to the model.

In addition to the missing pump stations, the review also found that the Tularcitos pump station was supplying water to the Tularcitos reservoir instead of the Minnis reservoir. This pump station was rerouted. After that, normal operations of all five pump stations (i.e. pressure and flow setting) were confirmed with the City staff and set/adjusted accordingly in the model.

4.2.2.3 Reservoirs

All reservoirs in the distribution system were modeled as fixed-head reservoirs in the H_2ONET model. The physical model acceptability review showed that similar to the Gibraltar SCVWD pump station, the Gibraltar SCVWD reservoir was also missing from the model. This reservoir was added and all five reservoir bottom elevations and water level settings in the model were confirmed with daily operation data.

In addition to the reservoirs, turnouts were also previously modeled in H_2ONET as fix-head reservoirs, representing an infinite supply source. To simulate the PRVs at North Milpitas, the Sunnyhills turnout, and Main turnout, the previous model used extra reservoirs set at a lower hydraulic grade line. As a result, there were three reservoirs at the Sunnyhills turnout, two at Calaveras, and two at Main. While in theory, reservoirs could be used to simulate PRVs if the PRVs are located next to the turnout. However, using reservoirs to simulate PRVs in the model does not accurately portray the system. For example, the area between the Calaveras turnout and the North Milpitas PRV was inaccurately modeled as zone SF1 because the North Milpitas PRV was modeled as a second reservoir set at a lower HGL at the Calaveras turnout. Therefore, extra reservoirs at turnouts used in the previous model to represent PRVs were deleted (2 from Sunnyhills, 1 from Calaveras, 1 from Main) and replaced by PRVs.

4.2.2.4 PRVs and EPRVs

The model was reviewed to ensure all PRVs and EPRVs in the system were included and that the pressure settings were correct. During the review and update, a missing PRV at Gibraltar turnout for the SCVWD line was added. Pressure settings for PRVs and EPRVs were confirmed with the City's staff and adjusted as necessary. PRVs and EPRVs were checked to ensure that a pipeline was not hidden underneath, hence bypassing the valves. EPRVs between the SCVWD and SFPUC zones were checked to ensure that they are modeled closed. SCVWD and SFPUC lines were traced from their turnouts through PRVs and to their respective zones to ensure no cross connections at nodes were being made. Several corrections were necessary to rectify the cross connection of SCVWD and SFPUC pipelines.

4.2.2.5 Isolation Valves, Interties, and Wells

Closed valves between the two supply lines in the plats were checked against the models. In several instances, missing isolation valves were added to the model to fully represent the system. Furthermore, the Alameda County interties, new SFPUC/SCVWD intertie, and Curtis Well were also added to the model.

4.2.3 Calibration Data

In general, water distribution system models can be calibrated by comparing field data to model results. Calibration can typically be achieved by comparing fire flow data (i.e. field observations) to model results and modifying pipeline roughness factors and various settings until the model results are within a reasonable range of the field observed fire flow data.

For the 1994 Master Plan, static hydrant pressure data were compared to modeled pressure. Gross pressure variations were identified and modifications to the model were made to reduce pressure differences between model results and field data to less than 10%. The Hazen-William roughness coefficient, or "C" factor, was adjusted down from 120 to 110.

4.2.3.1 Calibration Strategy

At the time of this 2002 Water Master Plan, the City of Milpitas was in the process of completing the design of a supervisory control and data acquisition (SCADA) system. Since the City did not have a SCADA system on-line at the time of this study, available data for the 2002 Water Master Plan H_2ONET model calibration was limited to fire hydrant test data and City monitored operating parameters. Table 4-8 summarizes the available operating data according to the Department of Public Works. The City typically performs fire flow testing every two years. The most recent set of fire hydrant test data is for July 1999. Hydrant testing was not completed in the summer of 2001 because the City was not operating under normal conditions since the Penitencia WTP was offline for maintenance for a period of 17 months. Hence, during this period, the SCVWD turnout to the City was supplied by the Santa Teresa WTP.

Table 4-9 presents an analysis for two calibration strategies. Model calibration could have been achieved by using static pressure and fire flow data from the 1999 hydrant tests. However, this first strategy would have required the development of the model to simulate 1999 conditions. The development of a 1999 model would entail an evaluation of 1999 average water demand, an adjustment of land use information, a revision of model geometry, and an analysis of 1999 daily water use records at the turnouts to determine actual water demands on the hydrants test days. The development of the hydraulic model to a 1999 level would have needed additional tasks and significant efforts that were not defined under the scope of services for the 2002 Water Master Plan.

The second calibration strategy involved using 2001 fire flow data for a model developed to 2001 levels. This strategy would allow the model to reflect the 2001 condition in terms of demand and capital improvements. Therefore, it was decided that the second strategy would be used to calibrate the H_2ONET model. Since hydrant testing was not completed in the summer of 2001, the second strategy required that fire flow testing be performed to collect calibration data. During the period of fire flow testing, data for daily water use and known boundary conditions (i.e. reservoir water level, turnout pressure, pump discharge HGL, etc.) were also collected.

Table 4-8: Monitored Operating Data for the City of Milpitas

DATA TYPE	SYSTEM	NAME	FUNCTION/DESCRIPTION	PARAMETERS RECORDED
7 day circular strip chart	SFPUC Turnouts	Sunnyhills	Turnout & PRV	Pressure: High side (SF2) & low side (SF1)
		Calaveras	Turnout	Pressure (SF2)
		Main Street	Turnout & PRV	Pressure: High side (SF2) & low side (SF1)
	SFPUC	Milpitas PRV	Reduce pressure from Calaveras turnout to SF1	Pressure: High side (SF2) & low side (SF1)
	SFPUC Zone SF2	Ayer Pump Station (SF2 Pump Station)	SF2 peak shaving & Fire/Emergency Storage;	Pressure: Pump discharge (SF2) Flow: Pump discharge & reservoir fill rate
	SFPUC – La Questa (Hillside)	Calera Creek Heights	SF4-1 PRVs fed from Minnis Reservoir	Pressure: High side (SF4) & low side (SF4-1)
		North Vault		Pressure: High side (SF4) & low side (SF4-1)
		South Vault		Pressure: High side (SF4) & low side (SF4-1)
		Country Club Pump Station	Booster Pumping Station; Feeds Tularcitos Reservoir & SF3 while pumping	Pressure: Pump suction (supplied by SF2) & pump discharge (Gravity flow from Tularcitos when pumps are off) Flow: Pump discharge; Level: Tularcitos Reservoir
		Tularcitos Pump Station & Reservoir	Booster pumping station; Feeds Minnis Reservoir & SF4 from reservoir &/or SF3; Reservoir Storage; Supplies SF3 by gravity	Flow: Pump discharge; Level: Minnis reservoir; Pressure: Pump discharge (Gravity flow from Minnis when pumps are off)
	SCVWD System	Curtis PRV Station	Lead & lag regulator station; Supplies SC1 with SC2 water	Lead PRV: High side & low side pressure; Lag PRV: High side & low side pressure
		Capitol PRV Station	SC1 regulator station; Supplies SC1 with SC2 water	Pressure: High side & low side
	SCVWD Zone SC2	Gibraltar Pump Station	Turnout; Lead & lag regulators for SC2	Lead PRV: High side & low side pressure; Lag PRV: High side & low side pressure
Strip Charts	SFPUC Zone SF1	Gibraltar Pump Station	Peak shaving for SF1; Fire/Emergency Storage	Flow: Pump discharge & Reservoir fill rate;
	SCVWD Zone SC2	Gibraltar Pump Station	Peak shaving for SC2; Fire/Emergency Storage; Booster Pump SC2	Flow: Turnout total, zone SC2, peak shaving pump discharge, reservoir fill rate
Electronic Data	SFPUC Zone SF2	Ayer Pump Station	SF2 peak shaving and Fire/Emergency Storage;	Pressure: Discharge (SF2); Flow: Discharge & fill rate; Level: Reservoir
	SFPUC Zone SF1	Gibraltar Pump Station	Peak shaving for SF1; Fire/Emergency Storage	Pressure: Pump discharge (SF1) Flow: Pump discharge, reservoir fill rate; Level: Reservoir
	SCVWD Zone SC2	Gibraltar Pump Station	Peak shaving for SC2; Fire/Emergency Storage; Booster Pump System for SC2	Pressure: Turnout, peak shaving pump discharge (SC2, PRV or Booster System Pressure); Flow: Turnout total, reservoir fill rate, peak shaving discharge pump rate, PRV or Booster System Flow; Level: Reservoir

Source: Department of Public Works (August 2001)

Table 4-9: Summary of Calibration Strategies

	CALIBRATION DATA	MODEL DEVELOPMENT
Strategy 1	• Static hydrant pressure data available throughout system for calibration. • Fire flow test pressure data available throughout system for validation. • 1999 Operating Data.	Need to construct 1999 water model, including: • Evaluate 1999 water demand • Update geometry of 1999 model
Strategy 2	• 2001 Operating Data. • 2001 Hydrant Test data.	Need to construct 2001 water model, including: • 2001 water use records, • Update geometry of 2001 model.

4.2.3.2 Fire Flow Tests

The City conducted fire flow tests in December 2001 and January 2002 to collect field data for the H_2ONET model calibration under Strategy 2. As part of the field data collection task, the operation of the boundary conditions (turnouts, pump stations, PRVs, and reservoir levels) for each pressure zone were also collected one week prior to, during, and one week after the completion of the fire flow tests to set the geometry of the model to match the normal field operation for calibration. Hence, four weeks of normal winter operating data were collected during this test period.

In all, twenty-two locations were tested for fire flow over a two-week period. These locations are shown in **Figure 4-3**. The number of sites per pressure zone was directly related to the size of the zone. In general, the fire flow test sites were located near high water users and at locations farthest from turnouts. This approach optimized the amount of headloss in measured in the system and allowed for maximum pressure drops during testing.

The fire flow tests were conducted during peak hours to ensure the headloss measured is considerably greater than the error in measuring the headloss. For residential zones, peak hours were between 7 a.m. and 9 a.m. For the industrial/commercial zones, the peak hours were around noon time. During the testing period, normal operations were maintained. Hence, the pumps at the Ayer and Gibraltar Reservoirs were activated. For the hillside test (zones SF3 and SF4), the Tularcitos and Minnis Reservoirs were filled the night before and the Tularcitos and Country Club pump stations were turned off during the test.

Figure 4-3: Fire Flow Locations

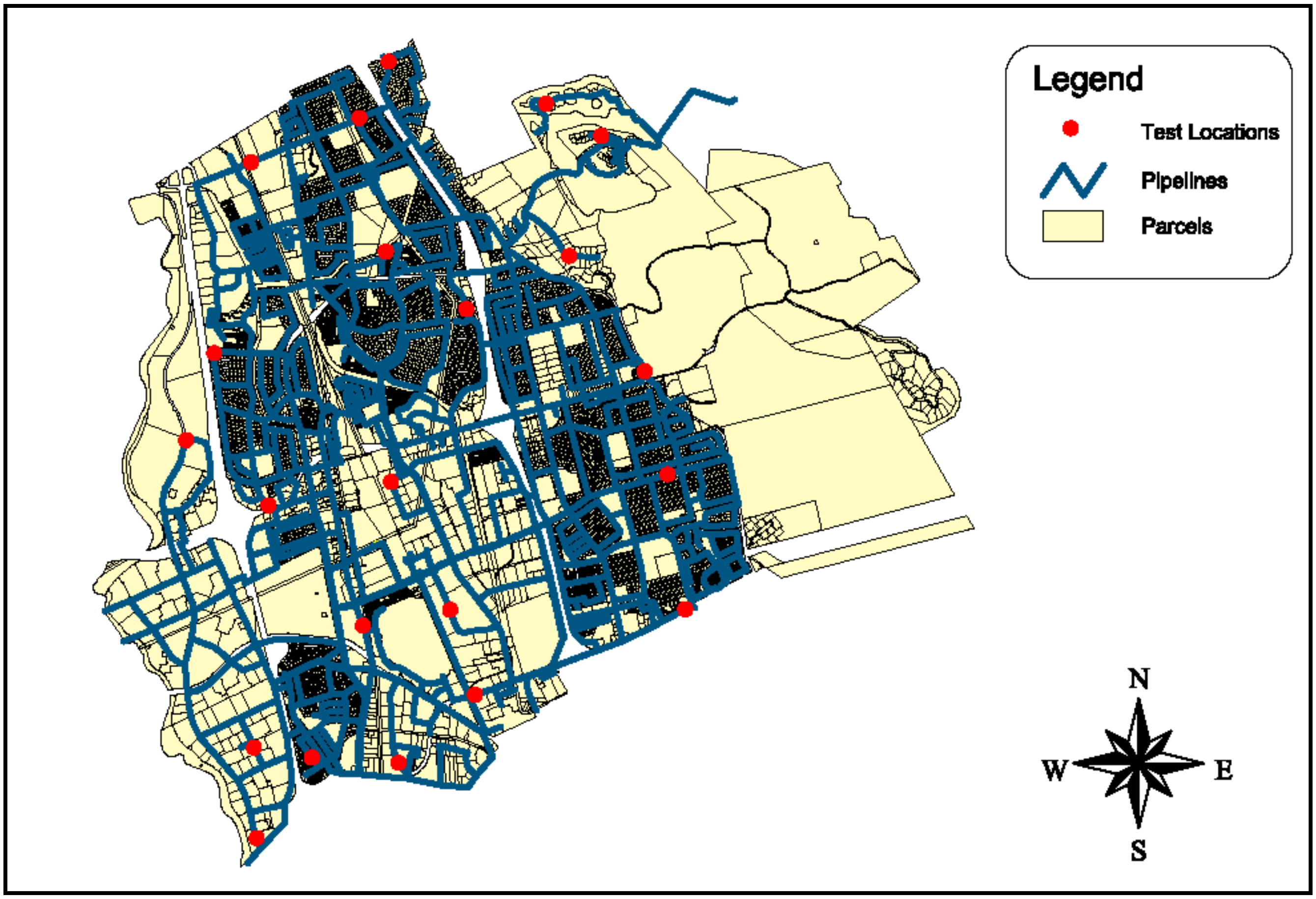


Figure 4-4: Fire Flow Test at Hydrant

Figure 4-4 was taken at one of the fire hydrant tested showing a pitot tube and pressure gage. Three consecutive hydrants were used at each of the fire flow test locations to ensure accurate pressure readings. Before the testing began, a pressure gage was installed in the middle hydrant to measure static pressure and pitot tubes were attached to the upstream and downstream fire hydrant. The test then began with the opening of the upstream hydrant to full flow. Residual pressure was read at the middle hydrant while dynamic pressure was measured at the upstream hydrant (as shown in Figure 4-4). The downstream hydrant was then allowed to flow and residual

pressure was again read at the middle hydrant while dynamic pressures were measures at the upstream and downstream hydrants. The test concluded with the shut off of the downstream and upstream hydrants.

4.2.4 Calibration Results

The goal of the model calibration is to develop an accurate and useful model that provides meaningful results for evaluating current and future deficiencies within the distribution system. Model calibration compares the computer results with actual system data to determine whether the distribution system is adequately modeled or needs further adjustments. For the 2002 Water Master Plan, the model was considered calibrated when error for fire flow pressures between the model and field data was ±10%. A deviation of ten percent or less between field data and model prediction is generally acceptable for most planning applications while a maximum deviation of less than five percent would be highly desirable for most operation or water quality applications.[2] The calibration steps included:

- comparing the pressures and flow rates with known values at turnouts, pump stations, and reservoirs;
- checking the model output against fire flow pressure data;
- revising and rechecking the model accordingly until it reasonably reflected actual operating conditions

Since the fire flow tests were conducted during December 2001 and January 2002, the average winter water demand was used as a basis for model calibration. As presented in Table 2-12, the average winter water demand was estimated based on FY 00/01 water use records for November through February and showed a daily usage of approximately 10.5 MGD. Field monitoring during the four weeks of fire flow data collection period showed a demand of approximately 8.6 MGD after an unaccounted-for-water usage factor of 6.4% was added to the observed data. This discrepancy was most likely due to the field data being collected during the peak holiday season (i.e. from the middle of December through the middle of January) instead of the full four months period. Furthermore, there had been a decrease in industrial/commercial activity for the area due to the economic downturn in FY 01/02. Since specific address and demand information was unavailable for mapping the field monitoring data into the hydraulic model, the calculated demand of 10.5 MGD was uniformly scaled down to 8.6 MGD and used in the model instead. A peak hour factor of 1.5 was then applied to represent peak hour usage conditions during the fire flow test.

The first step in the calibration process was to verify that the boundary conditions (i.e. turnout flows, reservoirs flows, etc.) of the model matched what was observed during the fire flow test. Field monitoring during the fire flow tests showed that flows from the three SFPUC turnouts varied between 40 gpm and 1,000 gpm with an average of 400 gpm and that the Sunnyhills turnout has the highest flow rate; flows from the Gibraltar SF reservoir varied from 1,900 gpm to 2,500 gpm with an average of 2,300 gpm; and flows from the Ayer SF reservoir varied from 1,400 gpm to 1,800 gpm with an average of 1,600 gpm. No accurate boundary data were obtained for the SCVWD zones. The SCVWD turnout flow meter readings were in units of 10,000 gallons. Therefore, it was not possible to obtain accurate flow reading for the turnout due to the short (i.e. ten minutes) duration of the fire flow tests. Flow data from the SCVWD reservoir consisted only of the reservoir level.

The H_2ONET model showed that the average demand at the three SFPUC turnouts was 300 gpm with the highest flow coming from the Sunnyhills turnout, the flow at the Gibraltar SF reservoir was 2,200 gpm, and flow from the Ayer reservoir was 2,000 gpm. Comparisons with the field data from the SFPUC boundary condition showed that the updated model was consistent with field data in that most of the City's demands were met by the reservoirs during the fire flow testing period.

After the system boundary verification was performed, fire flow data was used to further fine-tune the model. The fire flow pressure calibration consisted of two sets of data: static pressure and residual pressure. Static pressure was the system pressure measured at the middle hydrant before the fire flow testing began. The fire

[2] Ormsbee, Lindell E. and Lingireddy, Srinivasa, ***Calibration of Hydraulic Networks.***

flow testing process is described in Section 4.2.3.2. Table 4-10 presents the calibration results. Static pressure comparisons showed that the model was representing the actual system within the calibration criteria for all pressure zones, except for one location in zone SC2 at Montague Expressway and Piper Drive. At this location, the model showed a static pressure of 126 psi while field measurement showed a static pressure of 106 psi. The other two locations measured in the field for zone SC2 showed a static pressure of 124 psi and 128 psi. Even though field measurement showed a static pressure of 106 psi, the City believes that a 126 psi prediction by the model was reasonable for this location based on past historical data showing static pressure of 125 psi in 1997 and 120 psi in 1999. The field measurement for this location could have been skewed by conditions such as construction of the light rail project at the nearby Great Mall Parkway or an abnormal peak demand from some industrial user nearby. Based on discussions with City staff, it was agreed that this location should be discarded from the calibration process.

Residual pressure was the system pressure measured after the upstream and downstream hydrants were fully opened to simulate a fire flow situation. Similar to the static pressure, the residual pressure used to calibrate the model was measured at the middle hydrant, shown in **Table 4-10** as Residual 2. The residual pressure comparison showed that the model was representing the actual system for the valley floor zones. For the hillside zones (i.e. SF3 and SF4), the pressure difference between the model and field measurement was higher due to the sharp changes in elevation. This was also evident in the field data for the Calera Creek Heights Drive location where field measurements varied from 15 psi to 49 psi.

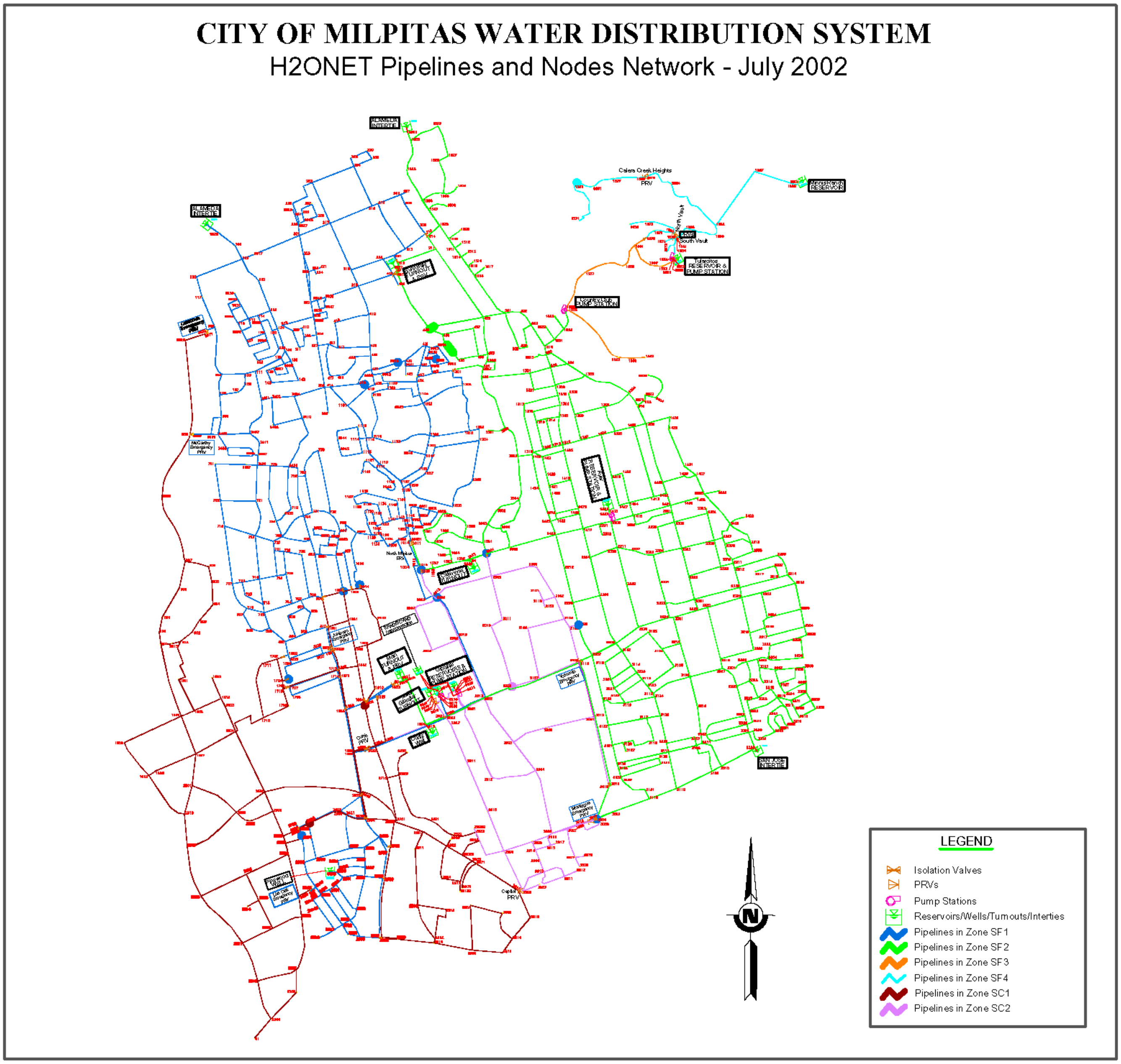
The overall pressure difference between the model and the field data for the system were two percent for static pressure and four percent for residual pressure. The pipe roughness coefficient (Hazen-Williams “C” factor) in the model was adjusted down from 120 to 110 by Carollo in the 1994 Master Plan. While a “C” factor of 110 was fine for static conditions in the 2002 model, under fire flow conditions, a “C” factor of 120 better represents areas where there are high discrepancies. Hence, the roughness coefficient has been adjusted back to 120 in the model. **Figure 4-5** shows the updated and calibrated H_2ONET model.

Table 4-10: Calibration Results

ZONE	LOCATION	STATIC PRESSURE (psi)		PRESSURE W/ UPSTREAM & DOWNSTREAM HYDRANTS FLOWING (psi)				>10 psi PRESSURE DIFF.[a]	TOTAL FLOW (gpm)	DURATION (min.)	PRESSURE DIFFERENCE ANALYSIS	
		Hydrant	Model	Residual 2	Pitot Down	Pitot Up	Model				Static	Fire Flow[b]
SF1	Blue Spruce Way & Fallen Leaf Drive	77	*78*	58	47	48	*56*	OK	2313	11	+1.8%	-4.2%
	Calaveras Boulevard & Abbott Avenue	83	*83*	73	65	59	*74*	**X**[c]	2642	9	+0.0%	+0.8%
	Heath Street & Redwood Avenue	85	*86*	61	52	50	*52*	OK	2396	9	+0.7%	-14.6%
	Dixon Landing Road & Milmont Ave.	81	*83*	72	60	60	*72*	**X**	2599	8	+2.0%	+0.6%
	Dixon Landing Road & Conway Street	54	*54*	44	26	40	*46*	**X**	1917	6	+0.0%	+3.5%
	Sandalwood Lane & Idaho Court	78	*79*	69	55	63	*71*	**X**	2576	5	+0.7%	+3.0%
										average	**+1%**	**-2%**
SC1	McCarthy Boulevard & Ranch Drive	83	*80*	66	56	54	*69*	OK	2489	9	-3.3%	+4.6%
	Buckeye Drive & Buckeye Court	86	*78*	64	57	57	*67*	OK	2534	9	-9.8%	+4.6%
	McCarthy Boulevard & Montague Expy.	75	*75*	62	51	45	*62*	OK	2324	8	+0.6%	+0.6%
	Trade Zone Blvd. & McCandless Drive	82	*75*	67	53	60	*68*	OK	2521	7	-9.0%	+1.0%
	Escort Avenue & Main Street	84	*79*	70	60	58	*71*	OK	2578	7	-5.8%	+1.6%
										average	**-6%**	**+2%**
SC2	Montague Expressway & Piper Drive	106	*124*	63	62	65	*114*	OK	2674	6	--[d]	--[d]
	Gibraltar Drive	124	*125*	110	93	87	*110*	OK	3183	14	+0.5%	+0.2%
	Los Coches Street & Topaz Street	128	*137*	116	99	92	*126*	OK	3279	10	+6.7%	+8.6%
										average	**+4%**	**+4%**
SF2	Tramway Dr. & Hillview Dr.	130	*137*	122	105	97	*133*	**X**	3372	7	+5.3%	+9.4%
	N. Park Victoria Drive & Bolton Drive	76	*82*	58	53	43	*47*	OK	2322	6	+8.3%	-19.2%
	Evans Road & Calaveras Boulevard	90	*95*	82	68	70	*89*	**X**	2788	5	+5.8%	+8.4%
	Yosemite Drive & Sequoia Drive	89	*92*	83	78	62	*83*	**X**	2803	6	+3.9%	+0.3%
	Yellowstone & Landess Avenue	82	*87*	76	75	58	*77*	**X**	2731	10	+5.9%	+1.8%
										average	**+6%**	**+0.0%**
SF3	Calveras Ridge Drive	133	*146*	51	55	49	*47*	OK	2273	7	+9.5%	-7.6%
	Calera Creek Heights Drive	124	*122*	40	49	15	*55*	OK	1893	4	-1.6%	+37.8%
										average	**+4%**	**+15%**
SF4	Pebble Beach Court	70	*70*	40	41	38	*34*	OK	2049	5	+0.0%	-15.5%
										OVERALL DIFFERENCE	**+2%**	**+4%**

[a] Pressure difference is measured between static hydrant pressure and residual 2 hydrant pressure. In order to obtain adequate data for model calibration, it is normally desirable to have a pressure drop of at least ten psi when two hydrants are flowing.
[b] Fire flow compare between model result and Residual 2 pressure difference. A roughness coefficient ("C" factor) of 120 was used in the model for analysis.
[c] **X** = Accuracy of test results reduced somewhat for pressure drop <=10 psi.
[d] Location discarded from the test due to accuracy of field data, refer to discussion in Section 4.2.4.

Figure 4-5: The Updated and Calibrated H_2ONET Model



CHAPTER 5 DISTRIBUTION SYSTEM ANALYSIS

Chapter Synopsis: *This chapter presents the water distribution system performance criteria, analysis, and identification of deficiencies.*

This analysis follows the same performance criteria used in the 2002 Master Plan. The pipes that failed to meet the velocity and headloss criteria in the three scenarios are listed in Table 5-3, Table 5-4, and Table 5-5. Six locations failed to meet the fire flow residual pressures are shown in Table 5-6. Storage analysis, summarized in Table 5-7 and Table 5-8, showed that the City will be able to meet the CDPH requirements in all three scenarios while falling short under the recommended storage criteria.

The H_2OMAP model was used to simulate the system's performance under different water demand patterns and land use scenarios. Results from the model's simulations were compared to the performance criteria to evaluate the adequacy of the distribution system and to identify deficiencies.

5.1 Performance Criteria

The development of the performance criteria are discussed in detail in the *Recommended Performance Criteria for Water Master Plan* TM dated March 26, 2002, located in Appendix E of the 2002 Master Plan. **Table 5-1** presents the criteria used for the Master Plan.

Table 5-1: Summary of Operation and Performance Criteria

<table>
<tr><th colspan="4">PRESSURE CRITERIA</th></tr>
<tr><th colspan="2">Minimum Pressure Criteria</th><th colspan="2">Maximum Pressure Criteria</th></tr>
<tr><th>Demand Scenario</th><th>Pressure (psi)</th><th>Zone</th><th>Pressure (psi)</th></tr>
<tr><td>Maximum Day
Peak Hour
Maximum Day + Fire Flow[1]</td><td>40
30
20</td><td>Zone 1: SFPUC & SCVWD
Zone 2: SFPUC & SCVWD
Hillside Zones</td><td>80
150
130-150</td></tr>
<tr><th colspan="4">VELOCITY & HEADLOSS CRITERIA</th></tr>
<tr><th colspan="2" rowspan="2">Maximum Velocity (ft/sec)</th><th colspan="2">Headloss for Pipe Diameter (ft/kft)</th></tr>
<tr><th>Less than 16 inch</th><th>Greater than or equal to 16 inch</th></tr>
<tr><td colspan="2">10</td><td>10</td><td>5</td></tr>
<tr><th colspan="4">STORAGE CRITERIA</th></tr>
<tr><th colspan="2">Operational Storage</th><th>Fire Flow Storage</th><th>Emergency Storage</th></tr>
<tr><td colspan="2">20 to 25 percent of Maximum Day</td><td>Maximum fire flow rate x duration</td><td>50 percent of Maximum Day</td></tr>
</table>

5.1.1 Pipeline Criteria

The three criteria for water distribution system pipelines consist of pressure, flow velocity, and headloss. Pressure is the most important pipeline criteria and is used to evaluate the system's ability to provide acceptable pressures at points of delivery to customers under various demand conditions. Pipeline flow velocity and headloss criteria are interrelated because headloss per 1,000 feet is a function of velocity and pipe roughness.

5.1.1.1 Pressure Criteria

Pressure criteria for pipelines consist of the maximum limit, minimum limit, and fire flow residual. The fire flow residual pressure requirement ensures that the system has adequate pressures during fire events to both suppress the fire and maintain a positive pressure necessary to prevent backflow and cross contamination. Operating pressures for a water distribution system typically range from a minimum of 20 psi to a maximum of 150 psi. Federal and state agencies recommend a minimum system pressure of 20 psi for fire emergency conditions to suppress a fire. Section 1007 of the Uniform Plumbing Code requires pressure-regulating valves on individual service connections where delivery pressures are greater than 80 psi.

