CHAPTER 7

Water System Analysis

INTRODUCTION

Ball Park Well No. 1

This chapter presents the analysis of the existing City of Bonney Lake (City) water system. Individual water system components were analyzed to determine their ability to meet policies and design criteria under existing and future water demand conditions. The policies and design criteria are presented in **Chapter 5** and the water demands are presented in **Chapter 4**. A description of the water system facilities and current operation is presented in **Chapter 2**. The last section of this chapter presents the existing and projected system capacity analyses that were performed to determine the maximum number of equivalent residential units (ERU) that can be served by the City's water system. These analyses are based on regulatory requirements for water system design and for maintaining an acceptable level of service. The City's primary goal is to have all of its facilities in compliance with Federal and State requirements, and the secondary goal is to have all of its facilities provide the ideal level of service as defined by the City's policies and criteria.

IMPROVEMENTS SINCE 1996

Numerous changes to the water system have occurred since the completion of the 1996 Comprehensive Water System Plan. The City has implemented a majority of the recommended 10-year 1996 Capital Improvement Program (CIP). Approximately 80 percent by cost ($39 million) or 48 of the 72 CIP projects that were listed have been constructed or are currently under design with funding already secured. An additional 19 projects, totaling over $23 million, that were not listed in the CIP have also been constructed or started. **Table 7-1 – *CIP Improvements Since 1996*** lists the CIP projects that have been implemented.

In addition to these major City-funded projects, there were also many developer-funded projects that were implemented as system extensions in order to extend service to or improve capacity for their specific plats. The impacts of all of these improvements can easily be seen when the pipe inventories for 1996 and 2006 are compared. The following tables show the percent increase of total water main length in the City's system. Overall, the system has grown by over 69 miles of water main or by approximately 57 percent. As can be seen in **Table 7-2 – D*istribution Improvements Since 1996 (by size)*** and **Table 7-3 – D*istribution Improvements Since 1996 (by material)***, the relative proportions of undersized or substandard material water mains have decreased significantly, as is to be expected for expanding systems which are increasing transmission and distribution capacity. In addition, the numbers of fire hydrants have increased from 798 to approximately 1,422, or by over 78 percent and the number of valves have increased from 783 to approximately 1,645, or by over 110 percent (see **Table 7-4 – *Valve and Hydrant Improvements***).

Table 7-1
CIP Improvements Since 1996

Summary	% of Total Cost	Total Costs	% of Total Projects	Total Projects
Completed	56%	$27,383,085	62%	56
Under Construction	22%	$11,031,400	4%	4
Under Design	1%	$612,500	3%	3
Need For Project Alleviated	1%	$262,500	3%	3
Delayed	8%	$3,798,750	14%	13
Pending	13%	$6,232,250	13%	12
Total	*100%*	$49,320,485	100%	*91*

Note: The 1996 CWSP CIP projected that 72 projects would be started within the first ten years of program. To date 66 projects (or 80% of the 10-yr CIP by cost) have been completed or started. The remaining projects were postponed to allow for 19 new, higher priority, projects worth $23,162,510 to be completed.

10-Year Capital Improvement Program (CIP)

	CIP #		Description	Component	Estimated 1996 Cost	Notes
1996	1	P1	Ponderosa Water Tank No. 2	Storage	$2,343,750	Completed
	2	B1	12" Replacement - Church Lake Drive	Distribution	$2,012,500	Completed
1997	3	P2	12" Extension - S. Prairie Road/214th Ave E.	Distribution	$603,750	Completed
	4	P3	System Expansion	Distribution	$200,000	View Royal assumption - delayed
	5	P4	12" Extension - 200th Ave CT E.	Distribution	$359,375	Completed
	6	B2	8" Extension - 109th St. E.	Distribution	$25,000	Need for project alleviated by Developer Extension improvements
	7	S1	Water Source Assessment Study	Source	$45,000	Completed
	8	S2	Water Rights Strategy	Source	$50,000	Completed
	9	S3	Spring Source Meter Replacements	Source	$30,000	Completed
	10	P5	PRS - 93rd St. E.	Distribution	$78,750	Completed
	11	T1*	County Roadway Proj. - 9th St. 8" Replacement	Distribution	$89,375	Delayed by County
	12	T2*	- Bowman Lake 8" Extension	Distribution	$227,500	Delayed by County
	13	T3*	- 12th St. 12" Replacement	Distribution	$121,875	Delayed by County
	14	B3	8" Replacement - 26th St. E (Sch. B)	Distribution	$230,000	Completed
	15	Q1	Compliance Monitoring	Source	$10,000	Completed
	16	Q2	Wellhead Protection Plan	Source	$300,000	Completed
1998	17	Q3	Corrosion Control Special Monitoring	Source	$15,000	Completed
	18	L1	Lakeridge Water Tank Structural Study	Storage	$5,000	Completed
	19	L2	Install New Zone Valves	Distribution	$25,000	Completed
	20	L3	BPS - 84th/Locust	Distribution	$660,000	Delayed by construction of Lakeridge BPS (CIP# L18)
	21	L4	8" Connection - S. Tapps Hwy. to 178th Ave E.	Distribution	$100,000	Completed
	22	L5	PRS - Bonney Lake Blvd./188th	Distribution	$93,750	Completed
	23	L6	PRS - S. Tapps Drive E./186th	Distribution	$93,750	Completed
	24	L7	PRS - 42nd Street East	Distribution	$93,750	Completed
	25	S4	Victor Falls Watershed Fencing	Source	$212,500	Under Design
	26	S5	Victor Falls Expansion	Source	$275,000	Under Design
	27	B4	8" Replacement - 82nd St. E./191st Ave. E.	Distribution	$175,000	Completed
1999	28	B5	8" Replacement - 190th Ave E./80th St. E.	Distribution	$375,000	Completed
	29	B6	12" Replacement - W. Tapps Hwy.	Distribution	$258,750	Completed
	30	B7	8" Replacement - McGhee Drive/65th St. E.	Distribution	$600,000	Completed
	31	Q4	Corrosion Control Facilities (one-site)	Source	$260,000	Completed
	32	S6	Well No. 6 Drilling	Source	$350,000	Completed
2000	33	B8	12" Replacement - Lakeridge Drive E.	Distribution	$1,150,000	Completed
2001	34	L8	BPS - Sumner-Tapps Co. Rd./S. Tapps Hwy.	Distribution	$522,500	Completed
	35	S7	Well No. 6 Development	Source	$812,500	Completed
	36	T4	PRS - Winchester Heights	Distribution	$66,000	Pending
	37	Q5	Detention Facilities for CT at Victor Falls	Source	$199,200	Completed
	38	Q6	Detention Facilities for CT at Grainger Springs	Source	$308,400	Completed
	39	Q7	SWTR Compliance Monitoring	Source	$125,000	Need for project eliminated per DOH review of water quality data
	40	Q8	Wellhead Protection Improvements	Source	$300,000	Completed
	41	L9	8" Replacement - Locust Ave Ext.	Distribution	$112,500	Need for project alleviated with pressure zone reconfiguration
	42	L10	8" Extension - 166th Ave. E.	Distribution	$100,000	Pending
	43	B9*	10" Extension - Meyers Road	Distribution	$137,500	Completed
	44	S8	Emergency Response and O&M Manual	Source	$150,000	Completed
2002	45	Q9	Ballpark Well Iron and Manganese Removal	Source	$1,040,000	Completed
	46	S9	Telemetry and Supervisory Control	System	$150,000	Completed
	47	S10	Comprehensive Water Plan Update	System	$125,000	Under Design
	48	S11	Well No. 7 Drilling	Source	$375,000	Completed
	49	B10	8" Replacement - 36th St. E.	Distribution	$125,000	Reprioritized as part of PWTF Leaking Main Projects
	50	B11	8" Replacement - 190th Ave Ct. E.	Distribution	$300,000	Reprioritized as part of PWTF Leaking Main Projects
	51	B12	8" Replacement - 176th Ave E.	Distribution	$250,000	Under Construction
	52	B13	8" Replacement - 194th Ave E./67th St. E.	Distribution	$275,000	Reprioritized as part of PWTF Leaking Main Projects
2003	53	P6	8" Replacement - La Rita Drive/107th St. E.	Distribution	$312,500	Reprioritized as part of PWTF Leaking Main Projects
	54	S12	Well No. 7 Development	Source	$812,500	Completed
	55	P7	8" Replacement - 202nd Ave E./93rd St. E.	Distribution	$300,000	Reprioritized as part of PWTF Leaking Main Projects
	56	P8	8" Replacement - 208th Ave E.	Distribution	$250,000	Reprioritized as part of PWTF Leaking Main Projects
2004	57	P9	8" Replacement - 210th Ave E.		$412,500	Reprioritized as part of PWTF Leaking Main Projects
	58	B14	8" Replacement - 179th Ave.E./185th Ave E.		$525,000	Reprioritized as part of PWTF Leaking Main Projects
2005	59	T5	BPS - Sumner-Tapps Hwy. E.		$675,000	Pending
	60	T6	PRS - Driftwood Point		$78,750	Pending
	61	T7	Tacoma Point Tank Modifications		$937,500	Pending
	62	T8	16" Replacement - Tacoma Point Tank		$93,750	Pending
	63	T9	12" Extension - 4th St. E.		$86,250	Completed
	64	T10	8" Extension - 9th St. E.		$75,000	Completed
	65	T11	8" Replacement - 17th St. E./180th Ave E.		$250,000	Completed
	66	L11	Lakeridge Tank Modifications		$200,000	Pending
	67	L12	Lakeridge Water Tank No. 2		$2,393,750	Pending
2006	68	P10	8" Replacement - Bonanza Drive		$312,500	Reprioritized as part of PWTF Leaking Main Projects
	69	B15	8" Replacement - 91st St. E./207th Ave. E.		$412,500	Reprioritized as part of PWTF Leaking Main Projects
	70	B16	8" Replacement - 188th Ave E.		$300,000	Reprioritized as part of PWTF Leaking Main Projects
	71	B17	8" Replacement - Church Lake Drive		$662,500	Reprioritized as part of PWTF Leaking Main Projects
	72	B18	8" Replacement - Maple Point		$125,000	Completed
	CIP Totals				**$26,157,975**	
	Additional Projects					
	73	R23*	8" Replacement - 77th St. E.	Distribution	$138,125	Completed
	74	B19*	8" Replacement - Inlet Island	Distribution	$1,525,000	Completed
	75	X	8" Replacement - 74th St. E.	Distribution	$678,500	Completed
	76	X	8" Replacement - Driftwood Point	Distribution	$148,500	Completed
	77	X	Edwards Road Water Main	Distribution	$300,000	Completed
	78	X	Driftwood Drive Water Main	Distribution	$348,408	Completed
	79	R29	190th (McGhee II) Water Main	Distribution	$500,000	Completed
	80	X	188th and Elementary School Water Main	Distribution	$151,112	Completed
	81	X	12" Replacement - 189th Ave E./Church Lake Road	Distribution	$100,000	Completed
	82	X	Spring Source Treatment	Source	$1,245,840	Completed
	83	T12	8" Replacement - 186th Ave. E.		$525,000	Completed
	84	R1	8" Replacement - 185th Ave E.		$361,250	Completed
	85	R3	8" Replacement - 179th Ave E.		$340,000	Under Construction
	86	R6	8" Replacement - Deer Island Drive		$138,125	Under Construction
	87	R33	8" Replacement - 191st Ave Ct. E.		$106,250	Completed
	88	R28	8" Replacement - 192nd Ave E. (Ball Park)		$371,875	Completed
	89	R22	8" Replacement - 64th St. E.		$106,250	Completed
	90	X	Peaking Storage Facility		$10,303,275	Under Construction
	91	X	Wholesale Supply Project (TPU)		$5,775,000	Completed
	Sub-total				*$23,162,510*	
	Grand Total				**$49,320,485**	

Table 7-2
Distribution Improvements Since 1996 (by size)

Diameter	2006	1996	Change	Percent
2-inch	12,728 ft.	23,973 ft.	(11,245) ft.	-2%
4-inch	93,717 ft.	139,359 ft.	(45,642) ft.	-7%
6-inch	100,397 ft.	126,288 ft.	(25,891) ft.	-4%
8-inch	462,424 ft.	205,838 ft.	256,586 ft.	40%
10-inch	34,425 ft.	31,506 ft.	2,919 ft.	0%
12-inch	249,648 ft.	95,861 ft.	153,787 ft.	24%
14-inch	746 ft.		746 ft.	0%
16-inch	47,072 ft.	17,773 ft.	29,299 ft.	5%
20-inch	1,524 ft.		1,524 ft.	0%
42-inch	320 ft.		320 ft.	0%
48-inch	160 ft.		160 ft.	0%
Total	1,003,161 ft. 190 miles	640,598 ft. 121 miles	362,563 ft. 69 miles	57%

Table 7-3
Distribution Improvements Since 1996 (by material)

Diameter	2006	1996	Change	Percent
Steel	107,897 ft.	196,877 ft.	(88,980) ft.	-14%
AC	26,184 ft.	39,682 ft.	(13,498) ft.	-2%
CI	78,159 ft.	55,004 ft.	23,155 ft.	4%
PVC	11,928 ft.	20,193 ft.	(8,265) ft.	-1%
DI	773,324 ft.	325,979 ft.	447,345 ft.	70%
HDPE	2,861 ft.	-	2,861 ft.	0%
C-900	2,808 ft.	2,863 ft.	(55) ft.	0%
Total	1,003,161 ft. 190 miles	640,598 ft. 121 miles	362,563 ft. 69 miles	57%

Table 7-4
Valve and Hydrant Improvements Since 1996

	2006	1996 CWSP	Change	Percent
Valves	1,645	783	862	110%
Hydrants	1,422	798	624	78%

DISTRIBUTION AND TRANSMISSION SYSTEM ANALYSIS

The deficiencies of the City's transmission and distribution system can be divided into two broad categories: substandard materials and inadequate hydraulic capacity. Substandard pipe materials can result in leaking water mains and unsafe water quality. Hydraulic capacity is affected by water main configuration, undersized pipelines, and lack of redundant transmission mains. A large number of improvements presented in both the 1990 CIP and 1996 CIP consisted of replacing water mains that were either undersized or that are in poor condition structurally, with new water mains that are large enough to provide the flow capabilities currently required.

Substandard Materials Analysis Criteria

The following is a brief discussion of typical water main construction material.

Water Main Construction Materials

DI (Ductile Iron) - DI pipe is cement-lined to resist corrosion and has superior strength with less stringent bedding and backfilling requirements relative to other typical water main construction materials. DI pipe is the preferred water main construction material and is required under most conditions.

PVC (Polyvinyl Chloride) - Not as strong as ductile iron and requires higher quality bedding and trench backfill material. PVC is considered substandard unless it meets or exceeds C-900 requirements.

AC (Asbestos Cement) - AC water main has a relatively short design life and must be very carefully bedded and backfilled. In addition, airborne asbestos may cause lung cancer which is a major concern for workmen who repair this type of pipe. AC water pipe is no longer manufactured. AC is considered a substandard material.

CI (Cast Iron) - Not cement lined and, therefore, poses corrosion and high iron concentration concerns. In addition, CI pipe is not as strong as ductile iron pipe. CI water pipe is no longer manufactured. CI is considered a substandard material.

HDPE (High Density Polyethylene) – HDPE pipe is flexible, light weight and leak tight. It is capable of handling a variety of environmental conditions including extreme cold, earthquakes and corrosive materials. It must be heat fused, which makes a leak tight joint, but requires special equipment. HDPE pipe doesn’t corrode or support biological growth and has a smooth interior. It has a projected life of over 70 years.

Substandard Materials Analysis Results

Figure 5 – *Existing Pipe Materials* shows the distribution of water mains delineated by construction material. As system pressures have increased the City has experienced a high level of pipe failures (leaks) in its steel water mains. The City is currently implementing a $6 million program to aggressively replace substandard material water mains, concentrating first on steel water mains, then on AC water mains, then on non C-900 PVC and, finally on CI mains. The CIP provides a schedule for replacing all mains constructed of steel, AC, or non C-900 PVC within the next 20 years.

Hydraulic Analysis Criteria

Distribution and transmission water mains must be capable of adequately and reliably conveying water throughout the system at acceptable flow rates and pressures. The criteria used to evaluate the City's distribution and transmission system is the state mandated requirements for Group A water systems contained in *WAC 246-290-230* Distribution Systems. The pressure analysis criteria states that the distribution system "…shall be designed with the capacity to deliver the design peak hour demand quantity of water at 30 psi under peak hour demand flow conditions measured at all existing and proposed service water meters". It also states that if fire flow is to be provided, "… the distribution system shall also provide maximum day demand (MDD) plus the required fire flow at a pressure of at least 20 psi at all points throughout the distribution system".

Hydraulic analyses of the existing system were performed under existing peak hour demand conditions to evaluate its current pressure capabilities and to identify existing system deficiencies. The existing system was also analyzed under existing peak day demand conditions to evaluate the current fire flow capabilities and to identify additional existing system deficiencies. Additional hydraulic analyses were then performed with the same hydraulic model, but under future peak day demand conditions for the years 2012 and 2026. Six-year, ten-year and twenty-year proposed improvements were incorporated into the model to demonstrate that the identified improvements will eliminate the deficiencies and meet the requirements far into the future. Following is a description of the hydraulic model and the operational conditions and facility settings used in the analyses.

Undersized pipes in the water system can reduce both the overall transmission ability and the local flow capacity of the water system and create excessive water velocities. Operating a water system with high or excessive water velocities may cause damage or unnecessary wear to the system. It is standard engineering design practice to limit the maximum velocity in any water main to less than 5 feet per second during maximum day demand flow conditions. Furthermore, during maximum day demand or maximum instantaneous demand with fire flow conditions, the water velocity in any pipe should not exceed 8 feet per second. The performance of the existing water system was analyzed using these criteria.

Hydraulic Model

Description

A computer-based hydraulic model of the existing water system was updated using version 8.0 of the WaterCAD program, developed by Haestad Methods. All water mains in the City's water system were modeled. The City's existing hydraulic model contained a majority of the systems water mains. The model was updated with additional and replaced water mains from recent developments and City projects. The junction node elevation data was extracted from as-built information or from the aerial survey contours of the area. A hydraulic model node diagram that provides a graphical representation of the model of the water system is contained in **Appendix J**. Due to the complexity of the system the model was divided into three zones for fire flow modeling. These correspond to the system's three major pressure zones: Bonney Lake 748; Ponderosa 800; and Lakeridge 810. Zones supplied by any of these three zones were modeled as part of the supplying zone. The peak hour demand hydraulic analyses contemplated the water system as a whole.

Demand Data

The hydraulic model of the existing system contains 2006 average day demand data. Supply data from the 2006 average day demand was distributed throughout the junction nodes of the model, based on allocation levels that reflect the proportionate share of total supply to each pressure zone. The peaking factors determined from the diurnal curves and telemetry data available from the summer of 1998 were used to analyze the system under peak hour and peak day demand conditions.

The hydraulic model of the proposed system contains 6-year and 20-year demand levels that are projected for the years 2012 and 2026. The distribution of demands is based on estimated future demand levels in each pressure zone.

Facilities

The hydraulic model of the existing system for the pressure analysis contains all active existing system facilities with settings that correspond to peak hour demand events. All sources of supply and booster pump stations were operating at their normal pumping rates. The tank levels were modeled to reflect full utilization of operational and equalizing storage. All active pressure reducing stations were modeled as being in service and at their normal set points. As previously mentioned, the entire system was modeled under 2006, 2012 and 2026 peak hour demand conditions.

The hydraulic model of the existing system for the fire flow analyses contains all active existing system facilities with settings that correspond to peak day demand events. However, the Department of Health standards require that one major source needs to be off-line. Thus, the following source was taken off-line for the Bonney Lake 748 Zone: Tacoma Point Well No. 6

and for the Ponderosa 800 and Lakeridge 810 zones, the largest pump within a pump station was assumed to be off-line. All other sources of supply were operating at their normal pumping rates. The tank levels were modeled to reflect full utilization of operational, equalizing and fire flow storage. Fire flow storage, based on the maximum requirement of 2,500 gpm for 2 hours or 300,000 gallons, for the entire system was provided equally from all tanks. All active pressure reducing stations were modeled as being in service and at their normal set points.

The hydraulic model of the proposed system in the years 2012 and 2026 contains all active existing system facilities and proposed system improvements that are identified in **Chapter 9**. During the peak hour demand analysis, all existing sources were operating at their normal or proposed rates of supply. The tank levels were modeled to reflect full utilization of operational and equalizing storage during the pressure analysis. During the fire flow analysis, a major source of supply was removed from the previously identified zones. Existing and proposed tanks were modeled to reflect full utilization of operational, equalizing, and fire flow storage, based on the maximum required fire flow storage for all three major pressure zones independently, which is 900,000 gallons. All existing and proposed pressure reducing stations were modeled as being in service and at their normal set points.

Calibration

Hydraulic model calibration was conducted in 2006 and was achieved by adjusting the roughness coefficients of the water mains in the model. The resulting pressures and flows from the hydraulic analyses closely match the pressures and flows from actual field tests under similar demand and operating conditions. Initial Hazen-Williams roughness coefficients were entered in the model based on computed estimates of the coefficients from available pipe age and material data. For example, older water mains were assigned lower roughness coefficients than new water mains; thereby assuming that the internal surface of water pipe becomes rougher as it gets older. Additional calibration of the model was achieved using field flow and pressure data, which was collected throughout the system for this purpose.

Hydraulic Analysis Results

Pressure Analysis, Peak Hour Demand

Several hydraulic analyses were performed to determine the capability of the system to meet the pressure requirements identified in **Chapter 5** and contained in *WAC 246-290-230*. Pressure analyses were performed throughout the system under existing and future peak hour demand conditions. The results of these analyses were used to identify locations of low and high pressures. To satisfy the minimum pressure requirements, the pressure at all water service locations must be at least 30 psi during these demand conditions. Similarly, to satisfy maximum pressure requirements, the system should not have widespread areas with high pressures, generally considered to be more than 100 psi. **Table 7-5 – *Hydraulic Modeling Results, Pressure Analysis*** summarizes the results for these analyses. Although the entire system was analyzed during each test, this table presents a summary of values for each of the three major open zones in the system.

