E | EXECUTIVE SUMMARY

PURPOSE OF THE WATER SYSTEM PLAN

The City of Snoqualmie's (City) water system is a major infrastructure, much of which is invisible to the customers that receive its water. The water system requires qualified staff to operate and maintain an ongoing capital improvement program to replace old components to meet the requirements mandated by federal and state laws. The primary purpose of the City of Snoqualmie Water System Plan (WSP) is to identify and schedule water system improvements that correct existing system deficiencies and ensure a safe and reliable supply of water to current and future customers. This WSP complies with Washington State Department of Health (DOH) regulations under Chapter 246-290 Washington Administrative Code (WAC), which requires water purveyors to update their water system plans every 10 years.

The City's previous WSP was prepared in February 2013. This updated 2021 WSP reflects King County's (County) population allocation to the City and the City's current Urban Growth Area (UGA), which are consistent with the 2014 City and 2018 County *Comprehensive Plan* updates. The WSP also reflects improvements and changes to the water system since the completion of the 2013 WSP.

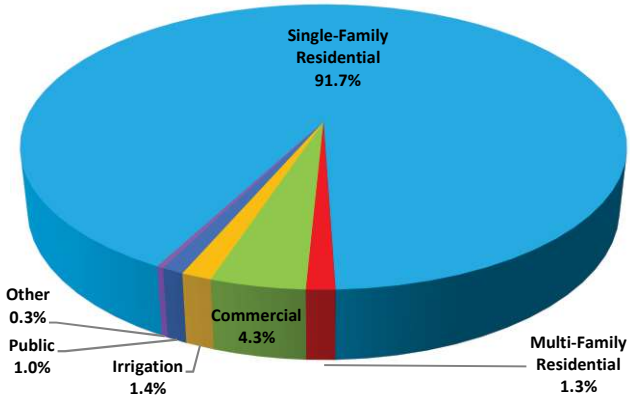
SUMMARY OF KEY ELEMENTS

This WSP presents a description of the existing water system and service area, a forecast of future water demands, policies and design criteria for water system operation and improvements, the operations and maintenance program, staffing requirements, a schedule of improvements, and a financial plan to accomplish the improvements. The WSP also includes several ancillary elements that include a water use efficiency plan, a water quality monitoring plan, a wellhead protection plan, a watershed control plan, and a cross-connection control program. A summary of the key issues related to these elements is provided in the following sections.

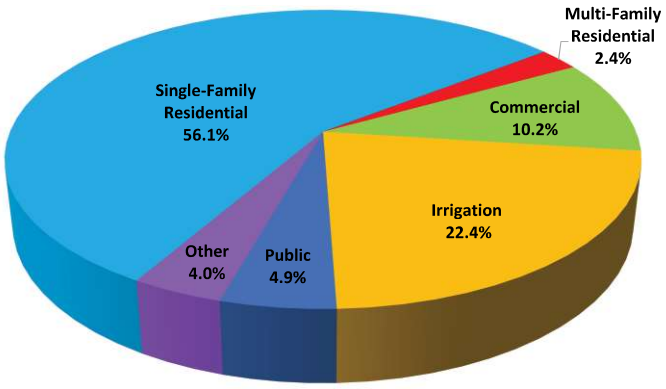
Water Service Area

The City provides water service to approximately 14,322 people throughout its water service area boundary, which extends beyond the City's corporate limits. The City is responsible for providing public water service, utility management, and water system development within this area. The City will provide new water service within the City limits and where there are existing water mains (i.e., the retail water service area). Requests for new water service outside of the City limits but within the UGA, where there are no existing water mains fronting the property, will only be granted after completion of an annexation agreement.

In 2017, the City provided water service to an average of 4,911 connections, which were mainly comprised of single-family connections. Single-family connections represent approximately 91.7 percent of all accounts, but the single-family class only consumed 56.1 percent of all water supplied to the system in 2017.



2017 Water Connections



2017 Water Consumption

Existing Water System

The City's water system was initially established from springs and surface streams. In 1950, the City began to utilize the Canyon Springs source. Well No. 1 was the City's next source, which was constructed in 1973 on the Mount Si High School property. This well was eventually decommissioned and replaced with Well No. 1-R in 2006. Well No. 2 was drilled by a developer in 1995 and fully developed in 2009 as a second well. Both Well Nos. 1-R and 2 currently comprise the South Wellfield. Well Nos. 6 and 7 were drilled in 1995 and equipped in 1996 to become the North Wellfield. Well No. 8 was drilled in 2001 and equipped in 2002 to become a part of the North Wellfield. A summary of the City's sources is shown in **Table ES-1**.