The City uses two maximum pressure criteria consisting of 80 psi for pressure zones located in the valley and 150 psi for zones located in the hillside areas. There is no requirement for the minimum pressure; however, experience in the industry indicates that 40 psi is the customer complaint threshold for more than brief periods. Hence, the 40 psi minimum criterion was used for maximum day demand conditions. In addition to the 40 psi minimum pressure criterion, the recommended AWWA minimum pressure criterion for peak hour demand of 30 psi was also used.

5.1.1.2 Velocity and Headloss Criteria

The City uses the AWWA criteria for maximum velocity in pipe segments of 10 ft/s. For new water mains, the City also has design criteria specifying that the maximum velocity shall be 8 ft/s. This criterion was developed by the City for developers who are making water system improvements within their respective developments.

The maximum headloss criterion was also used to evaluate the distribution system's performance. Separate headloss criteria were defined for large-diameter and small-diameter pipelines, as is the case with the AWWA definition of deficiency conditions. For pipelines smaller than 16-inches, a maximum headloss criterion of 10 ft/1,000 ft (ft/kft) was used. The maximum headloss criterion of 5 ft/kft was used for pipelines with diameter equal to or greater than 16 inches.

5.1.2 Storage Criteria

Water distribution systems should have sufficient storage capacity to meet peak hour demands, provide emergency supply, and provide supply for fire-fighting. Hence, storage volume is an integral aspect of operation and reliability for a water distribution system. As reported in the AWWA Hydraulic Design Handbook, the principal function of storage is to provide reserve supply for the following three components:

- Operational (or equalization) storage;
- Emergency reserve storage; and
- Fire suppression storage

The storage volume criteria for a water distribution system is, therefore, a summation of the above three individual components. The City's existing criteria for operational, emergency, and fire suppression storage are comparable to the criteria utilized by the other agencies, and hence no modifications were needed. As an additional part of the distribution system analysis, all zones within the system were evaluated to ensure that at least 8 hours of supply at maximum day demand, excluding fire-fighting reserves, would be available to meet the requirement of Section 116530 of the California Health and Safety Code.

5.1.2.1 Operational Storage

Also known as equalization storage, operational storage is defined as the amount of stored water necessary to meet peak demands in excess of normal supply delivery for a water distribution system. Since the supply source for a water distribution system should normally be able to at least meet the projected maximum day demand, operational storage is typically the component of total storage used for meeting normal demands in excess of the maximum day demand rate.

According to the 1994 Master Plan, since operational storage is related to the maximum day demand, it is generally preferred to estimate operational storage needs based on an evaluation of the hourly demand curve during maximum day demand condition. However, since the City does not have the necessary data to develop an hourly demand curve, the AWWA recommendation for operational storage of 20 to 25 percent of the maximum day demand was used.

5.1.2.2 Emergency Reserve Storage

Emergency reserve storage is the volume of water stored to meet demand during emergency situations such as an extended power outage, main trunk failures, natural disasters, raw water contamination, or supply failures from SFPUC Bay Division Pipelines No. 3 and No. 4 or SCVWD supply. Unlike operational and fire storage, which should be available at all system storage sites, emergency storage may be included at only one or a few of the storage sites if the storage from one reservoir was available to several areas because they are hydraulically linked to each other. The criterion of 50 percent of the maximum day demand for emergency storage was also used in this Master Plan Update.

5.1.2.3 Fire Suppression Storage

Fire suppression storage is the amount of stored water required to provide a specified fire flow for a specified duration, particularly during Maximum Day or Peak Hour demand periods. The fire storage volume needs are sub-zone demands and fire flow duration is directly related to potential fire demand durations in each zone. Insurance Services Office (ISO) and AWWA recommend that fire storage volume be estimated by multiplying the required minimum fire flow rate required for the area served by a given reservoir by the projected duration. Each major pressure zone in the City of Milpitas currently has at least one storage reservoir. In determining the storage volume required for each pressure zone, the largest fire flow potentially possible in the particular pressure zone was utilized.

The City of Milpitas has established minimum fire flow rates for various types of development within the City, listed in **Table 5-2**. The multifamily flow requirement of 2,500 gpm was added since the 1994 Master Plan, while the mixed flow requirement of 3,000 gpm was added since the 2002 Master Plan. Flow rates are accompanied by a requirement of 20 psi minimum residual pressure at any location for each condition.

Table 5-2: Fire Flow Rates and Durations Used for Various Types of Development

Type of Development	Minimum Fire Flow Rate (gpm)	Duration (hours)
Residential	1,500	2
Multifamily	2,500	2
Commercial	3,000	3
Mixed	3,000	3
Industrial	5,000	4

5.2 Distribution System Deficiencies

This section presents an overview of the City's water distribution system performance and the deficiencies identified during the analysis process using the H_2OMAP model. The H_2OMAP model was used to simulate the system's performance under two water demand patterns (peak hour and maximum day with fire flow) and three land-use scenarios discussed in Chapter 2.

5.2.1 Normal Day Demand

Analysis under normal day demand is not part of the scope of this Master Plan Update. Therefore, no updated information is provided for this section.

5.2.2 Maximum Day Demand

Analysis under maximum day demand is not part of the scope of this Master Plan Update. Therefore, no updated information is provided for this section.

5.2.3 Peak Hour Demand

The same peaking factors are used for the modeled scenarios. The peak hour to average day demand peaking factors for residential and industrial/commercial zones are 3.8 and 2.4, respectively.

5.2.3.1 Pressure Criteria

The minimum pressure criterion for peak hour demand is 30 psi. All demand nodes were able to meet the 30 psi minimum pressure criterion for all three land use scenarios, except for the high and low pressure nodes listed in Table 5-3 of the original Master Plan, as expected.

5.2.3.2 Velocity and Headloss Criteria

The velocity and headloss criteria for peak hour demand consist of 10 ft/s for velocity and 10 ft/1000 ft (ft/kft) for pipelines with diameters of less than 16 inches, and 10 ft/s for velocity and 5 ft/1000 ft for pipelines with diameters greater than or equal to 16 inches for headloss. During peak hour conditions, if the velocity criterion for a pipeline was met, then excessive headloss was considered to be an issue only if the supply pressures were low. In general, pipelines that were unable to meet the headloss criteria were located near supply turnouts and pressure reducing valves, where system flows were concentrated.

Table 5-3, Table 5-4, and **Table 5-5** list the locations of pipelines failing to meet the headloss criteria under peak hour demand conditions in the 3 scenarios. These three tables replace Table 5-4 in the 2002 Master Plan. The locations of the deficiencies are shown in **Figure 5-1**, **Figure 5-2**, and **Figure 5-3**. Among the 3 scenarios, Scenario 3 has the most number of deficient pipes, followed by Scenario 2. Nonetheless, locations of deficiencies for the 3 scenarios are generally similar. The most extreme deficiency occurs on pipe ID 213, with a headloss exceeding the criteria by 10 – 12 times in the studied scenarios.

Table 5-3: Scenario 1 (19 General Plan Amendments) Deficiencies under Peak Hour Demand Conditions.

Deficiency No.	Pipe ID	Zone	Comments	Length (ft)	Velocity (ft/s)	HL/1000 (ft/kft)	Current Diameter (inch)
1	828	SF1	N. Milpitas downstream of PRV	180	5.1	5.4	18
2	1223	SF2	Calaveras Turnout @ pipe ID 2557	70	7.1	13.4	14
3	2557	SF2	Calaveras Turnout	60	7.8	16.1	14
4	1351	SF2	Main Turnout upstream of PRV	180	6.3	13.0	12
5	**227**	**SC1**	**Curtis Avenue after PRV**	**320**	**10.0**	**18.9**	**18**
6	**212**	**SC2**	**Curtis Avenue before PRV**	**2,300**	**10.5**	**20.8**	**18**
7	9805	SC2	Gibraltar turnout upstream of PRV	10	9.4	12.0	24
8	**213**	**SC2**	**SCVWD Turnout**	**750**	**16.7**	**48.9**	**18**
9	2536	SC2	Yosemite Drive near Gibraltar Pump Station	600	7.7	13.2	16
10	512	SC2	Along Western Pacific Railroad	240	6.5	13.5	12
	2529	SC2	Along Western Pacific Railroad	1,230	7.8	19.0	12
	2553	SC2	Along Western Pacific Railroad, near Piper Dr.	1,180	6.3	12.8	12
	2554	SC2	Along Western Pacific Railroad, near Piper Dr.	1,470	6.5	13.5	12
	2560	SC2	Along Western Pacific Railroad	1,140	6.5	13.5	12
11	2527	SC2	Montague near S. Milpitas next to pipe ID 2563	450	6.5	16.7	10
	2563	SC2	Montague near S. Milpitas & Gladding Court	160	9.5	33.8	10
12	2564	SC2	Montague Expressway ext.	260	4.6	11.6	8
13	2566	SC2	Gladding Ct. ext.	440	4.6	11.4	8
14	854	SC2	Extension @ Gladding Court - new development	350	8.8	38.1	8
15	858	SC2	New Pipe @ Main Driveway (West)	860	4.9	12.8	8
16	9986	SF2	Old Evans Road	140	3.8	11.04	6

Notes:
1. Deficiencies failing to meet the velocity criteria of 10ft/s are shown in bold.

Table 5-4: Scenario 2 (Transit Area Specific Plan) Deficiencies under Peak Hour Demand Conditions.

Deficiency No.	Pipe ID	Zone	Comments	Length (ft)	Velocity (ft/s)	HL/1000 (ft/kft)	Current Diameter (inch)
1	828	SF1	N. Milpitas downstream of PRV	180	5.1	5.4	18
2	1223	SF2	Calaveras Turnout @ pipe ID 2557	70	7.7	15.7	14
3	2557	SF2	Calaveras Turnout	60	8.5	18.9	14
4	1351	SF2	Main Turnout upstream of PRV	180	6.9	15.4	12
5	**227**	**SC1**	**Curtis Avenue after PRV**	**320**	**10.5**	**20.6**	**18**
6	**212**	**SC2**	**Curtis Avenue before PRV**	**2,300**	**11.0**	**22.6**	**18**
7	**9805**	**SC2**	**Gibraltar turnout upstream of PRV**	**10**	**10.3**	**14.3**	**24**
8	**213**	**SC2**	**SCVWD Turnout**	**750**	**18.4**	**58.2**	**18**
9	2536	SC2	Yosemite Drive near Gibraltar Pump Station	600	8.3	15.4	16
	2538	SC2	Yosemite Drive near Gibraltar Pump Station, next to pipe ID 2536	610	4.8	5.5	16
10	512	SC2	Along Western Pacific Railroad	240	8.1	20.3	12
	2529	SC2	Along Western Pacific Railroad	1,230	7.5	17.8	12
	2553	SC2	Along Western Pacific Railroad, near Piper Dr.	1,180	6.8	15.0	12
	2554	SC2	Along Western Pacific Railroad, near Piper Dr.	1,470	8.1	20.3	12
	2560	SC2	Along Western Pacific Railroad	1,140	8.1	20.3	12
11	2520	SC2	South Milpitas Blvd.	1,800	7.1	13.5	14
12	2527	SC2	Montague near S. Milpitas next to pipe ID 2563	450	7.7	22.9	10
	2563	**SC2**	**Montague near S. Milpitas & Gladding Court**	**160**	**11.8**	**51.0**	**10**
13	2564	SC2	Montague Expressway ext.	260	5.7	17.1	8
14	2566	SC2	Gladding Ct. ext.	440	5.2	14.7	8
15	854	SC2	Extension @ Gladding Court - new development	350	8.4	35.5	8
16	858	SC2	New Pipe @ Main Driveway (West)	860	4.5	11.2	8
17	1590	SC1	So. Main St.	80	6.7	22.8	8

Notes:
1. Deficiencies failing to meet the velocity criteria of 10ft/s are shown in bold.

Table 5-5: Scenario 3 Deficiencies under Peak Hour Demand Conditions.

Deficiency No.	Pipe ID	Zone	Comments	Length (ft)	Velocity (ft/s)	HL/1000 (ft/kft)	Current Diameter (inch)
1	828	SF1	N. Milpitas downstream of PRV	180	5.1	5.5	18
2	1223	SF2	Calaveras Turnout @ pipe ID 2557	70	7.1	13.5	14
3	2557	SF2	Calaveras Turnout	60	7.8	16.1	14
4	1351	SF2	Main Turnout upstream of PRV	180	6.3	13.0	12
5	1588	SC1	Curtis Avenue	620	5.1	10.8	10
6	**227**	**SC1**	**Curtis Avenue after PRV**	**320**	**11.5**	**24.5**	**18**
7	**212**	**SC2**	**Curtis Avenue before PRV**	**2,300**	**12.0**	**26.7**	**18**
8	**9805**	**SC2**	**Gibraltar turnout upstream of PRV**	**10**	**10.9**	**15.8**	**24**
9	**213**	**SC2**	**SCVWD Turnout**	**750**	**19.4**	**64.2**	**18**
10	2536	SC2	Yosemite Drive near Gibraltar Pump Station	600	8.5	15.9	16
	2538	SC2	Yosemite Drive near Gibraltar Pump Station, next to pipe ID 2536	610	4.7	5.4	16
11	512	SC2	Along Western Pacific Railroad	240	8.1	20.3	12
	2529	SC2	Along Western Pacific Railroad	1,230	7.5	17.7	12
	2553	SC2	Along Western Pacific Railroad, near Piper Dr.	1,180	6.8	15.0	12
	2554	SC2	Along Western Pacific Railroad, near Piper Dr.	1,470	8.1	20.3	12
	2560	SC2	Along Western Pacific Railroad	1,140	8.1	20.3	12
12	2520	SC2	South Milpitas Blvd.	1,800	7.1	13.6	14
13	2527	SC2	Montague near S. Milpitas next to pipe ID 2563	450	7.7	22.9	10
	2563	**SC2**	**Montague near S. Milpitas & Gladding Court**	**160**	**11.8**	**51.1**	**10**
14	2564	SC2	Montague Expressway ext.	260	5.7	17.2	8
15	2566	SC2	Gladding Ct. ext.	440	5.2	14.7	8
16	854	SC2	Extension @ Gladding Court - new development	350	8.4	35.4	8
17	858	SC2	New Pipe @ Main Driveway (West)	860	4.5	11.2	8
18	1590	SC1	So. Main St.	80	7.6	29.4	8

Notes:
1. Deficiencies failing to meet the velocity criteria of 10ft/s are shown in bold.

Figure 5-1: Scenario 1 (19 General Plan Amendments) Deficiencies under Peak Hour Demand Conditions.

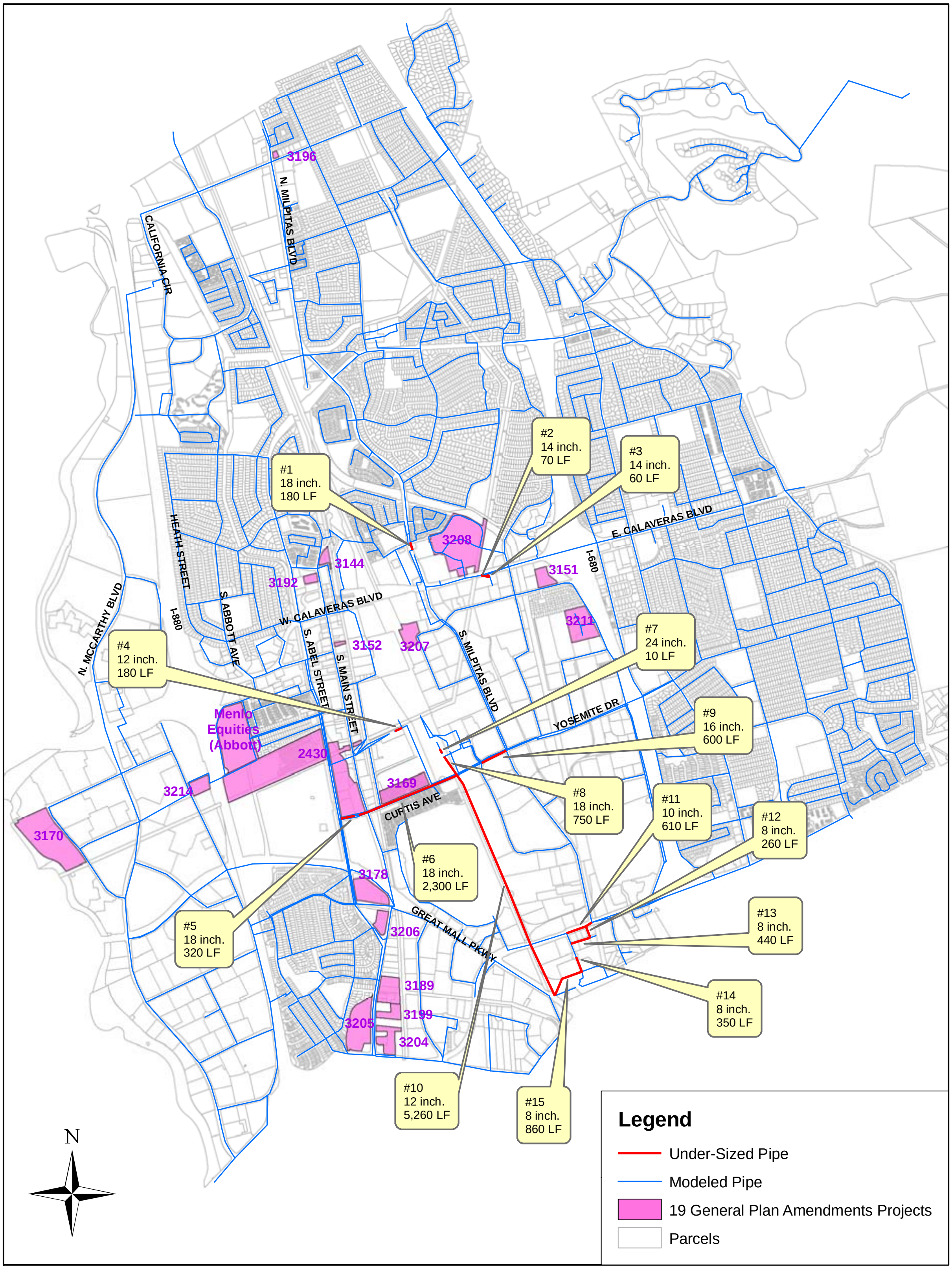


Figure 5-2: Scenario 2 (Transit Area Specific Plan) Deficiencies under Peak Hour Demand Conditions.

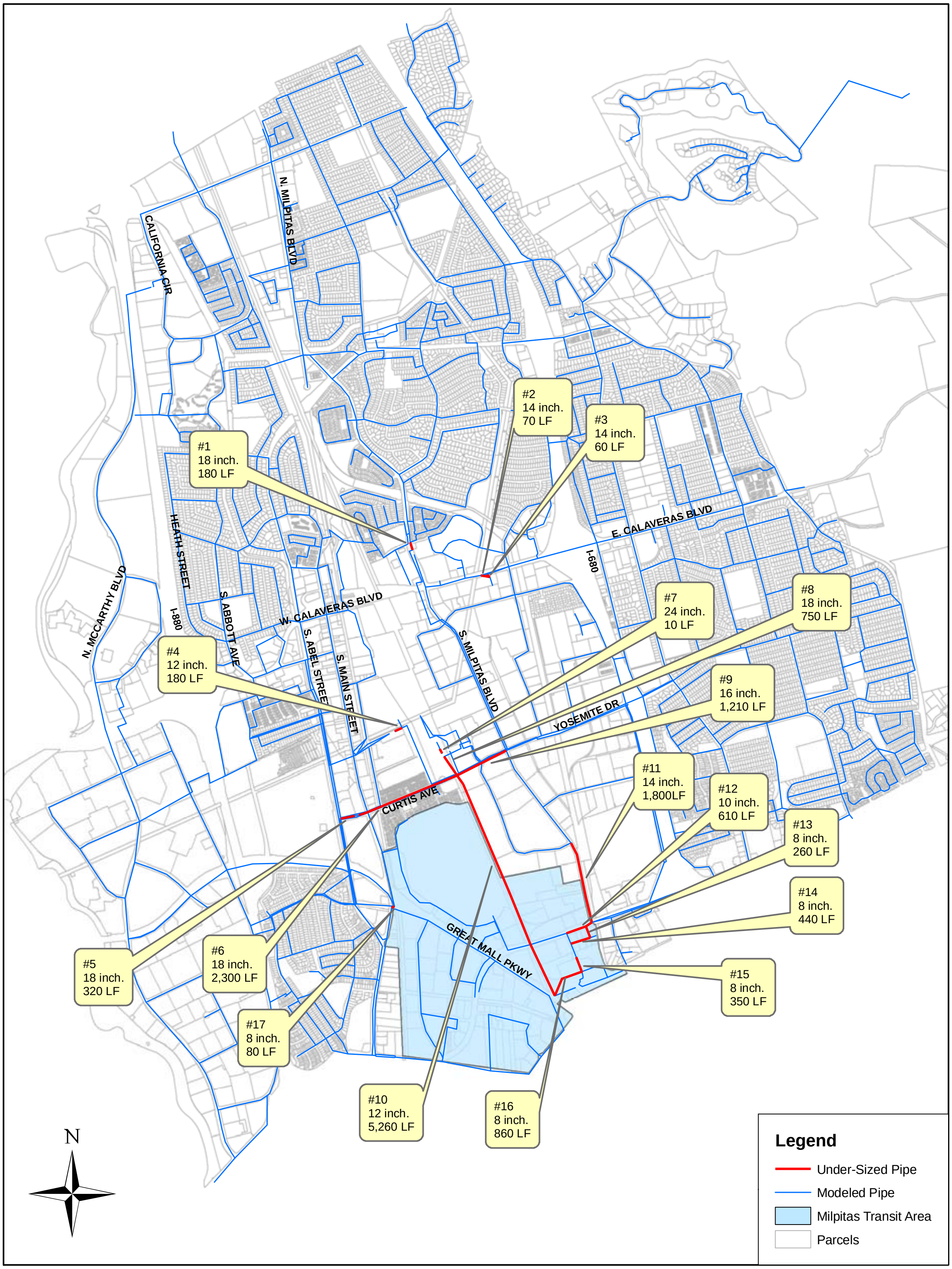
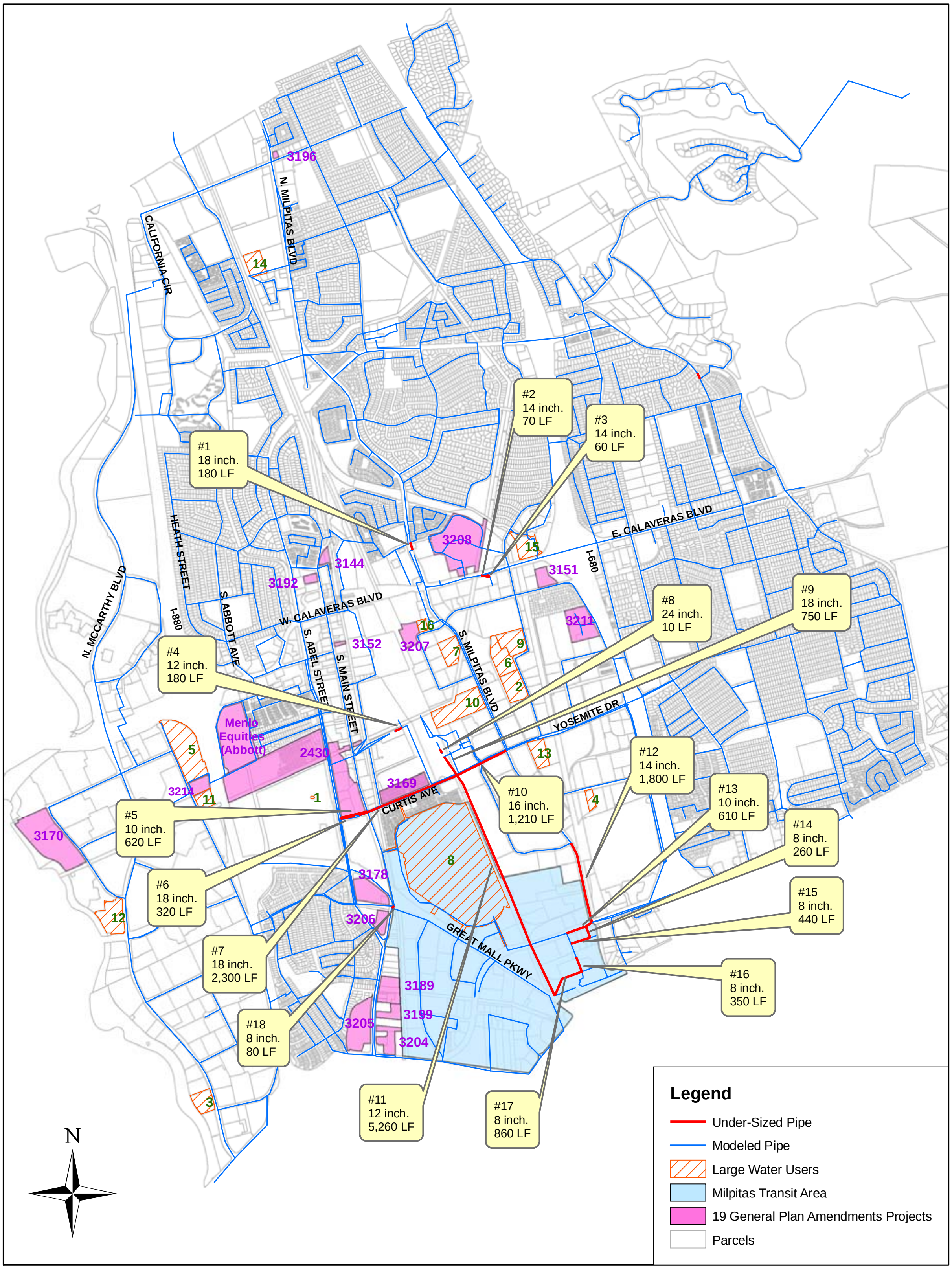


Figure 5-3: Scenario 3 Deficiencies under Peak Hour Demand Conditions.



5.2.4 Fire Flow Simulation

Table 5-6 presents a summary of the fire flow simulations for each of the three scenarios evaluated for the Water Master Plan Amendment. The locations were selected from the nodes used in the 2002 Master Plan and only the nodes with a pressure less than 50 psi and which are in the proximity of project areas in all land use scenarios were selected. A pressure of 50 psi was used as the cut-off because the new demands are very similar to those in the 2002 Master Plan and therefore pressure is not expected to vary significantly. In fact, the simulation results are very close to the values obtained in 2002.

The majority of the locations tested showed that the system was able to meet the minimum 20-psi pressure criterion except at six locations, one of which, node 2509, failed to meet the criterion in only Scenario 1 (19 General Plan Amendments). Node 2509 is located at Montague Expressway & McCarthy Boulevard and it was not identified as deficient in the 2002 Master Plan. The other five locations were previously noted in the 2002 Master Plan as having low pressure issues. Of the six locations failing to meet the pressure criterion, two were in zone SF1, three locations were in zone SC1, and one location was in zone SC2. Within zone SC1, nodes 1909 and 9914 are located east of Interstate 880 near Calaveras Boulevard and the Southern Pacific Railroad. Each deficient node is identified in **Figures 5-4 to 5-9**.

The first location is node 230 on Levin Street at the northeastern end of the City in zone SF1, as shown in **Figure 5-4.** This location has a residual pressure of 16 psi for residential fire flow demand of 1,500 gpm in all land use scenarios. As discussed in the 2002 Master Plan, this area also has low pressure during maximum day demands. In the 1994 Master Plan, this location was reportedly at low pressure due to the fact that this area is at the highest elevation of zone SF1.

The second location is at the dead-end of Hanson Court (node 309) in zone SF1 shown in **Figure 5-5.** A fire flow rate of 5,000 gpm was used during the simulation since the land-use information for this court indicates that it is designated for industrial park and manufacture/warehousing activities. The predicted pressure was –57 psi during the fire flow simulation runs while the residual pressure immediately upstream was above 50 psi. The situation at this location is stable for all of the three scenarios because there are no changes in land use in this area between the scenarios. Operation staffs have indicated that flow is present at a hydrant near this location even when the upstream valve is closed. This suggests that there could be an unknown connection to the pipeline. Further investigation should be carried out to verify pipelines connecting to this location.

The third location violating the 20 psi minimum residual pressure criteria is node 1909, at the intersection of Hammond Way and Sinnott Lane in zone SC1, as shown in **Figure 5-6.** This location has a residual pressure between 6 to 7 psi for commercial fire flow demand of 3,000 gpm in all land use scenarios.

The fourth location violating the 20 psi minimum residual pressure criteria is node 2509, at the intersection of Montague Expressway & McCarthy Boulevard in zone SC1, as shown in **Figure 5-7**. This location failed the minimum pressure criteria in only Scenario 1 and has a residual pressure between 19 to 20 psi for industrial fire flow demand of 5,000 gpm in all land use scenarios.

The fifth node not meeting the 20 psi residual pressure requirement is node 9914, shown in **Figure 5-8**, at the intersection of Railroad Avenue and Carlo Street in zone SC1. This area has low residual fire flow pressure because it is at the boundary of zone SC1 and SF1 and hence has many isolation valves in the area. This area was described in the 1994 Master Plan as having low pressures during fire flow simulation and improvements were recommended. Although the specific improvements have not yet been implemented, the City has constructed a new pipeline (Preston pipe) in the area to improve system performance. The model predicted that the new Preston pipeline on Bothelo Avenue is contributing flows into the hydrant at this location (flow reaches the node from two directions); however the pressure was still below the criteria.

The sixth and last location unable to meet the 20 psi residual pressure requirement is node 3005, a dead-end node located at Pecten Court shown in **Figure 5-9**. The 1994 Master Plan also identified this location as not meeting the residual pressure criterion during fire flow simulation and recommended the installation of a 12-inch pipeline connecting the dead-end pipeline with a 10-inch pipe at Montague Expressway, thereby creating a service loop.