Table 7-5
Hydraulic Modeling Results, Pressure Analysis

ZONE	2006		2012		2026	
	MIN (psi)	MAX (psi)	MIN (psi)	MAX (psi)	MIN (psi)	MAX (psi)
748	33	126	34	124	32	120
800	34	80	34	74	34	73
810	35	105	33	103	36	103

Additional high and low pressures not reported in the summary table were observed at three transmission mains. Additional high pressures, no greater than 145 psi, were observed for all three years modeled on the 16-inch transmission main in the vicinity of the Victor Falls Springs (nodes J-1849 and J-1852). Additional low pressures, greater than 20 psi but lower than 30 psi, were observed on the 12-inch main in the vicinity of Panorama Heights (node J-1413) and on the 16-inch transmission main in the vicinity of Highway 410 and 198th Avenue East (node J-853). For this study, it was assumed that the pressures observed at these nodes were not significant since these mains are strictly for transmission as defined in WAC 246-290-010.

As shown in **Table 7-5**, two pressure zones have pressures greater than 100 psi; however, these are localized nodes and not widespread areas. For the year 2006 in the Bonney Lake 748 zone, the high pressure reported corresponds to the intersection of Forest Canyon Road and 165th Avenue East (node J-159). At the time of this study, the City was actively working with the developers of the Forest Canyon project to resolve this deficiency. See **Figure 8 - *Proposed Pressure Zones*** for configuration. It was assumed that these improvements would be completed by the year 2012. For the year 2006 in the Bonney Lake 748 zone, locations corresponding to the Bridlecreek Estates (nodes J-2176 and J-1605), location corresponding to North Lake Estates (node J-25) and location corresponding to the transmission main at the intersection of Edwards Road and 198th Avenue East (node J-14) are the only four nodes with pressures above 120 psi. These four locations also have pressures above 100 psi during the year 2012 and 2026. Consequently, the City has required pressure regulators on all services in these areas and is confident in the integrity of the water mains. Thus, pressure zone improvements were not proposed for these areas. The City has also taken a similar approach at the location of Tapps Drive East and 41st Street East (node J-1375) in the Lakeridge 810 Zone where the pressure exceeds 100 psi.

Fire Flow Analysis, Peak Day Demand

The second set of analyses was performed to determine the capability of the existing water system to provide fire flow throughout the existing water system under peak day demand conditions. Several hydraulic analyses were performed to determine the capability of the system to meet the flow requirements contained in *WAC 246-290-230*. Additional, more stringent, fire

flow modeling criteria specific to site development is presented in **Chapter 5**. Note that for the intent of this study these requirements were not evaluated. The City will evaluate each proposed development using these additional requirements as part of the permitting process.

A separate fire flow analysis was performed for each node in the model to determine the available fire flow at a minimum residual pressure of 20 psi. The water system was divided into three zones as previously mentioned. More than 1,800 fire flow node analyses were performed to comprehensively evaluate the water system under existing demand conditions, year 2006, and under projected demand conditions, years 2012 and 2026. Nodes located at dead-end mains or nodes in the vicinity or within facilities not carrying fire flow were not considered during the hydraulic modeling. In the same fashion, pipes in the vicinity or within facilities were not considered during the hydraulic modeling.

For each node analyzed, the resulting fire flow was compared to its general fire flow requirement, which was assigned according to the land use classification that it is located within. The three most common land uses within the water system are residential single-family (SF), residential multi-family (MF) and commercial (COM). Additional uses such as large commercial buildings (i.e. Home Depot and Lowe's) with specific fire flow demands were also analyzed. A summary of results for the fire flow analyses is presented in **Table 7-6 – *Hydraulic Modeling Results, Fire Flow Analysis***. This table presents a summary of total nodes evaluated and compares them to the total of nodes that satisfied the different fire flow requirements for each of the three zones evaluated. Nodes evaluated or modeled are presented in total number nodes analyzed. Nodes satisfying fire flow requirements are presented in total number of nodes that satisfy the requirements and as corresponding percentage of the total number of nodes analyzed. Finally, fire flow requirements specific to the Lakeland Hills South development served by the Bonney Lake 748 zone are presented in the SF (1,500 gpm) entry for this zone.

Table 7-6
Hydraulic Modeling Results, Fire Flow Analysis

Zone	Fire Flow Requirements per Land Use & Zoning	2006			2012			2026		
		Total Nodes Modeled (QTY)	Total Nodes that Satisfied Fire Flow (QTY)	(%)	Total Nodes Modeled (QTY)	Total Nodes that Satisfied Fire Flow (QTY)	(%)	Total Nodes Modeled (QTY)	Total Nodes that Satisfied Fire Flow (QTY)	(%)
748	SF (1,000 gpm)	1081	1001	93%	1088	1059	97%	1088	1088	100%
	SF (1,500 gpm)	193	192	99%	229	228	100%	230	230	100%
	MF & COM (2,500 gpm)	108	96	89%	121	110	91%	127	127	100%
748 Zone Summary		1382	1289	93%	1438	1397	97%	1445	1445	100%
800	SF (1,000 gpm)	177	146	82%	180	166	92%	196	196	100%
	MF & COM (2,500 gpm)	77	71	92%	77	71	92%	79	79	100%
	COM (>3,600 gpm)	6	6	100%	6	6	100%	6	6	100%
800 Zone Summary		260	223	86%	263	243	92%	281	281	100%
810	SF (1,000 gpm)	145	135	93%	147	136	93%	147	147	100%
	MF & COM (2,500 gpm)	6	2	33%	6	4	67%	6	6	100%
810 Zone Summary		151	137	91%	153	140	92%	153	153	100%
Overall Model Summary		**1793**	**1649**	**92%**	**1854**	**1780**	**96%**	**1879**	**1879**	**100%**

As previously mentioned, the fire flow analysis used Department of Health requirements to evaluate the system's capability to deliver fire flow. This includes maximum day demand conditions, residual pressures above 20 psi and distribution system's pipe velocities not exceeding 8 ft/s. Additionally, the major source of supply for each zone was assumed to be off-line. For the Bonney Lake 748 zone, the Tacoma Point Well No. 6 was taken off-line. For the Ponderosa 800 and Lakeridge 810 zones, the largest pump was assumed to be off-line. Note that due to redundancy deficiencies during the year 2006 the Lakeridge 810 did not satisfy this requirement. The data presented in **Table 7-6 – *Hydraulic Modeling Results, Fire Flow Analysis*** corresponds to 2006 maximum day demand conditions with all sources and facilities operating under normal conditions. It was assumed that this redundancy deficiency would be addressed by the year 2012 as shown in **Chapter 9 – *Water System Improvements*** and **Figure 7 – *Proposed Water System Improvements*.** Data for the results of year 2012 are summarized in the table and reflect this assumption.

The results of the fire flow analyses were used to identify undersized water mains and proposed water main improvements. Most of the fire flow deficiencies within the system are due to small asbestos cement and steel water mains in older sections of the system. These improvements are depicted in **Figure 7 – *Proposed Water System Improvements*.** Once all deficiencies were identified, proposed water main improvements were included in the model and fire flow analyses were performed throughout the system to demonstrate that the improvements will eliminate the deficiencies and meet the flow and pressure requirements. These analyses were modeled under projected year 2012 and 2026 peak day demand conditions to ensure that the improvements are sized sufficiently to meet the needs of the future.

PRESSURE ZONES ANALYSIS

This section evaluates the City's existing service pressures to identify deficiencies related to the pressure zones that serve each customer.

Analysis Criteria

The ideal static pressure of water supplied to customers is between 40 psi and 80 psi. Pressures within a water system's distribution system are commonly as high as 120 psi, requiring pressure regulators on individual service lines to reduce the pressure to 80 psi or less. It is difficult for the City's water system, as is common for most others systems, to maintain distribution pressures between 40 and 80 psi, primarily due to the topography of the water service area.

Pressure Zone Analysis Results

Table 7-7 – *Minimum and Maximum Distribution System Static Pressures* lists each of the City's 15 pressure zones, the highest and lowest elevation served in each zone, and the minimum and maximum distribution system pressures within each open zone, based on maximum static water conditions (full tanks and zero demands). While this table presents the results of the

evaluation of pressures based on the adequacy of the pressure zones under static conditions, the hydraulic analysis section later in this chapter presents the results of the evaluation of pressures based on the adequacy of the water mains under dynamic conditions.

When all of the system's tanks are full, the City is able to provide minimum water pressures of at almost 40 psi to all services in each zone.

The Bonney Lake 748 Zone has several areas of high pressure. Most of the high pressures occur in the Tacoma Point and north end of the water service areas. Individual services that have pressures greater than 80 psi are required to have pressure regulators to reduce the pressures to acceptable levels. In the table above, the listed pressures are calculated in the water main and the actual service pressure is lower due to the required pressure regulators.

The City has accepted these high pressures due to the pressure regulator requirement and the good condition of the ductile iron water mains. Although the north side of Lake Tapps experiences pressures above 80 psi they do not generally exceed 120 psi and are not deemed unacceptable for a distribution system. The only way to dramatically reduce pressures in these areas would be the creation of a new pressure zone; however, this would reduce north and south transmission capacity in the system and reduce system redundancy. However, there are a few areas in the Forest Canyon area that has pressure that exceed 120 psi. It is recommended that future developments in this area participate in creating lower pressure zones for this area.

PRESSURE REDUCING STATIONS ANALYSIS

This section evaluates the City's existing pressure reducing stations to identify deficiencies related to their current condition and operation capability.

Analysis Criteria

The City has a total of 21 operational pressure reducing stations. Fourteen of the pressure reducing stations are for supply to lower closed pressure zones, while the other seven are located between the upper zones and the Bonney Lake 748 Zone and are for use during a fire flow event or other drop in pressure within this zone. All pressure reducing stations are functioning properly.

Pressure reducing stations are predominately used to either maintain supply and pressures in areas during high demand conditions (i.e. fire flows) or provide an entire pressure zone source of supply. Ten of the City's 15 pressure zones receive 100 percent of their supply through pressure reducing stations. In the event of valve failures, these zones could experience either higher than normal pressures if the valve failed in the open position or limited supply and inadequate pressures if the valve failed in the closed position. While it is difficult to protect against valves failing open, resulting in high pressures, the City has taken precautions to protect against valves failing closed, by providing redundancy to most of the lower zones. Seven of the ten lower zones have at least two independent pressure reducing station serving them and the City has plans to add stations to the other three lower zones.

Table 7-7
Minimum and Maximum Distribution System Static Pressures

Pressure Zone	Type**	Maximum Hydraulic Grade Line	Highest Service Elevation (feet)	Highest Service Static Pressure* (psi)	Lowest Service Elevation (feet)	Lowest Service Static Pressure* (psi)
Current Pressure Zones						
Lakeridge	Closed	810 ft.	720 ft.	39 psi	587 ft.	97 psi
Ponderosa	Open	800 ft.	710 ft.	39 psi	622 ft.	77 psi
Pinnacles Estates	Closed	795 ft.	656 ft.	60 psi	630 ft.	71 psi
Summit	Closed	790 ft.	680 ft.	48 psi	610 ft.	78 psi
Bonney Lake	Open	748 ft.	640 ft.	47 psi	425 ft.	140 psi
Sky Island	Closed	660 ft.	554 ft.	46 psi	477 ft.	79 psi
166th Ave	Closed	630 ft.	540 ft.	39 psi	450 ft.	78 psi
47th Street	Closed	625 ft.	530 ft.	41 psi	400 ft.	97 psi
Angeline Valley	Closed	620 ft.	530 ft.	39 psi	435 ft.	80 psi
Rhodes Lake	Closed	565 ft.	456 ft.	47 psi	380 ft.	80 psi
Forest Canyon 2	Closed	530 ft.	430 ft.	43 psi	340 ft.	82 psi
Panorama West 1	Closed	465 ft.	375 ft.	39 psi	280 ft.	80 psi
Panorama West 2	Closed	385 ft.	280 ft.	45 psi	200 ft.	80 psi
Panorama West 3	Closed	385 ft.	270 ft.	50 psi	200 ft.	80 psi
Panorama West 4	Closed	310 ft.	200 ft.	48 psi	146 ft.	71 psi
Proposed Pressure Zones						
Lakeridge	Open	810 ft.	720 ft.	39 psi	587 ft.	97 psi
Ponderosa	Open	800 ft.	710 ft.	39 psi	622 ft.	77 psi
Pinnacles Estates	Closed	795 ft.	656 ft.	60 psi	630 ft.	71 psi
Summit	Closed	790 ft.	680 ft.	48 psi	610 ft.	78 psi
Bonney Lake	Open	748 ft.	640 ft.	47 psi	450 ft.	129 psi
Ridgewest	Closed	710 ft.	620 ft.	39 psi	480 ft.	100 psi
47th Street	Closed	690 ft.	600 ft.	39 psi	500 ft.	82 psi
Upper Fennel Creek	Closed	665 ft.	550 ft.	50 psi	480 ft.	80 psi
Sky Island	Closed	660 ft.	554 ft.	46 psi	477 ft.	79 psi
Forest Canyon 1	Closed	650 ft.	560 ft.	39 psi	440 ft.	91 psi
Salmon Springs 1	Closed	640 ft.	550 ft.	39 psi	440 ft.	87 psi
166th Ave	Closed	630 ft.	540 ft.	39 psi	450 ft.	78 psi
Ascent	Closed	610 ft.	510 ft.	43 psi	420 ft.	82 psi
Angeline Valley	Closed	620 ft.	530 ft.	39 psi	435 ft.	80 psi
Rhodes Lake	Closed	565 ft.	456 ft.	47 psi	380 ft.	80 psi
Forest Canyon 2	Closed	530 ft.	430 ft.	43 psi	340 ft.	82 psi
Salmon Springs 2	Closed	525 ft.	430 ft.	41 psi	340 ft.	80 psi
Panorama West 1	Closed	465 ft.	375 ft.	39 psi	280 ft.	80 psi
Forest Canyon 3	Closed	410 ft.	320 ft.	39 psi	200 ft.	91 psi
Panorama West 2	Closed	385 ft.	280 ft.	45 psi	200 ft.	80 psi
Panorama West 3	Closed	385 ft.	270 ft.	50 psi	200 ft.	80 psi
Panorama West 4	Closed	310 ft.	200 ft.	48 psi	146 ft.	71 psi

*****Optimum conditions - all reservoirs operating full.
******Open zones are pressures zones that have a water tank with a water surface open to atmospheric pressure.
Closed zones are zones that have no free water surfact (i.e. no water tank) and therefore cannot "float" on the system.

Pressure Reducing Stations Analysis Results

Table 7-8 – *PRV Supply and Failure Pressures* shows the sources of supply for each existing and proposed pressure zone.

Also presented is the maximum and minimum pressure that would result in a zone in the event of a pressure reducing valve failure. The City's goal is to not have pressures exceed 150 psi in the event of a pressure reducing valve failing in the open position. It is also the City's goal to be able to provide some level of water supply from lower zones to higher zones and maintain positive system pressures during emergency conditions.

Table 7-8
PRV Supply and Failure Pressures

Pressure Zone	Sources of Supply	Pressure if upstream PRV fails	Pressure if served from lower zone
Current Pressure Zones			
Lakeridge	LR BPS1	highest zone	12 psi
Ponderosa	P BPS, P Tank2, Tacoma Intertie	highest zone	16 psi
Pinnacles Estates	PE BPS	highest zone	40 psi
Summit	PH BPS	highest zone	29 psi
Bonney Lake	GS, VF, TP, BP, P Tank1, LR Tank1, TP Tank, Tacoma Intertie, Peaking Storage Tank, Spiraea Glen PRV, Cedar View PRV	highest zone	9 psi
Sky Island	SI PRV1, SI PRV2	117 psi	5 psi
166th Ave	166th PRV	156 psi	lowest zone
47th Street	47th PRV	177 psi	lowest zone
Angeline Valley	AVS PRV, AVN PRV, PH PRV,	135 psi	15 psi
Rhodes Lake	RL PRV, SIW PRV3	121 psi	4 psi
Forest Canyon 2	FC4	177 psi	lowest zone
Panorama West 1	CG PRV, PW PRV1	123 psi	4 psi
Panorama West 2	PW PRV4	115 psi	13 psi
Panorama West 3	PW PRV3	115 psi	17 psi
Panorama West 4	RL PRV	103 psi	lowest zone
Proposed Pressure Zones			
Lakeridge	LR BPS1, LR BPS2, LR Tank2	highest zone	12 psi
Ponderosa	P BPS, P Tank2, Tacoma Intertie, Peaking Storage Tank	highest zone	16 psi
Pinnacles Estates	PE BPS	highest zone	40 psi
Summit	PH BPS	highest zone	29 psi
Bonney Lake	GS, VF, TP, BP, P Tank1, LR Tank1, TP Tank, Tacoma Intertie, Peaking Storage Tank, Spiraea Glen PRV, Cedar View PRV	highest zone	9 psi
Ridgewest	RW1, RW2	143 psi	9 psi
47th Street (proposed)	47th PRV	134 psi	17 psi
Upper Fennel Creek	F1, F2	116 psi	lowest zone
Sky Island	SI PRV1, SI PRV2	117 psi	5 psi
Forest Canyon 1	FC1, FC2, FC3	133 psi	-13 psi
Salmon Springs 1	SS1, SS2	117 psi	lowest zone
166th Ave	166th PRV	104 psi	lowest zone
Ascent	A PRV1 A PRV2	142 psi	lowest zone
Angeline Valley	AVS PRV, AVN PRV, PH PRV,	135 psi	15 psi
Rhodes Lake	RL PRV, SIW PRV3	121 psi	4 psi
Forest Canyon 2	FC4, FC5	134 psi	-9 psi
Salmon Springs 2	SS3	130 psi	lowest zone
Panorama West 1	CG PRV, PW PRV1	123 psi	4 psi
Forest Canyon 3	FC6	143 psi	lowest zone
Panorama West 2	PW PRV4	115 psi	13 psi
Panorama West 3	PW PRV3	115 psi	17 psi
Panorama West 4	PW PRV2, PW PRV5	103 psi	lowest zone

SOURCE CAPACITY ANALYSIS

This section evaluates the combined capability of the City's existing sources such as groundwater wells, springs and wholesale interties to determine if there is sufficient capacity to meet the overall demands of the system, based on existing and future water demands. The section that follows will address the evaluation of the individual facilities to determine if they have sufficient capacity to meet the existing and future demands of the individual zone, or zones, that they supply.

Analysis Criteria

Supply facilities must be capable of adequately and reliably supplying high quality water to the system. In addition, supply facilities must provide a sufficient quantity of water at pressures that meet the requirements of *WAC 246-290-230*. The evaluation of the combined capacity of the sources in this section is based on the criteria that they provide supply to the system at a rate that is equal to or greater than the 10-year maximum peak-day-demand (PDD).

The 10-year maximum was chosen to ensure the City has enough supply to meet the demands of most summers and correlates the maximum PDD experienced in the last ten years, which was during the summer of 1998. This approach allows the City to provide a high level of service to its existing customers based on available supply and storage capacities and to accommodate growth while promoting water conservation.

As a goal, the City's should strive for having enough supply capacity to meet a demand that is 20 percent more than the 10-year average PDD of the system, whether that be through the pursuit of additional water rights, or additional peak (equalizing) storage capacity. By using the 10-year maximum PDD factor the City has enough supply capacity to meet a demand that is 13 percent higher than the 10-year average.

Based on historical data, the City's spring supply sources typically exhibit production capacity declines near the end of the summer months. These declines are typical of many systems after periods of dry and hot weather. The supply analyses conducted for this Plan is based on the average 9-year low production capacity of 980 gpm for Victor Falls and 880 gpm for Grainger Springs, as shown in **Table 6-4 – *Spring Source Production Capacity***.

Source Capacity Analysis Results

The combined capability of the City's active sources to meet both existing and future demand requirements, based on existing production capacities of the individual supply facilities, is presented below in **Table 7-9 – *Water Source Capacity Evaluation***.

The demands used in the evaluation for 2012 and 2026 are future demand projections without reductions from enhanced conservation efforts, as shown in **Table 4-14** – ***Future Water Demand Projections*** of **Chapter 4**. Therefore, if additional reductions in water use are achieved in the future through water conservation efforts, the total source capacity required in the future will be less than that shown in the table.

