CHAPTER 10-1

WATER SOURCE, STORAGE, AND DISTRIBUTION

Section 1 Inventory and Capacities of Existing Water System Facilities

1.1 EXISTING WATER SYSTEM

A. GENERAL

The City of Washougal is the identified water purveyor for the Washougal Water Service Area as outlined in the current Clark County Coordinated Water Service Plan (CWSP). The Washougal Water Service Area boundary is generally described as extending west to the Camas Water Service Area, north to the Little Washougal and Washougal Rivers, east to the Clark/Skamania County limits, and south to the Columbia River as illustrated in Figure 10-1.1. The area contains approximately 15,200 acres. Included within this area is the 20-year Washougal Urban Growth Area (UGA) and designated urban reserve.

B. WATER TRANSMISSION AND DISTRIBUTION

Water mains range in size from 3/4-inch through 16-inch diameter. Steel and ductile iron are the principal materials for pipe sizes 4 through 16-inch. A small amount of PVC and asbestos cement type pipe has been installed in the 6 and 8-inch sizes. For sizes less than 4-inch, the principal materials are galvanized iron and PVC. For new construction, the City design standards require the installation of ductile iron pipe.

C. WATER RESERVOIR AND BOOSTER PUMP STATION FACILITIES

The City has six reservoirs which serve five pressure zones, which are further divided into sub-zones by pressure reducing valves. The existing distribution system and pressure zones are illustrated in Figure 10-1.2. The following discussion of reservoir and booster pump station facilities is based on the pressure zone served.

Pressure Zone 1. Reservoirs No. 1A and No. 1B serving Pressure Zone 1 are welded steel tanks with capacities of 1.5 MG and 1.0 MG respectively. These reservoirs are sited east of Stiles Road and south of 'W' Street, and serve Pressure Zone 1. This low pressure zone serves the majority of the City from approximately elevation 150 and below, and is supplied directly from the well sources. Reservoir No. 1A was initially constructed in 1970 to replace an undersized elevated tank at Hathaway Park, which was later abandoned. The construction of Reservoir No. 1B followed in 1991.

Pressure Zone 2. Pressure Zone 2 is served by Reservoir No. 2A and No. 2B. Reservoir No. 2A is a bolted steel tank with a capacity of 0.16 MG constructed in 1992. Reservoir No. 2B is a bolted steel tank with a capacity of 0.45 MG constructed in 2004. Pressure Zone 2 provides service to the east side of the City between elevation 280 and 150.

Booster Pump Station No. 1 located at the Reservoir No. 1A/1B site supplies water to this pressure zone. Built in 1970, it was originally designed to serve a limited number of upper zone customers prior to the construction of Reservoir No. 2A. Recent modifications included pump upgrades and the installation of an emergency standby generator. Installed pumps now include three end suction centrifugal pumps sized at 400 gpm, 680 gpm, and 1,000 gpm.

Pressure Zone 3. Pressure Zone 3 is located in the northwest corner of the City, north of the Washougal River. This area is served by Reservoir No. 3, a bolted steel tank constructed in 1998 with a capacity of 0.42 MG. The reservoir is located outside the City Limits on Woodburn Hill, with access provided from Woodburn Road. This pressure zone includes multiple sub-zones between elevation 580 and 150.

Booster Pump Station No. 3 is located off Shepherd Road to provide Reservoir No. 3 fill. The pump station has three canned vertical turbine pumps each sized for a capacity of 350 gpm. A natural gas emergency generator is located in the pump building.

Pressure Zone 4. The recently constructed Reservoir No. 4, a welded steel standpipe with a total volume of 0.53 MG, serves Pressure Zone 4. The effective storage capacity of this reservoir is 0.1 MG. Pressure Zone 4 extends above 'W' Street, including multiple sub-zones between elevation 600 and 280.

Reservoir No. 4 is filled by Booster Pump Station No. 4, located adjacent to Reservoir No. 2A/2B. This pump station has two end suction centrifugal pumps each with a capacity of 300 gpm. Suction and discharge manifold provisions are provided to allow for the installation of a third booster pump. A natural gas emergency generator is located in a sound attenuated enclosure outside the pump building.