Table 5-6: Summary of Fire Flow Simulations

Node ID	Zone	Elevation (ft)	Comments	Scenario 1 (19 Gen Plan Amend.)		Scenario 2 (Transit Area Specific Plan)		Scenario 3 (19 Gen Plan Amend., Transit Area and Adj. LWU Info)	
				Demand (gpm)	Pressure (psi)	Demand (gpm)	Pressure (psi)	Demand (gpm)	Pressure (psi)
230	**SF1**	**105**	**Levin St**	**1,507**	**17**	**1,507**	**17**	**1,507**	**17**
309	**SF1**	**10**	**End of Hanson Court**	**5,010**	**-57**	**5,010**	**-57**	**5,010**	**-57**
731	SF1	15	Marylinn Dr. & Vasona St	3,026	70	3,026	70	3,026	70
2622	SF1	30	Starlite Dr. & Blue Spruce Way	1,509	59	1,509	60	1,509	59
1058	SF2	18	Calaveras Blvd & North Milpitas @ Town Center	5,010	138	5,010	138	5,010	138
3127	SF2	75	Chewpon Ave. & Dempsey Rd.	3,004	67	3,004	67	3,004	67
3502	SF2	24	Hillview & Tramway Dr.	1,538	134	1,538	134	1,538	134
601	SC1	20	McCarthy Blvd & Ranch Dr. (South end)	5,003	43	5,003	45	5,003	42
607	SC1	20	McCarthy Blvd & Ranch Dr.	5,189	31	5,189	32	5,189	30
1602	SC1	18	North end of Barber Court	5,030	50	5,030	51	5,030	49
1909	**SC1**	**16**	**Hammond Way & Sinnott Lane**	**3,098**	**7**	**3,098**	**7**	**3,098**	**6**
2509	**SC1**	**31**	**Montague Expwy & McCarthy Blvd**	**5,009**	**19.9**	**5,009**	**21**	**5,009**	**20**
2514	SC1	27	Buckeye Court	5,199	36	5,199	37	5,010	38
2710	SC1	23	Main St @ Great Mall Dr (near Fire Dept)	5,004	50	5,004	50	5,004	48
2812	SC1	35	McCandless Dr. & Montague Expwy	5,020	48	3,020	57	3,037	55
9914	**SC1**	**15**	**Railroad Ave. & Carlo St**	**5,015**	**-66**	**5,015**	**-66**	**5,015**	**-66**
2007	SC2	20	Los Coches & Topaz St	5,111	101	5,111	96	5,022	95
2908	SC2	47	Piper Dr. & Montague Expwy	5,018	66	3,138	71	3,138	69
2912	SC2	45	Gibraltar Dr.	5,083	77	5,083	70	5,083	68
3005	**SC2**	**73**	**End of Pecten Court**	**5,022**	**-5**	**5,022**	**-15**	**5,022**	**-17**

Figure 5-4: Residual Fire Flow Pressure at Node 230 located on Levin Street

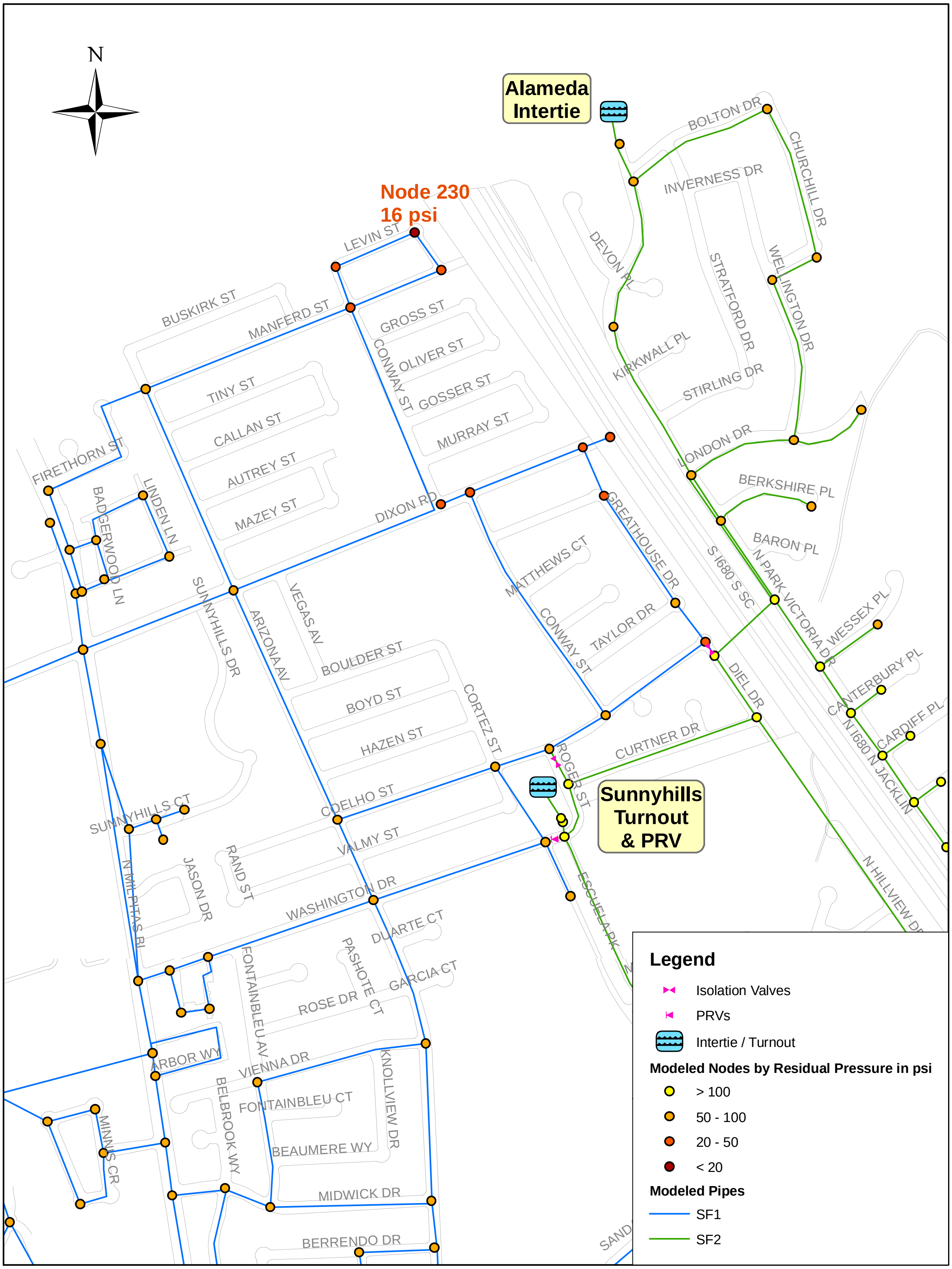


Figure 5-5: Residual Fire Flow Pressure at Node 309 located on Hanson Court

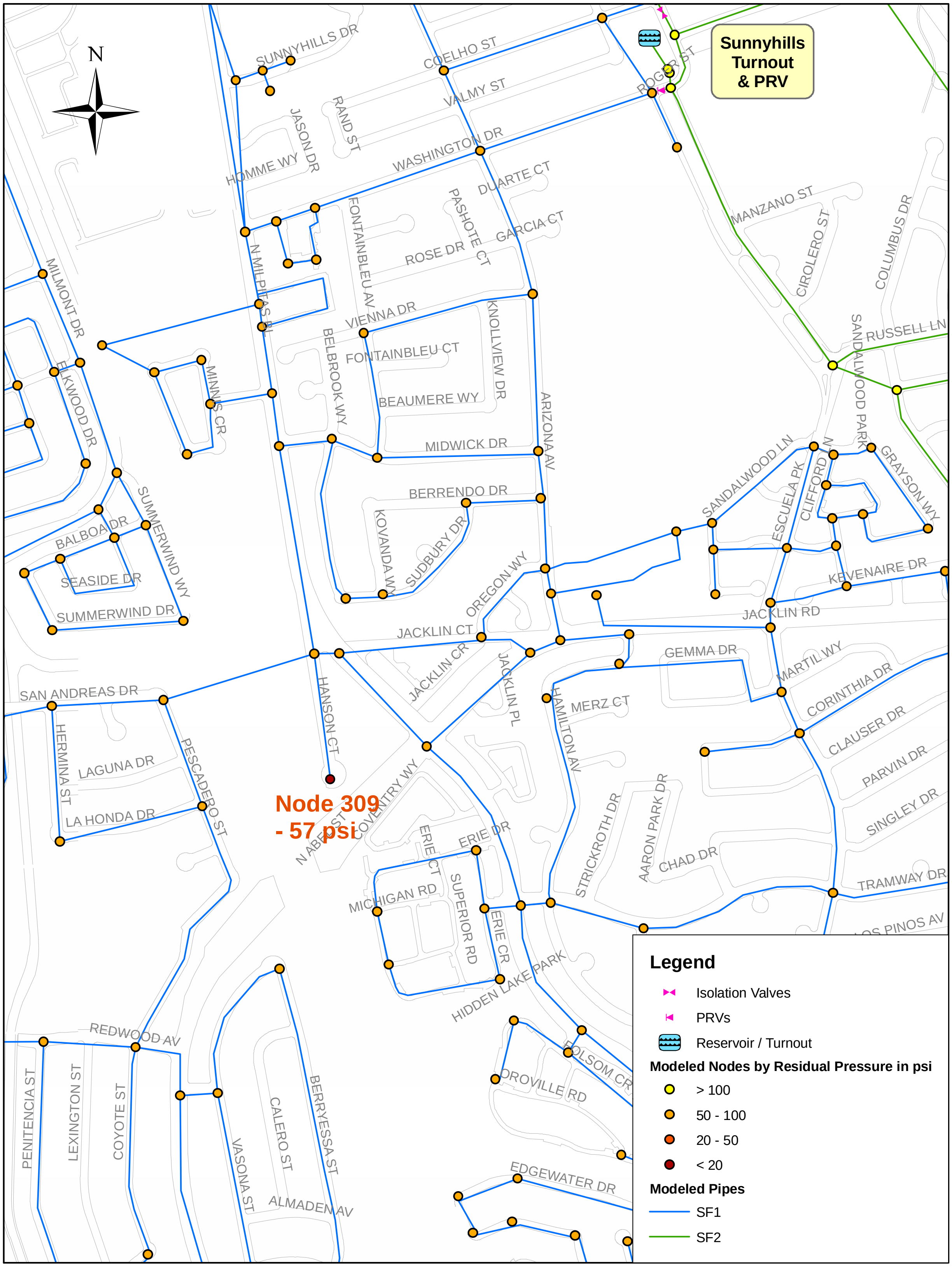


Figure 5-6: Residual Fire Flow Pressure at Node 1909 located at Hammond Way and Sinnott Lane

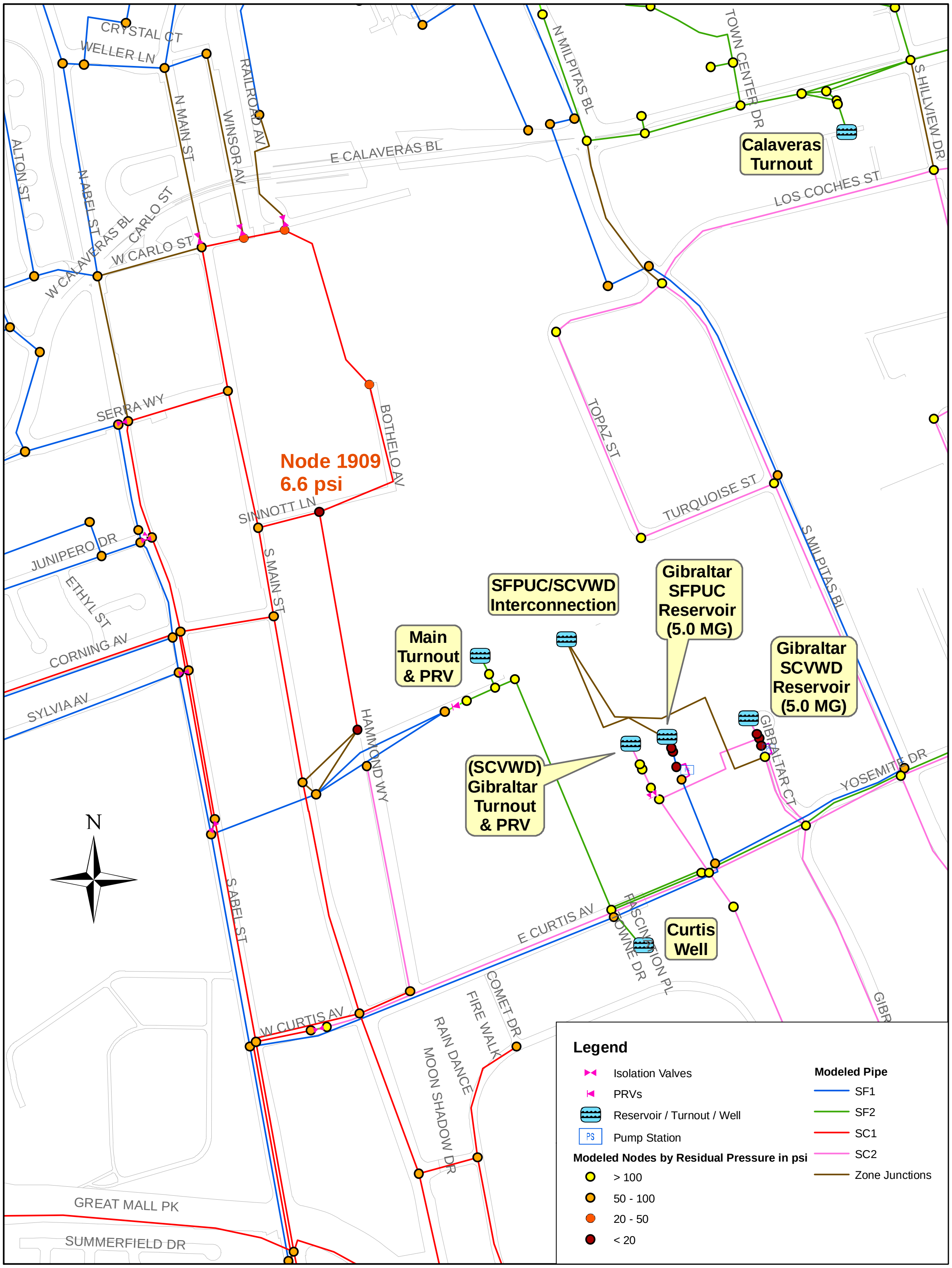


Figure 5-7:
Residual Fire Flow Pressure at Node 2509 located at Montague Expressway and McCarthy Boulevard

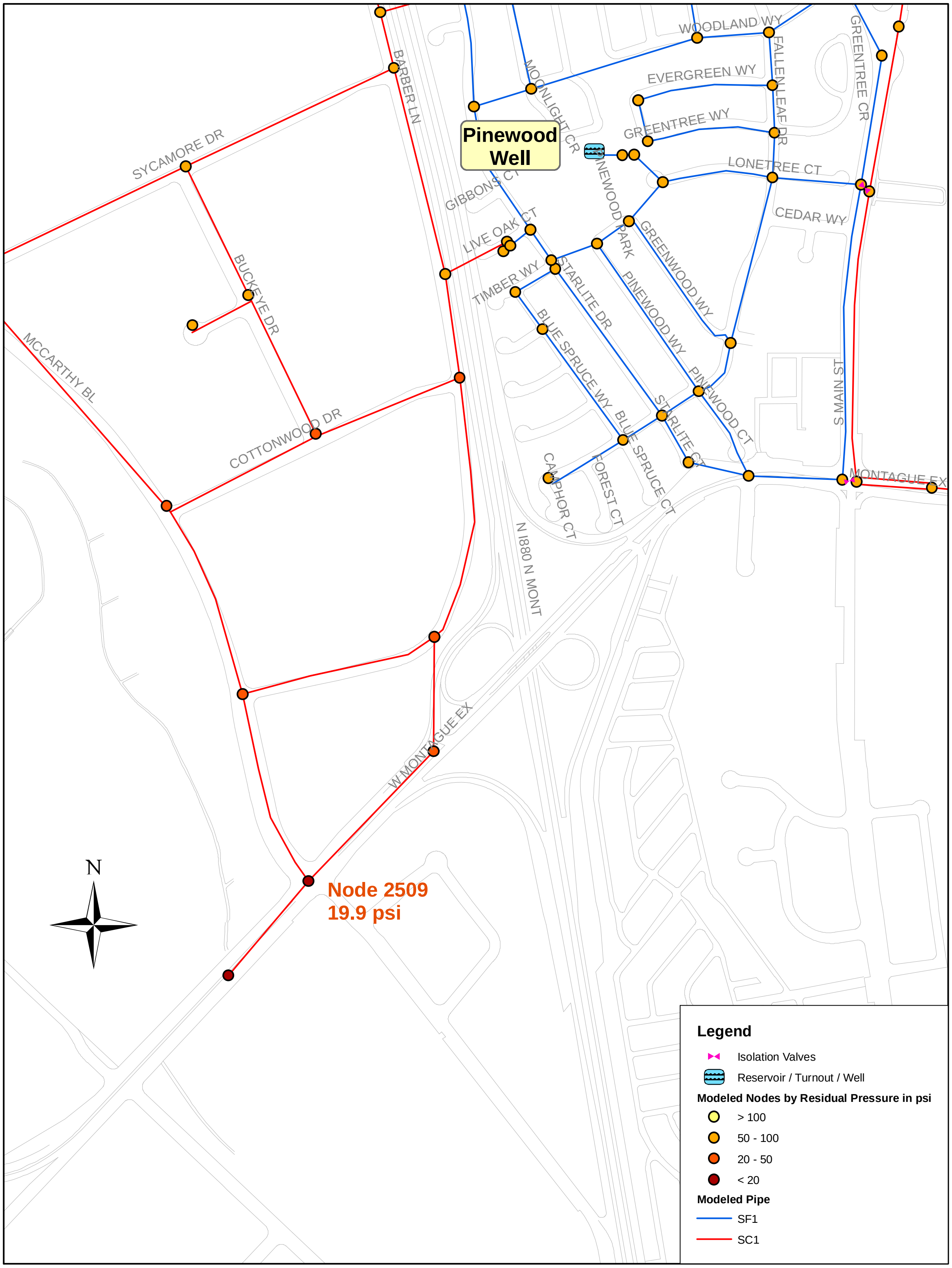


Figure 5-8: Residual Fire Flow Pressure at Node 9914 located at Railroad Avenue and Carlo Street

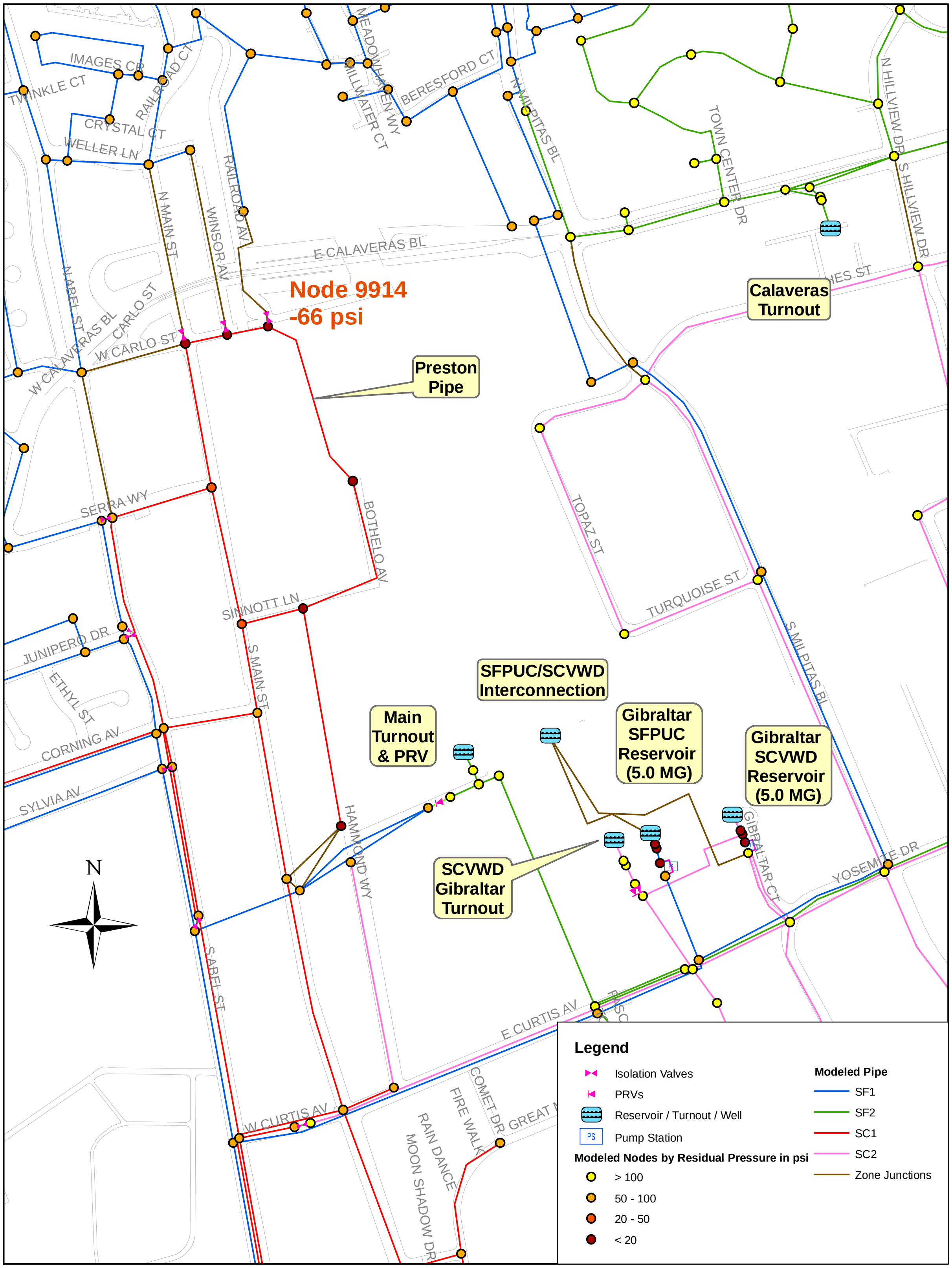
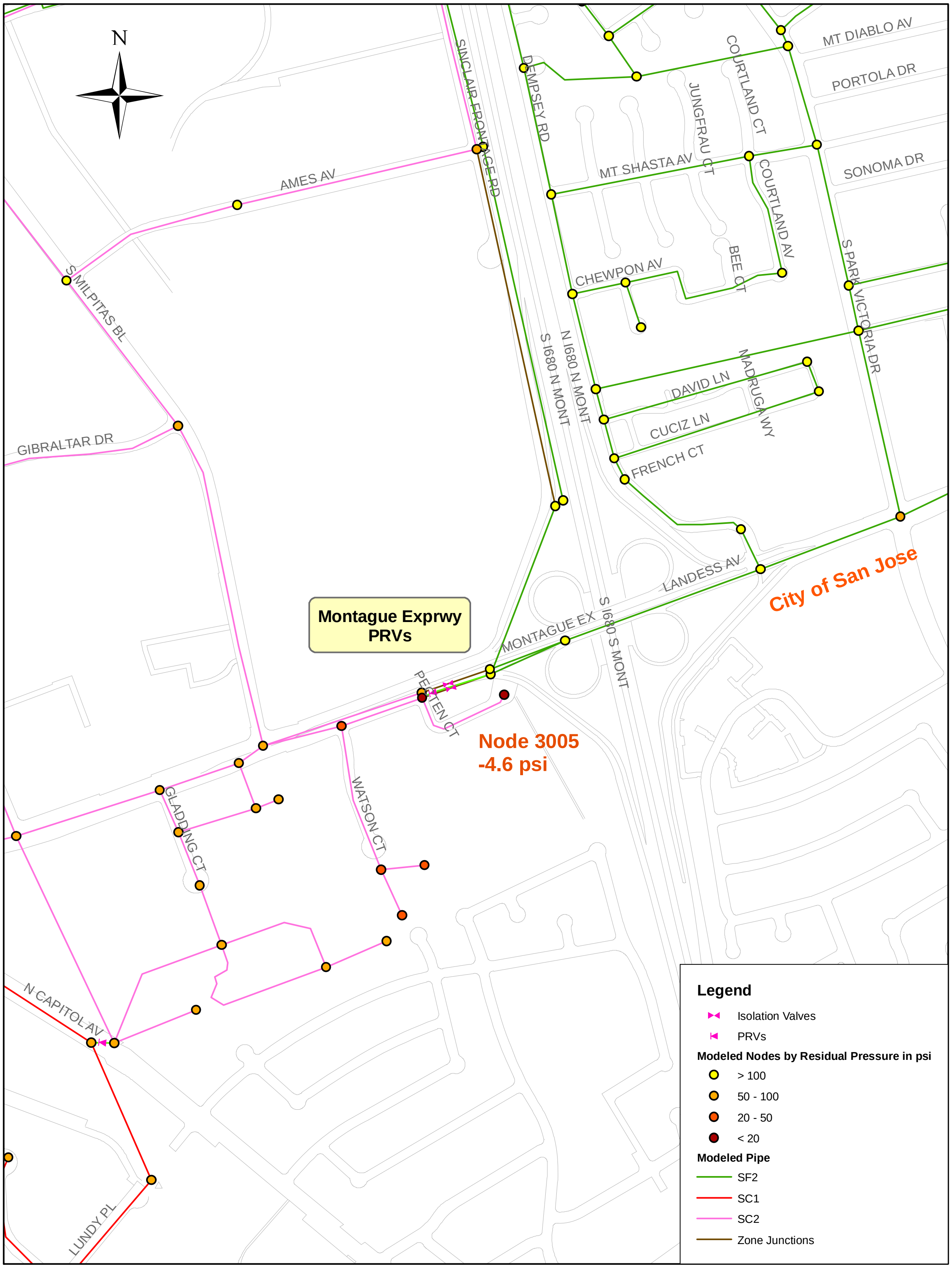


Figure 5-9: Residual Fire Flow Pressure at Node 3005 located at Pecten Court



5.2.5 Supply and Storage

The storage requirement is updated based on storage criteria and CDPH criteria as discussed in the 2002 Master Plan. The following sections discuss the methodology and summarize the results.

5.2.5.1 Impact of Recycled Water on Storage

In determining both the supply and the storage criteria, recycled water volumes will be taken into account since the maximum day demand will be reduced by the amount of recycled water used. As discussed in Section 3.2.2, the current annual recycled water use in the service area is 312,000 hundreds cubic feet (HCF). This amount has been accounted for as the water demands were based on billing data. In the build-out condition, the estimated additional recycled water use is 275,000 HCF, or 0.56 MGD. This amount was subtracted from the maximum day demand for Scenario 1 (19 General Plan Amendments).

In the buildout scenarios 2 and 3, 0.16 MGD recycled water is anticipated to be used in the Transit Area developments. This amount is part of the estimated future recycled water use of 0.56 MGD and has been accounted for in the water demand estimation of the Transit Area parcels. Therefore, a water demand reduction of 0.40 MGD, instead of 0.56 MGD, was used for the supply and storage analysis for Scenarios 2 and 3.

5.2.5.2 Supply Contract

There is no update to this section of the report. Please refer to Section 5.2.5.2 of the 2002 Water Master Plan for the content covered in this section.

5.2.5.3 Turnout Capacity

There is no update to this section of the report. Please refer to Section 5.2.5.3 of the 2002 Water Master Plan for the content covered in this section.

5.2.5.4 Emergency Wells and Storage

As discussed in the 2002 Master Plan, the City has an existing emergency well at Pinewood and is building a second well at Curtis as part of a previous CIP. The chlorination facility for the Pinewood Well will be installed during the upcoming well upgrade project while the chlorination facility for Curtis Well will be part of the well construction project. Since the City uses these groundwater sources solely for emergency purposes, groundwater production capacity at the Pinewood emergency well was converted into storage supply and used in this analysis. Curtis Well will also be included in the storage analysis since it is anticipated to be put in operation in the build-out condition. In order for the wells to be counted as emergency supplies, there must be backup power for the pumps on-site for at least 12 hours since the emergency storage criteria is defined as 50 percent, or 12 hours, of water supply at maximum day demand. The reserve power supply at the Pinewood and Curtis wells can operate the pumps for approximately 5.0 days and 5.5 days, respectively. The City has also performed pumping tests to confirm that Pinewood well can reliably produce 1.7 MGD of groundwater. Preliminary evaluation on Curtis well shows that the well can produce, based on a pumping rate of 1,200 gpm for 24 hours, 1.73 MGD of groundwater. Further testing will be conducted after the completion of the well. For the storage analysis, it was conservatively assumed that the capacity of the wells would provide one day's supply in an emergency (i.e. 1.7 MG of water supply would come from Pinewood well and 1.73 MG would come from Curtis well) even though the wells have the capability to be operated continuously for more than one day.

The CDPH does not consider wells to be part of storage facilities. Therefore, the water supply capacities of the Pinewood and Curtis Wells have been excluded from the computation of CDPH storage requirements. CDPH records indicate that Pinewood Well is classified as an active well even though the City is only using it for emergency purposes. By CDPH definition, emergency or standby sources/wells are those that are not operated more than 15 calendar days per year, and not more than five consecutive days each year. The current CDPH

Waterworks standard requires a water distribution system to have at least eight hours of storage supply at maximum day demand. The eight-hour storage supply excludes fire-fighting reserves. As **Table 5-8** shows, the distribution system was able to meet the CDPH Waterworks standard of having at least eight hours of supply, excluding fire-fighting, at maximum day demand for all zones in the City under all land use scenarios.

5.2.5.5 Storage

Using the same method as in the 2002 Water Master Plan, storage was analyzed by examining the system under two different angles: 1) dividing the City into two separate zones, SFPUC and SCVWD, and 2) assuming the entire City as one zone. The City was first analyzed as two separate zones (SFPUC and SCVWD) since there is a concern over the differing corrosion control methods applied to each source. Since zone SF1 does not deliver water to zone SF2, zone SF2 was also analyzed separately. Storage was also analyzed assuming that the City has only one zone since the two systems (SFPUC and SCVWD) are physically connected via EPRVs and isolation valves. Looking at the City as one zone provides a less conservative perspective on storage requirements, leading to water quality issues.

The results of the analysis are summarized in **Table 5-7** and **Table 5-8**, which are the replacement of Tables 5-6, 5-7, and 5-8 in the 2002 Master Plan.

Storage Analysis with Two Separate Zones: SFPUC and SCVWD

Table 5-7 shows the storage analysis for all zones. For the SFPUC service areas, reservoirs and emergency wells capacity are sufficient to meet the storage criterion on a zone-wide (i.e. SFPUC total) basis in all three scenarios. However, the City will be short of storage for the SCVWD service areas. The storage shortage for scenarios 1, 2, and 3 are 5.4 MG, 6.3 MG, and 6.6 MG respectively.

Under Scenario 1 (19 General Plan Amendments), residential zone SF2 and the total SFPUC zone have sufficient storage capacity as recommended by the storage criteria due to the construction of the Curtis Well. However, the SCVWD area is 5.4 MG short of the storage criteria recommendation. As shown in **Table 5-7**, the SCVWD zone has less than half of the storage amount recommended by the criteria.

Under Scenario 2 (Transit Area Specific Plan), residential zone SF2 and the total SFPUC zone have sufficient storage capacity as recommended by the storage criteria. However, the SCVWD area does not meet the storage criteria and is 6.3 MG short. As shown in **Table 5-7**, the SCVWD zone has less than half of the storage amount recommended by the criteria.

Under Scenario 3 (19 General Plan Amendments, Transit Area Specific Plan and updated large water users information), residential zone SF2 and the total SFPUC zone have sufficient storage capacity as recommended by the storage criteria. However, the SCVWD area does not meet the storage criteria and is 6.6 MG short. As shown in **Table 5-7**, the SCVWD zone has less than half of the storage amount recommended by the criteria.

Table 5-8 shows the amount of storage recommended CDPH criteria for all zones. For the SFPUC service areas, reservoirs capacity is sufficient to meet the storage criterion on a zone-wide (i.e. SFPUC total) basis in all three scenarios. However, the City will be short of storage for the SCVWD service areas. The storage shortage for scenarios 1, 2, and 3 are 0.6 MG, 1.0 MG, and 1.2 MG respectively.

Storage Analysis with Combined SFPUC and SCVWD zones

As shown in **Table 5-7**, analyzing the City as one zone, the storage analysis per storage criteria showed that the City would have insufficient storage in all three scenarios. Under Scenario 1 (19 General Plan Amendments), the City will be 1.8 MG short and under Scenario 2 (Transit Area Specific Plan), this shortage will be 3.2 MG. Under Scenario 3 (19 General Plan Amendments, Transit Area Specific Plan and updated large water users information), the shortage will be 3.1 MG.

Under the CDPH criteria, as shown in **Table 5-8**, the City would be under compliance with the required storage in the discussed scenarios.