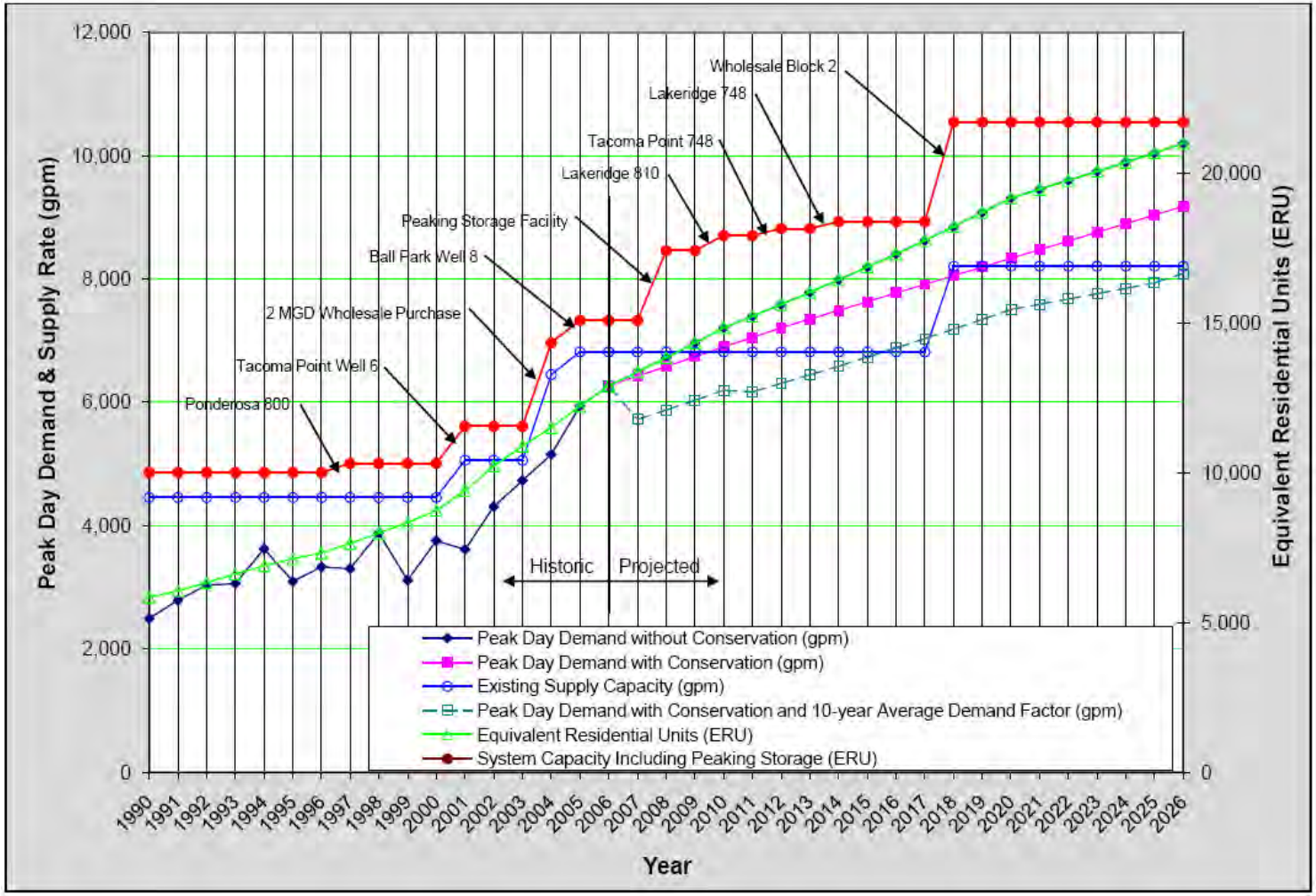
Table 7-9
Water Source Capacity Evaluation

Description	Existing 2006	Future Projections 2012	Future Projections 2026
Required Source Capacity (gpm)			
Peak Day Demand	6,000	7,590	10,200
Available Source Capacity (gpm)			
Tacoma Point Wellfield	2,300	2,300	2,300
Ball Park Wellfield	1,270	1,270	1,270
Grainger Springs	880	880	880
Victor Falls Springs	980	980	980
Tacoma Wholesale Purchase	1,390	1,390	1,390
Peaking Storage Supply Equivalent	0	1,160	1,160
Future Wholesale Purchase	0	0	1,390
Totals	6,820	7,980	9,370
Surplus or Deficient Source Capacity (gpm)			
Surplus or Deficient	820	390	-830

The results of the analysis indicate that the City has approximately 820 gpm of surplus source capacity to meet existing demands based on an average Peak Day Demand of 0.486 gpm per customer. Additional supply sources may be necessary when the peak day demand for the system approaches the combined capacity of the existing sources and depends on the level of water conservation achieved. **Chart 7-1** – ***Future Water Supply and Demand Projections*** shows that the peak day demand is expected to exceed the supply capacity between 2014 and 2018.

Chart 7-1 – ***Future Water Supply and Demand Projections*** also shows a potential second wholesale purchase of 1,390 gpm of additional supply in approximately 2017.

Chart 7-1
Future Water Supply and Demand Projections



SUPPLY FACILITIES ANALYSIS

Since all of the City's wells and springs pump directly into the Bonney Lake 748 Zone this section evaluates the existing supply facilities (booster pumps to the upper zones and pressure reducing valves to the lower zones) to the City's other pressure zones to determine if they have sufficient capacity to provide water supply at a rate that meets the existing and future demands of the one or more zones that they supply. This section also identifies facility deficiencies that are not related to the capacity of the supply facilities.

Analysis Criteria

The evaluation of supply facilities to determine if they have adequate capacity is based on one of two criteria. If the pressure zone that the facility provides supply into has water storage, then the amount of supply required is equal to the peak day demand of the zone. If the pressure zone that the facility provides supply into does not have water storage, then the amount of supply required is equal to the peak hour demand of the zone. The higher supply requirement of the latter criteria is due to the lack of equalizing storage that is utilized to provide short-term supply during times of peak system demands. **Table 7-10** – ***Pressure Zone Supply Evaluation*** summarizes the current and future supply requirements of each pressure zone, based on existing and projected water demands, including both domestic and the largest fire flow requirements for each zone. **Table 7-10** ***Pressure Zone Supply Evaluation*** also summarizes the current amount of water supply available to each zone based on the current flow capacity of booster pump stations, pressure reducing valves, sources of supply, and/or storage tanks.

Table 7-10
Pressure Zone Supply Evaluation

Pressure Zone	ERU	Domestic Demand	Fire Flow Demand	Total Demand	Pump or PRV Capacity	Surplus
2006						
Lakeridge	1,346	1,312 gpm	2,500 gpm	3,812 gpm	3,860 gpm	48 gpm
Ponderosa[1]	2,752	1,338 gpm	4,000 gpm	5,338 gpm	6,000 gpm	662 gpm
Pinnacle Estates	1	1 gpm	1,500 gpm	1,501 gpm	1,650 gpm	149 gpm
Summit[2]	4	4 gpm	0 gpm	4 gpm	114 gpm	110 gpm
Bonney Lake[1]	8,257	7,179 gpm	2,500 gpm	9,679 gpm	11,820 gpm	2,141 gpm
Sky Island	4	4 gpm	1,000 gpm	1,004 gpm	2,400 gpm	1,396 gpm
166th Aveune[3]	4	4 gpm	0 gpm	4 gpm	320 gpm	316 gpm
47th Street[3]	4	4 gpm	0 gpm	4 gpm	320 gpm	316 gpm
Angeline Valley	418	487 gpm	1,000 gpm	1,487 gpm	4,800 gpm	3,313 gpm
Rhodes Lake	77	82 gpm	1,000 gpm	1,082 gpm	1,200 gpm	118 gpm
Forest Canyon	20	19 gpm	1,000 gpm	1,019 gpm	1,200 gpm	181 gpm
Panorama West 1	2	8 gpm	1,000 gpm	1,008 gpm	2,400 gpm	1,392 gpm
Panorama West 2	2	6 gpm	1,000 gpm	1,006 gpm	1,200 gpm	194 gpm
Panorama West 3	2	2 gpm	1,000 gpm	1,002 gpm	1,200 gpm	198 gpm
Panorama West 4	2	2 gpm	1,000 gpm	1,002 gpm	1,200 gpm	198 gpm
Total	12,895					
2012						
Lakeridge[1, 4]	1,629	796 gpm	2,500 gpm	3,296 gpm	3,860 gpm	564 gpm
Ponderosa[1]	3,331	1,619 gpm	4,000 gpm	5,619 gpm	6,000 gpm	381 gpm
Summit[2]	52	50 gpm	0 gpm	50 gpm	114 gpm	64 gpm
Bonney Lake[1]	8,397	5,081 gpm	2,500 gpm	7,581 gpm	11,820 gpm	4,239 gpm
166th Aveune[3]	4	4 gpm	0 gpm	4 gpm	320 gpm	316 gpm
47th Street[3]	4	8 gpm	0 gpm	8 gpm	320 gpm	312 gpm
Ascent	60	58 gpm	1,000 gpm	1,058 gpm	1,200 gpm	142 gpm
Angeline Valley	927	1,472 gpm	1,000 gpm	2,472 gpm	4,800 gpm	2,328 gpm
Upper Fennel Creek	120	116 gpm	1,000 gpm	1,116 gpm	1,200 gpm	84 gpm
Rhodes Lake	393	574 gpm	1,000 gpm	1,574 gpm	2,400 gpm	826 gpm
Pinnacles Estates	104	101 gpm	1,500 gpm	1,601 gpm	1,650 gpm	49 gpm
Forest Canyon 1	80	192 gpm	1,000 gpm	1,192 gpm	1,200 gpm	8 gpm
Forest Canyon 2	88	114 gpm	1,000 gpm	1,114 gpm	1,200 gpm	86 gpm
Forest Canyon 3	30	29 gpm	1,000 gpm	1,029 gpm	1,200 gpm	171 gpm
Ridgewest	70	91 gpm	1,000 gpm	1,091 gpm	1,200 gpm	109 gpm
Salmon Springs 1	25	24 gpm	1,000 gpm	1,024 gpm	1,200 gpm	176 gpm
Salmon Springs 2	10	10 gpm	1,000 gpm	1,010 gpm	1,200 gpm	190 gpm
Sky Island	87	658 gpm	1,000 gpm	1,658 gpm	2,400 gpm	742 gpm
Panorama West 1	96	196 gpm	1,000 gpm	1,196 gpm	2,400 gpm	1,204 gpm
Panorama West 2	32	76 gpm	1,000 gpm	1,076 gpm	1,200 gpm	124 gpm
Panorama West 3	25	69 gpm	1,000 gpm	1,069 gpm	1,200 gpm	131 gpm
Panorama West 4	46	45 gpm	1,000 gpm	1,045 gpm	1,200 gpm	155 gpm
Total	15,611					

Continued On Next Page

Table 7-9
Pressure Zone Supply Evaluation (Continued)

Continued rom Previous Page

Pressure Zone	ERU	Domestic Demand	Fire Flow Demand	Total Demand	Pump or PRV Capacity	Surplus
2026						
Lakeridge[1]	2,190	1,074 gpm	2,500 gpm	3,574 gpm	3,860 gpm	286 gpm
Ponderosa[1]	4,477	2,176 gpm	4,000 gpm	6,176 gpm	6,000 gpm	-176 gpm
Summit[2]	52	50 gpm	0 gpm	50 gpm	114 gpm	64 gpm
Bonney Lake[1]	11,773	6,856 gpm	2,500 gpm	9,356 gpm	11,820 gpm	2,464 gpm
166th Aveune[3]	10	10 gpm	0 gpm	10 gpm	320 gpm	310 gpm
47th Street[3]	10	19 gpm	0 gpm	19 gpm	320 gpm	301 gpm
Ascent	60	58 gpm	1,000 gpm	1,058 gpm	1,200 gpm	142 gpm
Angeline Valley	1,147	1,685 gpm	1,000 gpm	2,685 gpm	4,800 gpm	2,115 gpm
Upper Fennel Creek	120	116 gpm	0 gpm	116 gpm	1,200 gpm	1,084 gpm
Rhodes Lake	393	574 gpm	1,000 gpm	1,574 gpm	2,400 gpm	826 gpm
Pinnacles Estates	104	101 gpm	1,000 gpm	1,101 gpm	1,650 gpm	549 gpm
Forest Canyon 1	80	192 gpm	1,000 gpm	1,192 gpm	1,200 gpm	8 gpm
Forest Canyon 2	88	114 gpm	1,000 gpm	1,114 gpm	1,200 gpm	86 gpm
Forest Canyon 3	30	29 gpm	1,000 gpm	1,029 gpm	1,200 gpm	171 gpm
Ridgewest	100	144 gpm	1,000 gpm	1,144 gpm	1,200 gpm	56 gpm
Salmon Springs 1	50	48 gpm	1,000 gpm	1,048 gpm	1,200 gpm	152 gpm
Salmon Springs 2	10	10 gpm	0 gpm	10 gpm	1,200 gpm	1,190 gpm
Sky Island	87	658 gpm	1,000 gpm	1,658 gpm	2,400 gpm	742 gpm
Panorama West 1	96	196 gpm	1,000 gpm	1,196 gpm	2,400 gpm	1,204 gpm
Panorama West 2	32	76 gpm	1,000 gpm	1,076 gpm	1,200 gpm	124 gpm
Panorama West 3	25	69 gpm	1,000 gpm	1,069 gpm	1,200 gpm	131 gpm
Panorama West 4	46	45 gpm	1,000 gpm	1,045 gpm	1,200 gpm	155 gpm
Total	20,980					

[1]Open Zone (with storage tank)
[2]Zone gets fire flow from lower 748 zone
[3]Zone gets fire flow from closest hydrant in the upper Lakeridge 810 Zone
[4]Lakeridge goes from closed zone (pumps must meet PHD) to open zone (only meet MDD)

Supply Facilities Analysis Results

Existing Pressure Zones

Lakeridge 810 Zone Facilities

The Lakeridge Booster Pump Station currently provides all water supplied to the Lakeridge 810 Zone. This zone also supplies the 166th Avenue and 47th Street local zones. A future storage tank is planned for this zone, as well as, another booster pump station to improve transmission capacity across the lower 748 zone.

Ponderosa 800 Zone Facilities

Supply to the Ponderosa 800 Zone is provide by both the Ponderosa 800 Tank and the Ponderosa Booster Pump Stations (domestic and fire). There is also an exiting emergency intertie with the City of Tacoma in this zone. In addition, a wholesale intertie with Tacoma, as well as a connection to the peaking storage tank, is proposed for this zone. This zone is an upper zone and does not supply lower zones.

Pinnacle Estates 795 Zone Facilities

The Pinnacle Estates Booster Pump Station was brought on-line in 2006 and will provide both domestic and fire suppression demand to the Pinnacle Estates neighborhood. This zone is an upper zone and does not supply lower zones.

Summit 790 Zone Facilities

The Panorama Heights Booster Pump Station currently provides all domestic water supplied to the Summit 790 Zone. The elevations in this zone are low enough that fire flow capacity can be provided from the lower 748 zone. A 12-inch diameter 748 zone transmission main runs through this zone and provides the necessary fire flows. This zone is an upper zone and does not supply lower zones.

Bonney Lake 748 Zone Facilities

All sources of supply feed directly into the Bonney Lake 748 Zone Facilities, including the springs, wells and wholesale intertie. In addition, three of the City's four existing storage tanks are located in this zone. This zone also has emergency interties with the City of Auburn and the City of Tacoma. Pressure reducing valves from the upper Lakeridge 810 and Ponderosa 800 zones are also available for emergency conditions. This zone also supplies all other zones in the City's system.

Sky Island 660 Zone Facilities

Two pressure reducing stations currently provide all water supplied to the Sky Island 660 Zone Facilities. This zone serves other lower zones.

Forest Canyon 530 Zone Facilities

One pressure reducing station currently provides all water supplied to the Forest Canyon 650 Zone. This zone serves other lower zones and will be expanded in the future to improve looping, establish redundancy and better serve lower zones.

Angeline Valley 620 Zone Facilities

Three pressure reducing stations currently provide all water supplied to the Angeline Valley 620 Zone. This zone serves other lower zones.

Rhodes Lake 565 Zone Facilities

One pressure reducing station currently provides all water supplied to the Rhodes Lake 565 Zone Facilities. This zone does not serve other lower zones and zone will be expanded in the future to improve looping, establish redundancy and better serve lower zones.

Panorama West Zone Facilities

There are four zones that serve the Panorama West neighborhood located in the southwest part of the water service area. These zones are all supplied via at least two dedicated pressure reducing stations. These zones currently serve very few customers.

Local Zones

There are two zones that serve localized areas and do not need to serve any lower zones. The City's lowest zones include the 166th Avenue and 47th Street zones. These zones are all supplied via dedicated pressure reducing valves, and currently serve less than five customers and get fire flow from the nearest hydrant located in the Lakeridge 810 Zone. These zones would experience pressures in excess of 150 psi if the pressure reducing valves failed in the open position. If additional customers are to be connected to either of these zones, additional pressure-reducing valves and closer hydrants should be required.

Proposed Pressure Zones

Upper Fennel Creek Zone

Water service to areas in the upper Fennel Creek regions will require that pressures be reduced off of the 748 Pressure Zone. A new zone is proposed for any new services in the upper Fennel Creek Valley north of the Sumner-Buckley highway. The design of this zone should address redundancy, valve failure and pressure relief issues.

Northwest Plateau Area (Forest Canyon, Ridgewest, and Salmon Springs)

Water service to the steep northwestern slope of the Lake Tapps will require numerous pressure zones. Current plans are underway to serve the Forest Canyon (south), Forest Canyon (north) and Forest Canyon Highlands developments. In addition, if developments occur west of the Lakeridge pressure zone, additional pressure zones will be required to ensure that service pressures are within an acceptable range. These zones will be relatively small and will be served via pressure reducing valves. The design of these zones should address redundancy, valve failure and pressure relief issues.

STORAGE FACILITIES ANALYSIS

This section evaluates the City's existing water storage tanks to determine if they have sufficient capacity to meet the existing and future storage requirements of the system. This section also identifies facility deficiencies that are not related to the capacity of the water tanks.

Analysis Criteria

Water storage is typically made up of the following components, operational storage, equalizing storage, standby storage, fire flow storage and dead storage. Each storage component serves a different purpose and will vary from system to system. A definition of each storage component and the criteria used to evaluate the capacity of the City's storage tanks is provided below.

Operational Storage - Volume of the tank used to supply the water system under normal conditions when the source or sources of supply are not delivering water to the system (i.e., sources are in the off-mode). Operational storage is essentially the average amount of draw down in the tank during normal operating conditions, which represents a volume of storage that will most likely not be available for equalizing storage, fire flow storage, or standby storage. The operational storage in the Ponderosa and Lakeridge tanks is the amount of storage between the average level of the tanks and the overflow elevations. The operational storage in the Tacoma Point Tank is taken as zero since this tank has an overflow 10 feet below the pressure zones normal hydraulic grade line and therefore, has an altitude valve that is normally closed.

Equalizing Storage - Volume of the water tank used to supply the water system under peak demand conditions when the system demand exceeds the total rate of supply of the sources. The Department of Health (DOH) requires that equalizing storage be stored above an elevation that will provide a minimum pressure of 30 psi at all service connections throughout the system under peak hour demand conditions. The equalizing storage requirements are determined using the standard DOH formula that considers the difference between the system peak hour demand and the combined capacity of the supply sources because the City's supply sources primarily operate on a "call on demand" basis to fill the tanks.

Standby Storage - Volume of the water tank used to supply the water system under emergency conditions when supply facilities are out of service due to equipment failures, power outages, loss of supply, transmission main breaks, and any other situation that disrupts the supply source. DOH requires that standby storage be stored above an elevation that will provide a minimum pressure of 20 psi at all service connections throughout the system. The criteria for determining the standby storage requirements for the City's system, which has multiple supply sources, is based on the standard DOH formula that requires average day demand and supply source capacity data. The amount required is sufficient to supply the system for a 48-hour period when the primary supply facility is out of service and the system is experiencing demands that are close to average day demands.

Fire Suppression Storage - Volume of the water tank used to supply water to the system at the maximum rate and duration required to extinguish a fire at the building with the highest fire flow requirement. The magnitude of the fire suppression storage is the product of the fire flow rate and duration of the system's maximum fire flow requirement established by the local fire authority, East Pierce Fire and Rescue. DOH requires that fire suppression storage be stored above an elevation that will provide a minimum pressure of 20 psi at all points throughout the distribution system under peak day demand conditions. The fire suppression storage requirements shown in the analyses that follow are based on a maximum fire flow requirement of 2,500 gpm for a 2-hour duration, with the exception of areas within other cities which were modeled using those cities' minimum fire flow requirement.

Dead Storage - Volume of the water tank that cannot be used because it is stored at an elevation that does not provide system pressures that meet the minimum pressure requirements established by DOH without pumping. This unusable storage occupies the lower portion of most ground level tanks. Water that is stored below an elevation that cannot provide a minimum pressure of 20 psi is considered dead storage for the analyses that follow.

Storage Facilities Analysis Results

The existing storage analyses are based on an evaluation of the existing storage facilities providing water to two supply areas, one being the Ponderosa 800 Zone and the other being the Bonney Lake 748 Zone, and all the other zones they serve.

Existing Storage

Table 7-11 - *Existing Storage Tank Data* summarizes the physical parameters of the City's existing tanks and calculates the total volume and usable storage volume for each tank. The elevation of the highest customer served by each tank is use to determine the volume of storage that is considered effective. Effective storage, or available and usable storage, is that storage which is able to provide a minimum service pressure of 20 psi under static conditions. The physical attributes of the 15 MG Peaking Storage Tank is shown for reference only. The Peaking Storage Tank's capacity is not used in any storage analysis since it is meant for peaking supply only.

Table 7-11
Existing Storage Tank Data

Water Tank (HGL)	Base Elev.	HWL	Total Volume	Tank Diam.	Gal/ft	20 psi MWL	Effective Storage	Elev. Served
Existing Tank								
Ponderosa No. 1 (748)	705'	748'	1.01 MG	63'	23,562	705'	1.01 MG	640'
Lakeridge No. 1 (748)	708'	741'	0.78 MG	63'	23,562	708'	0.78 MG	640'
Tacoma Point (748)	638'	738'	1.14 MG	44'	11,374	686'	0.59 MG	640'
Ponderosa No. 2 (800)	697'	800'	2.81 MG	68'	27,165	756'	1.16 MG	710'
Total			5.74 MG				3.54 MG	
Peaking Storage Tank	618'	652'	15.00 MG	275'	444,280	Boosted	15.00 MG	710'

HWL = High Water Level or tank overflow elevation

MWL = Minimum Water Level or lowest level in tank which will provide required pressures to system

As shown in **Table 7-12 – *Existing Storage Evaluation***, the maximum combined storage capacity of the City's tanks is 5.74 MG Dead storage (i.e., non-usable storage) is calculated as 2.20 MG; therefore, only 3.54 MG of the total storage capacity is usable for operational, equalizing, standby and fire flow. The results of the existing storage evaluation indicate that the system has a storage deficit of approximately 0.77 MG. The City is in the process of building additional storage to correct this deficit. If the City were to nest its stand-by and fire suppression storage requirements then a storage surplus of 0.01 MG would result. Nesting, or the consolidation of stand-by and fire suppression storage, is as allowed by the Department of Health if not prohibited by local code or the Fire Marshall.

Table 7-12
Existing Storage Evaluation

Description	Open Pressure Zones Bonney Lake[1]	Ponderosa	Totals
Available/Usable Storage (MG)			
Maximum Storage Capacity	2.93	2.81	5.74
Dead (Non-usable Storage)	0.55	1.65	2.20
Total Available Storage	2.38	1.16	3.54
Required Storage (MG)			
Operational Storage	0.05	0.05	0.10
Equalizing Storage	0.66	0.18	0.85
Standby Storage	2.03	0.55	2.58
Fire Flow Storage	0.30	0.48	0.78
Total Storage Required	3.04	1.27	4.31
Surplus or Deficient Storage (MG)			
Surplus or Deficient	-0.66	-0.10	-0.77

[1]Serves the closed zones: Lakeridge, Pinnacle Estates, Summit, and all lower zones

Future Storage

Table 7-13 - ***Future Storage Tank Data for 2012*** summarizes the physical parameters of the City's existing tanks, as well as, the tanks it proposes to construct by 2012. The City currently plans to replace the existing Tacoma Point tank with one that has a larger diameter and a overflow elevation that will match the existing 748 Pressure Zone. In addition, the City plans to build another tank in the Lakeridge neighborhood with an overflow elevation of 810 feet.