Table ES-1
Supply Facilities Summary

Facility	Pressure Zone	Year Installed	Use	Existing Capacity (gpm)	Well Depth (feet)	Water Treatment
Canyon Springs	599 Zone	1950s	Active	898	N/A	Chlorination
North Wellfield[1]						
Well No. 6	705 Zone	1996	Active	550	589	Chlorination, Filtration (Iron, Manganese, and Arsenic Removal)
Well No. 7	705 Zone	1996	Active	550	541	Chlorination, Filtration (Iron, Manganese, and Arsenic Removal)
Well No. 8	705 Zone	2002	Active	1,250	694	Chlorination, Filtration (Iron, Manganese, and Arsenic Removal)
South Wellfield[2]						
Well No. 1-R	599 Zone	2006	Active	600	557	Chlorination, Filtration (Iron and Manganese Removal)
Well No. 2	599 Zone	2009	Active	600	564	Chlorination, Filtration (Iron and Manganese Removal)

1 = Well No. 6 cannot be run simultaneously with Well No. 8, so the maximum combined capacity of the North Wellfield is approximately 1,800 gpm.
2 = The capacity of the South Wellfield is currently limited to 563 gpm by the South Wellfield WTP.

The City's water system currently has six storage facilities that provide storage directly to the 599 Zone, 705 Zone, 1040 Zone, and 1172 Zone. A summary of the City's storage facilities are shown in **Table ES-2**.

Table ES-2

Storage Facilities Summary

Reservoir	Approximate Location	Pressure Zone	Year Constructed	Construction Type	Capacity (MG)	Overflow Elevation (feet)	Diameter (feet)	Height (feet)
599 Zone								
599 Reservoir	South of Cortland Avenue SE	599 Zone	1961	Steel	0.51	599	52	32
Snoqualmie Ridge Pressure Zones								
705 Reservoir No. 1	Fisher Creek Park	705 Zone	1996	Steel	0.03	705	15	24
705 Reservoir No. 2			2018	Steel	0.13		30	24
1040 Reservoir No. 1	South of SE Jacobia St, between Hancock Ave SE and SE Keller St	1040 Zone	1997	Concrete	2.10	1,040	122	24
1040 Reservoir No. 2			2004	Concrete	1.72		110.5	24
South Pressure Zones								
1172 Reservoir	South of Snoqualmie Point Park	1172 Zone	1989	Steel	0.40	1,172	47	31

The City's water system currently has five booster pump station (BPS) facilities. The 705 BPS, 1040 BPS, and 1180-1260 BPS provide water to pressure zones in the Snoqualmie Ridge area. The 384th Avenue SE BPS and Snoqualmie Point BPS provide water to pressure zones in the southern areas of the system. A summary of the pumping facilities is shown in **Table ES-3**.

Table ES-3
Booster Pump Station Facilities Summary

Pump Station	Suction Pressure Zone	Discharge Pressure Zone	Year Constructed	Number of Pumps	Pump Type	Pump Motor Size (HP)	Pump Capacity	Has VFDs?	Sum of Pump Capacities (gpm)[1]	Generator
Snoqualmie Ridge Pressure Zones Booster Pump Stations										
705 BPS	599 Zone	705 Zone	1997	2	Horizontal end-suction	(2) 60	(2) 600 gpm @ 175' TDH	No	2,400	Kimball Creek LS Diesel Generator
			2008	2	Horizontal end-suction	(2) 60	(2) 600 gpm @ 175' TDH	Yes		Portable Diesel Generator
1040 BPS	705 Zone	1040 Zone	1996	4	Vertical turbine	(2) 100	(2) 625 gpm @ 385' TDH	No	2,500	Diesel Generator
						(2) 125	(2) 625 gpm @ 385' TDH	No		
1180-1260 BPS	1040 Zone	1180 Zone	2008	6	Vertical turbine	(1) 10	(1) 155 gpm @ 164' TDH	Yes	4,748	Diesel Generator
						(3) 40	(3) 531 gpm @ 215' TDH	Yes		
						(2) 125	(2) 1,500 gpm @ 210' TDH	No		
		1260 Zone		6	Vertical turbine	(1) 15	(1) 137 gpm @ 245' TDH	Yes	4,445	
						(3) 50	(3) 436 gpm @ 290' TDH	Yes		
						(2) 150	(2) 1,500 gpm @ 290' TDH	No		
South Pressure Zones Booster Pump Stations										
384th Avenue SE BPS	599 Zone	799 Zone	1982	3	Vertical turbine	(2) 20	(2) 200 gpm @ 216' TDH	No	1,600	Natural Gas Generator
					Horizontal end-suction	(1) 125	(1) 1,200 gpm @ 272' TDH	No		
Snoqualmie Point BPS	799 Zone	1172 Zone	1989	2	Submersible	(2) 25	(2) 150 gpm @ 414' TDH	No	300	None