Table 5-7: Storage Recommended by the Storage Volume Criteria

Zone	Maximum Day Demand[a] (MG)			Storage Volume Criteria: Operational & Emergency (20% & 50% of max. day demand)			Storage Volume Criteria: Fire Flow[b]	Total Storage Recommended by Criteria[c] (MG)			Reservoirs & Wells Capacity[d] (MG)	Surplus/Shortage Per Recommendation[e] (MG)		
Scenario[i]	1	2	3	1	2	3	All	1	2	3	All	1	2	3
Separate SFPUC and SCVWD Zones Analysis														
SF2	7.7	8.1	7.7	5.4	5.7	5.4	0.6	**6.0**	**6.3**	**6.0**	7.3[g]	1.4	1.1	1.4
Total SFPUC	15.9[f]	16.6[f]	16.0[f]	11.2	11.7	11.2	1.2	**12.4**	**12.9**	**12.4**	14.7[g,h]	2.3	1.8	2.3
SCVWD	13.1[f]	14.3[f]	14.8[f]	9.2	10.1	10.4	1.2	**10.4**	**11.3**	**11.6**	5.0	(5.4)	(6.3)	(6.6)
City of Milpitas As One Zone Analysis														
Milpitas	28.9[f]	30.9[f]	30.8[f]	20.3	21.7	21.6	1.2	**21.5**	**22.9**	**22.8**	19.7	(1.8)	(3.2)	(3.1)

Footnotes:

a. From Table 3-6
b. Assumes only one fire flow event for each zone. Commercial rate of 3,000 gpm for three hours was used in zone SF2. Industrial rate of 5,000 gpm for four hours was used in SFPUC and SCVWD zones
c. Total storage recommended = operational & emergency + fire flow
d. An in-depth discussion of how well capacity, normally rated in term of MGD, was translated into MG can be found in Section 5.2.5.4 of 2002 Master Plan Report.
e. Surplus/shortage = (reservoirs & wells capacity) – (storage recommended)
f. Future recycled water demand is estimated at 0.56 MGD for Scenario 1 and 0.40 MGD for Scenarios 2 and 3, divided equally between SFPUC and SCVWD systems, and subtracted from the maximum day demands from Table 3-6
g. Includes Curtis Well groundwater supply of 1.73 MG
h. Includes Pinewood Well groundwater supply of 1.7 MG
i. Scenario 1: 19 General Plan Amendments; Scenario 2: Transit Area Specific Plan; Scenario 3: 19 General Plan Amendments, Transit Area Specific Plan and updated large water users information.

Table 5-8: Storage Analysis per CDPH Criteria

ZONE	Storage Required[a] (MG)			Reservoir Capacity[b] (MG)			Surplus/Shortage Per Requirement[c] (MG)		
Scenario	1	2	3	1	2	3	1	2	3
Separate SFPUC and SCVWD Zones Analysis									
SF2	3.2	3.3	3.2	5.6	5.6	5.6	2.4	2.3	2.4
Total SFPUC	6.5	6.8	6.6	11.3	11.3	11.3	4.8	4.5	4.7
SCVWD	5.6	6.0	6.2	5.0	5.0	5.0	(0.6)	(1.0)	(1.2)
City of Milpitas As One Zone Analysis									
Milpitas	10.9	11.5	11.5	16.3	16.3	16.3	5.4	4.8	4.8

Footnotes:

a. CDPH Health and Safety Code Criterion requires at least 8 hours of storage supply on maximum day demand, excluding fire flow reserve
b. CDPH does not consider wells to be part of storage facilities
c. Surplus/shortage = (reservoirs capacity) – (storage required)
d. Scenario 1: 19 General Plan Amendments; Scenario 2: Transit Area Specific Plan; Scenario 3: 19 General Plan Amendments, Transit Area Specific Plan and updated large water users information

CHAPTER 6 ALTERNATIVE ANALYSIS

Chapter Synopsis: This chapter identifies and describes in detail alternatives to address the distribution system deficiencies identified in Chapter 5. It presents the approach for the alternative development and the cost estimation criteria and allocation. Table 6-1, Table 6-2, Table 6-3, Table 6-4, and Table 6-5 present the summary of the proposed improvements.

6.1 Approach for Alternative Development

The general approach and key assumptions used for developing improvements are presented in this section. Engineering judgment, assessment of the cost and general consideration of potential risk to the level of service were provided to arrive at alternatives to remedy the identified deficiencies. Improvements necessary to ensure that the system meets the existing and future capacity, supply and storage requirements were identified.

The existing and future capacity deficiencies were based on the performance criteria presented in Chapter 5.

6.2 Cost Estimation Criteria and Allocation

Preliminary cost estimates are based on bids received for recent construction projects in the Bay Area. A summary of the cost estimates are presented in **Appendix A**.

Cost estimates were adjusted using the Engineering News Records Construction Cost Index (ENR CCI). The ENR CCI is the primary index utilized by the water planning and engineering community to adjust cost estimates developed in different years. Cost estimates are developed using November 2009 ENR San Francisco ENR CCI of 9719 or the ENR 20 Cities Average CCI of 8592. All project costs are presented in November 2009 dollars and will need to be escalated to reflect the actual cost in the implementation year.

6.2.1 Pipelines Costs

Pipeline costs vary according to several factors including pipe materials, complexity of construction, traffic control, street repair, etc. The costs for the 6-inch to 12-inch pipelines averaged between $13 and $20 per lineal foot per inch of diameter for different pipe materials (steel, concrete, PVC, and DIP). These costs include pipe material and installation; appurtenances; excavation and backfill; pavement removal and replacement; allowances for limited sheeting; dewatering; shoring; contractor's overhead and profit. An average cost of $17 per lineal feet per inch of diameter was used for pipeline cost estimation.

6.2.2 Storage Tanks Costs

For storage tanks the costs average between $0.94 and $2.2 per gallon for different tank types (above grade steel tanks or buried concrete tanks), ranging in size from 0.5 to 10 MG. The costs include foundation, site preparation, inlet and outlet piping, mechanical controls. The costs do not include land acquisition and contingency costs. An average cost of $1.7 per gallon was used for the tank cost estimation. Pumping cost was estimated to be $3,770 per horsepower.

6.2.3 Well Costs

Well cost estimates were based on the amount of construction cost of the new Curtis Well and City of Milpitas Utility Depreciation Study. The estimated cost is $1.01 per gallon per day. This cost does not include land acquisition and contingency costs.

6.2.4 Property Easements and Right of Way Costs

Acquisition of property, easements, and right-of-way (ROW) will be required for some of the recommended projects, particularly new reservoir facilities. Land costs in Santa Clara County vary considerably between and within jurisdictions. Market factors, especially the desirability of the location, play a dominant role in setting property values. Local land costs are not easily determined, particularly in the master planning phase, and variables affecting properties can result in widely varying land prices. Therefore land costs will were not included in this CIP.

6.2.5 Other Costs

Two categories of costs will be included for each facility: a construction contingency and a project implementation multiplier. These costs will be applied similarly for all facilities identified in this CIP.

The construction contingency of 30% of the initial estimate of facility cost will be applied to determine the construction estimate. A construction contingency is necessary due to unforeseen construction that cannot be anticipated with a master planning phase review. The construction contingency is added to compensate for the planning level estimation.

The project implementation multiplier will be applied at a rate of 30% of the total construction estimate (initial estimate plus 30% construction contingency). The project implementation multiplier includes:

- Administration costs
- Environmental assessments and permits
- Planning & engineering design
- Construction administration and management
- Legal fees

These percentages are considered to be appropriate for master planning level estimates. Prior to design and construction of recommended improvements, these costs should be reevaluated as necessary to reflect current construction and ENR index trends.

6.3 Description of Alternatives

Improvement alternatives for the identified deficiencies are described in this section. Deficiencies in the same proximity were grouped together in the alternative analysis due to hydraulic interconnection of the pipelines involved. In addition to pipeline improvement, a turnout analysis was conducted for each of the scenarios. The results are presented in Table 6-1, Table 6-2, Table 6-3, Table 6-4, and Table 6-5, combining which replaces Table 6-1 in the 2002 Master Plan. **Table 6-1**, **Table 6-2**, and **Table 6-3** define the deficiency location, cause and scenario, and the improvements proposed for Scenarios 1, 2, and 3 respectively. The alternatives for deficiencies under the fire flow simulation for all scenarios are the same and are presented in **Table 6-4**. **Table 6-5** summarizes the proposed improvements for storage deficiencies in the three scenarios.

Table 6-1: Summary of Proposed Pipe Improvement Alternatives for Scenario 1

Alt	No.[a]	Zone	H2OMAP ID	Location	Issue	Improvements	2009 Cost[b]	Recommended CIP
1A	5&6	SC1 & SC2	227 & 212	Curtis Avenue before and after PRV	High Velocity and Excessive Headloss	Replace 320 LF of 18-in pipe with 26-in pipe, Replace 2,300 LF of 18-in pipe with 26-in pipe and Upsize 18-inch PRV to 26 inch.	$2,090,000	No
	7&8	SC2	9805 & 213	Gibraltar Turnout	High Velocity and Excessive Headloss	Replace 10 LF of 24-in pipe with 30-in pipe, Upsize 24-inch PRV to 30 inch., Replace 750 LF of 18-in pipe with 30-in pipe	$790,000	
						OR		
						Construct 10 LF of 28-in pipe parallel to existing pipe 9805, Install a 28-in PRV, Construct 750 LF of 28-in pipe parallel to existing pipe 213	$730,000	
						Total	**$2,880,000 or $2,820,000**	
OR								
1B	Turnout Analysis	SC2	Turnout	Montague Expwy and Piper Court	High Velocity and Excessive Headloss	Construct a new 20-inch Turnout	**$2,450,000**	Yes
			227 & 212	Curtis Avenue before and after PRV	High Velocity and Excessive Headloss	Replace 320 LF of 18-in pipe with 26-in pipe, Replace 2,300 LF of 18-in pipe with 26-in pipe and Upsize 18-inch PRV to 26 inch.		

Footnotes:

a. Deficiency Number based on Table 5-3.

b. Based on $17/in/LF for pipes, and PRV quotes. SFENR CCI 9719 (November 2009)/20 Cities Average CCI 8592 (November 2009) and a contingency of 30% for construction and 30% for implementation were used. Contingency includes design, construction management, utility coordination, environmental assessments, administration costs and planning level estimating coverage. Some of the City's documents published prior to 2009 referenced the costs of these projects in August 2007 dollar, which used SFENR CCI 9072/20 Cities Average CCI 8007.

Table 6-2: Summary of Proposed Pipe Improvement Alternatives for Scenario 2

Alt	No.[a]	Zone	H2OMAP ID	Location	Issue	Improvements	2009 Cost[b]	Recommended CIP
2A	5&6	SC1 & SC2	227 & 212	Curtis Avenue before and after PRV	High Velocity and Excessive Headloss	Replace 320 LF of 18-in pipe with 26-in pipe, Replace 2,300 LF of 18-in pipe with 26-in pipe and Upsize 18-inch PRV to 26 inch.	$2,090,000	No
	7&8	SC2	9805 & 213	Gibraltar Turnout	High Velocity and Excessive Headloss	Replace 10 LF of 24-in pipe with 32-in pipe, Upsize 24-inch PRV to 32 inch., Replace 750 LF of 18-in pipe with 32-in pipe	$840,000	
						OR		
						Construct 10 LF of 28-in pipe parallel to existing pipe 9805, Install a 28-in PRV, Construct 750 LF of 28-in pipe parallel to existing pipe 213	$730,000	
	12	SC2	2527 & 2563	Along Montague near S. Milpitas & Gladding Court	High Velocity and Excessive Headloss	Replace 450 LF of 10-in pipe with 14-in pipe and Replace 160 LF of 10-in pipe with 18-in pipe	$300,000	
						Total	**$3,230,000 or $3,120,000**	
				OR				
2B	Turnout Analysis	SC2	Turnout	Montague Expwy and Piper Court	High Velocity and Excessive Headloss	Construct a new 20-inch Turnout	**$2,950,000**	Yes
			213, 227 & 212	SCVWD Turnout at Gibraltar & Curtis Avenue before and after PRV		Construct 750 LF of 22-in pipe parallel to existing pipe 213, Replace 320 LF of 18-in pipe with 26-in pipe, Replace 2,300 LF of 18-in pipe with 26-in pipe & Upsize 18-inch PRV to 26 inch.		

Footnotes:

a. Deficiency Number based on Table 5-4.

b. Based on $17/in/LF for pipes, and PRV quotes. SFENR CCI 9719 (November 2009)/20 Cities Average CCI 8592 (November 2009) and a contingency of 30% for construction and 30% for implementation were used. Contingency includes design, construction management, utility coordination, environmental assessments, administration costs and planning level estimating coverage. Some of the City's documents published prior to 2009 referenced the costs of these projects in August 2007 dollar, which used SFENR CCI 9072/20 Cities Average CCI 8007.

Table 6-3: Summary of Proposed Pipe Improvement Alternatives for Scenario 3

Alt	No.[a]	Zone	H2OMAP ID	Location	Issue	Improvements	2009 Cost[b]	Recommended CIP
3A	6&7	SC1 & SC2	227 & 212	Curtis Avenue before and after PRV	High Velocity and Excessive Headloss	Replace 320 LF of 18-in pipe with 26-in pipe, Replace 2,300 LF of 18-in pipe with 26-in pipe and Upsize 18-inch PRV to 26 inch.	$2,090,000	No
	8&9	SC2	9805 & 213	Gibraltar Turnout	High Velocity and Excessive Headloss	Replace 10 LF of 24-in pipe with 32-in pipe, Upsize 24-inch PRV to 32 inch., Replace 750 LF of 18-in pipe with 32-in pipe	$840,000	
						OR		
						Construct 10 LF of 30-in pipe parallel to existing pipe 9805, Install a 30-in PRV, Construct 750 LF of 30-in pipe parallel to existing pipe 213	$790,000	
	13	SC2	2527 & 2563	Along Montague near S. Milpitas & Gladding Court	High Velocity and Excessive Headloss	Replace 450 LF of 10-in pipe with 14-in pipe and Replace 160 LF of 10-in pipe with 18-in pipe	$300,000	
						Total	**$3,230,000 or $3,180,000**	
				OR				
3B	Turnout Analysis	SC2	Turnout	Montague Expwy and Piper Court	High Velocity and Excessive Headloss	Construct a new 20-inch Turnout	**$2,950,000**	Yes
			213, 227 & 212	SCVWD Turnout at Gibraltar & Curtis Avenue before and after PRV		Construct 750 LF of 22-in pipe parallel to existing pipe 213, Replace 320 LF of 18-in pipe with 26-in pipe, Replace 2,300 LF of 18-in pipe with 26-in pipe & Upsize 18-inch PRV to 26 inch.		

Footnotes:
a. Deficiency Number based on Table 5-5.
b. Based on $17/in/LF for pipes, and PRV quotes. SFENR CCI 9719 (November 2009)/20 Cities Average CCI 8592 (November 2009) and a contingency of 30% for construction and 30% for implementation were used. Contingency includes design, construction management, utility coordination, environmental assessments, administration costs and planning level estimating coverage. Some of the City's documents published prior to 2009 referenced the costs of these projects in August 2007 dollar, which used SFENR CCI 9072/20 Cities Average CCI 8007.

Table 6-4: Summary of Proposed Improvement for Fire Flow Simulation in all Scenarios

Zone	H2OMAP ID	Location	Issue	Improvements	2009 Cost[a]	Recommended CIP
SF1	Node 207	Dixon Rd. & I-680	Low Pressure	Install pressure reducing valves and open/close isolation valves[b]	$225,000[c]	Yes
SF1	Node 230	Levin Street	Low Pressure			
SF1	Node 309	Hanson Court	Low Pressure	Construct 950 LF of 12-inch pipe connecting the dead-end at Hanson Court to N. Milpitas Blvd.	$356,000	No
SC1	Node 1909	Hammond Way & Sinnott Lane	Low Pressure and Reliability	Construct 300LF of 8-in pipe connecting the dead-end on Hammond Way to Main Street	$89,000	No
SC1	Node 9914	Railroad Avenue & Carlo Street	Low Pressure and Reliability	Construct 300 LF of 12-in pipe to three dead-end pipes, one on Abel and two on Carlo Street. Also parallel 260 LF of the existing 8-in pipe on Carlo with a 6-in pipe	$412,000[d]	Yes
SC2	Node 3005	Pecten Court	Low Pressure	Construct 150 LF of 12-in pipe connecting the dead-end point at Pecten Court to 10-inch pipe at Montague Expressway	$292,000[d]	Yes

Footnotes:

a. Based on $17/in/LF for pipes, and PRV quotes. SFENR CCI 9719 (November 2009)/20 Cities Average CCI 8592 (November 2009) and a contingency of 30% for construction and 30% for implementation were used. Contingency includes design, construction management, utility coordination, environmental assessments, administration costs and planning level estimating coverage. Some of the City's documents published prior to 2009 referenced the costs of these projects in August 2007 dollar, which used SFENR CCI 9072/20 Cities Average CCI 8007.

b**.** An alternative option to the installation of PRVs for all service connections would be to create a sub-zone "SF1-a" for this area for $40,000.

c. Construction costs are based on City of Milpitas *Sunnyhills Low Pressure Area Revision Study* dated January 2001 and escalated to FY2009 Dollars.

d. Includes $100,000 for boring and jacking under the Railroad or Montague Expressway.

Table 6-5: Summary of Proposed Storage Improvement

H2OMAP ID	Location	Issue	Improvements	2009 Cost[a]	Recommended CIP
Scenario 1 (19 General Plan Amendments)					
N/A	SCVWD service area	Insufficient Storage	Construct a 5.4 MG Tank (Incl. pump)	$17,970,000	Yes
			OR		
			Construct a 3,300-gpm Well	$8,160,000	
Scenario 2 (Transit Area Specific Plan)					
N/A	SCVWD service area	Insufficient Storage	Construct a 6.3 MG Tank (Incl. pump)	$21,160,000	Yes
			OR		
			Construct a 4,100-gpm Well	$10,130,000	
Scenario 3 (19 General Plan Amendments, Transit Area Specific Plan and updated large water users information)					
N/A	SCVWD service area	Insufficient Storage	Construct a 6.6 MG Tank (Incl. pump)	$22,260,000	Yes
			OR		
			Construct a 4,400-gpm Well	$10,870,000	

Footnotes:

a. Based on $1.7/gal for tanks and $1.01/gal/d for wells. SFENR CCI 9719 (November 2009)/20 Cities Average CCI 8592 (November 2009) and a contingency of 30% for construction and 30% for implementation were used. Contingency includes design, construction management, utility coordination, environmental assessments, administration costs and planning level estimating coverage. Some of the City's documents published prior to 2009 referenced the costs of these projects in August 2007 dollar, which used SFENR CCI 9072/20 Cities Average CCI 8007.

Sections 6.3.1, 6.3.2, and 6.3.3 in the 2002 Master Plan discuss the alternatives for deficiencies under the peak hour condition for the three land use scenarios discussed in previous chapters. The new content will replace the discussion covered in these sections in the 2002 Master Plan.

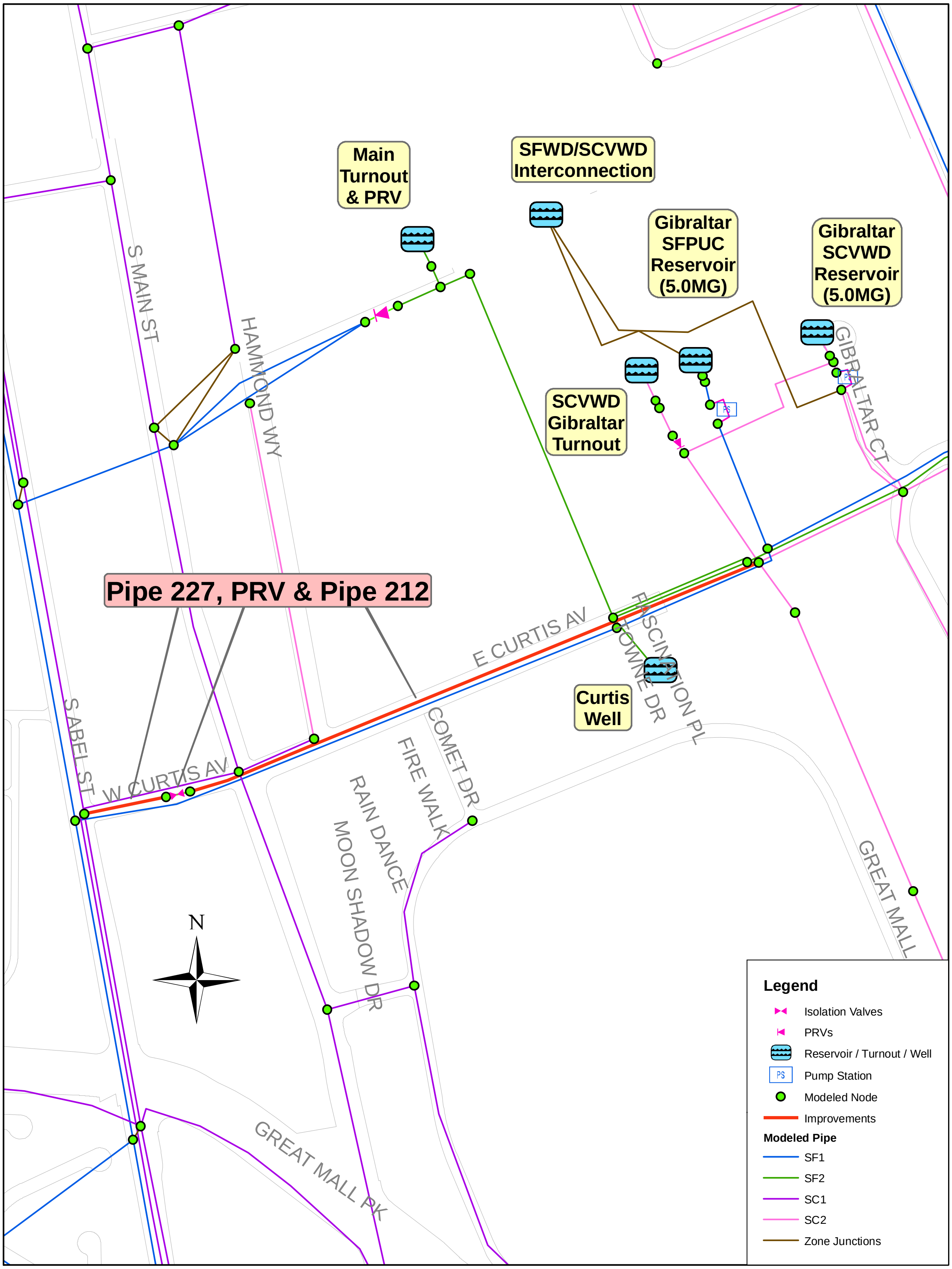
6.3.1 Alternatives for Deficiencies Under Scenario 1 (19 General Plan Amendments)

Under scenario 1, a number of pipelines, as shown in Table 5-2, will be unable to meet the headloss criteria. However, since the pressure and velocity criteria were met for all demand nodes and pipelines, it is recommended that the City keep track of these pipes for future references, monitor the system pressures to determine if a problem develops, and not undertake any capital improvement projects to mitigate the deficiencies at this time. Two alternatives were suggested – (1A) improving pipes 227, 212, 9505 and 213, and (1B) adding a new turnout and improving pipes 227 and 212. The results are presented in the following section.

6.3.1.1 Alternative 1A (Part 1) – Deficiency No. 5 & 6 Curtis Avenue

This project involves pipes 227 and 212, and the 18-inch pressure reducing valve (PRV) in between the two pipes. To reduce the headloss in these two pipes, upsize the pipes and the PRV from the current size of 18 inches to 26 inches at an estimated cost of $2,090,000 in FY 2009 dollars. Paralleling option is not recommended as there are multiple sewer pipelines in the project area. **Figure 6-1** shows the project area.

Figure 6-1: Alternative Projects on Curtis Avenue



6.3.1.2 Alternative 1A (Part 2) – Deficiency No. 7 & 8 Gibraltar Turnout

This project involves Pipes 9805 and 213 located at the SCVWD Turnout (**Figure 6-2**). In the 2002 Master Plan, pipe 213 was also identified as deficient and was recommended as part of the CIP. To reduce the headloss on these pipes, two options are available – (1) Upsize the current pipes and PRV as shown in **Table 6-6**, or (2) construct pipes and additional PRV parallel to the current sewer pipelines as shown in **Table 6-7**.

The replacement option might be easier to construct since there would be no need for new right-of-way acquisition or easement for additional pipelines, though the disruption of water service during installation would also have to be taken into consideration to more accurately determine the most effective option. Though a parallel piping option may cause installation difficulties, in the long term it would also provide redundancy in the system once the installation is complete.

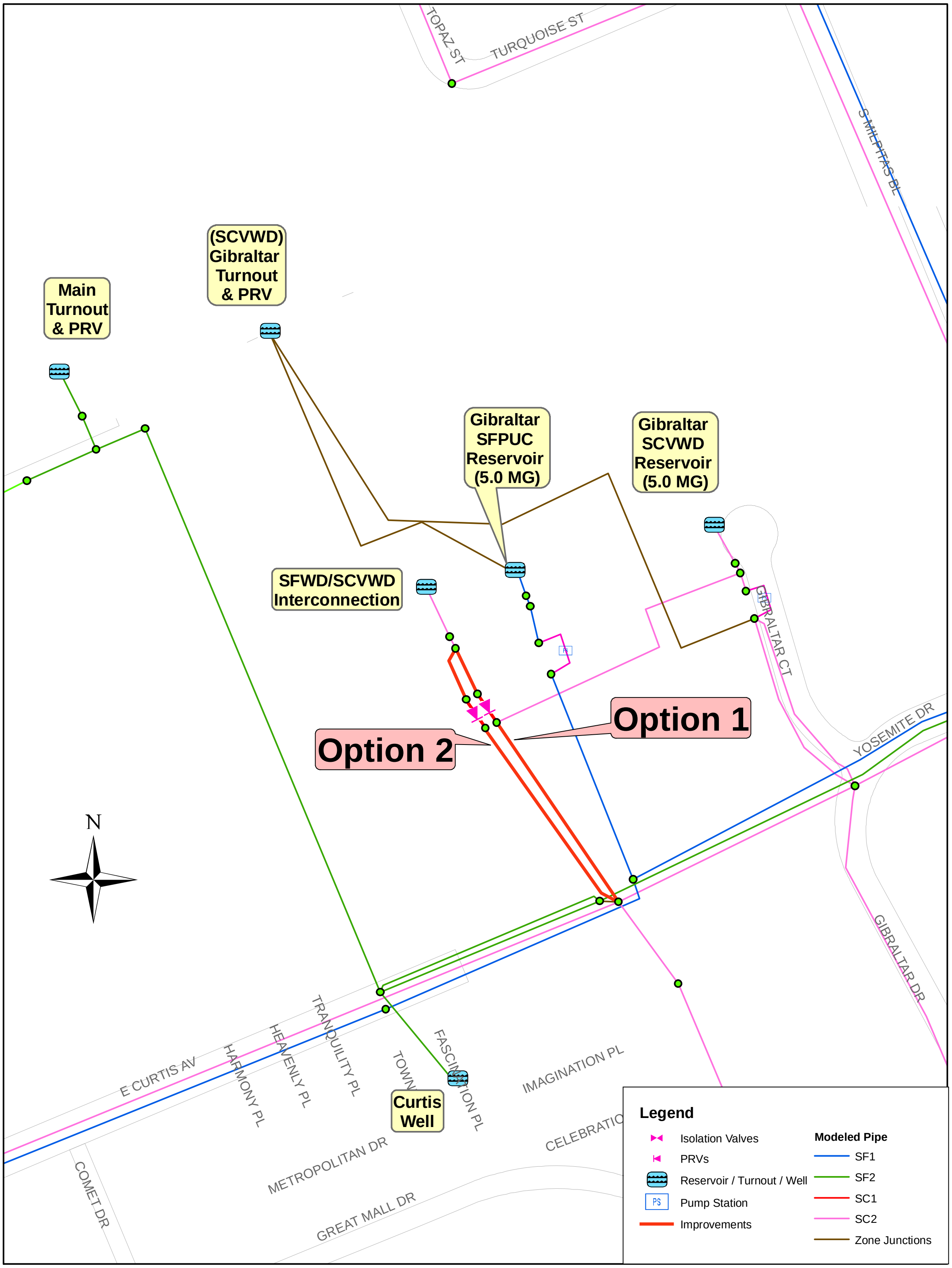
Table 6-6: Estimated Cost for Proposed Improvements at Gibraltar Turnout – Option 1

Pipe ID	Current Size (inch)	New Size (inch)	Estimated Cost (FY 2009 Dollars)
9805	24	30	$20,000
PRV	24	30	$100,000
213	18	30	$670,000
		Total	**$790,000**

Table 6-7: Estimated Cost for Proposed Improvements at Gibraltar Turnout – Option 2

Pipe ID	Size of Original Pipe (inch)	Size of Parallel Pipe (inch)	Estimated Cost (FY 2009 Dollars)
9805	24	28	$20,000
PRV	24	28	$80,000
213	18	28	$630,000
		Total	**$730,000**

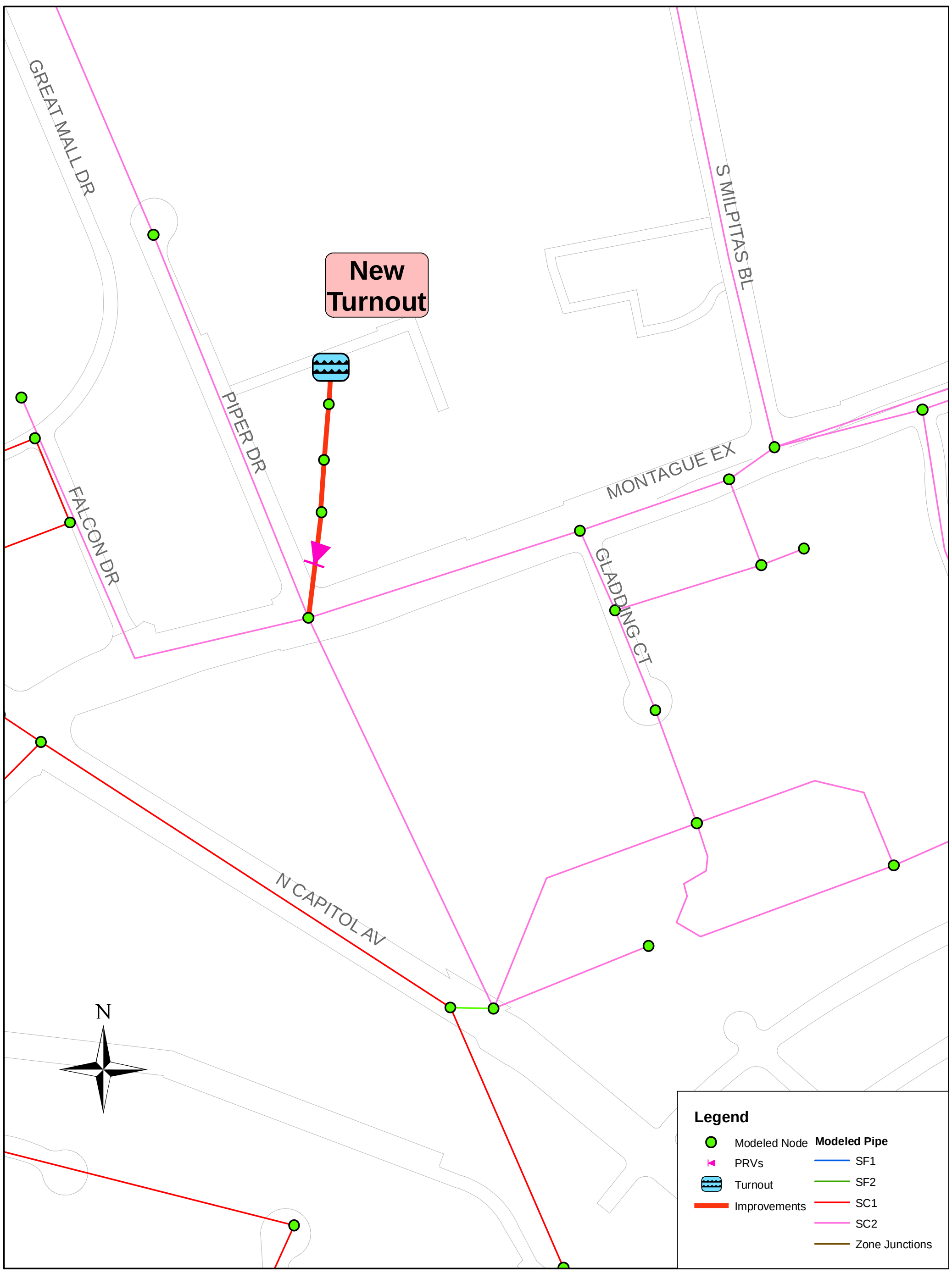
Figure 6-2: Alternative Projects at Gibraltar Turnout



6.3.1.3 Alternative 1B - Turnout Analysis

In the turnout analysis, a new 20-inch turnout with the same capacity as the existing SCVWD Gibraltar Turnout was added at the intersection of Montague Expressway and Piper Drive as an improvement to the system (**Figure 6-3**). In addition to the new turnout, pipes 227, 212 and the PRV between the two pipes need to be upsized from 18 inch to 26 inch in order to resolve all deficiencies in the system. The estimated total cost is $2,450,000 in 2009 dollars. This turnout will connect to the SCVWD pipeline, assuming that pressure at the Gibraltar turnout will not be impacted to the point that flow capacity is limited.