Pressure Zone 5. The Jordan Pointe Booster Pump Station No. 2 hydropneumatic system serves Pressure Zone 5. This system has operated reliably for over 10 years.

D. AQUIFERS

Underlying aquifers are the current source of supply to the City. Water is extracted from two wellfields - the Westside Wellfield located on Burlington Northern Railroad property near 1st Street, and the Hathaway Park Wellfield located near 28th and 'I' Streets adjacent to Hathaway Park.

Hathaway Park Wellfield. This wellfield was the first to be developed as a City water supply source. Wells No. 1 through 4 were driven in the period of 1925-1939. Well No. 10 was constructed in 1984 as a partial replacement for wells removed from service at this site.

Westside Wellfield. Faced with limited space for expansion at the Hathaway Park site and the need for increased production, the City undertook the development of the Westside Wellfield beginning with Well No. 5 in 1942, followed by Well No. 6 in 1947, Well No. 7 in 1954, and Well No. 11 in 1984.

Other Well Sites. Well No. 8 was developed near Orchard Hills Golf Course. Because of

operational problems, the well was later sold to private interests. Well No. 9 was constructed in 1978 in a City park near Addy and 45th Streets.

E. WATER WELLS

The City currently has valid water rights/claims to eight wells. Of these, six wells are in service with five currently operating. The following table summarizes the status of all wells developed by the City:

Table 10-1.1
WELL STATUS SUMMARY

Well Number	Current Status	Comment
No. 1	Operational	-------
No. 2	Abandoned	Incipient contamination. Water right transferred to Well No. 11.
No. 3	Out of service	Incipient contamination. May be returned to service in the future.
No. 4	Abandoned	Low capacity and sanding problem. Water right transferred to Well No. 10.
No. 5	Operational	-------
No. 6	Operational	-------
No. 7	Operational	-------
No. 8	Disconnected from system - Sold	Sanding problem.
No. 9	Out of service	Low capacity and taste/odor problem. Pump transferred to Well No. 10
No. 10	Standby	Incipient contamination. Low capacity pump. Currently disconnected from system
No. 11	Operational	-------

The following table indicates pump performance when operating in single status or in combination with other pumps. Data based on available performance records.

Table 10-1.2
WELL CAPACITY SUMMARY

Pump Number	Single Operation	Combined Operation	Installed HP
1	925 GPM		75
5	635 GPM		50
6	630 GPM		50
7	825 GPM		75
10	400 GPM		50
11	960 GPM		75
5 & 6		1,150 GPM	
5 & 7		1,325 GPM	
6 & 7		1,350 GPM	
5, 6, & 7		1,775 GPM	
1 & 10		1,220 GPM (estimated)	
5, 6, 7, & 11		2,380 GPM (estimated)	
1, 5, 6, & 7		2,820 GPM (estimated)	

City staff has observed under past recurrent drought conditions that Well No. 1 cannot be operated on a 24-hour basis under certain circumstances. Dropping water tables in the aquifer during summer and early fall pose the problem of the pump running out of water. The pump must be operated on a manual basis with close observation of the well drawdown. Such constraints severely limit reliance on the fixed capacity of this water source. The low water table condition is also expected to affect performance of Wells No. 3 and 10 if they are returned to service under drought conditions. These two wells have some advantage over Well No. 1 in that they are closer to the Washougal River and might benefit from a higher aquifer recharge rate from this source.

The Westside Wellfield has not been as severely impacted with lowering water table as the Hathaway Wellfield. The record low water table for the Westside Wellfield was recorded in fall 1994. This problem is again attributed to the drought condition affecting an otherwise excellent aquifer with a history of high production with little pump drawdown effects. Well No. 11 is most affected since it has a pump setting somewhat higher than the other three units in the Wellfield. This higher setting is due to the installed submersible motor which requires a certain cooling flow past its casing. The pump can be lowered another five feet to gain additional submergence. Any additional lowering would likely result in adverse operational conditions such as early motor failure.

In the event of power outage, the City has emergency power provisions for several wells. Well No. 7 has an engine-driven right angle gear drive. A natural gas driven generator is installed to operate Wells No. 3 and No. 11 under emergency conditions.