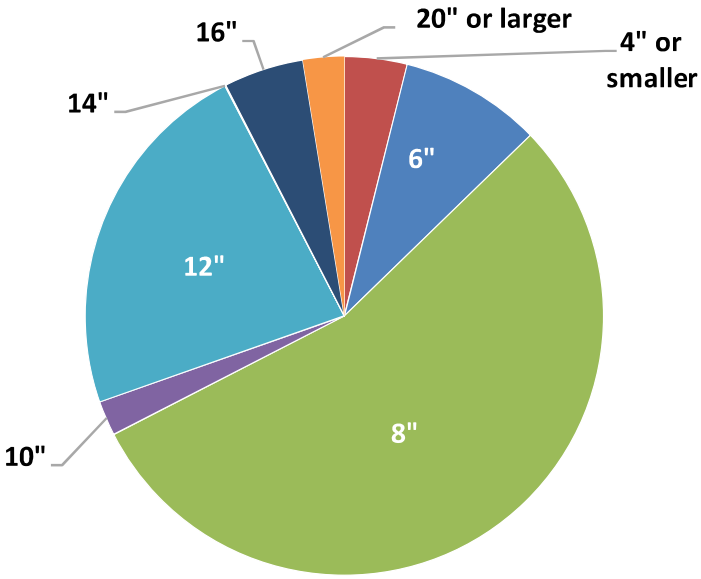
1 = The actual total station capacity is typically less than the sum of pump capacities, due to increased head losses at higher flow rates. Total capacity may also be limited if the BPS electrical system is not designed to run all pumps concurrently.

The City's water system contains approximately 69 miles of water main ranging in size from 2 inches to 24 inches. As shown in **Table ES-4**, most of the water main (approximately 92 percent) within the system is 12 inches in diameter or less. The remaining 8 percent of the water main is 14 inches in diameter or larger.

Table ES-4

Water Main Diameter Inventory

Diameter (Inches)	Length (Feet)	% of Total
4 or smaller	14,151	3.9%
6	32,069	8.8%
8	198,496	54.7%
10	7,872	2.2%
12	82,597	22.8%
14	227	0.1%
16	18,077	5.0%
20 or larger	9,338	2.6%
Total	**362,827**	**100%**



Past Water Usage

Table ES-5 presents the total annual supply and average day demand for 2011 through 2017. Water demands have generally been increasing since 2011. This is most likely the result of new development, which primarily consists of single-family residences in the Snoqualmie Ridge area.

Table ES-5

Historical Water Supply and System Demand

Year	Canyon Springs Supply (MG)	North Wellfield Supply (MG)	South Wellfield Supply (MG)	Total Supply (MG)	Average Day Demand (gpm)
2011	127.5	248.7	65.9	442.1	841
2012	128.8	239.1	104.2	472.2	896
2013	143.0	297.2	66.1	506.3	963
2014	156.1	300.7	79.3	536.0	1,020
2015	350.2	139.2	29.8	519.2	988
2016	398.7	90.7	0.0	489.4	929
2017	360.5	148.2	52.9	561.6	1,068

Per Capita Demands

Table ES-6 show the computation of the existing residential population per capita demand based on 2017 data. The existing per capita demand of 86 gallons per day (gpd) was calculated by adding the estimated distribution system leakage with the residential consumption.