Figure 6-3: Proposed Turnout



6.3.2 Alternatives for Deficiencies Under Scenario 2 (Transit Area Specific Plan)

Under scenario 2, a number of pipelines, as shown in Table 5-3, will be unable to meet the headloss criteria. However, since the pressure and velocity criteria were met for all demand nodes and pipelines, it is recommended that the City keep track of these pipes for future references, monitor the system pressures to determine if a problem develops, and not undertake any capital improvement projects to mitigate the problem at this time. Two alternatives were suggested – (2A) improving pipes 227, 212, 9505, 213, 2527 and 2563, and (2B) adding a new turnout and improving pipes 213, 227 and 212. The results are presented in the following section.

6.3.2.1 Alternative 2A (Part 1) - Deficiency No. 5 & 6 Curtis Avenue

The suggested improvement for this location is the same as that in scenario 1 (19 General Plan Amendments). Refer to Section 6.3.1.1 for details.

6.3.2.2 Alternative 2A (Part 2) - Deficiency No. 7 & 8 Gibraltar Turnout

This project involves Pipes 9805 and 213 located at the SCVWD Turnout (Figure 6-2 in Section 6.3.1.2). In the 2002 Master Plan, pipe 213 was also identified as deficient and was recommended as part of the CIP. To reduce the headloss on these pipes, two options are available – (1) Upsize the current pipes and PRV as shown in **Table 6-8**, or (2) construct pipes and additional PRV parallel to the current sewer pipelines as shown in **Table 6-9**.

The replacement option might be easier to construct since there would be no need for new right-of-way acquisition or easement for additional pipelines, though the disruption of water service during installation would also have to be taken into consideration to more accurately determine the most effective option. Though a parallel piping option may cause installation difficulties, in the long term it would also provide redundancy in the system once the installation is complete.

Table 6-8: Estimated Cost for Proposed Improvements at Gibraltar Turnout – Option 1

Pipe ID	Current Size (inch)	New Size (inch)	Estimated Cost (FY 2009 Dollars)
9805	24	32	$20,000
PRV	24	32	$100,000
213	18	32	$720,000
		Total	**$840,000**

Table 6-9: Estimated Cost for Proposed Improvements at Gibraltar Turnout – Option 2

Pipe ID	Size of Original Pipe (inch)	Size of Parallel Pipe (inch)	Estimated Cost (FY 2009 Dollars)
9805	24	28	$20,000
PRV	24	28	$80,000
213	18	28	$630,000
		Total	**$730,000**

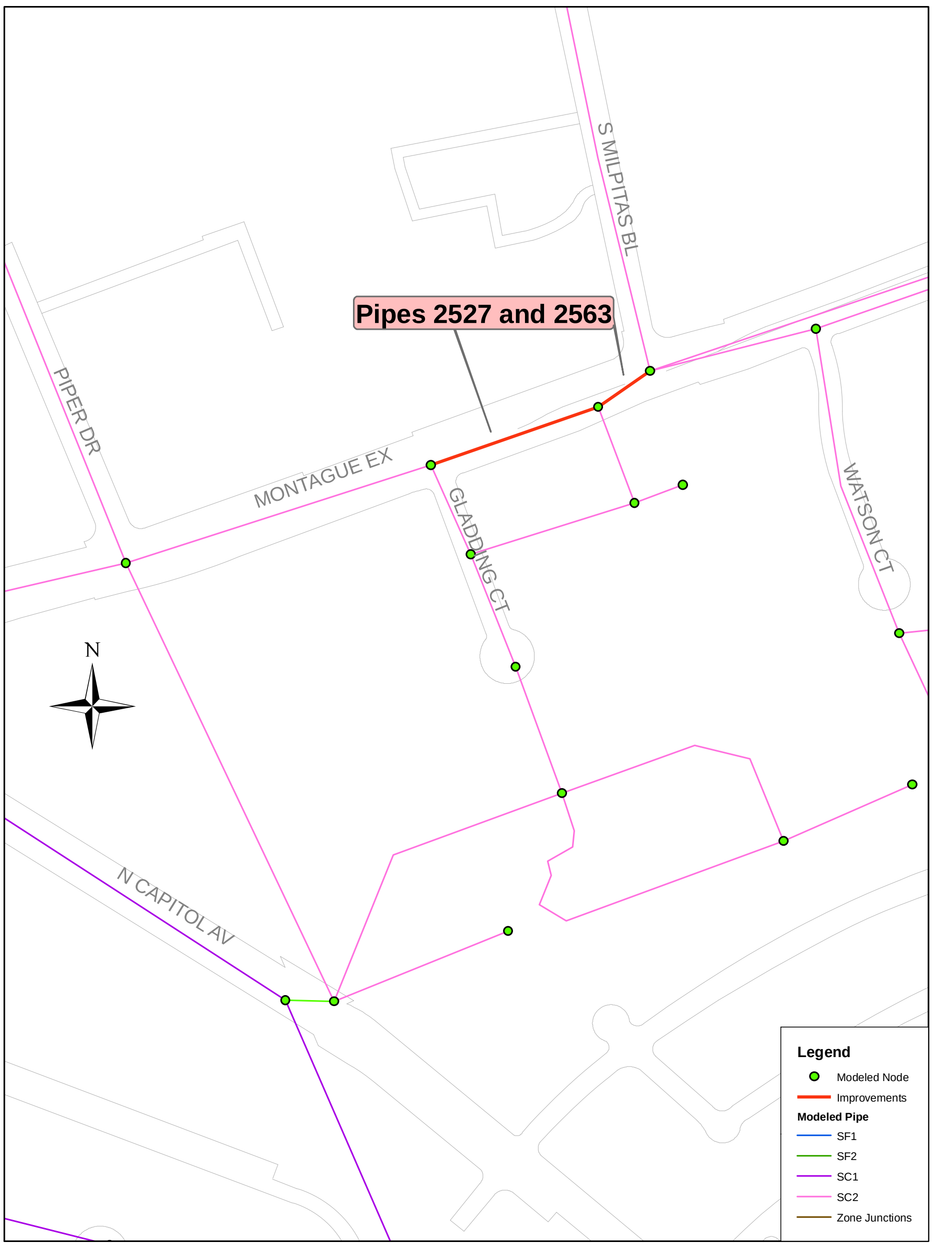
The suggested improvement for this location is similar to that in Scenario 1 (19 General Plan Amendments). Refer to Figure 6-2 for map showing project alternatives.

6.3.2.3 Alternative 2A (Part 3) - Deficiency No. 12 Montague Expressway near South Milpitas Boulevard

Under scenario 2 (Transit Area Specific Plan), pipe 2563 will be unable to meet both the headloss and velocity criteria. The alternative project also includes pipe 2527 which is the pipeline downstream of pipe 2563 (Figure 6-4). These two pipes are grouped for alternative analysis because of their hydraulic connectivity. To reduce the headloss and velocity on these two pipes, replace 450 feet of the existing 10-inch pipe 2527 by a 14-inch pipeline and 160 feet of the existing 10-inch pipe 2563 by a 18-inch pipeline at an estimated total cost of $300,000 in 2009 dollar.

Parallel option is not suggested because the project location resides on major streets where a considerable number of existing utilities are present.

Figure 6-4: Alternative Projects at Montague Expressway near South Milpitas Boulevard



6.3.2.4 Alternative 2B - Turnout Analysis

A new turnout was also considered for scenario 2 (Transit Area Specific Plan). The new turnout will also be 20-inch and added to the intersection of Montague Expressway and Piper Drive. Along with the new turnout, a few pipe improvements are necessary to resolve all deficiencies in the system. The suggested improvements for the turnout analysis are summarized in **Table 6-10**.

Table 6-10: Suggested Improvements for Turnout Analysis

Pipe ID	Improvements	Estimated Cost (FY 2009 Dollars)
Turnout	Construct a new 20-in turnout	$360,000
213	Construct 750 LF of 22-in pipe parallel to existing pipe	$500,000
227	Replace 320 LF of existing 18-in pipe with 26-in pipe	$250,000
212	Replace 2,300 LF of existing 18-in pipe with 26-in pipe	$1,760,000
PRV between pipes 227 and 212	Upsize 18-in PRV to 26 inch	$80,000
	Total	**$2,950,000**

With the new turnout and suggested pipe improvements, all pipes in the network will be able to meet the velocity criteria. This turnout will connect to the SCVWD pipeline, assuming that pressure at the Gibraltar turnout will not be impacted to the point that flow capacity is limited. Refer to Figure 6-3 for map showing turnout location.

6.3.3 Alternatives for Deficiencies Under Scenario 3

Under scenario 3, a number of pipelines, as shown in Table 5-5 will be unable to meet the headloss criteria. However, since the pressure and velocity criteria were met for all demand nodes and pipelines, it is recommended that the City keep track of these pipes for future references, monitor the system pressures to determine if a problem develops, and not undertake any capital improvement projects to mitigate the problem at this time. Two alternatives were considered – (3A) improving pipes 227, 212, 9805, 213, 2527 and 2563, and (3B) adding a new turnout and improving pipes 213, 227 and 212. The results are presented in the following section.

6.3.3.1 Alternative 3A (Part 1) – Deficiency No. 6 & 7 Curtis Avenue

The suggested improvement for this location is the same as that in scenario 1 (19 General Plan Amendments). Refer to Section 6.3.1.1 for details.

6.3.3.2 Alternative 3A (Part 2) – Deficiency No. 8 & 9 Gibraltar Turnout

This project involves Pipes 9805 and 213 located at the SCVWD Turnout (Figure 6-2 in Section 6.3.1.2). In the 2002 Master Plan, pipe 213 was also identified as deficient and was recommended as part of the CIP. To reduce the headloss on these pipes, two options are available – (1) Upsize the current pipes and PRV as shown in **Table 6-11**, or (2) construct pipes and additional PRV parallel to the current sewer pipelines as shown in **Table 6-12**.

The replacement option might be easier to construct since there would be no need for new right-of-way acquisition or easement for additional pipelines, though the disruption of water service during installation would also have to be taken into consideration to more accurately determine the most effective option. Though a parallel piping option may cause installation difficulties, in the long term it would also provide redundancy in the system once the installation is complete.

Table 6-11: Estimated Cost for Proposed Improvements at Gibraltar Turnout – Option 1

Pipe ID	Current Size (inch)	New Size (inch)	Estimated Cost (FY 2009 Dollars)
9805	24	32	$20,000
PRV	24	32	$100,000
213	18	32	$720,000
		Total	**$840,000**

Table 6-12: Estimated Cost for Proposed Improvements at Gibraltar Turnout – Option 2

Pipe ID	Size of Original Pipe (inch)	Size of Parallel Pipe (inch)	Estimated Cost (FY 2009 Dollars)
9805	24	30	$20,000
PRV	24	30	$100,000
213	18	30	$670,000
		Total	**$790,000**

The suggested improvement for this location is similar to that in scenario 1 (19 General Plan Amendments). Refer to Figure 6-2 for map showing project alternatives.

6.3.3.3 Alternative 3A (Part 3) – Deficiency No. 13 Montague Expressway near South Milpitas Boulevard

The suggested improvement for this location is the same as that in scenario 1 (19 General Plan Amendments). Refer to Section 6.3.2.3 for details.

6.3.3.4 Alternative 3B – Turnout Analysis

The suggested improvement for this location is the same as that in scenario 1 (19 General Plan Amendments). Refer to Section 6.3.2.4 for details.

6.3.4 Alternatives for Deficiencies Under Fire Flow Simulation

Fire flow simulations indicated that the City has six locations in zones SF1, SC1 and SC2 failing to meet the minimum residual pressure criterion of 20 psi in the three land use scenarios. Five of these locations, nodes 230, 309, 1909, 9914 and 3005, were also identified as deficient in the 2002 Master Plan. The new pressure at each of the nodes was compared to the corresponding pressure in the Build-out scenario in the 2002 simulation. Results showed that the pressures at nodes 230, 309, 1909, and 9914 are very close to the 2002 values. Therefore, the alternatives for these four locations are based on the proposed improvements in the 2002 Master Plan. The costs for the alternatives were escalated to 2009 dollars and presented in the following section.

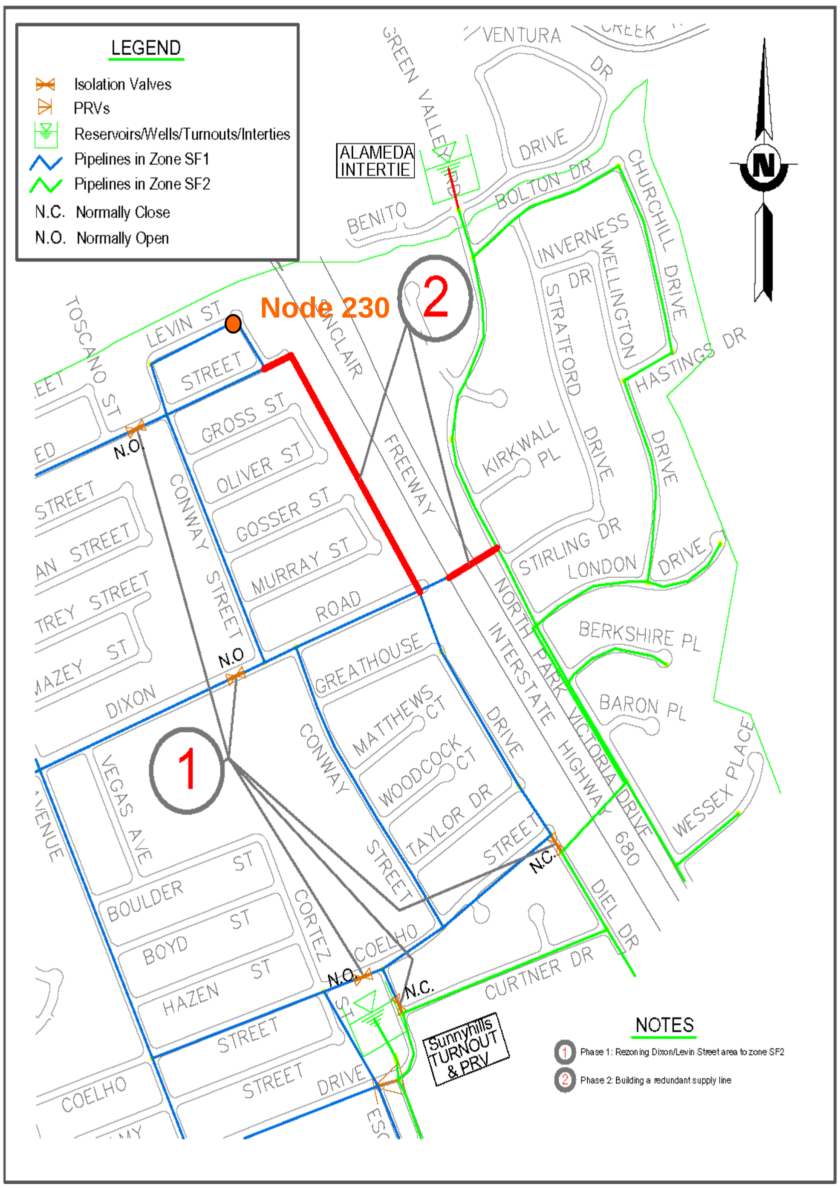
Unlike the other nodes, node 3005 reported new pressures that are considerably lower than the value in the 2002 simulation, with a difference of more than 10 psi in scenarios 2 (Transit Area Specific Plan) and 3 (19 General Plan Amendments, Transit Area Specific Plan and updated large water users information). The alternative for deficiency at this location is discussed in the following section. Node 2509 is the only newly identified deficiency under fire flow simulation, with a pressure between 19.9 psi and 20.8 psi in the three scenarios. Since the pressure criteria was exceeded only in scenario 1 (19 General Plan Amendments) by a very insignificant amount, no alternative is provided for this location.

The following discussion replaces the content in Section 6.3.4 of the 2002 Master Plan Report.

6.3.4.1 Node 230 - Dixon Road and Levin Street

This location was identified as a low pressure area in the 2002 Master Plan. The alternatives presented here are based on the proposed improvements in the Master Plan. The low pressure area at the end of Dixon Road is also in the vicinity of Levin Street (shown in Figure 6-5). This area reported low residual pressure of 16.5 psi using a residential fire flow of 1,500 gpm during the fire flow simulation. This area also reported low pressure during maximum day demands. The area encompassing Dixon Road and Levin Street has a history of low pressures and was noted in the 1994 Master Plan. The City of Milpitas conducted the *Sunnyhills Low Pressure Area Revision Study* in 2001 to evaluate alternatives for raising pressures in the area bounded by the City limits, Conway Street, Cohelo Street, and Interstate 680. The study named three recommendations for elevating the pressures in the area and the implementation of those solutions would resolve the deficiencies identified for the Levin Street under the fire flow simulation and the Dixon Road low pressure at maximum day demand simulation. The three recommendations were (1) installing individual pressure reducing valves for residential customers in zone SF1 around the Levin Street/Sunnyhills areas, (2) opening two and closing three isolation valves to rezone this area from zone SF1 to zone SF2, and (3) installing a supply pipe across Highway 680 to provide a redundant supply source for the newly created zone SF2 area.

Figure 6-5: Alternative Projects at Dixon Road and Levin Street

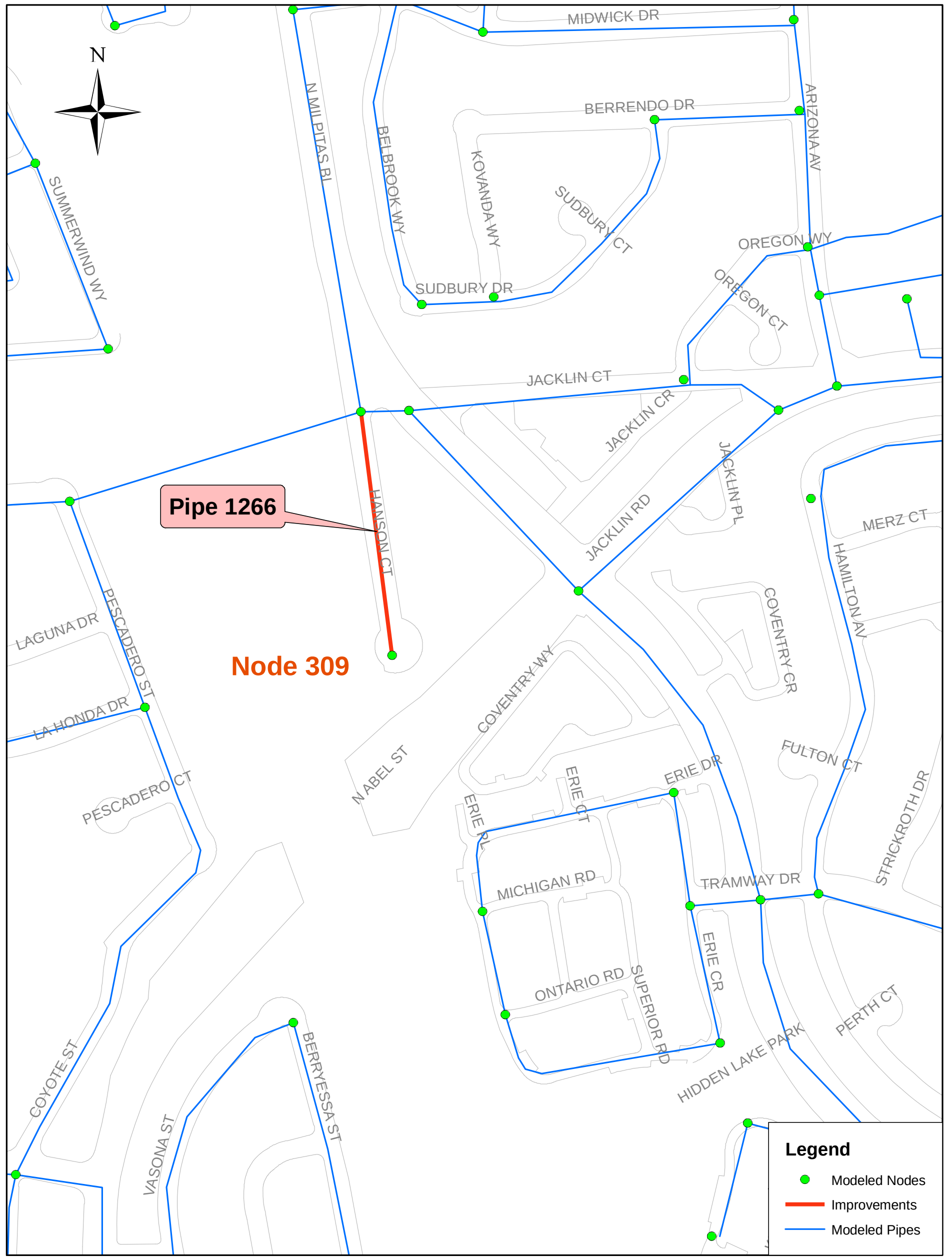


The City could implement all three improvements in two phases. Phase 1 would consist of rezoning the low pressure area to zone SF2 and installing pressure reducing valves at the customers supply lines at an estimated cost of $225,000 in 2009 dollars. Phase 2 would consist of building the redundant supply line, including the required boring and jacking under Highway 680 at an estimated cost of $621,000 in FY 2009 dollars. Since the cost for Phase 2 is quite high, the City could implement Phase 1 in the near future while deferring Phase two to a later date. Phase 1 and 2 locations are shown in **Figure 6-5**.

Alternative 2 for this area would be to create a sub-zone (i.e. zone SF1-a) for this area. The City would avoid having to install pressure reducing valves at all service connections by creating a sub-zone for the area. Similar to the previous alternative, the sub-zone alternative could also be implemented in two phases. Phase 1 would consist of closing three and opening two isolation valves shown as N.O. and N.C., respectively, in **Figure 6-5**, and installing two pressure reducing valves at the two normally closed valves. After the completion of Phase 1, the Sunnyhills low pressure area would receive zone SF2 water with zone SF1 pressure. Phase 2 would consist of building the same redundant supply line in alternative one, except for the addition of a pressure reducing valve. Phase 1 is estimated to cost $54,000 and Phase 2 is estimated to cost $647,000 in FY 2009 Dollars.

6.3.4.2 Node 309 - Hanson Court

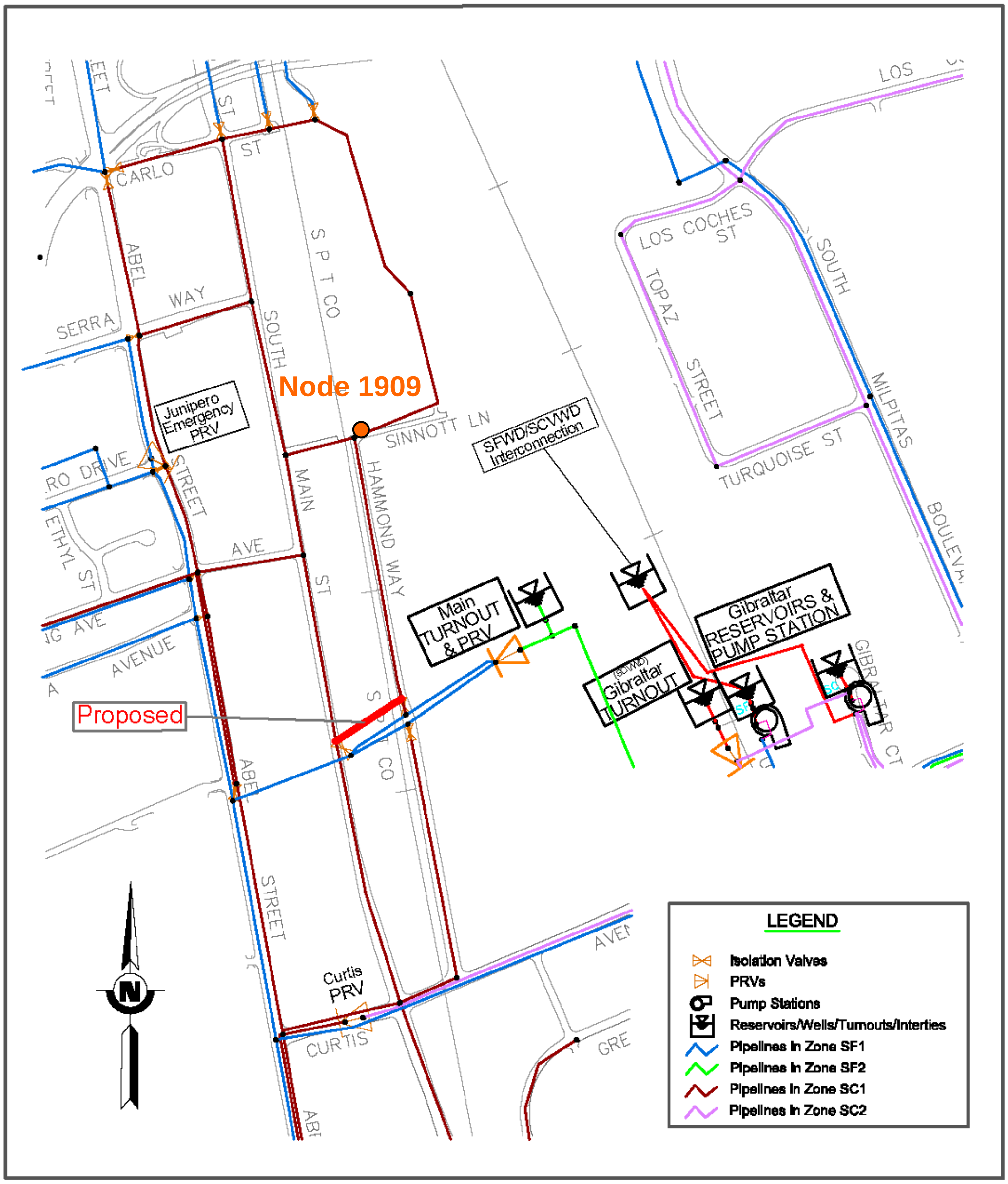
Figure 6-6: Alternative Projects at Hanson Court



This location was identified as a low pressure area in the 2002 Master Plan. The alternatives presented here are based on the proposed improvements in the Master Plan. This location is node 309 at the end of Hanson Court, shown in **Figure 6-6**. A 5,000 gpm fire flow rate was used during the simulation since the land-use information for this court indicates that it is designated for industrial park and manufacture/warehousing activities. According to the 2002 Master Plan, the flow that can be sustained without dropping below 20 psi is 3,169 gpm, which is much lower than the 5,000 gpm required flow. However, the node closest to node 309 at the intersection of Hanson Court and North Milpitas Boulevard, showed a residual of 73 psi when a fire flow rate of 5,000 gpm was applied. The 2002 Master Plan previously recommended installing (1) 650 feet of 12-inch pipe connecting the dead-end on Hanson Court to North Milpitas Boulevard along private lots, or (2) installing of 950 feet of 12-inch pipeline connecting the dead-end on Hanson Court to North Milpitas Boulevard using public easements. The alternatives were re-evaluated and a new alternative was proposed - upsize the 8-inch pie 1266 to 10-inch at an estimated project cost of $254,000 in 2009 dollars. The new alternative is the preferred alternative because it is more economical and no right-of-way and easement is required. Since the area surrounding Hanson Court is not expected to have any changes in the land-use designation and no new development is expected in the future, the City does not necessarily need to make immediate improvements.

6.3.4.3 Node 1909 - Hammond Way and Sinnott Lane

Figure 6-7: Proposed Project at Hammond Way and Sinnott Lane

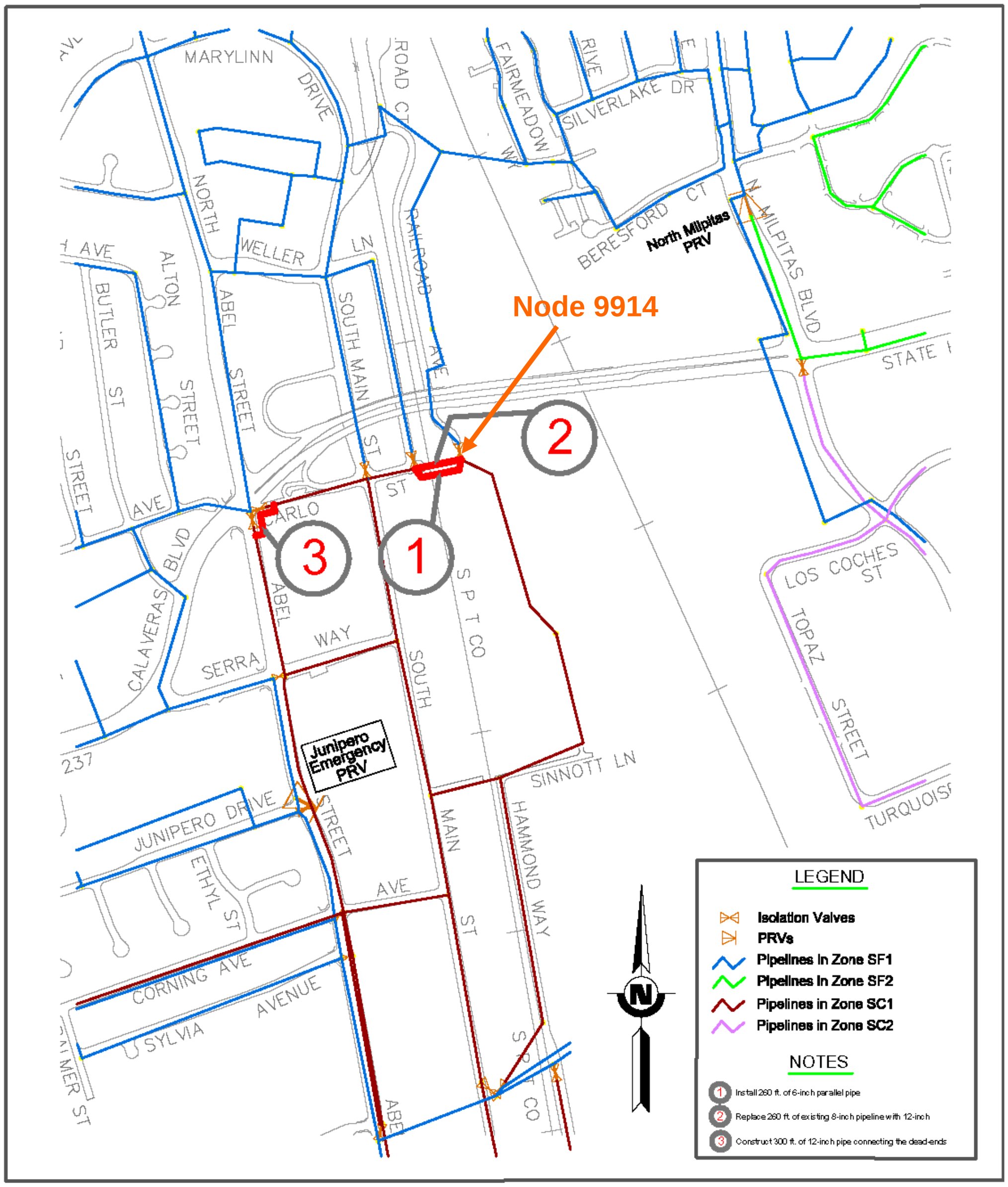


This location was identified as a low pressure area in the 2002 Master Plan. The alternatives presented here are based on the proposed improvements in the Master Plan. Within zone SC1, node ID 1909 failed to meet the minimum 20 psi pressure criteria. This node is located at Hammond Way and Sinnott Lane east of Interstate 880 near Calaveras Boulevard and the Southern Pacific Railroad. The flow at 20 psi is 2,921 gpm, which is close to the 3,000 gpm required. A possible solution to raise the residual pressure for node 1909 is the installation of 300 feet of 8-inch pipe connecting the dead-end on Hammond Way to the 8-inch pipe on Main Street at an estimated project cost of $89,000 in 2009 dollars. The proposed pipeline is shown in red in **Figure 6-7**. According to the 2002 Master Plan, the new 8-inch pipe would raise the residual fire flow pressure up to approximately 44 psi. This improvement was mentioned in the 1994 Master Plan, as well. At that time it was proposed to eliminate water stagnation at dead-ends, however this improvement will also resolve the low fire flow pressures residuals.