Table 7-13
Future Storage Tank Data for 2012

Water Tank (HGL)	Base Elev.	HWL	Total Volume	Tank Diam.	Gal/ft	20 psi MWL	Effective Storage	Elev. Served
Future Tank								
Ponderosa No. 1 (748)	705'	748'	1.01 MG	63'	23,562	705'	1.01 MG	640'
Lakeridge No. 1 (748)	708'	741'	0.78 MG	63'	23,562	708'	0.78 MG	640'
Tacoma Point - Rebuilt (748)	638'	748'	3.17 MG	70'	28,788	686'	1.78 MG	640'
Ponderosa No. 2 (800)	697'	800'	2.81 MG	68'	27,165	756'	1.16 MG	710'
Lakeridge No. 2 (800)	708'	810'	3.11 MG	72'	30,457	766'	1.30 MG	720'
Total			10.88 MG				6.04 MG	

HWL = High Water Level or tank overflow elevation

MWL = Minimum Water Level or lowest level in tank which will provide required pressures to system

Future storage requirements of the system were computed for the 6-year planning period based on year 2012 demand projections. The results of the analyses, shown in **Table 7-14 – *2012 Storage Projections***, are based on the scenario that one existing tank will be removed and two additional tanks will be added to the system prior to 2012. The analysis indicates that the City will have approximately 0.55 MG of surplus storage in 2012.

Table 7-14
2012 Storage Projections

Description	Open Pressure Zone			2012
	Bonney Lake[1]	Ponderosa	Lakeridge[2]	
Available/Usable Storage (MG)				
Maximum Storage Capacity	4.96	2.81	3.11	10.88
Dead (Non-usable Storage)	1.39	1.65	1.80	4.84
Total Available Storage	3.57	1.16	1.30	6.04
Required Storage (MG)				
Operational Storage	0.10	0.05	0.06	0.22
Equalizing Storage	0.73	0.23	0.11	1.07
Standby Storage	2.13	0.67	0.33	3.12
Fire Flow Storage	0.30	0.48	0.30	1.08
Total Storage Required	3.26	1.43	0.80	5.49
Surplus or Deficient Storage (MG)				
Surplus or Deficient	0.31	-0.27	0.51	0.55

[1]Serves the closed zones: Pinnacle Estates, Summit, and all lower zones
[2]Serves the closed zones: 166th, 47th.

Table 7-15 - *Future Storage Tank Data for 2026* summarizes the physical parameters of the City's existing tanks, as well as, the tanks it proposes to construct by 2026. In addition to the two tanks to be constructed between 2007 and 2012, the City also plans to build a fourth tank in the 748 Pressure Zone. This tank is needed to meet storage requirements and improve hydraulic conditions during peak demand periods.

Table 7-15
Future Storage Tank Data for 2026

Water Tank (HGL)	Base Elev.	HWL	Total Volume	Tank Diam.	Gal/ft	20 psi MWL	Effective Storage	Elev. Served
Future Tank								
Ponderosa No. 1 (748)	705'	748'	1.01 MG	63'	23,562	705'	1.01 MG	640'
Lakeridge No. 1 (748)	708'	741'	0.78 MG	63'	23,562	708'	0.78 MG	640'
Tacoma Point - Rebuilt (748)	638'	748'	3.17 MG	70'	28,788	686'	1.78 MG	640'
Ponderosa No. 2 (800)	697'	800'	2.81 MG	68'	27,165	756'	1.16 MG	710'
Lakeridge No. 2 (800)	708'	810'	3.11 MG	72'	30,457	766'	1.30 MG	720'
Lakeridge No. 3 (748)	708'	748'	1.50 MG	80'	37,599	708'	1.50 MG	640'
Total			12.38 MG				7.54 MG	

HWL = High Water Level or tank overflow elevation
MWL = Minimum Water Level or lowest level in tank which will provide required pressures to system

Future storage requirements of the system were computed for the 20-year planning period based on year 2026 demand projections. The results of the analyses, shown in **Table 7-16 – *2026 Storage Projections***, are based on the scenario that one existing tank will be removed and three additional tanks will be added to the system by to 2026. The analysis indicates that the City will have approximately 0.40 MG of surplus storage in 2026. It is anticipated that the fourth 748 Pressure Zone tank will be needed by 2014.

Table 7-16
2026 Storage Projections

Description	Open Pressure Zone Bonney Lake[1]	Ponderosa	Lakeridge[2]	2026
Available/Usable Storage (MG)				
Maximum Storage Capacity	6.46	2.81	3.11	12.38
Dead (Non-usable Storage)	1.39	1.65	1.80	4.84
Total Available Storage	5.07	1.16	1.30	7.54
Required Storage (MG)				
Operational Storage	0.18	0.05	0.06	0.30
Equalizing Storage	1.11	0.35	0.17	1.64
Standby Storage	2.86	0.90	0.44	4.20
Fire Flow Storage	0.30	0.48	0.30	1.08
Total Storage Required	4.45	1.78	0.97	7.22
Surplus or Deficient Storage (MG)				
Surplus or Deficient	0.62	-0.62	0.33	0.33

[1]Serves the closed zones: Pinnacle Estates, Summit, and all lower zones
[2]Serves the closed zones: 166th, 47th.

Storage Facility Deficiencies

The City's Lakeridge and Tacoma Point 748 Zone tanks should be repainted if they are going to be kept in service. The Ponderosa 748 and 800 tanks do not have any noticeable deficiencies and were designed to withstand a seismic event. Although the steel tank's paint coating is currently in good condition, a qualified coating inspector will be retained to inspect the integrity of the coating on a five-year time schedule, or more frequently, if visible signs of coating deterioration appear. In addition, the exterior needs to be pressure washed for general cleaning purposes.

Proposed improvements to resolve these deficiencies are identified in **Chapter 9**.

SYSTEM RELIABILITY ANALYSIS

Analysis Criteria

The City should continue to evaluate its system reliability and pursue proactive measures that ensure that it can provide safe reliable water even when one or more of its major facilities are out of service.

System Reliability Analysis Results

Interties

In order to maximize the reliability of the system to provide water during extreme emergency conditions, the City should maintain its existing emergency supply intertie agreements with the City of Auburn, the City of Tacoma and the Tapps Island Water Company, and should consider future intertie agreements with the City of Sumner and the Cascade Water Alliance, when and if it becomes available.

Power Generators

The City maintains emergency power generators at each of its supply facilities and booster pump stations. This practice maintains a high level of system reliability and the City should endeavor to continue this policy with all new facilities.

Fire Hydrants

The City continues to increase the number of fire hydrants and the overall density of hydrants per mile of water main. This has been accomplished mostly through developer extensions and water main replacement projects. The City should endeavor to continue this effort until the minimum hydrant spacing requirements are achieved throughout the system. In addition, the City should conduct a fire hydrant inventory and mapping program to help facilitate the maintenance and operation of all fire hydrants.

Transmission

The City's sources of supply are located throughout the service area. Although, the main distribution lines for the system is only one "backbone" that run north and south, most of the system forms a fairly well developed grid. These two factors, combined with the distribution of storage, do not make this system highly susceptible to loss of supply due to a break or emergency shutdown of one of the main distribution lines. However, hydraulic analysis has shown that the City has trouble moving water north and south through the system during high demand periods and should endeavor to increase transmission capacity around the Lake.

Supply Protection

The City should endeavor to protect all of its sources of supply from contamination and from loss of capacity due to loss of regional recharge areas. The City needs to secure its spring sources collection areas from public access. The City should continue to expand its aquifer protection program. In addition, the storm water utility should encourage the implementation of infiltration facilities when feasible and protect water quality. The City must also endeavor to maintain all of its pumping facilities and provide adequate redundancy and a reasonable supply of spare parts.

Seismic Considerations

The City should continue its effort to upgrade its facilities according to the recommendations made in its seismic report and ensure that all new facilities meet the most current design standards.

PEAKING STORAGE ANALYSIS

As with most water purveyors west of the Cascade Mountains, the City of Bonney Lake typically experiences its highest peak demand periods for only a short period each summer. This relatively short period of time each year is when the City's sources of supply and equalizing storage capacities are utilized to their fullest extent. For the remainder of the year both the sources and storage facilities can easily accommodate the demands of the City's customers. Perhaps more important, is the fact that each summer is different and historically there are only a few times each decade that summers have been hot and dry enough to really stand-out as very high water demand years. Since new water rights and additional water supplies are extremely difficult to obtain, having enough supply capacity to meet maximum day water demand period each summer including the less frequent, hot and dry summer, is an expensive endeavor.

A typical "source of supply strategy" is to have enough supply capacity to meet maximum day demands for each and every reasonably predictable summer demand period. Under this strategy, source capacity would be large enough to meet water demands, and replenish equaling storage volumes, within the highest 24-hour demand period each year. The City of

Bonney Lake is currently in the process of modifying this approach which it has strived to achieve in the past. This modification considers the need to accommodate growth, maintain a high level of customer service, and minimize the need for obtaining new sources of supply. It is the City's goal to move to a peak period storage approach, wherein, equalizing storage volumes are available to meet a much greater period of time than just a 24-hour period.

The City completed the construction of its at-grade, peaking storage tank with a volume of 15 million gallons (MG) in 2007. Based on predesign information developed as part of the 2001 Water System Improvements Project it was determined that this peaking storage facility would need to include a booster pump station, redisinfection treatment facility, and transmission water main.

The pumping capability is necessary since siting the storage tank at an elevation capable of serving the City's water system via gravity is unfeasible both hydraulically and economically. Pumping would also give the City better control over how the peaking storage water was made available to the system. The booster pump station will be capable of pumping water from the tank into either the City's 748 pressure zone or 800 pressure zone. A pressure reducing station with a flow control valve will allow for controlled filling of the proposed reservoir from the 748 Zone. A new transmission main will be required to connect the proposed reservoir and booster pump station to the existing system.

The treatment facility would allow the City to maintain a chlorine residual in the water pumped from the tank in the event that adequate turn-over rates were not maintained in the tank during low demand periods. Since this tank can also provide fire flow and standby storage redundancy in low demand periods it will be left on line year round.

The project schedule was developed to complete construction by the end of 2007. Analyses have been conducted using hourly demand data available from the telemetry system for most of the last nine years. These analyses show that a 15-million-gallon volume of storage capacity could extent supply capacity during peak summer periods by approximately 1,160 gpm and allow the City to accommodate between 2,400 and 2,900 additional ERU.

As was documented in the Supply Capacity Analysis section of this chapter, the City's current supply strategy is to have enough source of supply capacity to meet peak day demands (PDD) based on the maximum PDD data available for the last ten years

OVERALL SYSTEM CAPACITY ANALYSIS

This section evaluates the capacity of the City's existing and future water system components (supply, storage, transmission and water rights) to determine the maximum number of equivalent residential units (ERU) it can serve. Once determined, system capacity becomes useful in determining how much capacity is available in the water system to support new customers that apply for water service through the building permit process. The system capacity information, together with the projected growth of the system expressed in ERU, as shown in **Chart 4-6** of **Chapter 4**, also provides the City with a schedule of when additional system capacity is needed.

Analysis Criteria

The capacity of the City's system was determined from the limiting capacity of the water rights and supply, storage and transmission facilities. The supply capacity analysis was based on the limiting capacity of the supply facilities and the system's peak day demand per ERU. The storage capacity analysis was based on the total capacity of the storage facilities and the computed storage requirement per ERU. The storage requirement per ERU was determined from the existing storage requirements presented previously in this chapter and the existing number of ERU presented in **Chapter 4**. The annual water rights capacity evaluation was based on the existing annual water rights, as summarized in **Chapter 6**, and the system's average day demand per ERU. The instantaneous water rights capacity evaluation was based on the existing instantaneous water rights, as summarized in **Chapter 6,** and the system's peak day demand per ERU.

Existing Capacity Analysis Results

A summary of the results of the existing system capacity analysis is shown in **Table 7-17 – *Existing System Capacity Analysis***. The results of the 2006 system capacity analysis indicate that the system can support up to a maximum of approximately 12,945 ERU. The limiting component currently is storage. The City plans to have additional storage available once the Lakeridge 810 Zone tank is constructed.

Future Capacity Analysis Results

A summary of the results of the 6-year projected system capacity analysis is shown in **Table 7-18 – *2012 System Capacity Analysis***.

The results of the 2012 system capacity analysis indicate that the storage system can support up to a maximum of approximately 15,848 ERU once the two proposed new water tanks are constructed. In addition, the City's proposed 15-million-gallon peaking storage facility will increase supply capacity by approximately 1,160 gpm during peak demand periods.

However, these proposed improvements are not enough to increase the City's supply capacity to meet its projected 2026 demand of 20,980 ERU. As shown in **Table 7-19 – *2026 System Capacity Analysis***, the City will need to increase supply capacity to meet the 2026 demand. Assuming the City obtains an additional 2.0 MGD of supply capacity and builds a fourth 748 Pressure Zone tank it will have a system capacity of 21,417 ERU.

Table 7-17
Existing System Capacity Analysis

Demands Per ERU Basis	
Average Day Demand Per ERU (gal/day)	314
Peak Day Demand Per ERU (gal/day)	700
Peak Hour Demand Per ERU (gal/day)	1,395
Supply	
Limiting Supply Rate - Source Capacities (gal/day)	9,820,800
Peak Day Demand Per ERU (gal/day)	700
Maximum Supply Capacity (ERU)	14,030
Storage Capacity	
Maximum Storage Capacity (gal)	3,544,058
Storage Requirement[1] Per ERU (gal)	274
Maximum Storage Capacity (ERU)	12,945
Annual Water Rights Capacity	
Annual Water Right Capacity (gal/day)	5,711,204
Average Day Demand Per ERU (gal/day)	314
Maximum Annual Water Right Capacity (ERU)	18,189
Instantaneous Water Rights Capacity	
Instantaneous Water Right Capacity (gal/day)	11,093,636
Peak Day Demand Per ERU (gal/day)	700
Maximum Instantaneous Capacity (ERU)	15,848
Maximum System Capacity	
Based on Limiting Facility - Storage (ERU)	12,945
Unused Available System Capacity	
Maximum System Capacity (ERU)	12,945
Existing (2006 ERU at mid-year)	12,895
Surplus Capacity (ERU)	50

[1]Assumes nesting of stand-by storage and fire suppression storage

Table 7-18
2012 System Capacity Analysis

Demands Per ERU Basis	
Average Day Demand Per ERU (gal/day)	314
Peak Day Demand Per ERU (gal/day)	700
Peak Hour Demand Per ERU (gal/day)	1,395
Supply	
Limiting Supply Rate - Source Capacities (gal/day)	11,491,200
Peak Day Demand Per ERU (gal/day)	700
Maximum Supply Capacity (ERU)	16,416
Storage Capacity	
Maximum Storage Capacity (gal)	6,039,386
Storage Requirement Per ERU (gal)	352
Maximum Storage Capacity (ERU)	17,160
Annual Water Rights Capacity	
Annual Water Right Capacity (gal/day)	5,711,204
Average Day Demand Per ERU (gal/day)	314
Maximum Annual Water Right Capacity (ERU)	18,189
Instantaneous Water Rights Capacity	
Instantaneous Water Right Capacity (gal/day)	11,093,636
Peak Day Demand Per ERU (gal/day)	700
Maximum Instantaneous Capacity (ERU)	15,848
Maximum System Capacity	
Based on Limiting Facility - Water Rights (ERU)	15,848
Unused Available System Capacity	
Maximum System Capacity (ERU)	15,848
Projected (2012) ERU	15,611
Surplus Capacity (ERU)	237

Table 7-19
2026 System Capacity Analysis

Demands Per ERU Basis	
Average Day Demand Per ERU (gal/day)	314
Peak Day Demand[1] Per ERU (gal/day)	630
Peak Hour Demand Per ERU (gal/day)	1,395
Supply	
Limiting Supply Rate - Source Capacities (gal/day)	13,492,800
Peak Day Demand Per ERU (gal/day)	630
Maximum Supply Capacity (ERU)	21,417
Storage Capacity	
Maximum Storage Capacity (gal)	7,543,329
Storage Requirement Per ERU (gal)	344
Maximum Storage Capacity (ERU)	21,934
Annual Water Rights Capacity	
Annual Water Right Capacity (gal/day)	6,956,064
Average Day Demand Per ERU (gal/day)	314
Maximum Annual Water Right Capacity (ERU)	22,153
Instantaneous Water Rights Capacity	
Instantaneous Water Right Capacity (gal/day)	13,757,636
Peak Day Demand Per ERU (gal/day)	630
Maximum Instantaneous Capacity (ERU)	21,838
Maximum System Capacity	
Based on Limiting Facility - Water Rights (ERU)	21,417
Unused Available System Capacity	
Maximum System Capacity (ERU)	21,417
Projected (2026) ERU	20,980
Surplus Capacity (ERU)	437

[1]Assumes that a 90 percent conservation factor will be achieved by 2026

TELEMETRY AND SUPERVISORY CONTROL SYSTEM ANALYSIS

The City's telemetry system was updated and improved in 2003 and remote telemetry units are installed at all of the major water system facilities. Most of the existing remote telemetry units are linked to the master telemetry unit with bridged circuit telephone lines, which are less reliable than radio-based telemetry systems. The City is considering converting to a radio system or other more reliable system and proposed improvements to the City's telemetry and supervisory control system are contained in **Chapter 9**.

CHAPTER 8

OPERATIONS AND MAINTENANCE

Grainger Springs Treatment Facility

INTRODUCTION

The City of Bonney Lake's (City) water operations and maintenance program consists of the following four elements:

1. Normal Operations
2. Emergency Operations
3. Preventive Maintenance
4. Cross-Connection Control

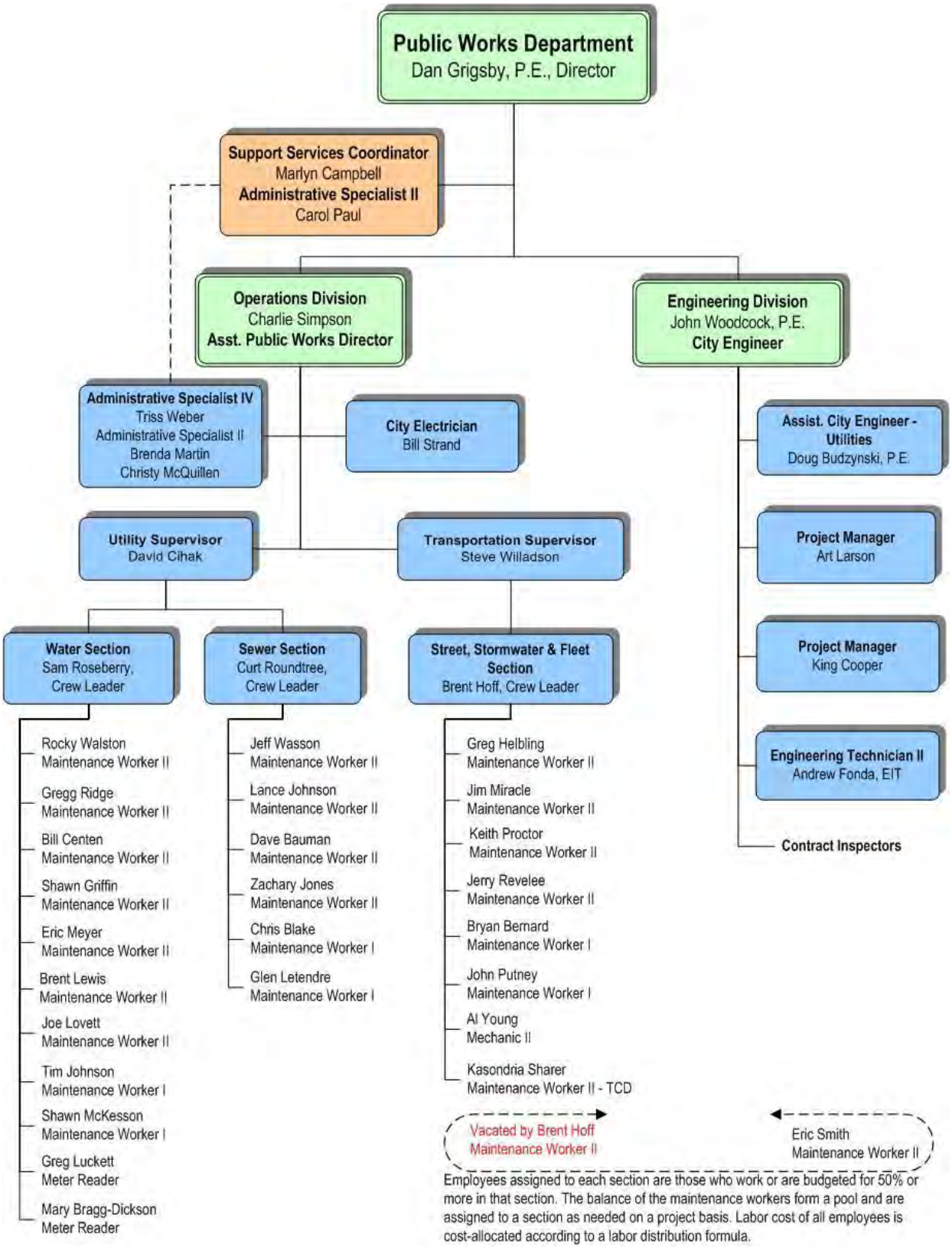
NORMAL OPERATIONS

City Personnel

The City of Bonney Lake Water Division is a one of several divisions under the Operations Section of the City's Public Works Department. The Water Division is s combined "utility" with the Sewer Division and functions under the direction of the Assistant Public Works Director, Mr. Rick Shannon. The public works organization chart is shown in **Chart 8-1 - *Public Works Department Organization Chart*.**

The current Water Division operations and maintenance staff consists of several maintenance personnel that function under the Water Utility's Lead Worker, as shown in **Chart 8-1 - *Public Works Department Organization Chart***. The water system tasks that are performed by the operations and maintenance staff include: inspection, testing, installation and repair of system facilities, routine operation and preventive maintenance, water quality sampling, regulatory compliance monitoring, record keeping, administrative tasks, general clerical work, and corrective or breakdown maintenance required in response to emergencies.