Table ES-6

Existing Residential Population Per Capita Demand

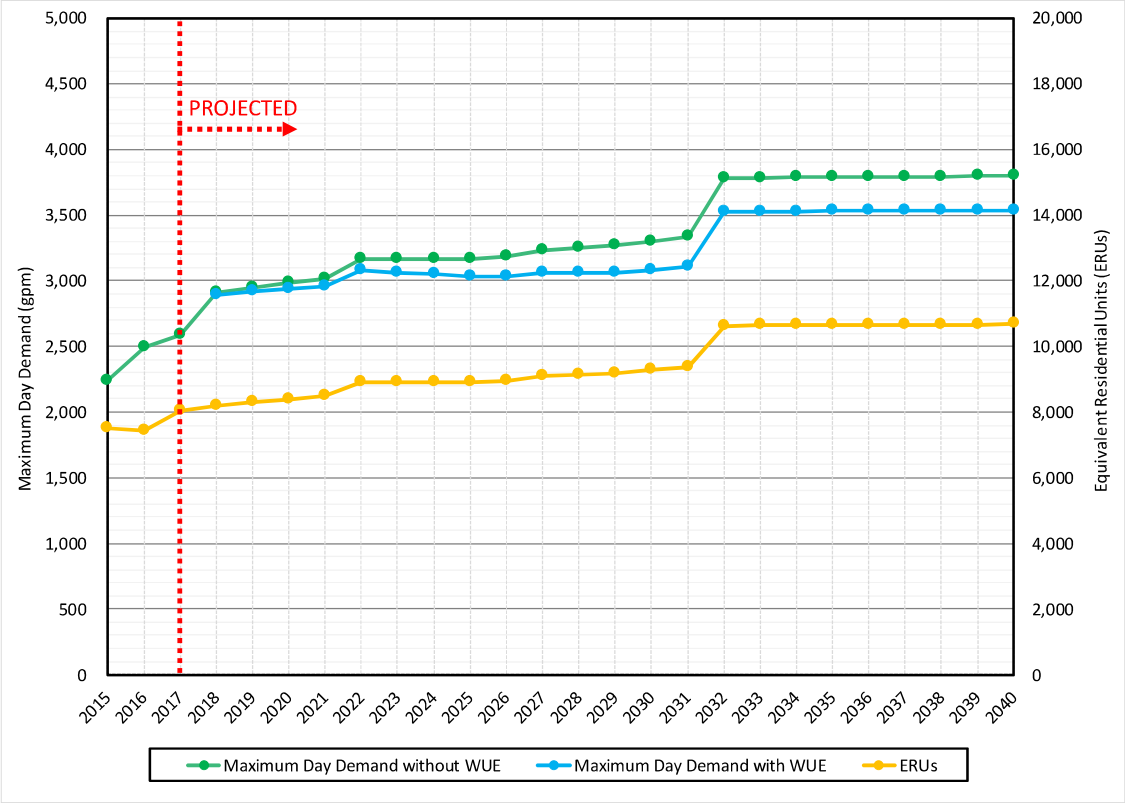
Calculated 2017 Residential Population Served	14,322
2017 Total Annual Residential Population Consumption (gallons)	441,469,877
Existing Residential Population Per Capita Consumption (gpd/capita)	84
2017 Estimated Residential Population DSL (gallons)	8,260,265
2017 Total Annual Residential Population Demand (gallons)	449,730,142
Existing Residential Per Capita Demand (gpd/capita)	**86**

Future Water Demands and Water Supply

Overall water demand within the City's system is expected to increase by approximately 32 percent of 2017 demand by the end of the 20-year planning period. Future demand projections were calculated with and without water savings expected from implementing the City's water use efficiency measures. **Chart ES-1** shows the Maximum Day Demand and ERU projections for the system through the end of the 20-year planning period.

Chart ES-1

Maximum Day Demand and ERU Projections (Demand Basis)



Water Source and Quality

Water is supplied to the City from Canyon Springs, the North Wellfield, and the South Wellfield. Canyon Springs is located in a deep canyon on the north hillside bank of the North Fork of the Snoqualmie River and has a capacity of 898 gallons per minute (gpm).

The North Wellfield consists of Wells No. 6, No. 7, and No. 8 located in the northernmost area of the City's water service area. Due to interference, Wells No. 6 and No. 8 are not operated simultaneously, so the wellfield has a combined capacity of approximately 1,800 gpm.

The South Wellfield consists of Wells No. 1R and No. 2 on property currently occupied by Mount Si High School. The wellfield has a capacity of 563 gpm.

All City water sources are chlorinated. The North Wellfield Water Treatment Plant (WTP) and South Wellfield WTP remove iron and manganese from the water produced by their respective wells. The North Wellfield WTP also treats the water to remove arsenic. At the North Wellfield WTP, a sodium hypochlorite solution is added to the raw water for oxidation, while ferric chloride is added to the raw water to coprecipitate with arsenic. Three filter trains are used to remove iron, manganese, and arsenic that binds with the ferric chloride.