Since the difference between the actual flow and the required flow is so small, and falls with the accuracy of the model for the fire flow simulation, no improvement is required at this location. The City should notify the Fire Department that this is a weak location and that at 20 psi the flow will be less than the required flow.

6.3.4.4 Node 9914 - Carlo Street and Railroad Avenue

Figure 6-8: Alternative Projects at Railroad Avenue and Carlo Street

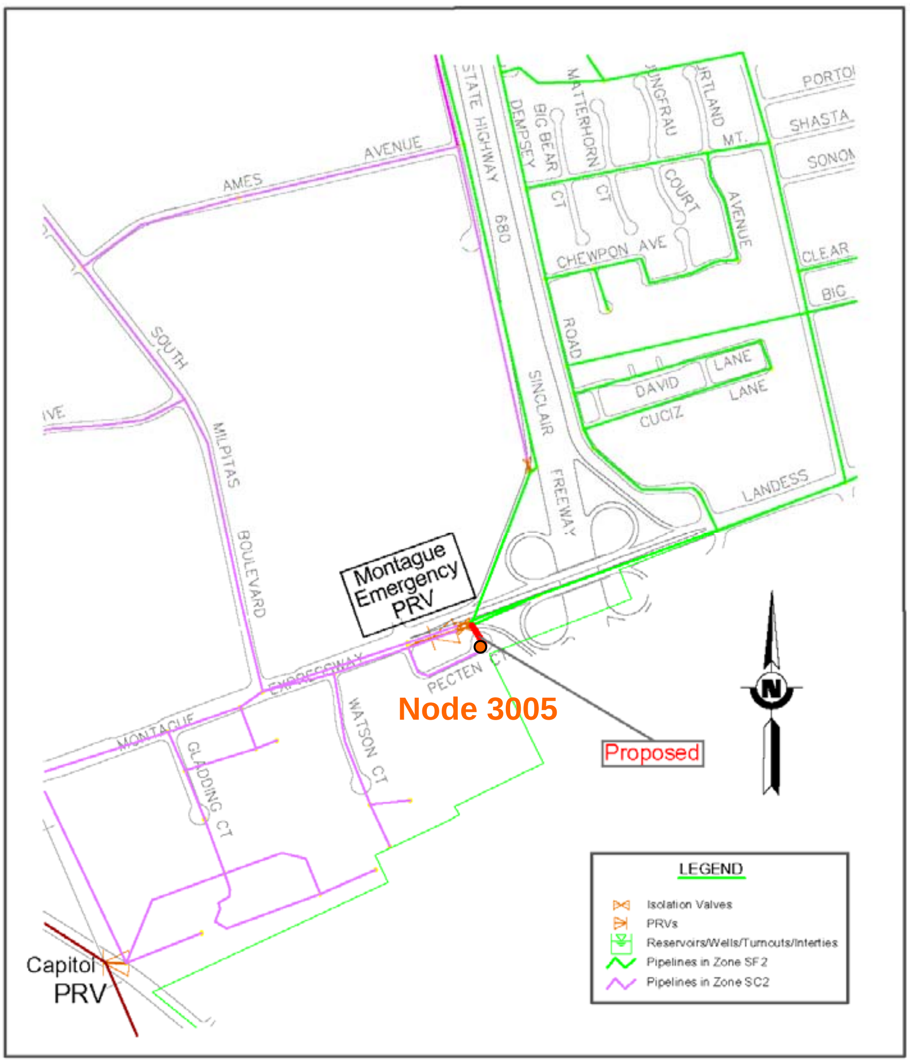


This location was identified as a low pressure area in the 2002 Master Plan. The alternatives presented here are based on the proposed improvements in the Master Plan. The location around node 9914 on Carlo Street and Railroad Avenue also failed the 20 psi minimum residual pressure criteria. According to the 2002 analysis, the flow that can be sustained without dropping below 20 psi is 3,169 gpm, which is much lower than the 5,000 gpm flow requirement. To raise the residual fire flow pressure, two improvements are necessary. The first improvement has two alternatives. The first alternative, shown in **Figure 6-8** as (1), is the installation of 260 feet of 6-inch pipe parallel to the existing 8-inch pipe on Carlo Street between Winsor Street and Railroad Avenue. Including the cost of boring and jacking under the railroad, the first alternative is estimated to cost $279,000 in FY 2009 dollars. The second alternative, shown in Figure 6-8 as (2), is replacing 260 feet of the existing 8-inch pipeline with a 12-inch pipeline. Including boring and jacking under the railroad, the estimated project cost for the second alternative is $331,000 in FY 2009 dollars. The second part of the improvement, shown in Figure 6-8 as (3), is the construction of 300 feet of 12-inch pipe connecting the dead-end on Abel Street and the two dead ends on Carlo Street at an estimated project cost of $133,000 in FY 2009 dollars.

6.3.4.5 Node 3005 - Pecten Court

This is a dead-end node located at Pecten Court. To mitigate this deficiency it is proposed to install a 12-inch pipeline connecting the dead-end pipeline with a 10-inch pipe at Montague Expressway. The proposed 12-inch pipeline is shown in red in **Figure 6-9**. Including boring and jacking under Montague Expressway, the project would cost $292,000 in FY 2009 dollars. The proposed improvement for this location was not recommended for the CIP in the 2002 Master Plan. However, the demand at this location in the studied scenarios will be higher compared to the 2002 Master Plan. Improvements are recommended to remedy the low pressure issue in this area.

Figure 6-9: Proposed Project at Pecten Court



As discussed earlier in this section, addition of a new turnout will be able to eliminate the low pressure issue in Pecten Court (Node 3005) under fire flow simulation. Therefore, no improvement in Pecten Court will be necessary if the turnout alternative is implemented. Nonetheless, the above improvement project is proposed for Pecten Court if the turnout alternative is not implemented in the near future.

6.3.5 Alternatives For Supply And Storage Deficiencies

The following discussion replaces the content in Section 6.3.5 of the 2002 Master Plan Report.

By analyzing the City as one system due to the connectivity of the two systems (SFPUC and SCVWD), the shortages for scenarios 1 (19 General Plan Amendments), 2 (Transit Area Specific Plan), and 3 (19 General Plan Amendments, Transit Area Specific Plan and updated large water users information) are 1.8 MG, 3.2 MG, and 3.1 MG. These conclusions were based on the assumption that it would be reasonable and feasible to connect the two systems (SFPUC and SCVWD) with no impact to water quality or other system issues. Given that this is uncertain at the time and needs further evaluation, it is recommended in this document that the City consider the storage requirement by analyzing the City as two separate systems, in which case the storage shortage in the SCVWD zone for the three scenarios are 5.4 MG, 6.3 MG, and 6.6 MG, respectively.

There are two alternatives to mitigate the storage shortage. One is building a new tank with pump system (Note: elevated storage could eliminate the need for a pump station); the other is building new emergency wells with emergency power supply and chlorination system similar to the Pinewood and Curtis Well.

The pump system for the new tank alternative is designed to operate at 70% efficiency and 150 psi, which is the maximum pressure allowed in the water system. The pumps were sized such that sufficient water is guaranteed to meet the maximum day demand and a fire flow of 5,000 gpm in the SCVWD zone, assuming the supply at the SCVWD turnout is not available. The design flow rate for the wells is in accordance with the pump flow of the tanks. Per the cost estimation criteria stated in Section 6.2.2, the costs for the alternatives were estimated and summarized in **Table 6-13**.

Table 6-13: Estimated Cost for Storage Alternatives

Scenario[a]	Additional Storage Requirement (MG)[b]	Cost in FY 2009 Dollars					
		Tank Option				Well Option	
		Tank Cost	Pump Flow (gpm) / Power (Hp)	Pumping Cost	Total Cost[c]	Flow Rate (gpm)	Total Cost
1	5.4	$15,288,000	3,300 / 420	$2,678,000	**$17,970,000**	3,300	**$8,160,000**
2	6.3	$17,836,000	4,100 / 520	$3,315,000	**$21,160,000**	4,100	**$10,130,000**
3	6.6	$18,680,000	4,400 / 560	$3,568,000	**$22,260,000**	4,400	**$10,870,000**

Footnotes:

a. Scenario 1: 19 General Plan Amendments
Scenario 2: Transit Area Specific Plan
Scenario 3: 19 General Plan Amendments, Transit Area Specific Plan and updated large water users information.

b. From Table 5-7

c. Total Cost for Tank Option = Tank Cost + Pumping Cost

From the perspective of implementation and constructability, the wells would need less land and the environmental clearance would be easier to obtain. Furthermore, with the wells, the water quality issue of circulation in the storage tank may be less severe. A major drawback of emergency wells is that the CDPH does not consider wells to be part of storage facility. Hence, a more detailed evaluation is needed to determine the cost/benefit of storage tanks versus emergency wells.

6.3.6 Alternatives For Reliability

There is no update to this section of the Master Plan. Please refer to Section 6.3.6 of the 2002 Water Master Plan for the content covered in this section.

CHAPTER 7 RECOMMENDATIONS

Chapter Synopsis: This chapter consists of recommendations for the CIP developed to upgrade the existing distribution system. Recommendations are based on the alternatives discussed in Chapter 6 for the CIP. Also included in this Chapter are additional recommendations regarding good practices and/or important observations. Recycled water improvements evaluated as part of the Transit Area Specific Plan are summarized. The recommendations provided in this Update are based on more current information and therefore replace the content in Chapter 7 of the 2002 Master Plan Report.

7.1 Capital Improvement Projects

The alternative projects identified in Chapter 6 were evaluated based on risk, liability, and cost. Three out of five proposed improvements for the fire flow simulation, which are identical for all three scenarios, were selected for Capital Improvement Program. As for the alternatives for deficiencies under the peak hour demand, addition of a new turnout is found to be the best option in the three scenarios. **Table 7-1** shows a summary of those projects. All project costs are presented in November 2009 dollars and will need to be escalated to reflect the actual cost in the implementation year. Full description and map of each project, estimated project costs and schedule of implementation are detailed in the following sections.

Table 7-1: Summary of Capital Improvement Program Projects

No.	Scen.[a]	Zone	H2OMAP ID	Location	Issue	Improvements	2009 Cost[b]	Recommended CIP
Near-Term CIP[e]								
1	All	SF1	Nodes 207 and 230	Dixon Rd. & I-680	Low Pressure	Install pressure reducing valves and open/close isolation valves	$225,000[c]	FY 2010/2011
2	All	SC1	Node 9914	Railroad Avenue & Carlo Street	Low Pressure and Reliability	Construct 300 LF of 12-in pipe to three dead-end pipes, one on Abel and two on Carlo Street. Also parallel 260 LF of the existing 8-in pipe on Carlo with a 6-in pipe	$412,000[d]	FY 2010/2011
3	All	SC2	Node 3005	Pecten Court	Low Pressure	Construct 150 LF of 12-in pipe connecting the dead-end point at Pecten Court to 10-inch pipe at Montague Expressway	$292,000	FY 2010/2011
Potential Long-Term Projects								
4	1	SC2	Turnout, pipes 227 and 212	Montague Expwy and Curtis Ave.	High Velocity and Excessive Headloss	Construct a new 20-inch Turnout, upsize pipes 227, 212 and PRV to 26 inch	$2,450,000	FY 2020/2021
	2	SC2	Turnout, pipes 213, 227 and 212	Montague Expwy, SCVWD Gibraltar Turnout and Curtis Ave.	High Velocity and Excessive Headloss	Construct a new 20-inch Turnout, construct 22-in pipe parallel to pipe 213, upsize pipes 227, 212 and PRV to 26 inch	$2,950,000	FY 2020/2021
	3	SC2	Turnout	Montague Expwy, SCVWD Gibraltar Turnout and Curtis Ave.	High Velocity and Excessive Headloss	Construct a new 20-inch Turnout, construct 22-in pipe parallel to pipe 213, upsize pipes 227, 212 and PRV to 26 inch	$2,950,000	FY 2020/2021
5	1	SCVWD Zone	N/A	SCVWD Zone	Insufficient Storage	Construct a 5.4 MG Tank and Pump Station	$17,970,000	FY 2020/2021
						OR		
						Construct a 3,300-gpm Well	$8,160,000	
	2	SCVWD Zone	N/A	SCVWD Zone	Insufficient Storage	Construct a 6.3 MG Tank and Pump Station	$21,160,000	FY 2020/2021
						OR		
						Construct a 4,100-gpm Well	$10,130,000	
	3	SCVWD Zone	N/A	SCVWD Zone	Insufficient Storage	Construct a 6.6 MG Tank and Pump Station	$22,260,000	FY 2020/2021
						OR		
						Construct a 4,400-gpm Well	$10,870,000	

Notes:

a. Scenario 1: 19 General Plan Amendments; Scenario 2: Transit Area Specific Plan; Scenario 3: 19 General Plan Amendments, Transit Area Specific Plan and updated large water users information.

b. Based on $17/in/LF for pipes, $1.7/gal for tanks, and PRV quotes. SFENR CCI 9719 (November 2009)/20 Cities Average CCI 8592 (November 2009) and a contingency of 30% for construction and 30% for implementation were used. Contingency includes design, construction management, utility coordination, environmental assessments, administration costs and planning level estimating coverage. Some of the City's documents published prior to 2009 referenced the costs of these projects in August 2007 dollar, which used SFENR CCI 9072/20 Cities Average CCI 8007.

c. Construction costs are based on City of Milpitas *Sunnyhills Low Pressure Area Revision Study* dated January 2001 and escalated to 2009 Dollars.

d. Includes $100,000 for boring and jacking under the Railroad.

e. The Near-Term CIP in the 2002 Master Plan includes installing an addition 8-PRV at Sunnyhills Turnout to mitigate reliability issue. This project is not included in the updated CIP because reliability was not re-evaluated in this Master Plan Update.

7.1.1 Near-Term CIP

The near-term CIP consist of three projects for mitigating system low pressure issues. All three projects are recommended for implementation in the upcoming FY 2010/2011. The total cost for all three projects, in 2009 dollars, is $929,000.

7.1.1.1 Project No. 1 - Dixon Road and Levin Street

This project, shown in **Figure 7-1**, is necessary to correct the low pressure problem in this area. Recommendation is based on the 2002 Mast Plan but an updated budget is provided. It consists of the closing or opening existing zone valves. Three valves that are normally open will be closed. These valves are located at:

- Manfred Street between Toscano and Conway Street
- Dixon Road west of Conway Street
- Coelho Street east of Cortez Street

Two other existing valves that are normally closed will be opened. These valves are located at:

- Diel Drive at Coehlo Street
- Roger Street at Curtner Drive

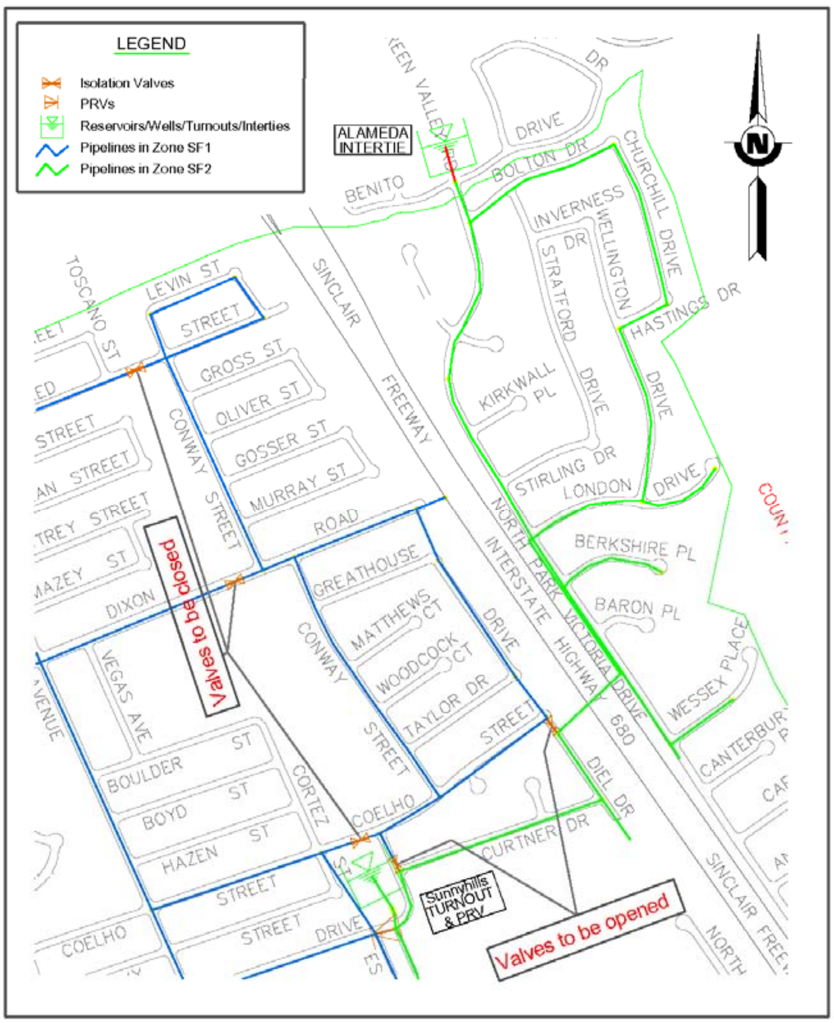


Figure 7-1: Project No. 1 – Dixon Road and Levin Street

The other component of this project is the installation of PRVs at approximately 300 existing residential services in the Sunnyhills area.

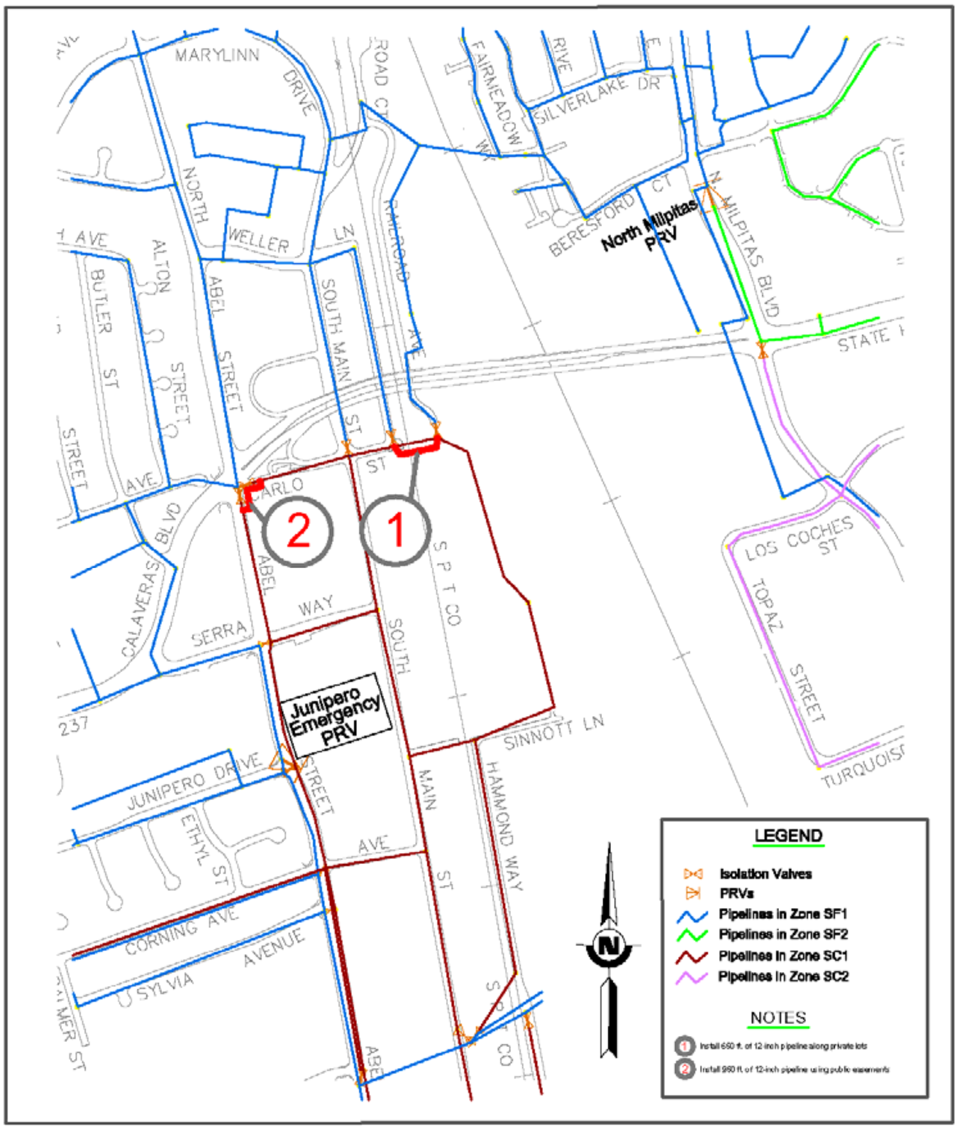
The total project cost is estimated to be $225,000 in 2009 dollars.

7.1.1.2 Project No. 2 – Carlo Street and Railroad Avenue

The recommended alternatives for this location have not changed since the 2002 Master Plan. The updated budget is estimated to be $412,000 in 2009 dollars. The details of the recommended improvements can be found in section 7.1.1 of the 2002 Master Plan Report.

This project, shown in **Figure 7-2**, is necessary to remedy the low residual pressure at fire flow simulation. Recommendation is based on the 2002 Mast Plan but an updated budget is provided. The project also helps eliminate water stagnation at the pipeline dead ends and improves water quality. The project consists of two parts. The first part, shown in Figure 7-2 as (1), is the installation of 260 feet of 6-inch pipeline parallel to the existing 8-inch pipeline running between Winsor Street and Railroad Street. This part of the project is estimated to cost $279,000 in FY 2009 dollars. The second part of the project, shown in Figure 7-2 as (2), is the installation of 300 feet of 12-inch pipeline connecting the dead end on the existing 12-inch pipeline running along Abel Avenue to the dead ends on the existing 6-inch and the 12-inch pipelines running along Carlo Street. The estimated cost for this part of the project is $133,000 in FY 2009 dollars.

Figure 7-2: Project No. 2 – Railroad Avenue and Carlo Street

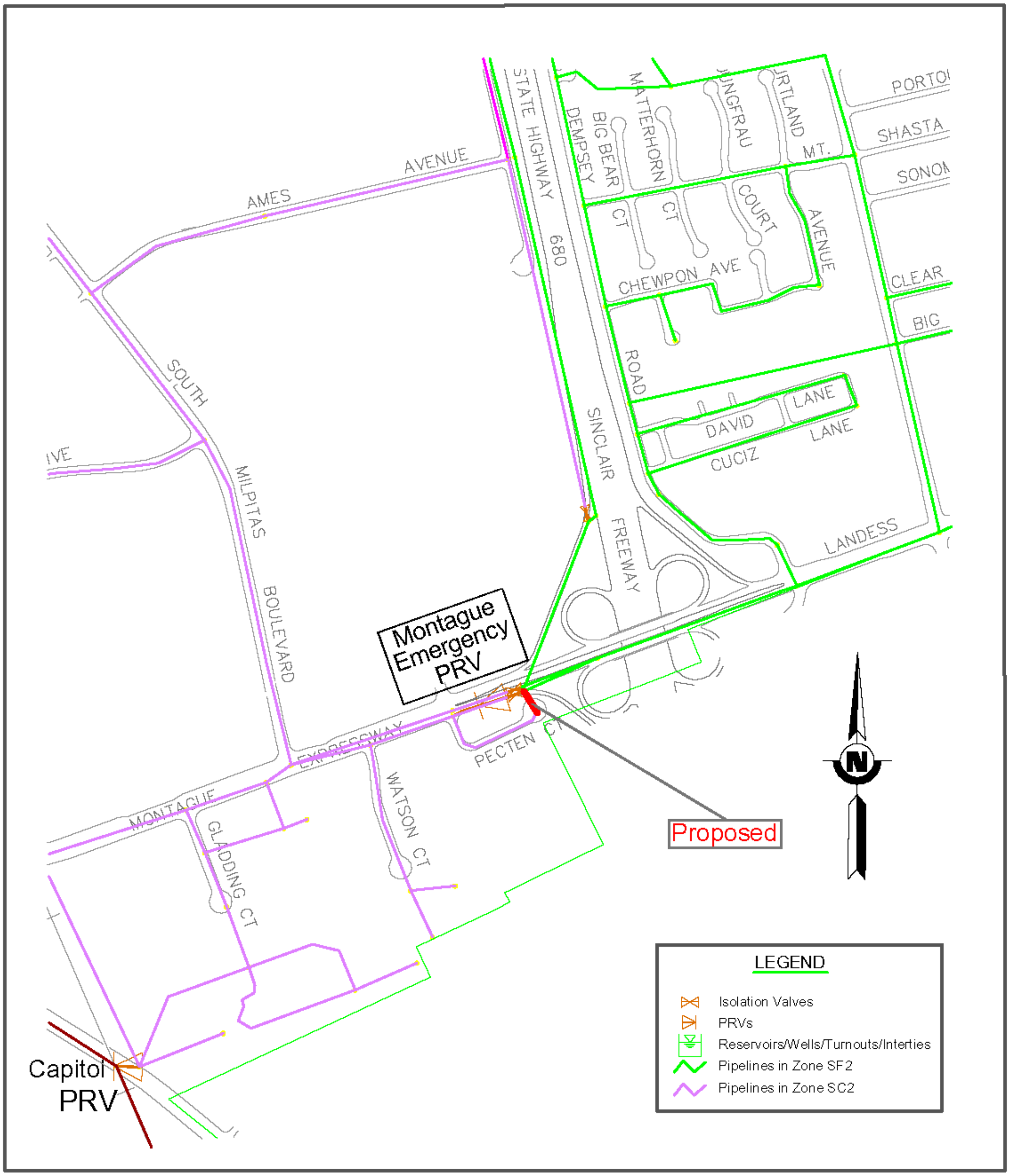


The total project cost is estimated to be $412,000 in 2009 dollars.

7.1.1.3 Project No. 3 – Pecten Court

This project is necessary to remedy the low residual pressure at fire flow simulation. This is a dead-end node located at Pecten Court. The project consists of installing a 12-inch pipeline connecting the dead-end pipeline with a 10-inch pipe at Montague Expressway. The proposed 12-inch pipeline is shown in red in **Figure 7-3**. Including boring and jacking under Montague Expressway, the estimated project cost is estimated to be $292,000 in 2009 dollars.

Figure 7-3: Project No. 3 – Pecten Court



7.1.2 Potential Long-Term Projects

Potential long-term project consist of a new turnout project for improving high velocity and excessive headloss and insufficient storage in all three scenarios. The projects are considered to be implemented by year 2020, the year the City anticipates to reach build-out condition. The project involves adding a new 20-inch turnout at the intersection of Montague Expressway and Piper Court, and constructing a new storage tank in the SCVWD service area in FY 2020/2021.

7.1.2.1 Project No. 4 – New 20-inch Turnout

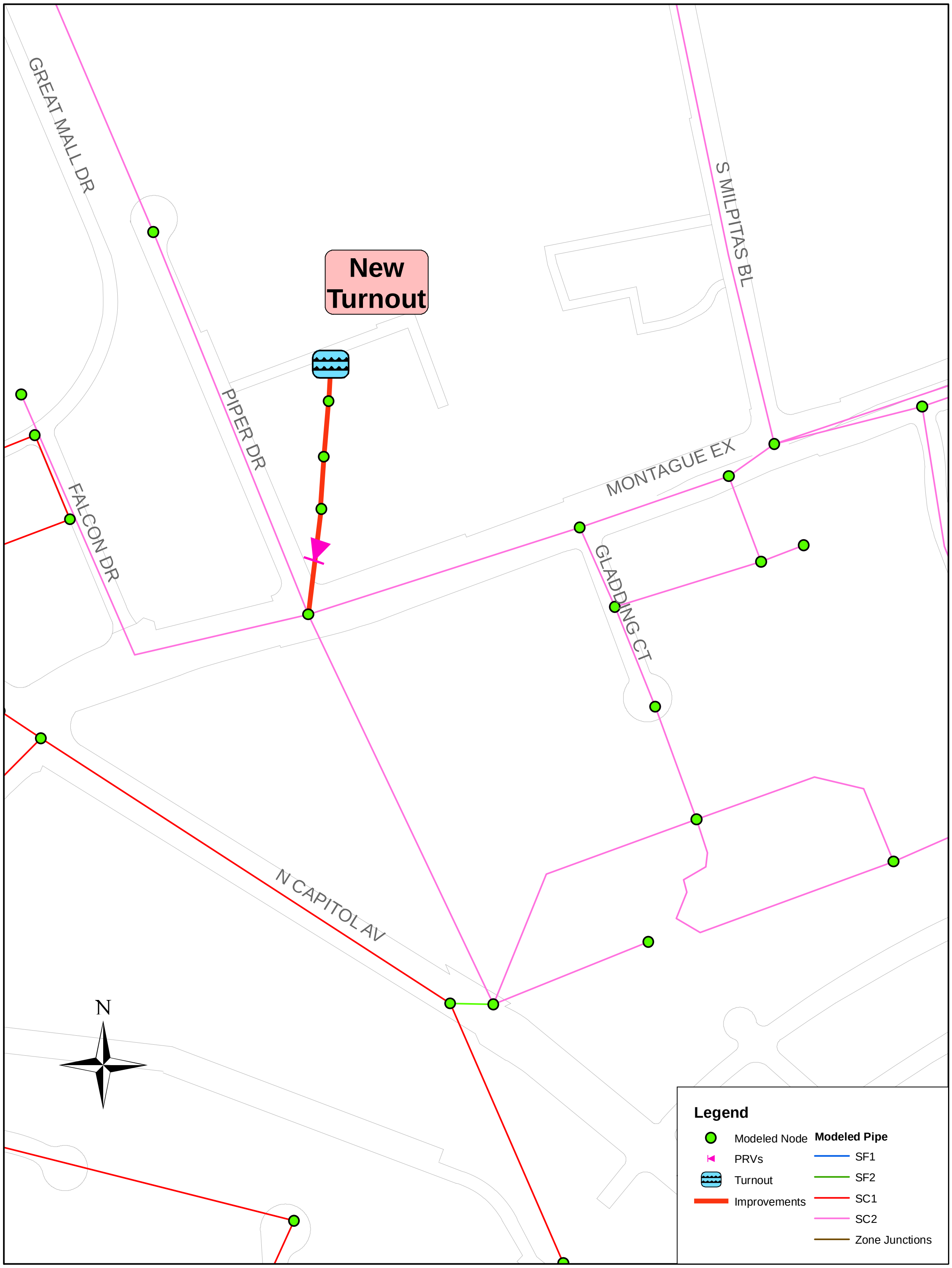
A new 20-inch turnout, shown in **Figure 7-4**, and a number of pipeline improvements are necessary to address the future excessive velocity and headloss in the pipe network. The suggested improvements and their estimated costs for the three scenarios are summarized in **Table 7-2**.