Chart 8-1
Public Works Department Organization Chart



Washington Administration Code (WAC 246-292) requires that the City's water system is operated by one or more certified operators. In addition, special certification is required for backflow device testing and cross-connection control program activities and management. **Table 8-1 - *Personnel Certification***, shows the current certifications of the City's water operations and maintenance staff. It is City policy to maintain a well-qualified, technically trained staff. The City annually allocates funds for personnel training, certification and membership in professional organizations, such as the American Water Works Association (AWWA). The City believes that the time and money invested in training, certification and professional organizations are repaid many times in improved safety, skills and confidence.

Table 8-1
Personnel Certification

Public Works Current Certification	Rick Shannon	Dave Bauman	Todd Bright	Larry Busch	Dave Cihak	Dana Fugere	Shawn Grifin	Greg Helbling	Brent Hoff	Joe Lovett	Jim Miracle	Jerry Revelee	Gregg Ridge	Sam Roseberry	Curt Roundtree	Kasondria Sharer	Pete Spain	Eric Smith	Bill Strand	Rocknie Walston	Jeff Wasson	Steve Willadson	Keith Proctor	Lance Johnson	Bruce Castillo	Brent Lewis	Eric Meyer	Chris Blake
Asbestos Abatement Certification (1)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X						X
Back Flow Assembly (BAT) (1)																												
CDL Class A		X	X	X	X			X	X	X	X	X		X						X	X		X	X	X	X	X	
CDL Endorsement for Hazardous Waste																				X								
CDL Endorsement for Tanker			X	X	X			X	X	X	X	X		X						X	X	X	X	X	X	X	X	
Confined Space		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	
Confined Space Competent Person				X	X			X	X		X				X	X						X	X					
Cross Connections Certification (1)					X								X	X						X								
Cross Connection Control Specialist	X												X							X								
Water Distribution Manager III (1)	X				X						X			X														
Water Distribution Specialist IT (In Trainning)																												
Water Distribution Specialist (1)								X					X	X		X			X									
Water Treatment Plant Operator Basic (Temporary)	X																											
Water Treatment Plant Operator II					X																							

(1) Annual Renewal expiring on December 31, 2007

Available Equipment

The water department has several types of equipment available for daily routine operation and maintenance of the water system. The equipment is stored at the City's Public Works Shop. If additional equipment is required for specific projects, the City will rent or contract with a local contractor for the services needed. A stock of supplies in sufficient quantities for normal system operation and maintenance and short-term emergencies is stored at the Public Works Shop. A list of major equipment and chemicals used in the normal operation of the water system is shown in **Table 8-2 -** ***Water Department Equipment List.***

Table 8-2
Water Department Equipment List

Year and Description	Manufacturer
Water Department Equipment	
1981 Loader Backhoe	Case
1994 3/4 Ton Servive Truck	Chevrolet
1994 Gruman Van	Chevrolet
1995 Service Truck	Ford
1995 Service Truck (Dually)	Ford
1998 EXTCAB 4x4 Pickup	Ford
1999 EXTCAB Pickup	Ford
2000 2WD Pickup	Chevrolet
2002 Towed Air Comp.	ATLAS
2003 Loader Backhoe	John Deere
2003 Pickup Truck	Chevrolet
2003 Pickup Truck	Chevrolet
2004 4000LB Forklift	Hyster
2005 (Diesel) Service Truck	Ford
2006 10YD Vac/Jetter	VACCON
2006 Ext Cab P/Up	Ford
2008 F350 Water Service Truck	Ford
60 LB Jack Hammer	ATLAS CO PO
90 LB Jack Hammer	ATLAS CO PO
Pavement Cutter	Concut Inc.
Pavement Cutter	Target
Portable Cutt-off Saw	STIHL
Portable Compactor	Case
Miscellaneous small tools, etc.	

Continued on Next Page

Table 8-2
Water Department Equipment List (Continued)

Continued from Previous Page

Equipment Available from Sewer Departments

1986 Utility Trailor with wood sides	
1988 Loader/Backhoe	Case
1993 1 Ton Service Truck	Chevrolet
1995 (12YD) Dump	Freightliner
2005 Ext Cab Pickup	Ford
2005 Service Truck (Dually)	Chevrolet
2008 F350 Service Truck	Ford
2008 F550 2-Line Sign Board	Ford
Tow Diesel 50KW Generator	Cummins
Tow Diesel 50KW Generator	Cummins
Tow Diesel 50KW Generator	Cummins
Miscellaneous small tools, etc.	

Equipment Available from Public Works Multi-Department

2004 Loader/Backhoe	John Deere
2004 Flail Boom Mower	Ferri
2004 Hyd. Breaker	John Deere
2004 Front Bucket Broom	Sweepster
2004 Pallet Fork	John Deere
2007 Ford F-550 Chassis 4x4	Ford
2004 (Diesel) Dump/FB	Ford
1995 Tommy lift Flatbed	Chevrolet
2005 Slope Mower	Harper/Deweze
1985 Farm Tractor	John Deere
1985 Flail Boom Mower	Bomford
1998 Brush Mower 6' Cut	Woods Cutter
2006 Motor Grader	Noram
1995 Flatbed/Dump	Ford
2005 4WD Loader/Backhoe	John Deere
2005 Hoe Pac	Breaker Tech. Inc
2004 Pallet Fork	John Deere
2004 TLR MTD LED	National Signal
1980 HYD Boom Truck	GMC
1987 Towed Equip. TLR	Eager Beaver
1975 5YD Dump Truck	GMC
2006 Olympic Trailer	Olympic
1975 5YD Dump Truck	GMC
2002 7YD Dump Truck	Freightliner
3/4 Ton Panel Van	GMC
1998 Vac/Jetter Truck	Ford
Auxiliary Engine	John Deere
1999 7YD Dump Truck	International
Line Trimmer	STIHL
Line Trimmer	STIHL
Back Pack Blower	Husqvarna
Gas Portable Power Washer	John Deere
Sprayer Unit	Hydro Eng.

Continued on Next Page

Table 8-2

Water Department Equipment List (Continued)

Continued from Previous Page
Chemical Inventory
Sodium Hydroxide (50%)
Sodium Hypochlorite (12.5% and 0.8%)
Communications Equipment
Cell Phones with Two-Way Radios
Two-Way Radios in All Vehicles

The following representatives typically provide the supplies and chemicals to the City.

- Supplies: H.D. Fowler
- Supplies: Hughes Supply
- Supplies: National Water Works
- Supplies: Trident
- Sodium Hydroxide (50%): Cascade Columbia (Jones Chemical as back-up)
- Sodium Hypochlorite (12.5%): Cascade Columbia (Jones Chemical as back-up)

The Water Department utilizes several different types of communications equipment to ensure a reliable and redundant means of communication within the Department. All vehicles are equipped with mobile two-way radios that are capable of communicating with similar base radios at the utilities office. In addition, all Public Works employees are equipped with cell phones that have two-way radio capability. The phones provide the capability for personnel to communicate, as necessary, with other cities and Pierce County.

Routine Operations

Routine operations involve the analysis, formulation and implementation of procedures to ensure that the facilities are functioning efficiently and meeting pressure and water quality requirements and other demands of the system. The utility's maintenance procedures are good, with repairs being made promptly so customers receive high quality water service.

The City should strive to develop standard operating procedures for all routine operations to facilitate and documents how all operation, maintenance, monitoring and reporting tasks are performed by staff. Detailed checklists and sample documents will ensure that staff completes all tasks appropriately and will also help pass procedures and “institutional knowledge” on to new staff members.

Continuity of Service

As a municipality, the City of Bonney Lake has the structure, stability, authority and responsibility to assure that water service will be continuous. For example, changes in the

Council or Staff would not have a pronounced effect on the City's customers or quality of service.

Routine Water Quality Sampling

The Washington State Department of Health (DOH) has adopted federal regulations that specify minimum monitoring requirements for water systems. The sampling requirements depend on the population served, source type and treatment provided. The specific requirements are contained in WAC 246-290-300 and the minimum monthly routine coliform sampling requirements are summarized in Table 2 (page 69) of the April 1999 "Drinking Water Regulations". The City currently performs all routine coliform sampling throughout the distribution system. A total of 30 samples are taken each month. A further discussion of the water quality monitoring program is contained in **Chapter 6** and **Appendix F** of this plan.

Cross-Connection Control

The City drafted a cross-connection control program in 1994 to comply with WAC 246-290-490 pertaining to contamination of potable water due to cross-connections. Currently, the City's Water Department works closely with the City's Building Department to arrive at mutual agreement on cross-connection control requirements. Backflow prevention devices are required at service connections where a potential for contamination exists. The Cross-Connection Control Plan was updated with this comprehensive water system plan and is included in **Appendix E**. Rick Shannon, Gregg Ridge and Rocky Walston are certified Cross-Connection Control Specialists, as shown in **Table 8-1 - *Personnel Certification***.

Recordkeeping and Reporting

The DOH has enacted regulations for recordkeeping and reporting that may be found in WAC 246-290-480. The regulations identify recordkeeping and reporting procedures for operations and water quality testing.

Recordkeeping

The City maintains, at a minimum, the following records for the specified time period.

Water Quality Analysis

- Bacteriologic — 5 years
- Inorganic Chemical — Permanently
- Volatile Organic Chemical — Permanently
- Synthetic Organic Chemical — Permanently
- Radionuclides — Permanently
- Chlorine Residuals — 5 years

• Lead and Copper	Permanently
Source/Treatment Data	
• Well Logs	10 years
• Intertie Readings	10 years
Customer Records	
• Meter Readings	6 years
• Service Account Records	Permanently
• Complaints and Concerns	6 years
• Cross-Connection/Backflow Assembly Reports	Permanently
Other Records	
• Meter Test Records	Life of Meter
• Maps and Drawings	Useful Life
• Comprehensive Water System Plan	12 years
• Water Quality Monitoring Plans	Useful Life
• Equipment Maintenance Manuals	Life of Equipment
• Valve Records	Life of Valve
• Hydrant Records	Life of Hydrant
• Wellhead Protection Program	Permanently

All records are maintained on file at the Public Works Office.

Reporting

1. The City must report the following to the DOH.
    - Within 48 hours: A failure to comply with the primary standards or treatment technique requirements specified in WAC 246-290.
    - Within 48 hours: A failure to comply with the monitoring requirements specified in WAC 246-290.
    - Within 48 hours: A violation of a primary maximum contaminant level (MCL).
    - Within one business day: A backflow incident, per WAC 246-290-490(8)f.
    - As soon as possible, but no later than 24-hours after the violation is known: National Primary Drinking Water Regulation (NPDWR) violations and situations with significant potential to have serious adverse effect on human health as a result of short-term exposure, which require Tier 1 public notices per 40 CFR 141.202.
2. The City must submit to the DOH all applicable reports required by WAC 246-290. Monthly reports are due by the tenth day of the following month, unless otherwise specified.
3. Daily source meter readings must be made available to the DOH on request.

4. Total annual water production records for each source must be made available to the DOH on request.
5. Water facilities inventory and report form (WFI) must be submitted to the DOH within 30 days of any change in name, category, ownership or responsibility for management of the water system.
6. The City must notify DOH of the presence of:
    - Coliform in a sample within 10 days of notification by the testing laboratory; or
    - Fecal coliform or E. coli in a sample by the end of the business day in which the City is notified by the testing laboratory.
7. When a coliform MCL violation is determined, the City must:
    - Notify the DOH within 24 hours of determining acute coliform MCL violations;
    - Notify the DOH before the end of the next business day when a non-acute coliform MCL is determined.
    - Notify water customers in accordance with WAC 246-290-71001 through 71007 and the Environmental Protection Agency's (EPA's) Public Notification Rule.
8. If Volatile Organic Chemical (VOC) monitoring is required, a copy of the results of the monitoring and any public notice must be sent to the DOH within 30 days of receipt of the test results.

Other Reports

Several other reports are required for state agencies, including the Department of Revenue, Department of Labor and Industries, Department of Social and Health Services, Department of Ecology and the Employment Security Department. All these reports are completed according to their instructions.

Operations and Maintenance Records

Facilities Operations and Maintenance Manuals

Operations and maintenance manuals are available for staff members. These manuals are kept on file at the water treatment plant and utilities office. The City intends to maintain its policies of requiring complete operation and maintenance manuals for all new equipment and facilities.

Mapping and As-Built Drawing Records

Maintenance of drawings is essential to maintenance crews, city planners, developers and anyone else needing to know how the water system is laid out throughout the City. The drawing records are stored in files at the Public Works Shop. In addition, they have also been scanned and electronic copies are available through the Public Works Department.

Operations and Maintenance Records

Records are stored at the utilities office for the following items:

- Backflow and cross-connections
- Confined spaces
- Hydrant repairs
- Hydrant meter forms
- Hydrant databases
- Pump motor tests
- Well sounding and static water levels
- Precipitation
- Water usage
- Water used for construction
- Water consumable inventory
- Water maintenance
- Water main notes
- Water worksheets
- Water main flushing
- Bacteriological tests
- Inorganic chemical tests
- Volatile organic compound tests
- Synthetic organic compound tests
- Water samples from new developments
- Lead and copper tests
- Chlorination levels
- Customer complaints
- Vandalism forms

Safety Procedures and Equipment

Safety is the concern and responsibility of all water operations and maintenance staff. To maintain the highest level of safety, the City has taken steps toward educating its staff and providing resources to ensure a safe working environment. The City will strive to improve its safety program on an on-going basis. The American Water Works Association publishes a manual entitled*, Safety Practices for Water Utilities (M3)*, that describes safety programs and provides guidelines for safe work practices and techniques for a variety of water utility work situations.

The following identifies procedures to be followed for operations and maintenance tasks that involve the most common potential work place hazards in the City's water system.

Use of Chlorine, Chlorine Products, Primary Coagulant and Filter Aide

Standard Procedure - Handle with care, provide adequate ventilation, and wear safety glasses and rubber gloves. Detailed handling procedures are found in the respective Material Safety Data Sheets (MSDS)

Sodium Hydroxide

Standard Procedure - Handle with care, provide adequate ventilation, wear safety goggles, apron, and rubber gloves. Keep container tightly closed, store in a dry, corrosion-proof area. Protect from unintentional contact with water. Never return contaminated material to its original container. Immediately contact the chemical supplier/manufacturer for handling instructions if drums of caustic appear to be swollen. Detailed handling procedures are found in the respective Material Safety Data Sheets (MSDS)

Working in Confined Spaces

Standard Procedure - Follow state requirements for confined space entry.

Working around Heavy Equipment

Standard Procedure - Obtain proper training and follow all safety procedures. Use noise protection equipment.

Working in Traffic Areas

Standard Procedure - Wear proper clothing and provide adequate signage and flagging for work area. Refer to the Manual of Uniform Traffic Control Devices (MUTCD) for current requirements.

Working on or Around Water Reservoirs

Standard Procedure - Follow proper safety harness procedures for working on tall structures.

Working in or Around Pump Stations

Standard Procedure – Obtain proper training and follow all safety procedures for working on pumps and electrical equipment. Use noise protection equipment.

Working on Asbestos Cement (AC) Water Main

Standard Procedure – Obtain proper training and follow all safety procedures for working with asbestos materials.

The water utility personnel are required to take training courses regarding the following topics: asbestos cement pipe handling; confined spaces; hazardous waste; fall protection; hearing protection; competent persons; lab safety; electrical hazards; heavy equipment operation; CPR; first aid; traffic flagging; lockout-tagout; and blood-borne pathogens.

The City's facilities are equipped with confined space entry equipment, oxygen-gas meters, and lockout-tagout equipment. Each City vehicle is equipped with first aid and blood-borne handling kits. The City also owns flagging signs and equipment for safe handling of traffic.

The Public Works Department follows all appropriate OSHA and WISHA regulations in its day-to-day operations and complies with the following state requirements:

- *WAC 296-62-145 to 14529* Part M - Entry into confined spaces.
- *WAC 296-155-650 to 66411* Part N - Shoring of open ditches.
- *WAC 296-155-429* - Lockout-tagout for work on energized or de-energized equipment or circuits.
- *WAC 296-155 Part C1* - Fall restraint for access to the top of the City's water reservoirs.
- *MUTCD* - Traffic control for work in the public right-of-way.

EMERGENCY OPERATIONS

Capabilities

The City is well equipped to accommodate short-term system failures and abnormalities. Its capabilities are as follows:

Multiple Supply Capability

Except for peak periods during the summer, the City could lose the operation of one of its groundwater wells or springs sources without adversely impacting its ability to meet normal demands of its customers. The City also has emergency interties with the Tacoma Public Utilities that could be used to augment supply to the system in the event that a source of supply is out of service.

Multiple Reservoirs

Water storage is provided by four active reservoirs that are located at three different sites. The duplication of reservoirs in the 748 Zone provides sufficient redundancy to prevent service disruption when one of the reservoirs is out of service for cleaning, painting or repairs. The Ponderosa 800 Zone Booster Pump Station provides the capability to distribute water to the 800 Zone when the 800 Zone Reservoir is out of service.

Distribution System

The City has attempted to loop water mains wherever possible to improve water circulation (i.e. water quality) and minimize impacts to the system in the event that a portion of the distribution system must be taken out of service for maintenance or repairs.

Emergency Equipment

The City is equipped with the necessary tools to deal with common emergencies. If a more serious emergency should develop, the City will hire a local contractor who has a stock of spare parts necessary to make repairs to alleviate the emergency condition.

Emergency Telephone

The water department has a published emergency pager number for the public to directly contact water department personnel. The Police or other City Departments can reach the water department via mobile phones or home contact numbers. Emergency contact information, including cell phone, pager and home phone numbers, is provided to each City Department.

On-Call Personnel

The "on-call" person is equipped with a service vehicle and is required to respond to a call within 30 minutes, but can often respond to a call within 15 minutes. A list of emergency telephone numbers is provided to each "on-call" employee. New employees are not placed "on-call" until they are familiar with the water system and maintenance procedures and are properly certified by the State of Washington as may be required.

Material Readiness

Some critical repair parts, tools and equipment are on-hand and kept in fully operational condition. As repair parts are used, they are re-ordered. Inventories are kept current and are adequate for most common emergencies that can reasonably be anticipated. The City has ready access to an inventory of repair parts, including parts required for repair of each type and size of pipe within the service area. Additionally, the City has been provided with after-hours emergency contact phone numbers for key material suppliers, which gives the City 24-hour access to parts not kept in inventory.

Emergency Response Program

The City has an Emergency Response Plan on file and available to staff members. The Emergency Response Plan contains a vulnerability assessment of the City's water system facilities, a contingency operation plan for responding to emergency events, a list of water personnel responsible for making decisions in emergency situations and other elements. For security reasons the Emergency Response Plan is not included in this Water System Plan. The Plan is available for review at the Department of Health by request.

Public Notification

The Federal Safe Drinking Water Act (SDWA), *WAC 246-290-495* and the EPA Public Notification Rule require purveyors to notify their customers if any of the following conditions occur.

- Failure to comply with a primary MCL described under *WAC 246-290-310*.
- Failure to comply with a surface water treatment technique.
- Failure to comply with monitoring requirements under *WAC 246-290.*
- Failure to comply with testing requirements.
- Failure to comply with a DOH order.
- Failure to comply with a variance or exemption schedule from DOH.
- If system is identified as a source of waterborne disease outbreak.
- If DOH issues the system a category red operating permit.
- If DOH issues an order.
- If the system is operating under a variance or exemption.

Specific notice content, distribution channels and time limit requirements as specified in *WAC 246-290-495* and the EPA's Public Notification Rule must be in compliance when notification is required.

In case of a water quality emergency, such as a waterborne disease outbreak, boil water orders, etc., a written public notice will be distributed by City personnel to all customers. Notice is also to be published in the Tacoma News Tribune, and given to radio and television stations serving the area as soon as possible. In all cases public notification will comply with WAC 246-290-330. Further, the following entities are to be notified within 24 hours of a water quality emergency.

Washington State Department of Health NW Drinking Water Operations	(253) 395-6757
Pierce County Health Department Communicable Diseases	(253) 798-6410

PREVENTIVE MAINTENANCE

Maintenance schedules that meet or exceed manufacturer's recommendations have been established for all critical components in the water system. The following schedule is used as a minimum for preventive maintenance and manufacturer's recommendations should be followed where conflict exists. In 2008, a computerized Work Management software program will be installed with all preventative and one-time projects scheduled.

Storage Facilities

Daily	Visual and audio inspections. Check security and inspect facilities for proper operation.
Monthly	Check interior condition, vents, hatches, etc., on tanks.
As Needed	Clean and/or repaint interior and exterior as needed on tanks (estimated 10 to 20 year frequency).

Distribution System

Water Mains	
Annually or As Needed	Leak survey.
Semi-Annually	Flush.
Wells	
Daily	Log and record volume delivered and current supply rate; visual and audio inspection; check oil level; check packing; check security; check for excessive heat and vibration of pump motors.
Annually	Check all valves and screens; check control valve settings; re-grease; change oil.
As Needed	Maintain electrical and mechanical equipment; paint structures and piping; calibration of equipment; replace o-rings and diaphragms in equipment.
Water Treatment Plant	
Daily	Log and record run hours, motor starts, chemicals used, chemicals added, chlorine solution generated, fuse indicators, backwash volumes, volume delivered and current supply rate; visually inspect pumps; check pump packing; check pump oil levels; check all equipment for proper function and operation; check security.

Quarterly	Measure treatment train media.
Annually	Check all valves and screens; check control valve settings; re-grease pumps; change pump oil.
As Needed	Maintain electrical and mechanical equipment; paint structures and piping; equipment calibration; indoor and outdoor facility maintenance and repairs.
Booster Pump Stations	
Daily	Visual and audio inspection; check security; check pump motors for excessive heat and vibration.
Weekly	Observe and record motor current draw (three phases); log and record volume delivered and pump motor hours; check motor oil level; measure and record discharge pressure; check motor noise, temperature, vibration.
Annually	Change motor oil.
Annually	Take inventory of parts, pumps and motors.
As Needed	Calibrate flow meter; maintain electrical and mechanical equipment; paint structures and piping; routine maintenance of equipment.
Engine Generator Sets	
Bi-Weekly	Operate to achieve normal operating temperatures; observe output.
Semi-Annually	Routine maintenance in accordance with manufacturer's recommendations.
As Needed	Replace fluids and filters in accordance with manufacturer's recommendations (or more frequently depending on amount of use).
As Needed	Perform tune-up; replace parts as necessary.
Pressure Reducing Stations	
Annually	Flush and check all valves and screens; check pressure settings; rebuild and paint every five years, or as necessary.
Interties	
As Needed	Review intertie procedures with adjacent utility.