At the South Wellfield WTP, sodium hypochlorite is used for oxidation and then filtered with pyrolusite media to remove iron and manganese compounds. Canyon Springs water currently is treated with sodium hypochlorite generated onsite. The sodium hypochlorite is injected into the 12-inch PVC transmission main from the springs 1,320 feet upstream of the disinfection building.

Operations and Maintenance

The City's operations and maintenance organization is staffed by well qualified, technically trained personnel. City staff regularly participate in safety and training programs to keep abreast of the latest changes in the water industry and ensure a smooth and safe operation of the water system. The current staff have effectively operated and maintained the water system in the past. However, to optimize the preventive maintenance program and operations of the water system, additional personnel are recommended. As the water system expands in the future and continues to age, additional staff will be required. The City plans to add staff to meet the increased requirements from system expansion as the budget allows.

The City has taken several steps to prepare for emergency situations. Vulnerability Assessment and Emergency Response Plans (ERP) have been prepared that conform to the requirements of the Bioterrorism Act of 2002. Per America's Water Infrastructure Act (AWIA) of 2018, the City is required to complete an all-hazards risk and resilience assessment (RRA) and ERP. The City's RRA was completed in June 2021. The ERP is currently being updated and will be completed in December 2021.

Water System Evaluation

The existing water system was evaluated to determine its ability to meet the policies and design criteria of the City and those mandated by DOH. The results of the evaluation are summarized as follows.

- The City will have a source capacity deficiency of approximately 41 gpm by 2030, increasing to 537 gpm at the end of the 20-year planning period. As part of a long-rang water supply plan, the City is considering implementation of an Aquifer Storage and Recovery program and other improvements to resolve the deficiency.

- Canyon Springs needs collector box upgrades and new access trail/road to replace the aging existing infrastructure. The City also is considering installation of a BPS to maximize source output.
- The City plans to install permanent backup power with an automatic transfer switch for Well Nos. 6 and 7.
- The South Wellfield's on-site hypochlorite generation system is aging. The City plans to upgrade the system to standardize with the Canyon Springs and North Wellfield WTP manufacturer.
- The 705 BPS is equipped with four pumps: two fixed speed and two variable frequency drives (VFDs). The City plans to retrofit the fixed speed pumps with VFDs to allow for more efficient operation.
- The City plans to install a fifth pump at the 1040 BPS to increase the capacity by approximately 625 gpm.
- The City plans to construct a new 1.6 million gallon (MG) 599 Reservoir No. 2 to resolve the storage deficiency for the 20-year planning period.
- The City plans to construct a new 1040 Reservoir No. 3 by 2030 to remedy storage deficiencies in the 1040 Zone operating area. The 1.8 MG capacity will remedy storage deficiencies in both the 1040 and 705 Zones.
- The City's Reinig Road PRV/PSV has been installed but is currently inactive. The City plans to activate this PRV/PSV and install a supervisory control system. An additional PRV also is recommended to supply water from the 705 Zone to the 599 Zone.
- Several pressure zone improvements, consisting of new water main, PRVs, and valve configuration changes, need to be implemented to address high and low pressures.
- Several areas of the system require water main replacements to resolve deficiencies related to low fire flows, aging water main, and undesirable materials.

Proposed Water System Improvements and Financing Plan

Improvements to the water system are necessary, primarily to resolve existing system deficiencies, but also to accommodate the increase in water demands from future growth. Improvements identified for the first 11 years (2020 through 2030) are estimated to cost approximately $50.7M. The 21-year period through 2040 includes $63.4M in total project costs.

The financial analysis is intended to illustrate the feasibility of funding the operation and maintenance and capital improvements recommended for the water system in the next 10 years. The results of the financial analysis indicate that rates must increase to provide sufficient revenue to cover all utility financial obligations. The City completed a rate study in 2020 that was based on a modified version of the CIP presented in **Table ES-7** that was adjusted based on comments received as part of the study. The results of the rate study indicated that beginning in 2022, annual rate increases of 4.80 percent through 2030 should provide for continued financial viability while maintaining affordable rates.