Table 7-2: Suggested Improvements for Turnout Analysis

Scenario[a]	Pipe ID	Improvements	Estimated Cost (FY 2009 Dollars)
1	Turnout, pipes 227 and 212	Construct a new 20-in turnout, upsize pipes 227, 212 and PRV to 26 inch	$2,450,000
2	Turnout, pipes 213, 227 and 212	Construct a new 20-in turnout, construct 750 LF of 22-in pipe parallel to pipe 213, upsize pipes 227, 212 and PRV to 26 inch	$2,950,000
3	Turnout, pipes 213, 227 and 212	Construct a new 20-in turnout, construct 750 LF of 22-in pipe parallel to pipe 213, upsize pipes 227, 212 and PRV to 26 inch	$2,950,000

Footnotes:
a. Scenario 1: 19 General Plan Amendments
Scenario 2: Transit Area Specific Plan
Scenario 3: 19 General Plan Amendments, Transit Area Specific Plan and updated large water users information

Figure 7-4: Proposed Turnout



7.1.2.2 Project No. 5 – SCVWD Zone Storage Reservoir

With the proposed developments in each of the three scenarios, and with the conservative assumption that the two systems (SFPUC and SCVWD) will *not* be connected, the distribution system will have a projected storage shortage of 5.4MG, 6.3MG, and 6.6MG respectively. This project is proposed for mitigating the project storage shortage. The storage shortage will exists in the SCVWD part of the system as noted in Tables 5-7 and 5-8.

The requirement for additional storage will increase as demand increases. As noted previously in section 6.3.5, there are two alternatives for mitigating the projected storage shortage: 1) building additional tanks with pump systems or 2) constructing additional emergency wells. The project costs, excluding land and right of way cost, for the scenarios are summarized as follows.

Table 7-3: Estimated Cost for Storage Alternatives

Scenario[a]	Additional Storage Requirement (MG)	Cost in FY 2009 Dollars	
		Tank and Pump Station	Well
1	5.4	$17,970,000	$8,160,000
2	6.3	$21,160,000	$10,130,000
3	6.6	$22,260,000	$10,870,000

Footnotes:
a. Scenario 1: 19 General Plan Amendments
Scenario 2: Transit Area Specific Plan
Scenario 3: 19 General Plan Amendments, Transit Area Specific Plan and updated large water users information

The potential long-term project recommended is building an additional reservoir since the CDPH does not consider wells to be part of storage facility. The exact location of the storage reservoir needs to be determined and the costs adjusted according to the land and easement acquisition costs estimated at that time. However, before emergency well is disregarded as an option for mitigating storage shortage altogether, it is highly recommended that the City perform an in-depth study to evaluate the cost/benefit of using reservoir or wells.

7.1.3 Cash Flow Analysis

Table 7-4 shows the cash flow for the near-term Capital Improvement Program and long-term potential projects.

Table 7-4: Cash Flow Analysis for Near-Term and Long-Term CIP

Scenarios[a]	Project Number	Project Name	2009 Cost[b]
Near-Term CIP[c] (CIP Year – 2010/2011)			
All	1	Dixon Rd. and Levin St.	$225,000
All	2	Railroad Ave. and Carlo St	$412,000
All	3	Pecten Court	$292,000
All	**TOTAL**		**$929,000**
Potential Long-Term Projects (CIP Year – 2020/2021)			
1	4	New 20-inch Turnout with pipe improvements	$2,450,000
2	4	New 20-inch Turnout with pipe improvements	$2,950,000
3	4	New 20-inch Turnout with pipe improvements	$2,950,000
1	5[d]	SCVWD Zone Storage Tank with Pump Station (5.4 MG)	$17,970,000
2	5[d]	SCVWD Zone Storage Tank with Pump Station (6.3 MG)	$21,160,000
3	5[d]	SCVWD Zone Storage Tank with Pump Station (6.6 MG)	$22,260 ,000
1	**TOTAL**		**$20,420,000**
2	**TOTAL**		**$24,110,000**
3	**TOTAL**		**$25,210,000**

Footnotes:

a. Scenario 1: 19 General Plan Amendments
Scenario 2: Transit Area Specific Plan
Scenario 3: 19 General Plan Amendments, Transit Area Specific Plan and updated large water users information

b. Based on $17/in/LF for pipes, $1.7/gal for tanks, and PRV quotes. SFENR CCI 9719 (November 2009)/20 Cities Average CCI 8592 (November 2009) and a contingency of 30% for construction and 30% for implementation were used. Contingency includes design, construction management, utility coordination, environmental assessments, administration costs and planning level estimating coverage. Some of the City's documents published prior to 2009 referenced the costs of these projects in August 2007 dollar, which used SFENR CCI 9072/20 Cities Average CCI 8007

c. The Near-Term CIP in the 2002 Master Plan included a project to add an 8-PRV at Sunnyhills Turnout to mitigate reliability issue. This project is not included in this updated CIP but may still be desirable to enhance reliability

d. Tank option is used for the cash flow analysis because CDPH does not consider wells to be part of storage facility

7.2 Other Miscellaneous Recommendations

In addition to the projects recommended to remedy the deficiencies, there are a few considerations to take that are good practice and would help address the deficiencies that were not included in the CIP.

7.2.1 Storage Facility Study

A more detailed evaluation would need to be done to determine the cost/benefit of emergency wells versus storage tanks. The location of the storage facility should be determined and considered during the evaluation process. Determining the location of the storage facility in advance will help in identifying the environmental impacts, physical constraints, and permits required for the project. The Capital Improvement Program did not include cost for the siting study, land acquisition, or easements. The critical siting factor for storage tank will be finding an appropriate site at the storage elevation needed.

7.2.2 Valves Maintenance

The analysis of the distribution system was made under the assumption that the pressure regulating valves and the emergency regulating valves are maintained annually and that they will respond as expected, especially in an emergency condition. Therefore, it is essential to keep the valves in good working condition and to continuously exercise them.

7.2.3 Fire Flows

As discussed in section 6.3.4, the Hammond Way/Sinnott Lane and Hanson Court areas have fire flows at 20 psi residual pressures are less than the required fire flows for that area. Based on discussion with City staff when the 2002 Master Plan was developed, it was determined that these areas do not require capital improvements at this time. The City should inform the Fire Department of these areas and consider them weak areas until a project has been built to eliminate the problem.

7.2.4 Hanson Court

As described in Section 6.3.4, Hanson Court, which was found to have a low pressure residual in a fire flow simulation, was also found to have a 70 psi residual pressure at the hydrant upstream of the dead end point. City maintenance staff has observed that there is flow in the pipeline even when all the valves are closed indicating that there are unknown connections. These connections need to be further investigated prior to determining if this area needs a project to remedy the problem. If new connections are found then the H_2OMAP Model and the plats needs to be updated with that information.

7.2.5 Emergency Wells

The emergency wells were taken into account as part of the storage capacity. To be able to take the wells into account two conditions need to be met. First is the existence of emergency power supply at the well pumps and second is to have chlorination at the wells. The existing Pinewood well does have an emergency power supply source and the City is in the process of adding a chlorination system to the well. The Curtis well, a CIP project, is being constructed and does include a chlorination system and emergency power supply as part of the construction specification. It is recommended that the City establish a maintenance program to ensure that the chlorination facilities at these two wells are up to standards for emergency purposes.

7.2.6 Pipelines with High Headlosses

As discussed in Section 5.2.3.2, there are a number of pipelines that have headlosses that exceeded the allowed headlosses for their appropriate pipe sizes. However, the velocities in these pipes stayed within the criteria therefore no recommendations were made. It is good practice to keep an eye on these pipelines and to upsize these pipes or parallel them with another pipeline if other circumstances such as low pressure or excessive velocity make it necessary to undertake a project in those areas.

7.2.7 Standard Pipe Size

The use of standard pipe sizes such as the 6, 8 and 12-ich pipelines is highly recommended. Pipes with these sizes tend to be cheaper in cost than the non-standard sizes such as the 10-inch pipe because the standard sizes are more available and sold off the shelf. Having standard sizes also helps in the maintenance and operation of the facilities. Therefore in this master plan where the analysis showed the need for a non-standard size pipe, the next larger standard-size pipe was recommended.

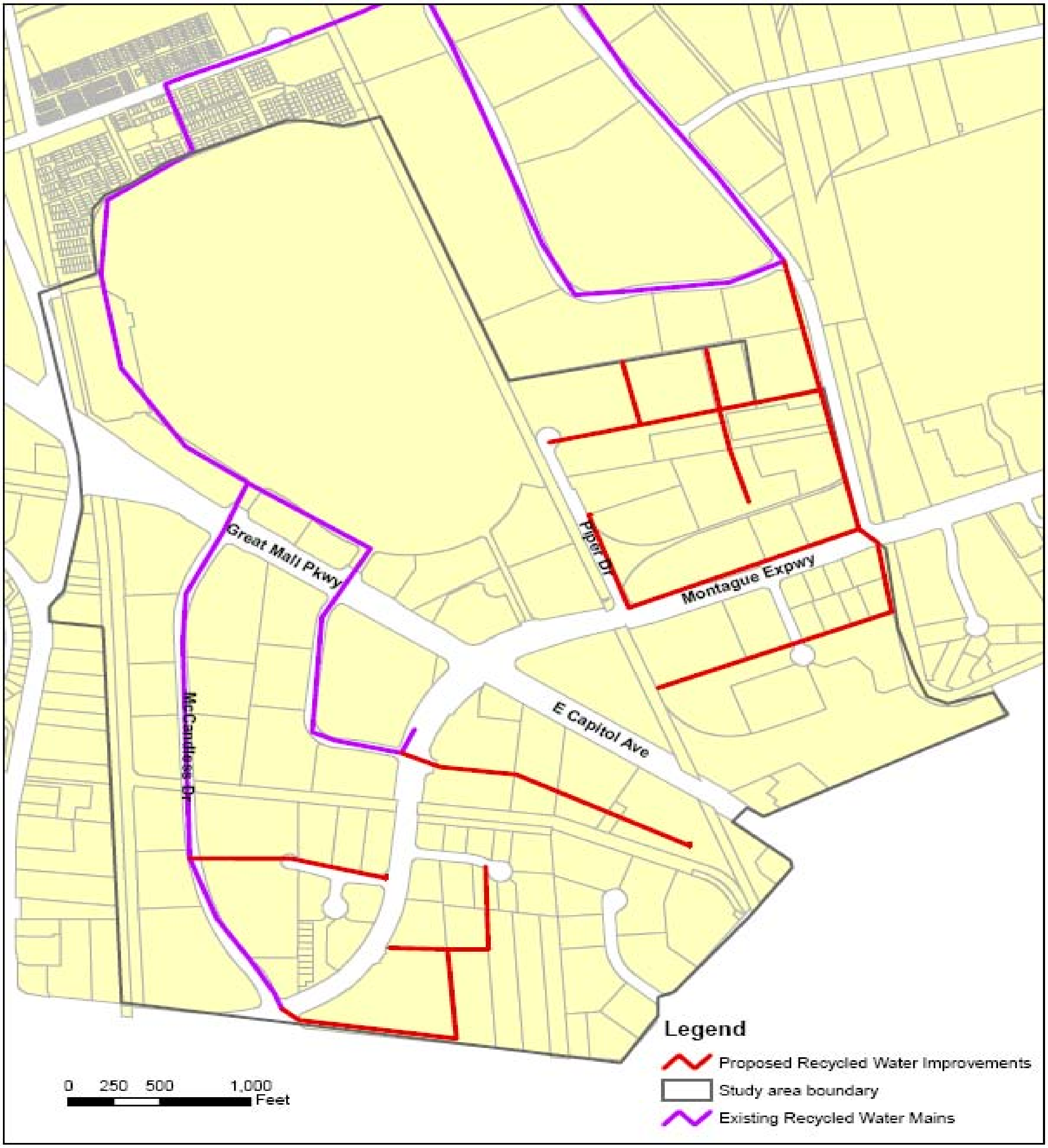
7.3 Recycled Water Improvements

Recycled water is provided to the City through the South Bay Water Recycling (SBWR) Program. SBWR uses recycled water from the San Jose/Santa Clara Water Pollution Control Plant (WPCP) for irrigation, industrial and other purposes. Use of recycled water reduces wastewater discharge to the bay which is limited to 120 mgd during dry weather months. Recycled water also helps conserve drinking water which benefits the community during drought periods.

Expansion of the recycled water system was evaluated in the *Transit Area Recycled Water Analysis TM* (RMC, July 2007) included in **Appendix B**. Recycled water may be used for landscape irrigation (i.e. parks, school yards, buffer, community facilities, etc), commercial, and industrial uses. Total estimated recycled water demand is 162,900 gpd. **Figure 7-5** shows the recommended improvements to distribute recycled water in the proposed Transit Area. The City anticipates modifications to the pipeline alignments shown in Figure 7-5 as projects enter into design phase when field conditions can be further evaluated.

This expansion includes approximately 14,970 ft of 8-inch and 6-inch pipe and has an estimated implementation cost of $5,710,000 (November 2009 value).

Figure 7-5: Recommended SBWR Expansion



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APPENDIX A

SUMMARY OF COST ESTIMATES

Appendix A
SUMMARY OF COST ESTIMATES

Location	Mitigation	Length (ft)	Dia. (in.)	$/LF/in	Initial Facility Cost Estimate	30% Construction Contingency	Subtotal Cost	30% Implementation Multiplier	2009 Total Cost	CIP Year
Scenario 1										
Alternative 1A										
Curtis Avenue before and after PRV	Replace 320 LF of 18-in pipe with 26-in pipe	320	26	$17	$144,108	$43,233	$190,000	$57,000	$250,000	2020/2021
	Replace 2,300 LF of 18-in pipe with 26-in pipe	2300	26	$17	$1,035,779	$310,734	$1,350,000	$405,000	$1,760,000	2020/2021
	Upsize 18-inch PRV to 26 inch.		26		$41,967	$12,590	$60,000	$18,000	$80,000	2020/2021
								Sub-Total	$2,090,000	
SCVWD Turnout at Gibraltar	Replace 10 LF of 24-in pipe with 30-in pipe	10	30.00	$17	$5,196	$1,559	$10,000	$3,000	$20,000	2020/2021
	Upsize 24-inch PRV to 30 inch.		30.00		$47,350	$14,205	$70,000	$21,000	$100,000	2020/2021
	Replace 750 LF of 18-in pipe with 30-in pipe	750	30.00	$17	$389,716	$116,915	$510,000	$153,000	$670,000	2020/2021
								Sub-Total	$790,000	
	OR									
	Construct 10 LF of 28-in pipe parallel to existing pipe 9805	10	28.00	$17	$4,850	$1,455	$10,000	$3,000	$20,000	2020/2021
	Install a 28-in PRV		28.00		$44,658	$13,398	$60,000	$18,000	$80,000	2020/2021
	Construct 750 LF of 28-in pipe parallel to existing pipe 213	750	28.00	$17	$363,735	$109,121	$480,000	$144,000	$630,000	2020/2021
								Sub-Total	$730,000	
								Total	**$2880000 or $2820000**	
Alternative 1B										
Curtis Avenue before and after PRV	Replace 320 LF of 18-in pipe with 26-in pipe	320	26	$17	$144,108	$43,233	$190,000	$57,000	$250,000	2020/2021
	Replace 2,300 LF of 18-in pipe with 26-in pipe	2300	26	$17	$1,035,779	$310,734	$1,350,000	$405,000	$1,760,000	2020/2021
	Upsize 18-inch PRV to 26 inch.		26		$41,967	$12,590	$60,000	$18,000	$80,000	2020/2021
Montague Expwy and Piper Court	Construct a new 20-inch Turnout	Project cost is presented in the Turnout Analysis TM completed by RMC in July 2007							$360,000	2020/2021
								SUM	**$2,450,000**	
Scenario 2										
Alternative 2A										
Curtis Avenue before and after PRV	Replace 320 LF of 18-in pipe with 26-in pipe	320	26	$17	$144,108	$43,233	$190,000	$57,000	$250,000	2020/2021
	Replace 2,300 LF of 18-in pipe with 26-in pipe	2300	26	$17	$1,035,779	$310,734	$1,350,000	$405,000	$1,760,000	2020/2021
	Upsize 18-inch PRV to 26 inch.		26		$41,967	$12,590	$60,000	$18,000	$80,000	2020/2021
								Sub-Total	$2,090,000	
SCVWD Turnout at Gibraltar	Replace 10 LF of 24-in pipe with 32-in pipe	10	32	$17	$5,543	$1,663	$10,000	$3,000	$20,000	2020/2021
	Upsize 24-inch PRV to 32 inch.		32		$50,042	$15,013	$70,000	$21,000	$100,000	2020/2021
	Replace 750 LF of 18-in pipe with 32-in pipe	750	32	$17	$415,697	$124,709	$550,000	$165,000	$720,000	2020/2021
								Sub-Total	$840,000	
	OR									
	Construct 10 LF of 28-in pipe parallel to existing pipe 9805	10	28	$17	$4,850	$1,455	$10,000	$3,000	$20,000	2020/2021
	Install a 28-in PRV		28		$44,658	$13,398	$60,000	$18,000	$80,000	2020/2021
	Construct 750 LF of 28-in pipe parallel to existing pipe 213	750	28	$17	$363,735	$109,121	$480,000	$144,000	$630,000	2020/2021
								Sub-Total	$730,000	
Along Montague near S. Milpitas & Gladding Court	Replace 450 LF of 10-in pipe with 14-in pipe	450	14	$17	$109,121	$32,736	$150,000	$45,000	$200,000	2020/2021
	Replace 160 LF of 10-in pipe with 18-in pipe	160	18	$17	$49,884	$14,965	$70,000	$21,000	$100,000	2020/2021
								Sub-Total	$300,000	
								Total	**$3230000 or $3120000**	
Alternative 2B										
SCVWD Turnout at Gibraltar	Construct 750 LF of 22-in pipe parallel to existing pipe 213	750	22	$17	$285,792	$85,738	$380,000	$114,000	$500,000	2020/2021
Curtis Avenue before and after PRV	Replace 320 LF of 18-in pipe with 26-in pipe	320	26	$17	$144,108	$43,233	$190,000	$57,000	$250,000	2020/2021
	Replace 2,300 LF of 18-in pipe with 26-in pipe	2300	26	$17	$1,035,779	$310,734	$1,350,000	$405,000	$1,760,000	2020/2021
	Upsize 18-inch PRV to 26 inch.		26		$41,967	$12,590	$60,000	$18,000	$80,000	2020/2021
Montague Expwy and Piper Court	Construct a new 20-inch Turnout	Project cost is presented in the Turnout Analysis TM completed by RMC in July 2007							$360,000	2020/2021
								Total	**$2,950,000**	
Scenario 3										
Alternative 3A										
Curtis Avenue before and after PRV	Replace 320 LF of 18-in pipe with 26-in pipe	320	26	$17	$144,108	$43,233	$190,000	$57,000	$250,000	2020/2021
	Replace 2,300 LF of 18-in pipe with 26-in pipe	2300	26	$17	$1,035,779	$310,734	$1,350,000	$405,000	$1,760,000	2020/2021
	Upsize 18-inch PRV to 26 inch.		26		$41,967	$12,590	$60,000	$18,000	$80,000	2020/2021
								SUM	$2,090,000	
	Replace 10 LF of 24-in pipe with 32-in pipe	10	32	$17	$5,543	$1,663	$10,000	$3,000	$20,000	2020/2021
	Upsize 24-inch PRV to 32 inch.		32		$50,042	$15,013	$70,000	$21,000	$100,000	2020/2021
	Replace 750 LF of 18-in pipe with 32-in pipe	750	32	$17	$415,697	$124,709	$550,000	$165,000	$720,000	2020/2021

Location	Mitigation	Length (ft)	Dia. (in.)	$/LF/in	Initial Facility Cost Estimate	30% Construction Contingency	Subtotal Cost	30% Implementation Multiplier	2009 Total Cost	CIP Year
SCVWD Turnout at Gibraltar								**SUM**	$840,000	
	OR									
	Construct 10 LF of 30-in pipe parallel to existing pipe 9805	10	30	$17	$5,196	$1,559	$10,000	$3,000	$20,000	2020/2021
	Install a 30-in PRV		30		$47,350	$14,205	$70,000	$21,000	$100,000	2020/2021
	Construct 750 LF of 30-in pipe parallel to existing pipe 213	750	30	$17	$389,716	$116,915	$510,000	$153,000	$670,000	2020/2021
								SUM	$790,000	
Along Montague near S. Milpitas & Gladding Court	Replace 450 LF of 10-in pipe with 14-in pipe	450	14	$17	$109,121	$32,736	$150,000	$45,000	$200,000	2020/2021
	Replace 160 LF of 10-in pipe with 18-in pipe	160	18	$17	$49,884	$14,965	$70,000	$21,000	$100,000	2020/2021
								SUM	$300,000	
								Total	**$3230000 or $3180000**	
Alternative 3B										
SCVWD Turnout at Gibraltar	Construct 750 LF of 22-in pipe parallel to existing pipe 213	750	22	$17	$285,792	$85,738	$380,000	$114,000	$500,000	2020/2021
Curtis Avenue before and after PRV	Replace 320 LF of 18-in pipe with 26-in pipe	320	26	$17	$144,108	$43,233	$190,000	$57,000	$250,000	2020/2021
	Replace 2,300 LF of 18-in pipe with 26-in pipe	2300	26	$17	$1,035,779	$310,734	$1,350,000	$405,000	$1,760,000	2020/2021
	Upsize 18-inch PRV to 26 inch.		26		$41,967	$12,590	$60,000	$18,000	$80,000	2020/2021
Montague Expwy and Piper Court	Construct a new 20-inch Turnout	Project cost is presented in the Turnout Analysis TM completed by RMC in July 2007							$360,000	2020/2021
								SUM	**$2,950,000**	
All Scenarios										
Hanson Court	Replace 710 LF of 8-in pipe with 10-in pipe	710	10	$17	$122,977	$36,893	$160,000	$48,000	$210,000	2020/2021

Storage

Scenarios	Mitigation	Volume (MG) - Tank or Flow (gpm) - Well	$/Gal - Tank or $/Gal/d - Well	Hp	$/Hp	Initial Construction Cost Estimate	30% Construction Contingency	Subtotal Cost	30% Implementation Multiplier	2009 Total Cost	CIP Year
1	Construct a 1.8 MG Tank	5.4	$1.7			$9,043,210	$2,712,963	$11,760,000	$3,528,000	$15,290,000	2020/2021
	Pump for demand of 13.31 MGD			420	$3,770	$1,583,400	$475,020	$2,060,000	$618,000	$2,678,000	2020/2021
									SUM	**$17,968,000**	
	OR										
	Construct a 3,300-gpm Well	3300	$1.01			$4,822,680	$1,446,804	$6,270,000	$1,881,000	**$8,160,000**	2020/2021
2	Construct a 3.2 MG Tank	6.3	$1.7			$10,550,411	$3,165,123	$13,720,000	$4,116,000	$17,840,000	2020/2021
	Pump for demand of 14.5 MGD			520	$3,770	$1,960,400	$588,120	$2,550,000	$765,000	$3,315,000	2020/2021
									SUM	**$21,155,000**	
	OR										
	Construct a 4,100-gpm Well	4100	$1.01			$5,991,814	$1,797,544	$7,790,000	$2,337,000	**$10,130,000**	2020/2021
3	Construct a 3.1 MG Tank	6.6	$1.7			$11,052,812	$3,315,844	$14,370,000	$4,311,000	$18,690,000	2020/2021
	Pump for demand of 14.9 MGD			560	$3,770	$2,111,200	$633,360	$2,744,560	$823,368	$3,568,000	2020/2021
									SUM	**$22,258,000**	
	OR										
	Construct a 4,400-gpm Well	4400	$1.01			$6,430,240	$1,929,072	$8,360,000	$2,508,000	**$10,870,000**	2020/2021

APPENDIX B

TRANSIT AREA RECYCLED WATER ANALYSIS TM

DRAFT Technical Memorandum

City of Milpitas

Subject: **Transit Area Recycled Water Analysis**

Prepared For: Marilyn Nickel

Prepared by: Marina Bronstein-Grouchnikov

Reviewed by: Tammy Qualls, Marc Nakamoto

Date: July 3, 2007

Reference: 051-12 Task 8.1

This technical memorandum (TM) summarizes the Task 8.1 Transit Area Recycled Water Analysis. The above task was added to "Agreement for Consultation and Other Services" in order to facilitate integration and completion of additional elements of the Transit Area Specific Plan and EIR.

The TM is organized as follows:

- Background and Objectives
- Existing System
- Recycled Water System Improvements
- Recycled Water Demands
- Cost Estimate

1 Background and Objectives

Recycled water is provided to the City of Milpitas (City) through the South Bay Water Recycling (SBWR) Program. The SBWR Program is an on-going, multi-year effort to use recycled water from the San Jose/Santa Clara Water Pollution Control Plant (WPCP) for irrigation, industrial and other purposes. Use of recycled water reduces wastewater discharge to the bay which is limited to 120 mgd during dry weather months. Recycled water also helps conserve drinking water which benefits the community during drought periods.

In Milpitas, the SBWR program currently provides recycled water to business/ retail areas surrounding McCarthy Ranch and Oak Creek Industrial Park. The City's current recycled water distribution system consists of 11 miles of water mains delivering water to approximately 90 service connections[1].

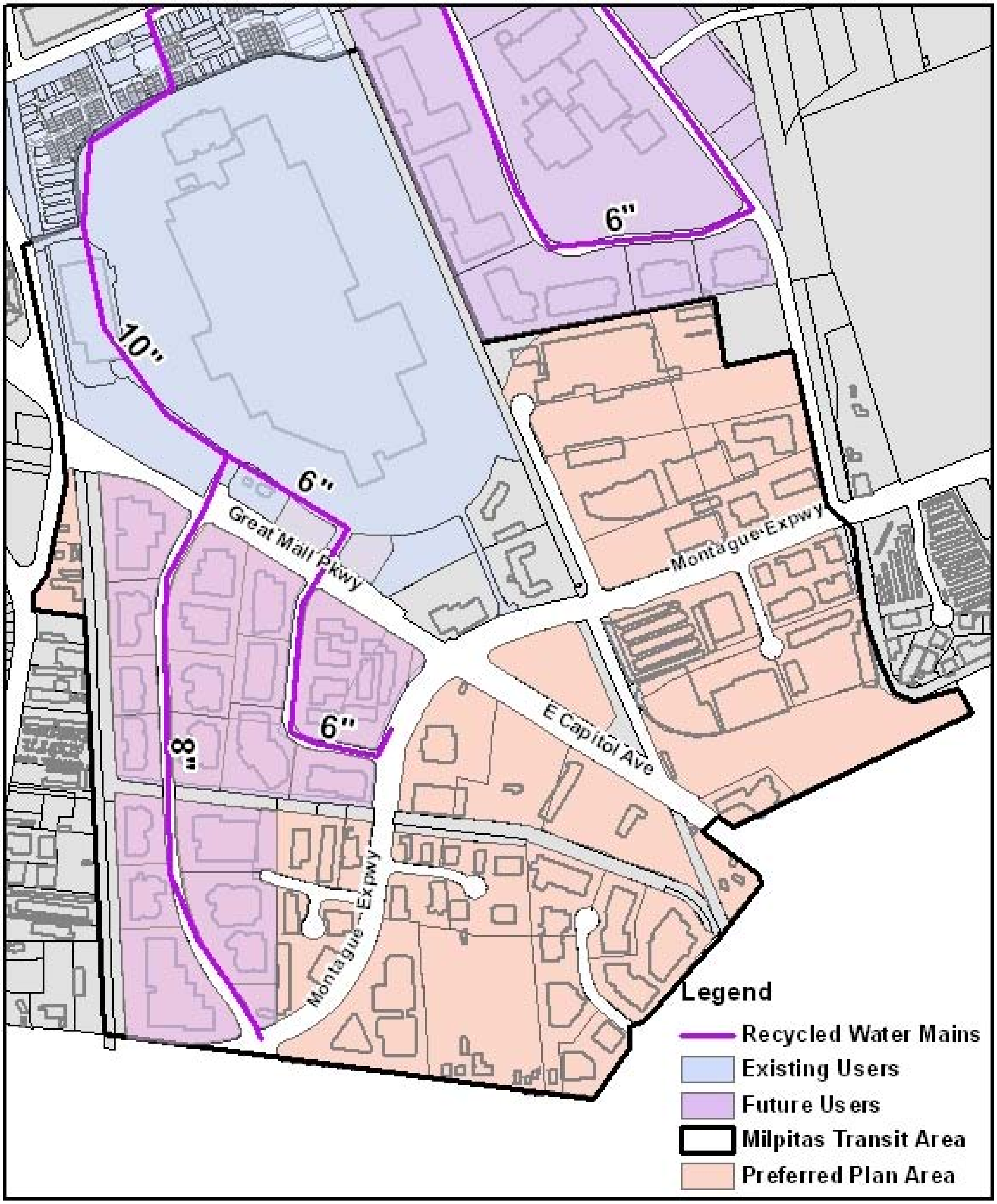
The objective of this evaluation is to develop a concept plan for recycled water expansion for the Transit area Specific plan and EIR. Use of recycled water for outdoor irrigation and indoor non-potable water use for non-residential customers was identified in the Transit Area Specific Plan Water Supply Assessment.

[1] Website: City of Milpitas – Public Works – Water and Sewer Storm Drain – Water Maintenance Services Section (http://www.ci.milpitas.ca.gov/citydept/publicworks/watermaintenanceservices.htm)

2 Existing System

Figure 2-1 shows the existing recycled water in and near Transit Area. A portion of the Transit area already has existing recycled water distribution pipelines.