Isolation Valves	
Annually	Operate full open/closed; uncover where buried; clean out valve boxes and repair as necessary. Repair and/or install valve marker posts as necessary.
Hydrants	
Annually - this is done by the Fire Department	Check for leakage and visual damage. Operate and flush; check drain rate; lubricate as necessary; measure pressure; paint as necessary. Check nozzle and cap threads, clean and lubricate per manufacturer's recommendations. Replace lost or damaged gaskets. Check and operate auxiliary valve in accordance with the valve maintenance schedule. Leave in open position. Inspect drain system to ensure proper drainage and protection from freezing weather.
Meters	
1-20 Year Intervals	Time and measure volume of meter-delivered flow; dismantle, clean, and inspect all parts, replace worn or defective parts; retest meter for accuracy. Frequency varies based on meter size. Customer meters shall be replaced when reading problems are encountered.
Air and Vacuum Release Valve Assemblies	
Annually	Flush and inspect, repair as needed.
Blowoff Assemblies	
Annually	Flush and inspect, repair as needed.
Telemetry and Control System	
Daily	Backup program and data.
Monthly	Visually inspect cabinets and panels for damage, dust and debris.
Semi-Annually	Inspect inside of cabinets and panels for damage, dust and debris.
Semi-Annually	Vacuum clean all modules.
Semi-Annually	Test alarm indicator units.
Semi-Annually	Clean and flush all pressure sensitive devices.

Semi-Annually	Visually inspect all meters to coordinate remote stations.
Annually	Check master and RTU's for proper operation; repair as necessary.

Tools and Equipment

Rolling Stock	
Weekly	Check all fluid levels and brakes. Fluid levels and brakes are checked each time the equipment is used.
As Needed	Replace fluids and filters in accordance with manufacturer's recommendations (or more frequently depending on type of use); preventive maintenance per manufacturer's recommendation.
Tools	
As Needed	Clean after each use; lubricate and maintain as necessary; inspected for damage and wear before each use; preventive maintenance performed per manufacturer's recommendation.

STAFFING

The preventive maintenance procedures, as well as the normal and emergency operations of the utility, are described in the previous sections. The hours of labor and supervisory activity required to effectively carry out the work of these on-going maintenance and operations schedules form the basis for determining adequate staffing levels.

Current Staff

The current staff includes management personnel, supervisory personnel, operators, maintenance workers, and office personnel engaged in operating and maintaining the water system. There are currently eight maintenance workers, two meter readers, and one lead worker in the operations and maintenance organization which support the City's water system. The Utility Supervisor also supports the City's sewer utilities; thus, only a portion of his time is available for the water utility. Therefore, the water utility is supported by approximately eleven full-time staff equivalents.

Staffing Requirements

The estimated hours of work required to achieve optimum operation and maintenance of the water system (excluding time required for clerical tasks) is shown in **Table 8-3 – *Staffing Requirements***. The upper section of the table identifies the staffing time requirements for preventive maintenance tasks and the lower section identifies the staffing time requirements for operations tasks.

To achieve the level of operations and maintenance shown in **Table 8-3 – *Staffing Requirements***, approximately 15 full-time personnel are required for the water system alone. The City plans to add three more employees, including a Utility Supervisor, to its current staff level of eleven, making the number of employees that is available to the water system 14. This is slightly inadequate to meet these requirements. At the current staffing level, the City is capable of adequately operating the water system and complying with the minimum requirement of the DOH. However, the preventive maintenance tasks listed in **Table 8-3** – ***Staffing Requirements*** have not been accomplished at the desired frequency shown in the table due to the staff shortage. As the water system expands in the future, the need for additional staff will become even greater. The City plans to add staff to optimize preventive maintenance and meet the additional requirements from system expansion, as the budget allows.

OPERATIONS AND MAINTENANCE IMPROVEMENTS

Telemetry and supervisory control improvements are needed to enhance the operation of the water system. The City will evaluate converting its existing hard-wire telephone-based telemetry system to a radio-based telemetry system. Radio telemetry is more reliable in an earthquake and major storms than hard-wire telemetry, which is vulnerable to ground faulting, settlement, slides, and underground construction activities.

The water department staff spends a considerable amount of time, approximately 20 percent of the total O&M time, reading customer water meters every month and will spend more time as the population of the City grows. The City has already installed approximately 2000 touch read meters, and should continue to install automatic meter reading equipment at each customer meter to provide faster and more accurate meter readings, resulting in more time for other tasks.

Other proposed improvements not mentioned above are addressed in **Chapter 9** and included in the City's Capital Improvement Program.

Table 8-3
Staffing Requirements

Description	Total Units In System	Frequency (Times/Year)	Time/Unit (Hours)	Time/Year (Hours)
Preventive Maintenance				
Hydrants	1422	1	0.5	711
Isolation Valves, Hydrant Valves	3,067	1	0.25	767
Air and Vacuum Release Valves	220	1	0.5	110
Blowoff Assemblies	220	1	0.25	55
Meters	11,373	0.1	2	2,275
Leak Survey of Water Mains	190 miles	1	0.5	95
Flushing Water Mains	190 miles	1	5	950
Booster Pump Station	4	1	40	160
Pressure Reducing Stations	21	1	6	126
Interties	5	1	6	30
Sources	4	1	50	200
Filtration Plant	1	1	770	770
Reservoirs	4	1	30	120
Telemetry and Control System	1	1	40	40
Operations				
Monitor System	8	260	0.3	624
False Alarm Response	1	12	2	24
Meter Reading	11,373	6	0.1	6,824
Groundskeeping	8	12	6	576
Inventory	1	1	40	40
Meter Repair/Replace	569	1	4	2,275
Main Breaks	1	4	8	32
System Failures	1	4	8	32
Hydrant Repairs	28	1	8	228
Service Connections	500	1	8	4,000
Main Connections	10	1	24	240
Water Quality Sampling	23	12	0.5	138
Administration	1	260	8	2,080
Total Requirements				
Total Hours Required				23,521
Total Full Time Staff Required	**(based on 1,540 hours per year per person)**			**15**
Time Availabe Per Year Per Person				
Beginning Hours Available				2,080
Less average vacation of 3 weeks per year				-120
Less average sick leave of 2 weeks per year				-80
Less holidays of 10 days per year				-80
Less average training of 40 hours per year				-40
Less average small tasks other than above of 1 hour per day				-220
Net Total Available Hours Per Year Per Person				1,540

CHAPTER 9

WATER SYSTEM IMPROVEMENTS

Water Main Installation

INTRODUCTION

This chapter presents proposed improvements to the City of Bonney Lake (City) water system that are necessary to resolve existing system deficiencies and accommodate the projected growth of water customers. The water system improvements were identified from an evaluation of the results of the water system analyses presented in **Chapter 7**. The water system improvements were sized to meet both the existing and future demand conditions of the system.

A Capital Improvement Program number, herein referred to as a CIP number, has been assigned to each improvement. Water main and facility improvements are shown in **Figure 7 – *Proposed Water System Improvements (6-Year and 20-Year CIP)***. Improvements to the configuration of the City's pressure zones are shown in **Figure 8 – *Proposed Pressure Zones***. The improvements are also illustrated in the hydraulic profile of the future water system that is shown in **Figure 9 – *Proposed Hydraulic Profile***. The improvements are organized and presented in this chapter according to the following categories:

- Water Main Improvements
    - Leaky Water Main Replacements
    - Transmission Improvements
    - Replacement Program
- Supply Improvements
- Storage Improvements
- Facility Improvements
- Pressure Zone Improvements
    - New Pressure Zones
    - Pressure Reducing Station Improvements
    - Pressure Relief Station Improvements
- Planning and Operational Improvements
- Annual Programs
- Developer Funded Improvements

The remainder of this chapter presents a brief description of each group of improvements, the criteria for prioritizing, the basis for the cost estimates and the implementation schedule.

DESCRIPTION OF IMPROVEMENTS

This section provides a general description of each group of improvements and an overview of the deficiencies that they will resolve. Most of the improvements are necessary to resolve existing system deficiencies. However, several improvements have also been identified for some undeveloped areas to illustrate the major facilities that will be required when development occurs in those areas. Additional developer funded projects include localized on-site water main improvements that are not associated with overall water distribution, but are necessary when the property served by the water main is redeveloped or expanded. The costs associated with these improvements shall be borne by the developers, rather than the existing water customers. The CIP list is shown in **Table 9-1 – *Proposed Improvements Implementation Schedule (6-Year CIP)***.

Table 9-1
Proposed Improvements Implementation Schedule (6-Year CIP)

CIP No.	Description	Location	Size	Replaced Length of Water Main	Cost	Estimated 2007 Cost	Year	Annual Totals
ST1	15 MG Peaking Storage Tank (completion)					$2,290,000	2007	
ST2	Peaking Storage Booster Pump Station (completion)					$1,610,000	2007	
ST3	Lakeridge Water Tank Recoating					$260,000	2007	
LM1A	Leaky Mains PWTF (Deer Island)		6,750 LF	6,750 LF	$130/LF	$877,500	2007	
S1	Wholesale Supply Study					$100,000	2007	
WS	Supply - TWD Purchase (installment payment #2)					$650,000	2007	
A	Tank Cleaning Program					$30,000	2007	
A	Leak Detection Program					$45,000	2007	
A	Meter Replacement Program					$40,000	2007	$5,902,500
ST4	Lakeridge 810 Zone Water Tank (purchase land)	Lakeridge				$200,000	2008	
S2	Supply - TWD Intertie BPS	System Wide				$1,676,000	2008	
S3	Supply - TWD Intertie Water Main	System Wide	5,750 LF		$246/LF	$1,414,500	2008	
WM1	192nd Water Main Replacement		2,800 LF	2,800 LF	$176/LF	$492,800	2008	
LM1B	Leaky Mains PWTF - 95th Loop and 181st Ave E		3,800 LF	3,800 LF	$145/LF	$551,000	2008	
F1	Public Works Facility (design)	System Wide				$540,000	2008	
LM2A(d)	Leaky Mains PWTF Phase 2a (design)		13,100 LF		$15/LF	$196,500	2008	
F2	Pressure Relief Stations		2 each		$26,000/ea	$52,000	2008	
P1	EPA Updated Rule Compliance	System Wide				$50,000	2008	
WM2	Eastown Water Main		4,900 LF		$176/LF	$862,400	2008	
WM3	184th Avenue East Water Main Replacement		1,100 LF		$185/LF	$203,500	2008	
P2	Valve and Fire Hydrant Inventory and Mapping					$150,000	2008	
P3	Establish Flushing Program					$30,000	2008	
WS	Supply - TWD Purchase (installment payment #3)					$650,000	2008	
A	Tank Cleaning Program					$30,000	2008	
A	Leak Detection Program					$45,000	2008	
A	Meter Replacement Program					$40,000	2008	$7,183,700
F3	Public Works Facility (construction)	System Wide				$1,500,000	2009	
PZ1	Northwest Plateau Pressure Zone Improvements		2 each		$20,000/ea	$40,000	2009	
LM2A(c)	Leaky Mains PWTF Phase 2a (construction)		13,100 LF	13,100 LF	$140/LF	$1,834,000	2009	
LM2B(d)	Leaky Mains PWTF Phase 2b (design)		8,800 LF		$15/LF	$132,000	2009	
ST5	Lakeridge 810 Zone Water Tank		3.2 MG		$1.20/MG	$3,840,000	2009	
WM4	89th, 90th and 186th Water Main Replacement		1,800 LF		$185/LF	$333,000	2009	
WM5	SR 410 Central Business District Water Main Extension		1,000 LF		$185/LF	$335,000	2009	
WS	Supply - TWD Purchase (installment payment #4)					$650,000	2009	
A	Flushing Program					$20,000	2009	
A	Valve and Fire Hydrant Program					$10,000	2009	
A	Tank Cleaning Program					$30,000	2009	
A	Leak Detection Program					$45,000	2009	
A	Meter Replacement Program					$40,000	2009	$8,809,000
F4	Tacoma Point ASR Improvements					$50,000	2010	
PZ2	Southwest Plateau Pressure Zone Improvements		1 each		$20,000/ea	$20,000	2010	
PZ3	BPS - Lakeridge 810 Zone (South End)					$2,000,000	2010	
LM2B(c)	Leaky Mains PWTF Phase 2b (construction)		8,800 LF	8,800 LF	$140/LF	$1,232,000	2010	
LM2C(d)	Leaky Mains PWTF Phase 2c (design)		8,200 LF		$15/LF	$123,000	2010	
PZ4	12" Replacement - 182nd Ave. E & 84th Street East		2,000 LF	2,000 LF	$170/LF	$340,000	2010	
P4	Security System Improvements	System Wide				$100,000	2010	
WS	Supply - TWD Purchase (installment payment #5)					$650,000	2010	
A	Flushing Program					$20,000	2010	
A	Valve and Fire Hydrant Program					$10,000	2010	
A	Tank Cleaning Program					$30,000	2010	
A	Leak Detection Program					$45,000	2010	
A	Meter Replacement Program					$40,000	2010	$4,660,000
LM2C(c)	Leaky Mains PWTF Phase 2c (construction)		8,200 LF	8,200 LF	$140/LF	$1,148,000	2011	
LM2D(d)	Leaky Mains PWTF Phase 2d (design)		11,100 LF		$15/LF	$166,500	2011	
WS	Supply - TWD Purchase (installment payment #6)					$650,000	2011	
WM6	16" Replacement - BPA Alignment	System Wide	5,400 LF	5,400 LF	$263/ea	$1,418,000	2011	
A	Flushing Program					$20,000	2011	
A	Valve and Fire Hydrant Program					$10,000	2011	
A	Tank Cleaning Program					$30,000	2011	
A	Leak Detection Program					$45,000	2011	
A	Meter Replacement Program					$40,000	2011	$3,527,500
P5	Comprehensive Water Plan Update	System Wide				$150,000	2012	
LM2D(c)	Leaky Mains PWTF Phase 2d (construction)		11,100 LF	11,100 LF	$140/LF	$1,554,000	2012	
P6	Security System Updates	System Wide				$250,000	2012	
ST6	Tacoma Point 748 Zone Water Tank Upsizing		3.2 MG		$1.20/gal	$3,840,000	2012	
F5	Victor Falls Watershed Fencing	Rhodes				$550,000	2012	
WS	Supply - TWD Purchase (installment payment #7)					$650,000	2012	
A	Flushing Program					$20,000	2012	
A	Valve and Fire Hydrant Program					$10,000	2012	
A	Tank Cleaning Program					$30,000	2012	
A	Leak Detection Program					$45,000	2012	
A	Meter Replacement Program					$40,000	2012	$7,139,000
						Grand Total		$37,221,700

Water Main Improvements

The following water main improvements were identified from the results of the distribution and transmission system analyses discussed in **Chapter 7**. Most of the water main improvements in the 6-year CIP are part of the City's "Leaky Main Replacement Program" project and have a CIP number of LM#. Other water main improvements that are more specific to solving a major problem, or are larger diameter water mains that function more like transmission than distribution mains, are identified as individual projects (CIP WM1). Distinctions between design phases (d) and construction phases (c) are also made. Most system improvement projects are shown on **Figure 7 – *Proposed Water System Improvements*.**

All new water main extensions and replacements shall be installed in accordance with the City's *Development Policies and Public Works Design Standards*, which are included in **Appendix D** (water system portion only). All new water mains shall be ductile iron pipe and sized by a hydraulic analysis to ensure that all pressure, flow and velocity requirements, as stated in **Chapter 5**, are met. In general, new water mains that will carry fire flow in residential areas shall be a minimum of 8 inches in diameter and looped for multi-family residential developments and single-family transmission purposes. New water mains in commercial, business park, industrial and school areas shall be a minimum of 12 inches in diameter and looped.

CIP LM#: Leaky Main Replacement Program

Deficiency: Many of the water main improvements shown in **Figure 7** are required to replace water mains that have been identified as the most prone to leaking during the City's leak detection program.

Improvement: Replace existing water main with new ductile iron water main in accordance with the City's construction standards. The individual water main improvements grouped under this project are numbered LM1, LM2, LM3, etc., as shown in **Figure 7**. Water mains will be upsized as necessary to improve hydraulic conditions and accommodate growth.

CIP WM1: 12-inch 192nd Water Main Replacement

Deficiency: Transmission capacity between SR 410 and Rhodes Lake Road needs to be improved. In addition, roadway improvements are planned for the 192nd corridor.

Improvement: Install new 12-inch ductile iron water main from SR 410 to approximately 101st Street East to replace the existing 6-inch steel water main. This will improve transmission capacity and fire flows to the area.

CIP WM2: 16-inch Eastown Water Main Extension

Deficiency: The water system needs to be extended into the Eastown area in order to accommodate growth and provide water service along the SR 410 area east of 214th Avenue East.

Improvement: Install new 16-inch ductile iron water main along 96th Street East and as necessary along SR 410 or through developing parcels to provide looped transmission to this area.

CIP WM3: 12-inch 184th Water Main Replacement

Deficiency: Transmission capacity between Sumner Buckley Highway and SR 410 Road needs to be improved to support more commercial and municipal uses.

Improvement: Install new 12-inch ductile iron water main from Sumner Buckley Highway to SR 410 to replace the existing 8-inch ductile iron water main. This will improve transmission capacity and fire flows to the area.

CIP WM4: 12-inch 89th, 90th & 186th Water Main Replacements

Deficiency: Transmission capacity between 184th and 186th needs to be improved to support more commercial and municipal uses.

Improvement: Install new 12-inch ductile iron water main from 184th Avenue East to 186th Avenue East along both 89th and 90th Streets and along 186th Avenue East to replace the existing 6-inch ductile iron and 2-inch steel water main. This will improve transmission capacity and fire flows to the area.

CIP WM5: 12-inch SR 410 Central Business District Water Main Extension

Deficiency: Transmission capacity along SR 410 between Sumner Buckley Highway and 184th Avenue East needs to be improved.

Improvement: Extend new 12-inch ductile iron water main along the SR 410 frontage between Sumner Buckley Highway and 184th Avenue East. This will improve transmission capacity and fire flows to the area.

CIP WM6: 16-inch BPS Easement Water Main Replacement

Deficiency: Need to improve north/south transmission capacity along the west side of Lake Tapps between the Tacoma Point area and the Lakeridge tank area.

Improvement: Install new 16-inch ductile iron water main along the BPS easement between 33rd Street CT East and Tapps Drive East to replace the existing 8-inch steel main.

CIP WM7: 12-inch Myers Road Water Main Replacement

Deficiency: Transmission capacity along the west side of the Lakeridge 810 Pressure Zone needs to be increased to accommodate growth in the south end of that zone and to improve fire flows to the existing system.

Improvement: Install new 12-inch ductile iron water main along Myers Road between 70th Street East and 182nd Avenue East. Replace existing 6-inch steel, cast iron, and ductile iron pipe.

CIP WM8: 12-inch Tacoma Point/Driftwood Point Crossing Easement

Deficiency: When the lakebed crossing between Tacoma Point and Driftwood Point was made a small section between the lake and the Channel Road East was not replaced due to access constraints. The remaining section of 6-inch steel acts as a bottleneck for north/south transmission capacity.

Improvement: Install new 12-inch water main to replace this section. Due to the proximity of houses on either side of the alignment directional drilling with the installation of HDPE pipe is the preferred alternative.

CIP WM9: 12-inch Inlet Island to Interlake Island Lakebed Crossing

Deficiency: The existing lakebed crossing between Inlet Island and Interlake island should be replaced due to its age and the size.

Improvement: Install new 12-inch HDPE water main along the lakebed from Inlet Island and Interlake Islands and new 12-inch ductile iron pipe along Interlake Island to West Tapps Drive. Permits and easements from the then current owner (PSE or possible CWA) of the lakebed will be required.

CIP WM10: 16-inch Sumner Buckley Water Main Replacement

Deficiency: The existing 12-inch cast iron water main along Sumner Buckley between Sr 410 and Angeline Road is a central hub for dispersing Grainger Springs water to the system and moving water from the south end of the system to the central part of the system. This line should be replaced due to its age and to improve connections between the north and central part of the system.

Improvement: Install new 16-inch ductile iron water main along Sumner Buckley Highway from SR 410 to Angeline Road.

CIP WM11: 12-inch Victor Falls Elementary School Water Main Looping

Deficiency: Currently, fire flow service to the Victor Falls elementary school is provided through a 10-inch water main. This is not large enough to provide the required 2,500 gpm fire flow without exceeding maximum allowed velocities of 8 fps and does not provide the level of redundancy to the site desired by the City.

Improvement: Install new 12-inch ductile iron water main to the north side of the school. This will require the acquisition of an easement from a property along either 111th Street East or 191st Street CT East.

CIP WM12: 8-inch Deer Island Lakebed Water Main Crossing

Deficiency: Transmission capacity between Deer Island and the main land has been shut off since a major leak developed in the lakebed crossing water main. This main was not replaced as part of the Deer Island water main project due to construction schedule issues (lowering of the lake levels) and permitting concerns. This main should be replaced to restore transmission capacity.

Improvement: Install new 8-inch HDPE lakebed crossing between Deer Island Drive East and the community park on the north end of Lakeridge Drive East. Permits and easements from the then current owner (PSE or possible CWA) of the lakebed will be required.

CIP WM13: 8-inch Cedar View Water Main Replacement

Deficiency: Water mains throughout the Cedar View neighborhood are of substandard materials and undersized. In addition, this is an area that has been targeted by City staff as being prone to leaking. Portions of water main in this area will be replaced as part of the Leaking Water Main project but the majority of the water main will still need to be replaced. It is anticipated that this project will be timed to coincide with extensions of sanitary sewers into the area.

Improvement: Install new 8-inch water main throughout the Cedar View neighborhood as necessary to replace existing 2-inch PVC and 4-inch steel water mains.

Supply Improvements

The City has agreed to purchase wholesale water from the City of Tacoma. The supply is necessary to accommodate projected growth.

CIP S1: Wholesale Supply Study

Deficiency: The City will need to obtain another source of supply to accommodate growth within the next ten years. It is estimated that the City will need an additional 2.00 MGD (peak day) to meet its projected 2026 growth needs.

Improvement: Continue the evaluation and ultimately determine where to purchase wholesale water to meet future needs.

CIP S2: Tacoma Intertie and Booster Pump Station

Deficiency: Wholesale supply from the Tacoma system will be off of Tacoma's gravity pipeline which will require pressure booster to serve the Bonney Lake system.