Table ES-7

Proposed Improvements Implementation Schedule

No.	Description	Estimated Cost (2020 $)	Schedule of Improvements Planned Year of Project and Estimated Cost in 2020 $ 2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030-2040
	Water Main Improvements												
WM1	Annual Water Main Replacement Program[1]	$21,036,000				$1,500K	$1,500K	$1,500K	$1,500K	$1,500K	$1,500K	$1,500K	$10,536K
WM2	SR 202 Bridge Water Main Replacement Feasibility Analysis	$75,000	$50K	$25K									
WM3	SR 202 Bridge Water Main Replacement	$1,424,000					$475K	$949K					
WM4	Infrastructure Improvement Program/Street Preservation Program	$8,500,000	$2,500K	$1,870K	$3,570K	$560K							
WM5	Investigation and Potential Replacement of Fisher Ave Water Main	$200,000					$200K						
WM6	Investigation and Potential Replacement of Denny Peak Water Main	$80,000						$80K					
WM7	SE 76th St in Ernie's Grove	$780,000											$780K
WM8	Williams Addition Water System	$580,000	$145K	$218K	$218K								
WM9	Spruce St SE Water Main Replacement	$550,000	$138K	$206K	$206K								
WM10	SE King St Water Main Replacement	$30,000					$30K						
WM11	Maple Ave SE Water Main Replacement	$240,000					$240K						
WM12	Mill Site WM Loop (Developer Funded)	$5,770,000			$1,443K	$2,885K						$1,443K	
	Pressure Zone Improvements												
PZ1	599 Zone Evaluation and Reinig Road PRV/PSV Station Activation	$10,000	$10K										
PZ2	SCADA for Reinig Rd PRV/PSV Station	$110,000	$110K										
PZ3	705 Zone to 599 Zone Conversion	$100,000				$100K							
PZ4	599 Zone to 705 Zone Conversion[2]	$90,000				$90K							
	PRV Improvements												
PRV1	670 Zone PRV Adjustment[2]	$19,000	$19K										
PRV2	1180/1040 Zone PRV at Raines Ave SE and Water Main	$830,000											$830K
PRV3	PRV Recirculation Study and Improvements	$140,000				$140K							
	Facility Improvements												
F1	1040 BPS Additional Pump	$390,000	$390K										
F2	South Wellfield VFDs	$50,000	$50K										
F3	Canyon Springs Improvements	$5,520,000								$920K	$2,300K	$2,300K	
F4	South Wellfield Chlorine Contact Time Improvements	$800,000				$267K	$533K						
F5	South Wellfield On-Site Sodium Hypochlorite Generation Improvements	$470,000				$157K	$313K						
F6	Permanent Backup Generator for South Wellfield/South Wellfield Treatment Plant	$1,020,000				$1,020K							
F7	Permanent Backup Generator for Well No. 6 and Well No. 7 (North Wellfield)	$1,020,000										$1,020K	
F8	Retrofit 705 BPS with VFDs	$70,000					$70K						
F9	705 BPS Additional Pump	$390,000					$390K						
F10	Install Drain System for 1040 Reservoir Valve Vaults	$30,000				$30K							
F11	Reservoir Siting Study	$40,000				$40K							
F12	1.6 MG 599 Reservoir No. 2 (Partially Developer Funded)	$3,970,000					$662K	$1,654K	$1,654K				
F13	1.8 MG 1040 Reservoir No. 3	$4,470,000						$745K	$1,863K	$1,863K			
F14	0.2 MG 1172 Reservoir No. 2/799 Reservoir	$1,180,000									$393K	$787K	
	Miscellaneous Improvements												
M1	Source of Supply Improvements - Study	$200,000	$200K										
M2	Source of Supply Improvements - Implementation	$2,000,000		$1,000K	$1,000K								
M3	Risk & Resiliency Assessment and Emergency Response Plan[3]	$60,000	$30K	$30K									
M4	Water Use Efficiency Audit and Programming	$299,000	$46K	$46K	$12K	$12K	$12K	$12K	$12K	$12K	$12K	$12K	$115K
M5	Water System Plan Update	$805,000										$403K	$403K
M6	Pump Condition Evaluation	$60,000				$60K							
Total Estimated Costs of City Funded Improvements		**$55,653,000**	**$3,688K**	**$3,395K**	**$5,005K**	**$3,975K**	**$4,094K**	**$4,113K**	**$4,201K**	**$4,294K**	**$4,205K**	**$6,021K**	**$12,664K**
Total Estimated Costs of Developer Funded Improvements		**$7,755,000**			**$1,443K**	**$2,885K**	**$331K**	**$827K**	**$827K**			**$1,443K**	

1 = Annual project cost can be adjusted to meet City budget goals. Remainder of project costs can be shifted to the 2040+ horizon.
2 = Project should be completed in the short-term due to pressures below 30 psi and/or significant impact on available fire flow.
3 = America's Water Infrastructure Act of 2018 requires development or update of the Risk and Resilience Assessment by June 30, 2021, and the Emergency Response Plan by December 30, 2021.