Figure 2-1: Existing Recycled Water Infrastructure in Transit Area

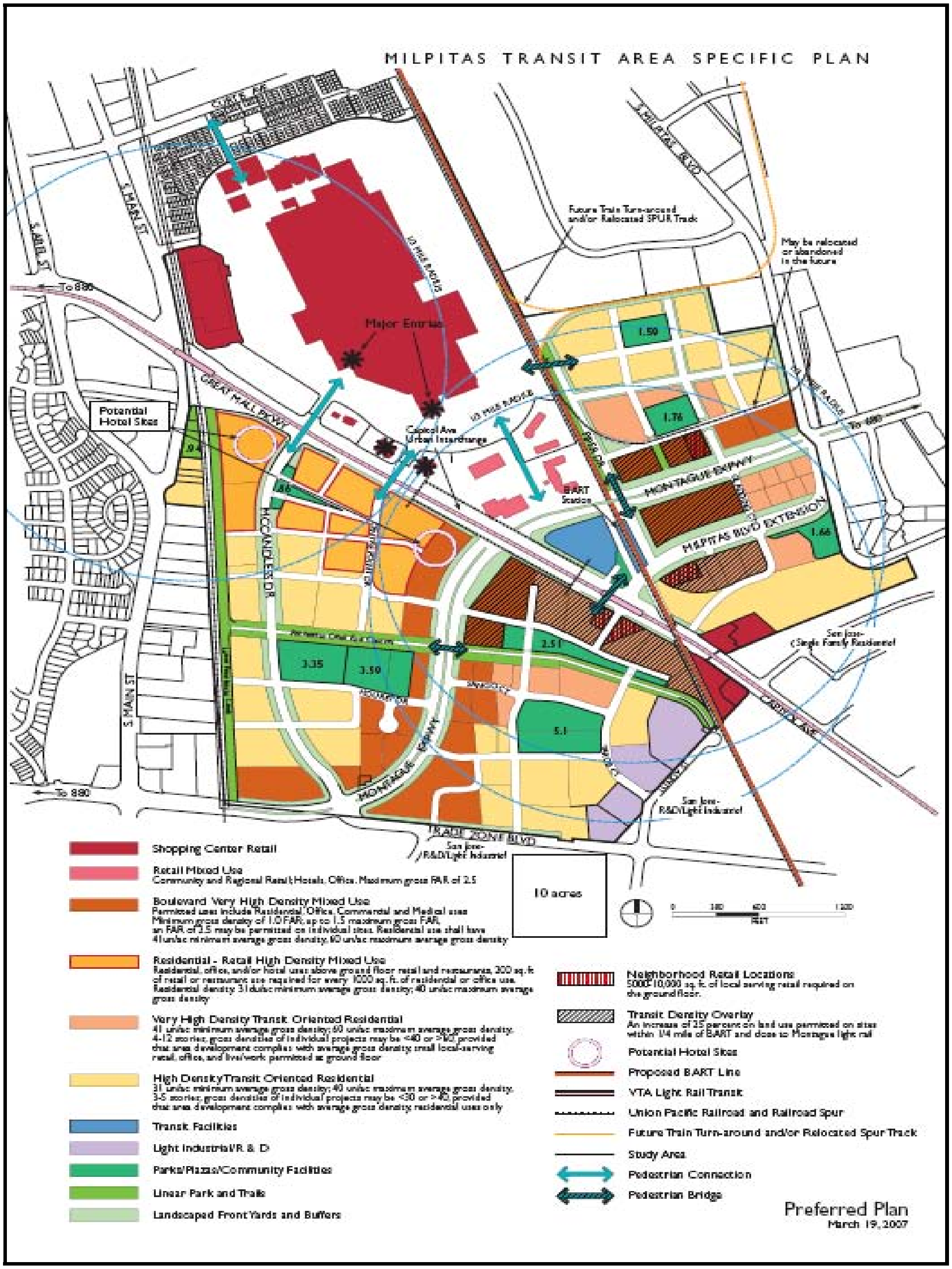


In the City of Milpitas, recycled water use exceeds 600 acre-feet per year (AFY) and is expected to rise to approximately 1,100 AFY by 2010.

3 Recycled Water System Improvements

Figure 3-1 shows the Specific Plan land use designations for the Transit area. The figure identifies the location of parks, plazas, community facilities, linear parks, landscaped front yards and buffer zones, which are assumed to be future recycled water users.

Figure 3-1: Milpitas Transit Area Specific Plan



The proposed new irrigation pipelines (located in Transit area) were connected at three points to the existing irrigation system. An estimated pipe size of 6-inch is thought to be adequate for recycled water delivery in the Transit Area and is the basis for concept level cost estimates.

This report identifies and describes two pipeline concepts for delivery to the Transit Area:

1. Concept 1: service to main parks, plazas and community facilities irrigation (Figure 3-2).
2. Concept 2: service to main parks, plazas, community facilities, landscaped front yards and buffers irrigation (Figure 3-3).

The two concepts for recycled water improvements in the Transit Area are shown in Figures 3-2 and 3-3.

Figure 3-2: Concept 1- Service to Parks, Plazas and Community Facilities Irrigation

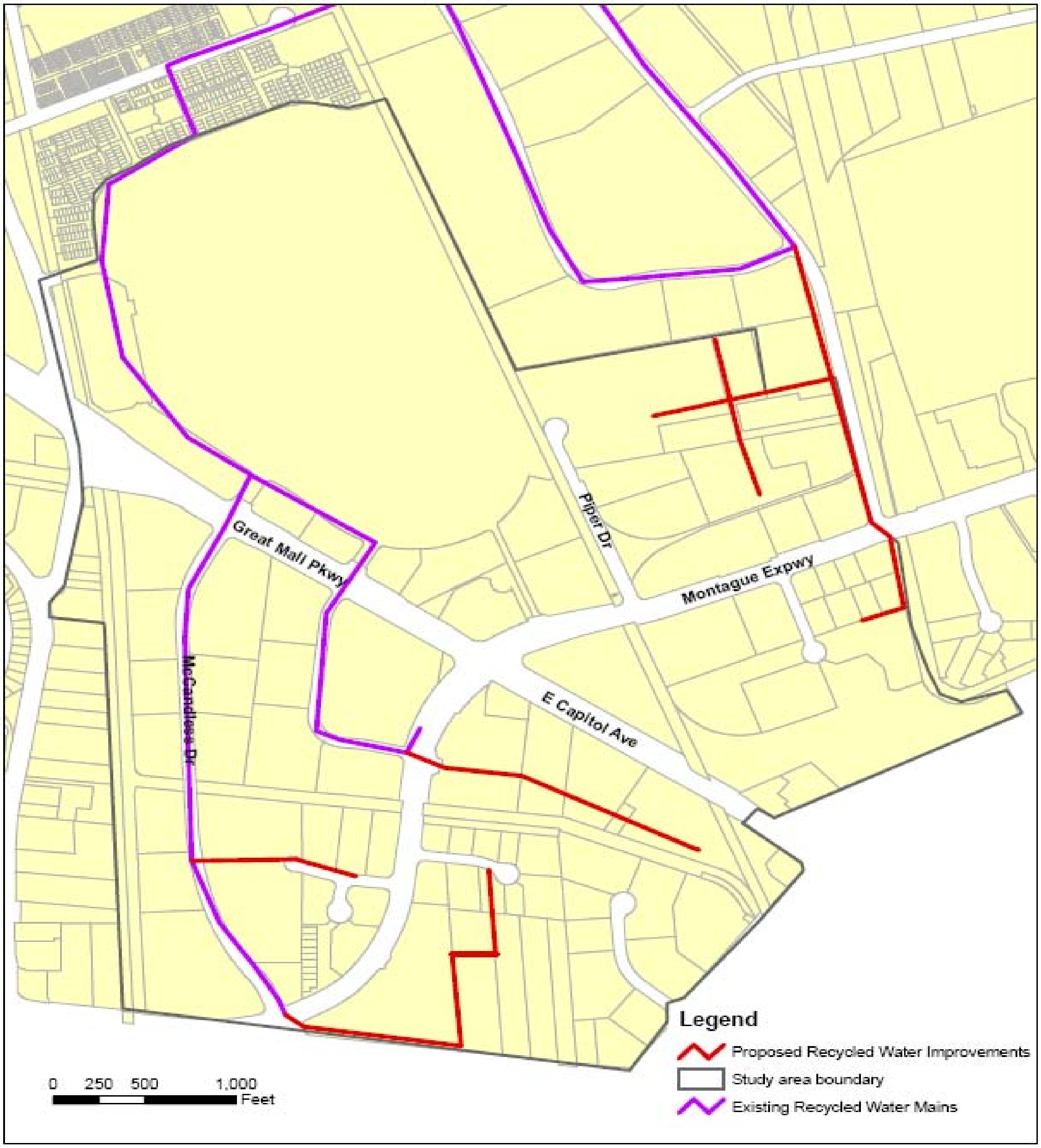
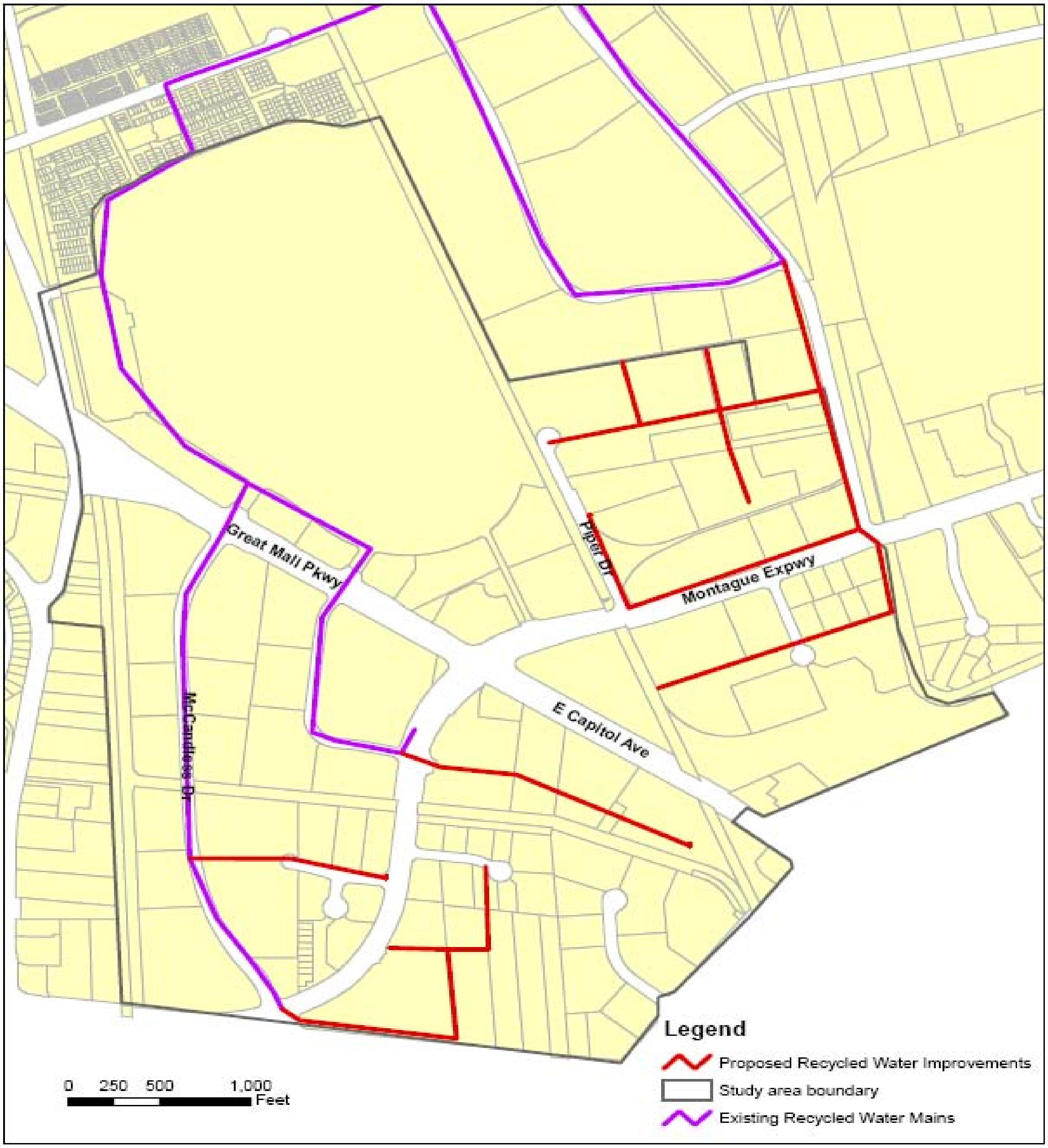


Figure 3-3: Concept 2 – Service to Parks, Plazas, Community Facilities, Linear Parks, Landscaped Front Yards and Buffers Irrigation



In June 2007, RMC contacted Tim Town and John Oberg of SBWR to discuss expansion at the system in the Transit area. Tim Town noted that there is no model available for the Milpitas recycled water mains or the SBWR system. Tim reviewed the current layout and estimated that there is an estimated 1,000 gpm available at the ends of the existing Milpitas system located near the Transit area, in both the 6" and 8" pipelines. Tim also noted that he did not have any information on static pressure, as the system is maintained by City of Milpitas. The City of Milpitas noted that there are no permanent pressure records in this area. Historical knowledge of the system indicated that the pressure of the recycled water lines in this area is roughly 110 psi. Based on the proposed land use plan shown in Figure 3-1 and assuming standard irrigation practices and systems, the 110 psi pressure and available flow rate of 1,000 gpm are thought to be more than adequate to serve proposed customers in the Transit area.

4 Recycled Water Demands

4.1 Landscape Irrigation

Irrigation demand for landscape areas were estimated using the Crop Coefficient Method[2], a method developed by the California Department of Water Resources and UC Extension for landscape irrigation.

Crop coefficients (K_c) is used with ET_o to estimate specific crop evapotranspiration rates. The crop coefficient of 0.8 for grass turf is assumed for this study. ET_o values is taken from report of CIMIS at Station #8 (Inland San Francisco Bay Area). K_c was multiplied by the ET_o value to arrive at a crop ET (ET_c) estimate. The resulting ET_c was used for irrigation demand estimate. The data on average monthly precipitation is taken from the reports published online by the Western Regional Climate Center (Newark Station, CA, #046144). The Transit Area landscape acreages and associated estimated average annual demand is shown in Table 4-1.

Table 4-1: Average Annual Demand and Acreage for Improvements of the Transit Area

Site	Gross Acreage	Estimated Irrigated Acreage	Ave. Annual Demand (acre-feet/year)
Parks and Plazas	8.05	6.13	20.84
Play Fields	8.45	7.61	29.33
Landscaped Front Yards and Buffers	27.5	14.02	46.79
Linear Parks and Trails	14.9	7.46	25.35
Total	**64.32**	**35.21**	**122.30**

Notes:

1. See Appendix A for additional details on the demand estimate and assumptions.

The estimated Water Use Factor (WUF) for grass turf is about 40.8 inches of water per year or an average day demand of 1,711 gpd/acre (See Appendix A for details of the estimate). This methodology is a theoretical evaluation assuming grass turf and does not account for other planting types.

The WUF estimated in Water Master Plan (December 2002) was 1,300 gpd/acre. This Master Plan method used water usage for each land use category (based on water data from the City of Milpitas) divided by the total acres. The differences in recycled water demands may be a function of type of landscaping and irrigation system operations which have not be evaluated in detail as part of this evaluation. Given the conceptual nature of this evaluation, the theoretical evaluation using crop evapotranspiration rates was adopted to estimate total recycled water demand.

4.2 Dual Plumbing

Recycled water use for non-residential customers is highly dependent on the type of commercial or industrial use. Transit Area land categories that have some potential for dual plumbed recycled water use includes commercial, hotel, schools and boulevard very high density mixed use. For concept planning purposes, it is assumed that recycled water in a dual plumb application is about 20 percent of the total non-residential water demand in the Transit Area.

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[2] A Guide to Estimating Irrigation Water Needs of Landscape Planting in California
Website: http://www.cimis.water.ca.gov/cimis/infoEtoCropCo.jsp

The estimated non-residential demand in Transit area is 268,260 gpd (excluding existing development, high density transit-oriented development residential, and very high density transit oriented residential) the dual plumbing demand is expected to be 53,700 gpd.

4.3 Total Transit Area Recycled Water Demands

Total recycled water demand is the sum of recycled water for irrigation and dual plumbing. Total estimated recycled water demand is 163,700 gpd.

5 Concept Level Cost Estimate

Conceptual level cost estimates for water pipelines, valves and installation are based on bids received for pipeline construction projects in the Bay Area. Cost estimates were adjusted using the Engineering News Records (ENR) construction cost index (CCI). The ENR CCI is the primary index utilized by the water planning and engineering community to adjust cost estimates developed in different years. Cost estimates in this TM are based on the June 2007 Engineering News Record San Francisco Construction Cost Index (ENR SF CCI) of 9,063.41. During the detailed design process, construction costs of the proposed improvements should be reevaluated to reflect current construction conditions.

Pipelines construction costs vary according to several factors, which include pipe materials, complexity of construction, traffic control, street repair, etc. In urban areas, an average cost of $25.17 per lineal feet per inch diameter is used for pipeline cost estimation (average cost of PVC and DIP materials of construction) (See Table 5.1).

Table 5-1: Installed Pipeline Costs

Description	Pipe cost /LF/ inch diameter
Ductile iron pipe 6”	$ 25.02
PVC pipe 6”	$ 25.32
Average for cost estimate	**$ 25.17**

Notes:

1. These costs include pipe material and installation; excavation and backfill; compaction, surfacing and traffic control.

Table 5-2 summarizes additional contingencies and allowances that were applied for estimating total project cost.

Table 5-2: Cost Contingencies and Allowances

Item	Assumption
Construction Contingency	30% of pipeline construction costs
Appurtenances	10% of pipeline construction costs
Engineering, Legal & Administration	25% of total construction costs
Overhead & Profit	15% of total construction costs
Construction Management	10% of total construction cost
Recycled Water Connection [a]	$ 10,000

Notes:

a. Each connection includes water meter, piping, vault, gate valve, and swivel and service connections.

Estimated costs for each Concept are summarized in Table 5-3 and are shown in detail in Appendix B. The total capital cost includes the main distribution lines and services connections plus costs for engineering, legal, administration, construction management, and overhead and profit. The estimated costs do not include onsite development of the parks, plazas, buffer areas, or trails. The estimated costs are based on a conceptual level of engineering and have an estimated accurate of plus 50% to minus 30%.

Table 5.3: Concept Cost Estimates

Concept	Pipe Size	Linear Feet (LF)	Total Capital Cost
Concept 1	6”	8,463	$2,784,000
Concept 2	6”	14,968	$5,325,000

APPENDIX A

RECYCLED WATER DEMAND ESTIMATION

Transit Area Specific Plan and EIR Project Integration with Master Plan
Transit Area Recycled Water Analysis

Recycled Water Demand Estimation

No.	Location	Type	Area (acre)	Ave. Annual Demand (in)*	Demand factor	Irrigated Acreage	Ave. Annual Demand (acre in)	Ave. Annual Demand (acre feet/year)
1	Future train turn	Urban residential park	1.59	40.8	80%	1.27	51.94	4.33
2	Piper Dr. & Montegue Expwy	Urban residential park	1.76	40.8	80%	1.41	57.49	4.79
3	Milpitas Blvd. extension	Trailhead parks	1.66	40.8	50%	0.83	33.89	2.82
4	Sando Ct.	Trailhead parks	2.51	40.8	50%	1.26	51.24	4.27
5	Tarob Ct	Sport fields	5.1	46.3	90%	4.59	212.40	17.70
6	Houret Dr.	Community center	3.59	40.8	20%	0.72	29.32	2.44
7	Mc Candless Dr.	Sport field	3.35	46.3	90%	3.02	139.52	11.63
8	Great mall Pkwy & Mc Candless Dr.	Urban plaza	0.86	40.8	20%	0.17	7.02	0.59
9	S. Main St.	Visual gateway park	0.94	40.8	50%	0.47	19.19	1.60
10	Landscape buffers		27.5	40.8	50%	13.75	561.42	46.79
11	Linear parks		14.9	40.8	50%	7.45	304.19	25.35
Total			**63.76**	**42**		**34.93**	**1467.62**	**122.30**

Average Annual Demand (gpd) = 109,200
Recycled Water Use Factor (gpd/acre) = **1,713**

Comments:
1. Peak hour demand is calculated on the basis peak month demand
2. Irrigation is throughout 10 hours a day
3. Landscape buffers included from "Milpitas Transit Area Specific Plan Buildout - Preferred Plan" (by Dyett and Bhatia)
4. Landscape buffers irrigation demand is estimated on basis of park site irrigation
5. Linear parks irrigation demand is estimated on basis of park site irrigation
* See Irrigation Demand (in/unit area) for Play Fields and Parks Sited

Average Annual Demand Estimation for Park Sites

Month	Crop Coefficient, K_c	ET_o [a]	Average Precipitation (in) [b]	Effective Precipitation [c]	Leaching Rate Factor [d]	Irrigation Efficiency [f]	Irrigation Demand, (in/unit area)	Irrigation Demand, (in/unit area)	Percent of Annual Demand	Monthly Peaking Factor [e]	Days/ Month	Acre Feet /Month	Daily Average Flow (MGD)
Jan	0.8	1.24	3.07	75%	1.1	85%	-1.7	0.0	0.0%	0.00	31	0	0.00
Feb	0.8	1.68	2.45	75%	1.1	85%	-0.6	0.0	0.0%	0.00	28	0	0.00
Mar	0.8	3.41	2.17	75%	1.1	85%	1.4	1.4	3.5%	0.42	31	91	0.95
Apr	0.8	4.80	1.09	75%	1.1	85%	3.9	3.9	9.6%	1.15	30	249	2.70
May	0.8	6.20	0.41	75%	1.1	85%	6.0	6.0	14.7%	1.77	31	383	4.02
Jun	0.8	6.90	0.11	75%	1.1	85%	7.0	7.0	17.2%	2.07	30	447	4.86
Jul	0.8	7.44	0.02	75%	1.1	85%	7.7	7.7	18.8%	**2.26**	31	489	5.13
Aug	0.8	6.51	0.06	75%	1.1	85%	6.7	6.7	16.4%	1.96	31	425	4.47
Sep	0.8	5.10	0.14	75%	1.1	85%	5.1	5.1	12.6%	1.51	30	327	3.55
Oct	0.8	3.41	0.73	75%	1.1	85%	2.8	2.8	6.9%	0.83	31	179	1.89
Nov	0.8	1.80	1.81	75%	1.1	85%	0.1	0.1	0.3%	0.03	30	7	0.07
Dec	0.8	0.93	2.49	75%	1.1	85%	-1.5	0.0	0.0%	0.00	31	0	0.00
Annual Total		**49.42**	**14.55**					**40.8**	**100.0%**			**2596**	**27.6**

a. ETo values reported in CIMIS at Station #8 (Inland san Francisco Bay Area)

b. Average Monthly precipitation from the Western Regional Climate Center at Newark Station, CA

c. Assumed 75% infiltration rate into the vegetation root zone.

d. Leaching rate factor represents a 10 percent leaching rate through the vegetation root zone

e. Monthly peaking factor is the calculated monthly irrigation demand divided by the average monthly irrigation demand

f. Assumes 85% irrigation efficiency is achieved through conservation practices.

MGD Annual Average **2.30**

Average Annual Demand Estimation for Play Fields

Month	Crop Coefficient, K_c	ET_o [a]	Average Precipitation (in) [b]	Effective Precipitation [c]	Leaching Rate Factor [d]	Irrigation Efficiency [f]	Irrigation Demand, (in/unit area)	Irrigation Demand, (in/unit area)	Percent of Annual Demand	Monthly Peaking Factor [e]	Days/ Month	Acre Feet /Month	Daily Average Flow (MGD)
Jan	0.8	1.24	3.07	75%	1.1	75%	-1.9	0.0	0.0%	0.00	31	0	0.00
Feb	0.8	1.68	2.45	75%	1.1	75%	-0.7	0.0	0.0%	0.00	28	0	0.00
Mar	0.8	3.41	2.17	75%	1.1	75%	1.6	1.6	3.5%	0.42	31	103	1.08
Apr	0.8	4.80	1.09	75%	1.1	75%	4.4	4.4	9.6%	1.15	30	282	3.06
May	0.8	6.20	0.41	75%	1.1	75%	6.8	6.8	14.7%	1.77	31	434	4.56
Jun	0.8	6.90	0.11	75%	1.1	75%	8.0	8.0	17.2%	2.07	30	507	5.51
Jul	0.8	7.44	0.02	75%	1.1	75%	8.7	8.7	18.8%	**2.26**	31	554	5.82
Aug	0.8	6.51	0.06	75%	1.1	75%	7.6	7.6	16.4%	1.96	31	481	5.06
Sep	0.8	5.10	0.14	75%	1.1	75%	5.8	5.8	12.6%	1.51	30	371	4.03
Oct	0.8	3.41	0.73	75%	1.1	75%	3.2	3.2	6.9%	0.83	31	203	2.14
Nov	0.8	1.80	1.81	75%	1.1	75%	0.1	0.1	0.3%	0.03	30	8	0.08
Dec	0.8	0.93	2.49	75%	1.1	75%	-1.6	0.0	0.0%	0.00	31	0	0.00
Annual Total		**49.42**	**14.55**					**46.3**	**100.0%**			**2942**	**31.3**

a. ETo values reported in CIMIS at Station #8 (Inland san Francisco Bay Area)

b. Average Monthly precipitation from the Western Regional Climate Center at Newark Station, CA (#046144)

MGD Annual Average **2.61**

c. Assumed 75% infiltration rate into the vegetation root zone.

d. Leaching rate factor represents a 10 percent leaching rate through the vegetation root zone

e. Monthly peaking factor is the calculated monthly irrigation demand divided by the average monthly irrigation demand

f. Assumes 75% irrigation efficiency is achieved through conservation practices.

Dual Plumbing

Land Use Category	Land Use Abbrev.	Water Use Factor			Floor to Area Ratio	Percent Com-mercial	Housing Density	# of rooms	Acreage	Water Demand (RMC)	Dual Plumbing Use
		gpd/ksf	gpd/room	gpd/DU			DU/acre			gpd	%
Boulevard Commercial	CMRL	150	-	-	0.5	100%	-	-	4.5	**14,800**	100%
Hotel	Hotel	-	200	-	-	0%	-	351	5	**70,200**	100%
Schools	SCHL	-	-	-	-	0%	-	-	-	**13,160**	100%
Existing	EXST	-	-	-	-	0%	-	-	-	443,047	0%
High Density Transit-Oriented Development Residential	HD-TOD	-	-	243	-	0%	32	-	106.2	**824,521**	0%
Very High Density Transit Oriented Residential	VHD-TOR	-	-	243	N/A	0%	49	-	53.4	**633,563**	0%
Boulevard Very High Density Mixed Use	Blvd VH MXD	160	-	243	1.2	35%	49	-	41.9	**486,000**	35%

Total = 211 2,485,291
Unaccounted for Flows = 154,088
Total Water Demand = 2,639,379
Non-Residential Water Demand (CMRL, Hotel, Schl, Blvd VH MXD Commercial) = 268,260

Recycled Water Use for Dual Plumbing

Estimated Dual Plumbing Factor **20%**

Recycled Water Demand for Dual Plumbing 53,700 gpd

APPENDIX B

RECYCLED WATER IMPROVEMENT COST ESTIMATION

Cost Estimation - Concept 2

New Line Location	Line (6") length (feet)	Pipeline cost ($)	Appurtances ($)	Contingencies ($)	No. of customer connections - Parks	Customer connection - Parks ($)	No. of customer connections - Buffers	Customer connection - Buffers ($)	Construction Cost Total ($)	Engineering legal & administration ($)	Overhead & Profit ($)	Construction Management ($)	Capital Cost ($)
From Mc Candleless Dr. through Montague and Trade Zone Blvd	1610.5	243,223	24,322	72,967					340,512	85,128			425,640
Parallel to Sango Ct.	568.4	85,843	8,584	25,753					120,181	30,045			150,226
Sango str.	473.7	71,536	7,154	21,461					100,151	25,038			125,188
Parallel Montague	505.3	76,305	7,631	22,892					106,827	26,707			133,534
Parallel Capitol Ave. (connection to Centre point Dr. through Montague)	1800.0	271,837	27,184	81,551					380,572	95,143			475,715
Centre point Dr. to creek east channel	347.4	52,460	5,246	15,738					73,444	18,361			91,805
Houret Dr.	1042.1	157,379	15,738	47,214					220,331	55,083			275,414
Subtotal south zone	**6,347**	**958,584**	**95,858**	**287,575**	**3**	**30,000**	**15**	**150,000**	**1,522,036**	**335,504**	**228,305**	**152,204**	**2,238,049**
S. milpitas Blvd	2368.4	357,681	35,768	107,304					500,753	125,188			625,941
Milpitas Blvd extension	1357.9	205,070	20,507	61,521					287,098	71,775			358,873
Piper Dr.	536.8	81,074	8,107	24,322					113,504	28,376			141,880
Parallel Milpitas Blvd Extension	1515.8	228,916	22,892	68,675					320,482	80,120			400,602
Parallel S. milpitas Blvd	663.2	100,151	10,015	30,045					140,211	35,053			175,264
Montague Expwy	1357.9	205,070	20,507	61,521					287,098	71,775			358,873
Parallel S. milpitas Blvd	410.5	61,998	6,200	18,599					86,797	21,699			108,496
Parallel S. milpitas Blvd	410.5	61,998	6,200	18,599					86,797	21,699			108,496
Subtotal north zone	**8,621**	**1,301,958**	**130,196**	**390,587**	**5**	**50,000**	**25**	**250,000**	**2,122,771**	**433,986**	**318,416**	**212,277**	**3,087,449**
Total Pipeline	**14,968**	**2,260,542**	**226,054**	**678,163**	**8**	**80,000**	**40**	**400,000**	**3,644,807**	**769,490**	**546,721**	**364,481**	**5,325,000**

Cost Estimation - Concept 1

New Line Location	Line (6") length (feet)	Pipeline cost ($)	Appurtances ($)	Contingencies ($)	No. of customer connections	Customer connection ($)	Total Construction Cost ($)	Engineering Legal & Administration ($)	Overhead & Profit ($)	Construction Management ($)	Total Capital Cost ($)
From Mc Candleless Dr. through Montague and Trade Zone Blvd	1610.5	243,223	24,322	72,967			340,512	85,128			425,640
Parallel to Sango Ct.	252.6	38,153	3,815	11,446			53,414	13,353			66,767
Parallel Montague	505.3	76,305	7,631	22,892			106,827	26,707			133,534
Parallel Capitol Ave. (connection to Centre point Dr. through Montague)	1800.0	271,837	27,184	81,551			380,572	95,143			475,715
Houret Dr.	694.7	104,920	10,492	31,476			146,888	36,722			183,609
Subtotal south zone	**4,863**	**734,438**	**73,444**	**220,331**	**3**	**30,000**	**1,058,216**	**257,053**	**158,732**	**105,822**	**1,579,823**
S. milpitas Blvd	2210.5	333,835	33,384	100,151			467,369	116,842			584,212
Parallel Milpitas Blvd Extension	884.2	133,534	13,353	40,060			186,948	46,737			233,685
Parallel S. milpitas Blvd	505.3	76,305	7,631	22,892			106,827	26,707			133,534
Subtotal north zone	**3,600**	**543,675**	**54,367**	**163,102**	**5**	**50,000**	**811,149**	**190,286**	**121,672**	**81,115**	**1,204,223**
Total Pipeline	**8,463**	**1,278,112**	**127,811**	**383,434**	**8**	**80,000**	**1,869,365**	**447,339**	**280,405**	**186,937**	**2,784,000**