Improvement: Construct a booster pumping facility at the proposed intertie location and 12-inch transmission main from the intertie to the Bonney Lake system. Additional water main improvements will also be required along 214th Avenue East and SR 410.

CIP S3: Wholesale Transmission Main

Deficiency: A transmission main from the Tacoma Intertie BPS to the north side of the City's Ponderosa 800 Pressure Zone will be required to transmit wholesale water into the core of the City's water system.

Improvement: Install 12-inch ductile iron water main from the BPS near the Tacoma Public Utilities Pipeline, along 214th Avenue East to near the 16-inch transmission main located near 214th Avenue East and 96th Street East.

Storage Improvements

The following water system storage improvements were identified from the results of the water system analyses that are discussed in **Chapter 7**. The improvements are primarily necessary to resolve existing system deficiencies, but have also been sized to accommodate projected growth.

CIP ST1 and ST2: Peaking Storage Facility

Deficiency: The City's supply policy is to provide sources of supply to meet the average Peak Day Demands in the system. The City experience sharp demand peaks during the summer which only last for a few days. Creating additional equalizing storage will help extend the City's source capacity to accommodate more growth. Construction of a 15 MG at grade storage tank and booster pump station is currently underway.

Improvement: The City will complete construction of the 15 million gallon grade storage tank and booster pump station by the end of 2007.

CIP ST3: Lakeridge Water Tank Cleaning and Recoating

Deficiency: The City's existing Lakeridge 748 water tank requires periodic inspections and cleaning and recoating to maintain the integrity of the structures.

Improvement: Inspect the interior and exterior of each reservoir and determine where cleaning or other improvements are required. Clean and recoat the reservoirs as necessary.

CIP ST4: Land Acquisition for Lakeridge 810 Tank

Deficiency: A site for the proposed Lakeridge 810 Storage Tank is needed.

Improvement: Select and obtain a property for the Lakeridge 810 Tank that has an optimum ground elevation and in conducive to permitting a tall water tank.

CIP ST5: 3.2 MG Lakeridge 810 Zone Reservoir

Deficiency: The City does not currently have a storage facility in this zone.

Improvement: Construct a new reservoir in the upper elevations of the 810 Zone to provide gravity storage for existing and future customers. The new reservoir will have an overflow elevation of approximately 810 feet. The new reservoir will be sized to provide approximately 1.3 MG of usable storage.

CIP ST6: Tacoma Point Storage Tank Replacement

Deficiency: The City's Tacoma Point tank is too small, has an inadequate overflow elevation, needs to be painted and seismically retrofitted.

Improvement: Remove and replace the existing tank with a taller larger diameter tank. It is anticipated that this tank will have a diameter of 70 feet and a volume of 3.2 MG.

CIP ST7: 1.5 MG Lakeridge 748 Zone Reservoir

Deficiency: Additional storage capacity will be required by 2014 to accommodate growth. It is estimated that 1.5 MG of storage capacity will be required to accommodate projected growth through 2026.

Improvement: Construct a new reservoir in the 748 Pressure Zone to provide gravity storage to the water system. The new reservoir will have an overflow elevation of 748 feet and needs to be sized to provide approximately 1.5 MG of usable storage. The preferred location for this tank is in the central part of the water a system since there are no sources of supply in this location.

CIP ST8: Ponderosa 748 Water Tank Cleaning and Recoating

Deficiency: The City's existing Ponderosa 748 water tank requires periodic inspections and cleaning and recoating to maintain the integrity of the structures.

Improvement: Inspect the interior and exterior of each reservoir and determine where cleaning or other improvements are required. Clean and recoat the reservoirs as necessary.

Facility Improvements

The following water system facility improvements were identified from the results of the water system analyses that are discussed in **Chapter 7**. The improvements are primarily necessary to resolve existing system deficiencies, but have also been sized to accommodate projected growth.

CIP F1 and F3: Public Works Facility

Deficiency: The City's has outgrown its Public Works Yard. Currently, the City is evaluating the construction of a new Public Works Facility at the City owned peaking storage site.

Improvement: Participate in the design and funding of a new Public Works Department shops and maintenance facility.

CIP F2: Pressure Relief Valves

Deficiency: Many of the City's existing pressure zones do not have adequate pressure relief capacity in the event of an emergency over-pressurization of the City's system.

Improvement: The City will find appropriate locations to discharge water from the system under emergency conditions and will install pressure relief stations at these locations. Preliminary evaluations indicate that the Bonney Lake 748 Zone, the Ponderosa 800 Zone, and the Lakeridge 810 Zone could all use additional pressure relief capacity. It is assumed that the City will identify sites and install two pressure relief stations per year for a period of three years.

CIP F4: Aquifer Supply and Recovery Improvements

Deficiency: The City is interested in augmenting aquifer recharge for both its Tacoma Point and Ball Park aquifers. Excess source of supply capacity currently exists during the winter and spring months of the year. This water could be used to recharge these aquifers.

Improvement: Improvements can be made to utilize the City's existing production wells to get water into the Tacoma Point and Ball Park aquifers.

CIP F5: Victor Falls Springs Watershed Fencing

Deficiency: The City's Wellhead Protection report identified the need to more adequately secure the Victor Falls Springs collection boxes from vandalism and inadvertent intrusion.

Improvement: The City will make fencing improvements around the three spring collection boxes.

CIP F6: Emergency Power Generator at Grainger Springs

Deficiency: The City's existing emergency generator at the Grainger Springs source is old and needs to be replaced.

Improvement: Replace the existing generator and automatic transfer switch.

CIP F7: Victor Falls Metering Improvements

Deficiency: Currently the City does not meter the flows from the individual spring collection boxes. This is an important step in demonstrating the appropriate withdrawals associated with each water right.

Improvement: Install flow meters and reconfigure piping as necessary to meter each of the three collection boxes separately.

CIP F8: Emergency Power Generator at Tacoma Point

Deficiency: The City's existing emergency generator at the Tacoma Point Wellfield is old and needs to be replaced.

Improvement: Replace the existing generator and automatic transfer switch.

Pressure Zone Improvements

The following pressure zone improvement will improve how the PRVs in the Angeline Valley area work together and provide for development of the western slopes of the Lake Tapps Plateau in the Forest Canyon area. A brief description of the existing deficiency that the improvement will resolve and a description of the improvement itself are provided below.

CIP PZ1: Reconfiguration of the Northwest Plateau Area

Deficiency: Much of the northwest plateau area around Forest Canyon Road and west of the Lakeridge 810 Pressure Zone is currently not developed. As development occurs in these areas the existing zones will need to be reconfigured and new zones established.

Improvement: Most of the pressure reducing stations required to make the improvements in the area will be funded by developer extensions. However, several new stations and water main connections may be required to be accomplished by the City

CIP PZ2: Reconfiguration of the Southwest Plateau Area

Deficiency: The existing Angeline Valley Zone has too many PRVs, dead-end pipes, zone valves and does not cover enough area. In addition, developments along the steep western slope of the Panorama West and Sky Island areas necessitate the need for additional pressure reducing stations.

Improvement: Most of the pressure reducing stations required to make the improvements in the area will be funded by developer extensions. However, several valve replacements, adjustments, vault removals and water main connections may be required to be accomplished by the City.

CIP PZ3: Booster Pump Station Lakeridge 810 Zone (south end)

Deficiency: North/South transmission capacity in the Bonney Lake 748 Pressure Zone limits the water system's ability to keep the Lakeridge 748 Water Rank full. Establishing an additional supply point for the Lakeridge 810 Pressure Zone will help alleviate some of this issue.

Improvement: Construct a booster pump station and the necessary transmission main to take water from the south end of the Bonney Lake 748 Pressure Zone and supply it to the south end of the Lakeridge 810 Pressure Zone.

CIP PZ4: 12-inch 182nd Avenue East and 84th Street East Water Main Upsizing

Deficiency: Transmission capacity from the south end Lakeridge 810 BPS station will need to be established from the BPS to the existing 12-inch cast iron transmission main in the 810 zone.

Improvement: Install new 12-inch ductile iron water main from the BPS located near the south end of the Lakeridge 810 Pressure Zone to existing 12-inch cast iron main located near 84th Avenue East and 185th Avenue East.

Planning and Operational Improvements

The following are planning efforts and operational program elements that are required to comply with various State water regulations and improve the systems operations.

CIP P1: EPA Updated Rule Compliance

Deficiency: The EPA is in the process of updated and creating several new rules that govern how purveyors operated, maintain, and monitory water systems. The City will need to prepare documentation and additional monitoring to comply with the new regulations.

Improvement: Prepare the required disinfection by product distribution study and increase monitoring as required to comply with the new rules.

CIP P2: Valve and Fire Hydrant Inventory Program

Deficiency: In order to maintain valves and fire hydrants and to ensure that they are easy to locate and operate in an emergency the City will need to conduct a inventory and mapping program.

Improvement: Inventory and document the location and physical parameters of all valves and fire hydrants in the City's water system. Prepare maps showing the location and identification of all valves and hydrants for use by Public Works staff and emergency personnel. Establish a valve and fire hydrant maintenance program to be used by staff.

CIP P3: Flushing Program

Deficiency: Systematic flushing of the City's water system will help ensure that the water system provides the highest quality water possible.

Improvement: Establish a unilateral flushing program that is well conceived and easy to administer so that Public Works staff can conduct the program with confidence.

CIP P4: Security System Improvements

Deficiency: Security improvements are necessary to comply with the City's Vulnerability Assessment recommendations.

Improvement: The City will install security measures as identified in their Vulnerability Assessment.

CIP P5: Comprehensive Water System Plan Update

Deficiency: WAC 246-290-100 requires that the City's Comprehensive Water System Plan be updated every six years and submitted to the Department of Health for review and approval.

Improvement: The City will update and submit its Comprehensive Water System Plan every six years to comply with State requirements. In addition, the City will perform a check of the Plan at the three year mark and adjust the projections as necessary.

CIP P6: Security System Improvements

Deficiency: Security improvements are necessary to comply with the City's Vulnerability Assessment recommendations.

Improvement: The City will install security measures as identified in their Vulnerability Assessment.

Annual Programs

The following programs will be performed on an annual basis.

CIP A1: Flushing Program

Deficiency: Systematic flushing of the City's water system will help ensure that the water system provides the highest quality water possible.

Improvement: Conduct a unilateral flushing program to specific parts of the water system according to the Flushing Program.

CIP A2: Valve and Fire Hydrant Program

Deficiency: The ability to easily locate and operation valves and fire hydrants in emergency situation is imperative to a timely response.

Improvement: Conduct valve and fire hydrant maintenance according to the established program.

CIP A3: Tank Cleaning Program

Deficiency: Cleaning of tanks exterior prolongs the life of the tank surface and improves tank appearance.

Improvement: Clean roofs of concrete tanks and pressure wash steel tanks.

CIP A4: Leak Detection and Conservation Program

Deficiency: The City needs to monitor its system annually to identify leaking water mains. Several water conservation measures must be carried out on an ongoing basis to comply with State conservation requirements.

Improvement: The City will continue to implement its comprehensive leak detection/water main repair program to further reduce the amount of unaccounted-for water. The City will perform other ongoing conservation measures, including public education programs, as outlined in the Water Conservation Plan included in **Appendix C**. The City budgets $45,000 per year for this program, which includes leak detection and a limited amount of water main repairs.

CIP A5: Touch Read Meter Conversion

Deficiency: The City currently uses a significant amount of staff time to read customer water meters. Only 4,000 meters have been converted to the touch read system to date.

Improvement: The City will continue to install touch read meter systems on all remaining customer meters. The City budgets $40,000 per year for this program.

Developer Funded Improvements

Improvements have been identified for the undeveloped areas of the City's existing and expected service area to illustrate the major facilities that will be required to properly serve that area. Additional developer funded projects include localized on-site water main improvements that are not associated with overall water distribution, but would be necessary if the property served by the water main is redeveloped or expanded. Although locations of many considered developer funded facilities are shown schematically in **Figure 7 – *Proposed Water System Improvements*** no attempt has been made to predict all improvements that may be required to reach buildout nor to comprehensively plan or delineate individual improvements required to serve specific areas or developments.

ESTIMATING COSTS OF IMPROVEMENTS

Project costs for the proposed improvements were estimated based on costs of similar, recently constructed water projects in Bonney Lake and around the Puget Sound area, and are presented in 2006 dollars. The cost estimates include the estimated construction cost of the improvement and indirect costs estimated at 35 percent of the construction cost for engineering preliminary design, final design, and construction management services, permitting, legal, and administrative services. The construction cost estimates include a 10 percent contingency and sales tax of 8.8 percent.

Construction cost estimates for water main projects were determined from the water main unit costs (i.e., cost per foot length) shown in **Table 9-2 – *Water Main Unit Costs*** and the proposed diameter and approximate length of each improvement.

Table 9-2
Water Main Unit Costs

Water Main Diameter (inches)	Construction Cost Per Foot Length (2007 $/LF)
8	$140
12	$170
16	$210

The unit costs for each water main size are based on estimates of all construction related improvements, such as materials and labor for the water main installation, water services, fire hydrants, fittings, valves, connections to the existing system, trench restoration, asphalt surface restoration and other work for a complete installation. The unit costs also include a contingency and sales tax. Additional costs were added to some water main improvements to cover anticipated, increased costs related to the project location and degree of difficulty.

PRIORITIZING IMPROVEMENTS

The water system improvements were prioritized from established criteria to formulate a schedule that identifies projects with the most deficiencies and greatest need for improvement to be completed prior to projects with fewer deficiencies. A description of the criteria and method for prioritizing each category of improvements are provided below.

Water Main Improvements

Table 9-3 – ***Water Main Improvements Priority Ranking*** lists criteria that were established for prioritizing the water main improvements. The criteria are based on the underlying deficiencies of the existing water main that will be replaced by the proposed water main improvements. The criteria are arranged in four different categories with a weight factor assigned to each category. The criteria given the most weight are the "Existing Water Main Fire Flow Capability" category.

Table 9-3
Water Main Improvements Priority Ranking Criteria

Points	Category	Weight Factor	Weighted Points
	Existing Water Main Fire Flow Capability		
3	Available Fire Flow is 69% or Less of Required Fire Flow	4	12
2	Available Fire Flow is 70-89% of Required Fire Flow	4	8
1	Available Fire Flow is 90-100% or More of Required Fire Flow	4	4
	Existing Water Main Year of Installation		
3	Before 1960	3	9
2	1960 - 1980	3	6
1	After 1980	3	3
	Existing Water Main Material		
3	PVC (Non C900)	3	9
2	Steel or Galvanized Iron	3	6
1	Asbestos Cement	3	3
	Existing Water Main Benefit Area		
3	Large Benefit Area (i.e. transmission main)	2	6
2	Medium Benefit Area	2	4
1	Small Benefit Area (i.e. localized area)	2	2

High Priority = 27 - 36 points
Medium Priority = 24 - 26 points
Low Priority = 12 - 23 points

The "Existing Water Main Fire Flow Capability" category ranks the water main improvements based on the ability of the existing water mains to provide the required fire flow, as determined from the results of the hydraulic analyses addressed in **Chapter 7**. The "Existing Water Main Year of Installation" category ranks the water main improvements based on the age of the existing water mains. The "Existing Water Main Material" category ranks the water main improvements based on the material of the existing water main. The "Existing Water Main Benefit Area" category ranks the water main improvements based on the size of the area that will benefit from the water main replacement.

The water main priority ranking criteria was applied to the water main replacement projects, which are grouped under CIP WM1 through WM32, as shown in **Figure 7 – *Proposed Water System Improvements*** and presented in the 6-year, 10-year, and 20-year CIP tables. Some modification of priority rankings were made to group different water main alignments into single projects according to their proximity to each other.

Other Improvements

The pressure zone, pressure reducing station and facility improvements were prioritized based on existing deficiencies, safety concerns, maintenance requirements, and capacity requirements. The miscellaneous improvements were prioritized based on regulatory requirements and assessment of the water system needs. The priority order of these improvements is reflected in the schedule of improvements, which is presented in the next section.

SCHEDULE OF IMPROVEMENTS

The results of prioritizing the improvements were used to assist in establishing an implementation schedule that can be used by the City for preparing its 6-year CIP and yearly water budget. The implementation schedule for the proposed improvements is shown in **Table 9-1 – *Proposed Improvements Implementation Schedule (6-Year CIP)*** for the 6-Year CIP and **Table 9-4 – *Proposed Improvements Implementation Schedule (10-Year CIP)*** for the 10-year CIP, and **Table 9-5 – *Proposed Improvements Implementation Schedule (20-Year CIP)*** for the 20-year CIP.

Future Project Cost Adjustments

All cost estimates shown in the tables are presented in year 2006 dollars. Therefore, it is recommended that future costs be adjusted to account for the effects of inflation and changing construction market conditions at the actual time of project implementation. Future costs can be estimated using the Engineering News Record (ENR) Construction Cost Index for the Seattle area or by applying an estimated rate of inflation that reflects the current and anticipated future market conditions.

Table 9-4
Proposed Improvements Implementation Schedule (10-Year CIP)

CIP No.	Description	Location	Size	Replaced Length of Water Main	Cost	Estimated 2007 Cost	Year	Annual Totals
ST1	15 MG Peaking Storage Tank (completion)					$2,290,000	2007	
ST2	Peaking Storage Booster Pump Station (completion)					$1,610,000	2007	
ST3	Lakeridge Water Tank Recoating					$260,000	2007	
LM1A	Leaky Mains PWTF (Deer Island)		6,750 LF	6,750 LF	$130/LF	$877,500	2007	
S1	Wholesale Supply Study					$100,000	2007	
WS	Supply - TWD Purchase (installment payment #2)					$650,000	2007	
A	Tank Cleaning Program					$30,000	2007	
A	Leak Detection Program					$45,000	2007	
A	Meter Replacement Program					$40,000	2007	$5,902,500
ST4	Lakeridge 810 Zone Water Tank (purchase land)	Lakeridge				$200,000	2008	
S2	Supply - TWD Intertie BPS	System Wide				$1,676,000	2008	
S3	Supply - TWD Intertie Water Main	System Wide	5,750 LF		$246/LF	$1,414,500	2008	
WM1	192nd Water Main Replacement		2,800 LF	2,800 LF	$176/LF	$492,800	2008	
LM1B	Leaky Mains PWTF - 95th Loop and 181st Ave E		3,800 LF	3,800 LF	$145/LF	$551,000	2008	
F1	Public Works Facility (design)	System Wide				$540,000	2008	
LM2A(d)	Leaky Mains PWTF Phase 2a (design)		13,100 LF		$15/LF	$196,500	2008	
F2	Pressure Relief Stations		2 each		$26,000/ea	$52,000	2008	
P1	EPA Updated Rule Compliance	System Wide				$50,000	2008	
WM2	Eastown Water Main		4,900 LF		$176/LF	$862,400	2008	
WM3	184th Avenue East Water Main Replacement		1,100 LF		$185/LF	$203,500	2008	
P2	Valve and Fire Hydrant Inventory and Mapping					$150,000	2008	
P3	Establish Flushing Program					$30,000	2008	
WS	Supply - TWD Purchase (installment payment #3)					$650,000	2008	
A	Tank Cleaning Program					$30,000	2008	
A	Leak Detection Program					$45,000	2008	
A	Meter Replacement Program					$40,000	2008	$7,183,700
F3	Public Works Facility (construction)	System Wide				$1,500,000	2009	
PZ1	Northwest Plateau Pressure Zone Improvements		2 each		$20,000/ea	$40,000	2009	
LM2A(c)	Leaky Mains PWTF Phase 2a (construction)		13,100 LF	13,100 LF	$140/LF	$1,834,000	2009	
LM2B(d)	Leaky Mains PWTF Phase 2b (design)		8,800 LF		$15/LF	$132,000	2009	
ST5	Lakeridge 810 Zone Water Tank					$3,840,000	2009	
WM4	89th, 90th and 186th Water Main Replacement					$333,000	2009	
WM5	SR 410 Central Business District Water Main Extension					$335,000	2009	
WS	Supply - TWD Purchase (installment payment #4)					$650,000	2009	
A	Flushing Program					$20,000	2009	
A	Valve and Fire Hydrant Program					$10,000	2009	
A	Tank Cleaning Program					$30,000	2009	
A	Leak Detection Program					$45,000	2009	
A	Meter Replacement Program					$40,000	2009	$8,809,000
F4	Tacoma Point ASR Improvements					$50,000	2010	
PZ2	Southwest Plateau Pressure Zone Improvements		1 each		$20,000/ea	$20,000	2010	
PZ3	BPS - Lakeridge 810 Zone (South End)					$2,000,000	2010	
LM2B(c)	Leaky Mains PWTF Phase 2b (construction)		8,800 LF	8,800 LF	$140/LF	$1,232,000	2010	
LM2C(d)	Leaky Mains PWTF Phase 2c (design)		8,200 LF		$15/LF	$123,000	2010	
PZ4	12" Replacement - 182nd Ave. E & 84th Street East		2,000 LF	2,000 LF	$170/LF	$340,000	2010	
P4	Security System Improvements	System Wide				$100,000	2010	
WS	Supply - TWD Purchase (installment payment #5)					$650,000	2010	
A	Flushing Program					$20,000	2010	
A	Valve and Fire Hydrant Program					$10,000	2010	
A	Tank Cleaning Program					$30,000	2010	
A	Leak Detection Program					$45,000	2010	
A	Meter Replacement Program					$40,000	2010	$4,660,000
LM2C(c)	Leaky Mains PWTF Phase 2c (construction)		8,200 LF	8,200 LF	$140/LF	$1,148,000	2011	
LM2D(d)	Leaky Mains PWTF Phase 2d (design)		11,100 LF		$15/LF	$166,500	2011	
WS	Supply - TWD Purchase (installment payment #6)					$650,000	2011	
WM6	16" Replacement - BPA Alignment		5,400 LF	5,400 LF	$263/LF	$1,418,000	2011	
A	Flushing Program					$20,000	2011	
A	Valve and Fire Hydrant Program					$10,000	2011	
A	Tank Cleaning Program					$30,000	2011	
A	Leak Detection Program					$45,000	2011	
A	Meter Replacement Program					$40,000	2011	$3,527,500
P5	Comprehensive Water Plan Update	System Wide				$150,000	2012	
LM2D(c)	Leaky Mains PWTF Phase 2d (construction)		11,100 LF	11,100 LF	$140/LF	$1,554,000	2012	
P6	Security System Updates	System Wide				$250,000	2012	
ST6	Tacoma Point 748 Zone Water Tank Upsizing		3.2 MG		$1.20/gal	$3,840,000	2012	
F5	Victor Falls Watershed Fencing	Rhodes				$550,000	2012	
WS	Supply - TWD Purchase (installment payment #7)					$650,000	2012	
A	Flushing Program					$20,000	2012	
A	Valve and Fire Hydrant Program					$10,000	2012	
A	Tank Cleaning Program					$30,000	2012	
A	Leak Detection Program					$45,000	2012	
A	Meter Replacement Program					$40,000	2012	$7,139,000
WM7	12" Replacement - Myers Road	System Wide	4,000 LF	4,000 LF	$213/LF	$850,000	2013	
WS	Supply - TWD Purchase (installment payment #8)					$650,000	2013	
A	Flushing Program					$20,000	2013	
A	Valve and Fire Hydrant Program					$10,000	2013	
A	Tank Cleaning Program					$30,000	2013	
A	Leak Detection Program					$45,000	2013	
A	Meter Replacement Program					$40,000	2013	$1,645,000
WM8	Tacoma Point/Driftwood Point Water Main Easement Crossing		100 LF	100 LF	$300/LF	$30,000	2014	
WM9	Inlet Island Lakebed Water Main Crossing		600 LF	600 LF	$300/LF	$180,000	2014	
ST7	Lakeridge 748 Zone Water Tank		1.5 MG		$1.20/gal	$1,800,000	2014	
WS	Supply - TWD Purchase (installment payment #9)					$650,000	2014	
A	Flushing Program					$20,000	2014	
A	Valve and Fire Hydrant Program					$10,000	2014	
A	Tank Cleaning Program					$30,000	2014	
A	Leak Detection Program					$45,000	2014	
A	Meter Replacement Program					$40,000	2014	$2,805,000
ST8	Ponderosa Tank 748 Repainting					$300,000	2015	
F6	Emergency Power Generator - Grainger Springs					$75,000	2015	
F7	Victor Falls Metering Improvement					$100,000	2015	
WM10	16" Replacement - Sumner Buckley Hwy		3,000 LF	3,000 LF	$263/LF	$788,000	2015	
WM11	Victor Falls Elementary School Water Main Looping		1,000 LF	1,000 LF	$170/LF	$170,000	2015	
WS	Supply - TWD Purchase (installment payment #10)					$650,000	2015	
A	Flushing Program					$20,000	2015	
A	Valve and Fire Hydrant Program					$10,000	2015	
A	Tank Video and Cleaning Program					$30,000	2015	
A	Leak Detection Program					$45,000	2015	
A	Meter Replacement Program					$40,000	2015	$2,228,000
WM12	Deer Island Lakebed Water Main Crossing		600 LF	600 LF	$300/LF	$180,000	2016	
F8	Emergency Power Generator - Tacoma Point					$75,000	2016	
WM13	Cedar View Water Main Replacement Program		23,100 LF	23,100 LF	$189/LF	$4,365,900	2016	
A	Flushing Program					$20,000	2016	
A	Valve and Fire Hydrant Program					$10,000	2016	
A	Tank Video and Cleaning Program					$30,000	2016	
A	Leak Detection Program					$45,000	2016	
A	Meter Replacement Program					$40,000	2016	$4,765,900
						Grand Total		**$48,665,600**

Table 9-5
Proposed Improvements Implementation Schedule (20-Year CIP)

No.	Description	Water Main Prioirty	Estimated Cost (2007 $)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
	Water Main Improvements												
WM14	8" Replacement - 36th St. E.	29	$189,000	$ 189,000									
WM15	8" Replacement - Jenk's Point Way	29	$227,000	$ 227,000									
WM16	8" Replacement - 189th CT. E.	28	$340,000	$ 340,000									
WM17	8" Replacement - Banker's Island	28	$567,000		$ 567,000								
WM18	8" Replacement - 184th Ave. E.	26	$189,000		$ 189,000								
WM19	8" Replacement - 43rd St. E./183rd Ave E.	26	$265,000		$ 265,000								
WM20	8" Replacement - 185th Ave. E.	25	$227,000		$ 227,000								
WM21	8" Replacement - Bonanza Drive	24	$851,000		$ 851,000								
WM22	8" Replacement - La Rita Drive/107th St. E.	24	$624,000			$ 624,000							
WM23	8" Replacement - West Tapps Drive	22	$1,153,000			$ 1,153,000							
WM24	12" Replacement - Myers Road	22	$1,423,000				$ 1,423,000						
WM25	8" Replacement - 58th St./59th Street E.	20	$567,000					$ 567,000					
WM26	8" Replacement - 193rd Ave Ct. E.	20	$284,000					$ 284,000					
WM27	8" Replacement - 202nd Ave E.	18	$662,000						$ 662,000				
WM28	8" Replacement - 108th Street E.	18	$473,000							$ 473,000			
WM29	8" Replacement - 178th Avenue E.	18	$567,000							$ 567,000			
WM30	8" Replacement - Bonney Lake Boulevard	18	$1,474,000								$ 1,474,000		
WM31	8" Replacement - West Tapps Highway	18	$567,000									$ 567,000	
WM32	8" Replacement - Church Lake Road	18	$567,000									$ 567,000	
WM33	8" Replacement - 206th Ave E.	18	$567,000									$ 567,000	
WM34	8" Replacement - Locust Ave E.	18	$1,134,000										$ 1,134,000
WM35	12" Replacement - Sumner Tapps Hwy E	15	$378,000										$ 378,000
	0	0	$0										
	Supply Improvements												
WS	Wholesale Supply - Block 2		$10,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000
WS	Wholesale Supply - Block 3		$0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Storage Improvements												
			$0										
ST9	Repainting Program		$1,100,000		$ 500,000				$ 300,000				$ 300,000
			$0										
	Facility Improvements												
F10	Water Quality Treatment Program		$1,000,000									$ 1,000,000	
F11	Grainger Springs Pump Station Rebuild		$1,000,000		$ 1,000,000								
F12	Victor Falls Pump Station Rebuild		$1,000,000					$ 1,000,000					
F13	Pump Replacement Program		$100,000						$ 50,000				$ 50,000
F14	Public Works Shop Building		$500,000			$ 500,000							
	Planning and Operational Improvements												
P7	Reclamation and Reuse Program		$1,000,000	$ 1,000,000									
P8	Telemetry and Control System Upgrades		$100,000								$ 100,000		
P9	Wellhead Protection Program		$500,000				$ 500,000						
P10	Security System Improvements		$0										
P11	Comprehensive Water System Plan Update		$400,000				$ 200,000						$ 200,000
	Annual Programs												
A1	Flushing Program		$200,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000
A2	Valve and Fire Hydrant Program		$100,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
A2	Tank Cleaning Program		$300,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000
A4	Annual Leak Detection Program		$450,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000
A5	Annual Water Meter Replacement Program		$500,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000
Total Estimated Project Costs			**$31,545,000**	**$ 2,911,000**	**$ 4,754,000**	**$ 3,432,000**	**$ 3,278,000**	**$ 3,006,000**	**$ 2,167,000**	**$ 2,195,000**	**$ 2,729,000**	**$ 3,856,000**	**$ 3,217,000**

CHAPTER 10

FINANCIAL ANALYSIS

INTRODUCTION

Washington Administrative Code (*WAC 246-290-100*) requires a comprehensive water system plan financial program to include a demonstration of financial viability by providing: a summary of past income and expenses; a balanced budget; a funding plan; and consideration of a rate structure addressing affordability and conservation. This chapter, in conjunction with the 2007 *System Development Charge and Rate Financial Analysis* and the 2005 *Comprehensive Water and Sewer Rate* Study (see **Appendix S),** addresses and complies with those requirements for the City of Bonney Lake's *Comprehensive Water System Plan*.

One of the City's most important objectives is to secure the necessary resources to fund needed capital improvement projects and support the ongoing operational requirements of the water system. In the formulation of the financial plan, we reviewed financial, operational, and budget information and worked with City staff and consultants to evaluate policy and strategic options to strengthen the water utility's financial position. While a combination of policy and operational steps are being evaluated, a refined rate structure that provides clear price incentives to customers is considered to be one of the most important elements to achieve rate equity and rate efficiency.

In executing this financial planning effort, the historical financial condition of the utility was documented; capital funding options were identified and evaluated; and the feasibility and impact of funding the capital improvement program (CIP) was evaluated.

CAPITAL FUNDING OPTIONS

The City may fund the water capital improvement program from a variety of sources. In general, these sources can be summarized as: (1) governmental grant and loan programs; (2) publicly issued debt; and (3) cash resources and revenues. These alternative sources are described below. In addition, there are numerous system improvements, primarily in the form of system extensions that are required of developers as a condition of service. Since there is no impact to rates stemming from these improvements, they are not addressed in this analysis.

Governmental Grant and Loan Programs

Historically, federal and state grant programs were available to local utilities for financial assistance; however, these have been mostly eliminated or replaced by loan programs. Remaining miscellaneous grant programs are generally funded lightly and highly competitive. Nonetheless, the benefit of even low-interest loans makes the effort of applying worthwhile. State programs reviewed as potential funding sources for the utility improvements set forth in this Plan are summarized below.

- **Public Works Trust Fund** - The Public Works Trust Fund (PWTF) is a commonly used, low cost revolving loan fund established in 1985 by the state legislature to provide financial assistance to local governments, such as the City, for public works projects. Eligible projects include repair, replacement, rehabilitation, reconstruction, or improvement of eligible public works systems to meet current standards for existing users. With recent revisions to the program, growth-related projects consistent with 20-year projected needs are now eligible.

  PWTF Loans are available at interest rates of 0.5 percent, 1 percent, and 2 percent, with the lower interest rates given to applicants who pay a larger share of the total project costs. The loan applicant must pay a minimum of 5 percent towards the project cost to qualify for a 2 percent loan, 10 percent for a 1 percent loan, and 15 percent for a 0.5 percent loan. The useful life of the project determines the loan term up to a maximum of 20 years.

  The applicant must have an approved long-term plan for financing its public works needs. Local governments must compete for PWTF dollars since more funds are requested each year than are available. The Public Works Board evaluates each application and transmits a prioritized list of projects to the legislature. The legislature then indicates its approval by passing an appropriation from the Public Works Assistance Account to cover the cost of the approved loans. Once the Governor has signed the appropriations bill into law, the local governments receiving the loans are offered a formal loan agreement with the appropriate interest rate and term, as determined by the Public Works Trust Fund Board.
- **Community Economic Revitalization Board** - Managed by the Department of Community Trade and Economic Development, this program provides grants and loans to fund public facilities that result in specific private sector development. Eligible projects include water, sewer, roads, and bridges. Funding varies.
- **Community Development Block Grant (CDBG) Program** - Also administered by the State Department of Community Trade and Economic Development, the CDBG program provides grants and loans for infrastructure improvements, including water projects, for business development that create or retain jobs for low and moderate-income residents.
- **Department of Ecology** - The Department of Ecology Water Quality Financial Assistance Program sponsors four grant and loan programs: the Centennial Clean Water Fund, Federal 319 Programs, State Revolving Fund (SRF) Loans, and the Aquatic Weeds Grant Programs. While most of the funding goes to wastewater programs, projects such as development and implementation of groundwater and wellhead protection programs are included. Congress has authorized a limited amount of money for the Drinking Water State Revolving Fund (DWSRF) loan specifically for programs to improve water quality. Funding is generally limited to 50 percent and comes in the form of either a grant or low interest loan (0 percent for up to 5-years, increasing to 4.8 percent for 15- to 20-years).

Of these programs, the PWTF provides the most attractive terms for the City, and lends itself well to the types of projects identified in the capital improvement program. The City has been extremely successful in securing numerous PWTF loans in the past.

Publicly Issued or Bonded Debt

Revenue Bonds – One of the most common source of funds for construction of major utility improvements is the sale of revenue bonds. Revenue bonds are issued by utilities and are typically repaid from rate revenues. In order to qualify to sell revenue bonds, the City must show that its net operating income (gross income less expenses) is equal to or greater than a factor, typically 1.3 to 1.4, times the annual revenue bond debt. This factor is commonly referred to as the coverage factor, and is applicable to revenue bonds sold on the commercial market. The coverage requirement is one of the two factors (together with cash needs) that could trigger future rate increases. Although commonly used, revenue bonds incur relatively high interest rates and therefore should be relied upon only after all other grant and low interest loan options have been exhausted.

Utility Cash Resources and Revenue

Utility financial resources available for capital funding include rate funding, cash reserves, and System Development Charge (SDC) also called a capital facilities charges (CFC).

- **Rates and Rate Funding** – At this point, the City does not have a specific policy in place for cash funding capital projects through rates. Direct rate-funding of capital improvement and replacement projects has historically been funded on an as-needed, pay-as-you-go basis.
- **Cash Reserves** – As mentioned previously, the City does not currently have cash reserves available to assist in funding the entire proposed capital improvement program. The rate increases presented herein will assist the City in rebuilding these reserves over time.
- **Capital Facilities Charges** – The City imposes a system development charge (SDC) on all new connections to the water system. The purpose of the SDC is two-fold: (1) to promote equity between new and existing customers; and (2) to provide a source of revenue (contributed equity) to fund capital projects. Equity is served by providing a vehicle for new customers to share in the capital costs incurred to support their addition to the system. SDC revenues provide a source of cash flow used to support utility capital needs. SDC revenues can only be used to fund utility capital projects or to pay debt service incurred to finance those projects.
- In the absence of a SDC, growth-related costs would be borne in large part by existing customers. In addition, the net investment in the utility already collected from existing customers, whether through rates, charges and/or assessments, would be diluted by the addition of new customers, effectively subsidizing new customers with prior customers' payments. To establish equity, a SDC should recover a proportionate share of the existing and future infrastructure costs form a new customer. From a financial perspective, a new customer should become financially equivalent to an existing customer by paying the SDC.

  The current 2007 SDC is $6,895 for a 5/8-inch meter. Revenues generated from this source are projected at around $2,500,000 to $3,000,000 a year. The City is in the process of adopting an updated SDC to reflect existing system investment and eligible (growth related) capital improvements identified in the current CIP. It is anticipated that the

updated charge will increase, thereby providing additional revenue to fund future capital projects. The analysis for updating the SDC is included in **Appendix S.**

PROJECTION OF FINANCIAL PERFORMANCE

The projection of financial performance begins with the six-year capital funding strategy, followed by the projection of cash operating expenses, and finally a summary of revenue requirements and necessary rate adjustments. The results of the revenue requirement analysis are significantly affected by underlying economic, financial, and policy-based assumptions used in the revenue and expense forecasts. It is important to recognize the sensitivity of the study's results to changes in the forecast assumptions discussed below.

The following forecast assumptions are used in the analyses:

- Capital projects planned over the next six years (2007 through 2012) total $37 million (current day dollars) and function as the basis for evaluating funding rate impacts.
- When new debt is used to finance capital costs, PWTF loan funding is assumed at an interest rate of 0.50 percent, local match of 15.0 percent, and a 20-year repayment schedule.
- Consistent with the Plan, customer growth is projected at approximately 3 percent per year.
- Labor cost inflation is estimated at 3.0 percent.
- Construction material inflation is estimated at 3.0 percent.
- In projecting future cash flows in the water utility fund, an earnings rate of 1.5 percent has been used to calculate interest earned on available cash balances. State taxes have been computed using prevailing excise and business and occupation rates for water rate and miscellaneous revenues.

Capital Funding Strategy

The revenue requirement analysis not only projects the operating requirements of the utility, but also incorporates planned capital needs for projects the City must complete. The capital funding component evaluates expected capital costs and available resources to determine whether additional funding for such projects will be required from rates, either to pay for new debt service or to directly fund the capital projects.

The City has historically funded capital projects through rates and SDC revenues and state loans (PWTF & SRF). The City's ability to fund the proposed six-year (2007 through 2012) CIP was analyzed as part of the rate study.

Fiscal Policies

Critical to the long-term financial health and performance of the water utility is the development of sound fiscal policies to guide the financial performance of the utility. The key policies incorporated into this financial plan include:

- Maintaining a minimum operating reserve balance.
- Maintaining a minimum capital reserve.
- System reinvestment funding through rates, using depreciation expense as the benchmark for the appropriate level of funding. The annual contribution is based on "net depreciation funding" from rates, which equals the annual depreciation expense less annual principal payments. This benchmark is roughly equivalent to "break-even" performance from a balance sheet perspective. Given the current and proposed level of water utility debt, additional funding would not be required from rates.

Revenue Requirements

The purpose of the revenue requirement analysis is to provide a forecast of rate revenue needs to meet ongoing costs, capital needs, and fiscal policies, allowing the City to implement projects necessary to meet water quality standards and allow continued growth and development of the community, as outlined in this Plan.

For rates to be sufficient, two individual conditions must be met:

- First, cash requirements must be fulfilled; these requirements may include discretionary elements established by the City's fiscal policies, as well as basic operating and capital-related needs.
- Second, all coverage requirements stipulated in bond or loan covenants, as a condition of borrowing money, must be realized.

Integrated in the technical approach, are two sufficiency tests intended to verify the status of these conditions. The Cash Flow Sufficiency Test examines all known cash requirements for the utility using budgeted annual revenues and expenditures and projections based on budget for the remaining years in the study period. (For this study a planning horizon of six years was used). Cash requirements consist of operating and maintenance expenses, existing debt service, new debt required for capital programs, directly-funded capital projects, depreciation-based capital funding for the repair and replacement of system infrastructure, and any other projected additions to reserves. All cash revenues of the system, including rate revenue, miscellaneous service revenue, revenue transfers, and operating fund interest earnings are compared against the total annual cash needs of the system. Any deficiencies are identified and the level of rate increase necessary to make up the shortfall is calculated.

The Coverage Sufficiency Test recognizes the cash needs of the utility in conjunction with any commitments to meet coverage requirements associated with debt service obligations. Coverage is a requirement of any bond covenant and some state loan programs.

The sufficiency tests assume that in the event of a shortfall, rates represent the revenue source that is controllable and can and should be increased to meet the deficiency. Utility revenues should be sufficient to meet both the cash and the coverage tests; thus the test with the greatest deficiency will drive the level of rate increase required.

RATE ASSESSSMENT

The rate assessment includes a review of projected rate levels and affordability, as well as a discussion of the effectiveness of the current rate structure to address conservation.

Rate Levels

The City's existing rates and charges in 2004 were not adequate to support the cost of the improvements identified in this plan. Therefore, the council adopted new rates in 2005 which are adequate and these rates are shown in **Tables 10-1** and **10-2.**

Tables 10-1 – ***Proposed Inside City Water Rates*** and **Table 10-2** – ***Proposed Outside City Water Rates*** summarizes existing and projected residential water rates through 2010.

Table 10-1
Proposed Inside City Water Rates

Meter Size	2004 Existing Base Rates	2005 Proposed Base Rates	2006 Proposed Base Rates	2007 Proposed Base Rates	2008 Proposed Base Rates	2009 Proposed Base Rates
Proprosed Rate Adjustment		**15.00%**	**15%**	**15%**	**4%**	**4%**
Fixed Monthly Meter Charge ($/month)						
5/8" & 3/4"	$9.80	$11.30	$13.00	$14.90	$15.50	$16.10
1"	$16.30	$18.75	$21.55	$24.80	$28.50	$29.65
1-1/4" & 1-1/2"	$32.40	$37.25	$42.85	$49.25	$56.70	$58.95
2"	$51.80	$59.60	$68.50	$78.80	$90.60	$94.20
3"	$97.10	$112.00	$128.50	$147.70	$169.00	$176.60
4"	$161.80	$186.00	$214.00	$246.00	$283.00	$294.00
6"	$323.60	$372.00	$428.00	$492.00	$566.00	$589.00
Consumption Charge ($/CCF)						
Winter (October through May)						
First 10 CCF	$0.69	$0.78	$0.90	$1.03	$1.07	$1.12
Over 10 CCF	$1.82	$1.55	$1.78	$2.05	$2.13	$2.22
Summer (June through September)						
First 10 CCF	$0.69	$0.78	$0.90	$1.03	$1.07	$1.12
Over 10 CCF	$1.82	$2.65	$3.05	$3.50	$3.64	$3.79
Typical Bill	$19.36	$23.17	$26.68	$30.57	$31.79	$33.11

Typical bill is calculated for an average use of 6,500 gal/month in the winter and 11,500 gals/month in the summer for a 3/4" meter for single family residential.

Table 10-2
Proposed Outside City Water Rates

Meter Size	2004 Existing Base Rates	2005 Proposed Base Rates	2006 Proposed Base Rates	2007 Proposed Base Rates	2008 Proposed Base Rates	2009 Proposed Base Rates
Proprosed Rate Adjustment		**15.00%**	**15%**	**15%**	**4%**	**4%**
Fixed Monthly Meter Charge ($/month)						
5/8" & 3/4"	$12.70	$14.60	$16.80	$19.30	$20.10	$20.90
1"	$21.10	$24.25	$27.90	$32.10	$36.90	$38.40
1-1/4" & 1-1/2"	$42.10	$48.40	$55.70	$64.00	$73.65	$76.60
2"	$67.30	$77.40	$89.00	$102.35	$117.70	$122.50
3"	$126.20	$145.13	$166.90	$192.00	$221.00	$230.00
4"	$210.20	$242.00	$278.00	$320.00	$367.50	$382.00
6"	$410.20	$472.00	$542.50	$624.00	$717.00	$746.00
Consumption Charge ($/CCF)						
Winter (October through May)						
First 10 CCF	$1.01	$1.13	$1.30	$1.50	$1.56	$1.62
Over 10 CCF	$2.64	$2.50	$2.58	$2.97	$3.09	$3.21
Summer (June through September)						
First 10 CCF	$1.01	$1.13	$1.30	$1.50	$1.56	$1.62
Over 10 CCF	$2.64	$3.84	$4.42	$5.08	$5.28	$5.50
Typical Bill	$26.65	$31.79	$36.58	$42.09	$43.80	$45.54

Typical bill is calculated for an average use of 6,500 gal/month in the winter and 11,500 gals/month in the summer for a 3/4" meter for single family residential.

INTRODUCTION **1**

CAPiTAL FUNDING OPTIONS **1**

Governmental Programs 1

Bonded Debt 3

Utility Cash Resources 3

PROJECTION OF FINANCIAL PERFORMANCE **4**

Capital Funding Strategy 4

Fiscal Policies 4

Revenue Requirements 5

Rate assessSment **6**

Rate Levels 6