1.2 SYSTEM INTERTIES

The City of Washougal has an inter-city agreement with neighboring City of Camas for the delivery of emergency flow through two interties. The higher pressure of the Camas water system allows for gravity flow into the Washougal water system if required. Providing flow from Washougal to Camas would require a pump station(s) which is not currently provided.

The first intertie is located on the 10-inch main in Shepherd Road approximately 400 feet northeast of the intersection with 3rd Avenue in Camas. This intertie is provided with block valving and a pressure reducing valve.

The second intertie is located at the Westside Wellfield with a connection between a 12-inch Washougal water main and 8-inch Camas water main. This intertie is furnished with blocking valves and a pressure reducing valve.

1.3 WATER RIGHTS/CLAIMS

The City currently holds rights or claims to eight wells. They are assigned to Wells No. 1, 3, 5, 6, 7, 9, 10, and 11. The total annual volume permitted by these rights/claims is estimated by the City at 6,504 acre-feet. This total, however, is under dispute with the State Department of Ecology (DOE). While DOE will not certify the annual rights/claims figure estimated by the City, they have acknowledged the City has adequate rights/claims to satisfy 20-year demand projections.

1.4 WATER QUALITY AND TREATMENT

A. WATER QUALITY

Chemical tests performed on water samples from both wellfields reveal good water quality in terms of specific chemical and physical constituents. Critical elements are less than the maximum contamination levels (MCL's) mandated by federal and state regulations. However, the naturally low water pH results in the corrosion of copper pipes (service lines and customer piping) such that excessive levels of copper were recorded in the past in water sampling required under the Lead and Copper Rule (see discussion below).

Bacteriological quality, in terms of the absence of pathological organisms, is also good with one exception. The Hathaway Park Wellfield has a seasonal history of E. coli contamination occurring during Washougal River high water events. The contamination is very light and occurs during the winter and spring. As a defensive measure, the City removes the upper Wellfield from service during the winter and spring seasons of high river stage (which is also a time of minimum demand) and uses the Westside Wellfield exclusively.

B. WATER TREATMENT

The City of Washougal completed initial tap water sampling as required under the Lead and Copper Rule in November 1992. While the lead results were satisfactory, the 90th percentile copper result of 2.9 mg/l exceeded the action level. The City completed construction of a chemical treatment facility

in 1998 at the Westside Wellfield. This facility provides for the addition of caustic soda to increase pH to approximately 7.2. The addition of caustic soda has resulted in copper levels consistently below 0.87 mg/l.

The Department of Health required a microscopic particulate analysis (MPA) of Well No. 1 in the Hathaway Park Wellfield. This analysis placed the risk of surface water influence as low, however, DOH determined that the source must provide minimum chlorine contact time. Follow-up improvements included the installation of approximately 900 linear feet of 14-inch ductile iron discharge piping prior to the first customer to satisfy chlorine contact requirements. These improvements were completed in 2001.

Construction is currently underway on piping improvements for the Westside Wellfield. These improvements will not only replace existing undersized steel lines which have experienced breaks in the past, but provide for minimum chlorine contact time in the future should this be required by DOH.

Section 2 Forecast of Future Water System Needs

2.1 BASIS OF NEED

Future requirements of the water system include provisions for growth and for the repair, replacement and upgrade of the existing system. Improvements must be scheduled to occur in advance of the actual need in order to avoid reduced levels of service.

A. GROWTH

Water system needs will be assessed on the basis of Equivalent Residential Units (ERUs). An ERU service unit is defined as the amount of water consumed by a typical full-time single family residence. Multi-family, commercial, and industrial customers typically have demand patterns that vary from that of a single-family residence. This system of capacity analysis allows all customers to be compared on the basis of an average single family residence.

Data from the community's Comprehensive Plan projects an equivalent annual growth rate of nearly 4.3 percent (compounded) for a year 2024 target population of 26,200 residents. Short term growth projections based on recent trends start at 10% through 2007, and level out at 3% for later years. A weighted average residential density of 2.59 people per housing unit for single and multi-family residential development is assumed. Residential connections outside of the UGA, but within the Washougal Water Service Area, will be projected at 2% of new residential ERUs.

Projecting future commercial and industrial water demands is more difficult, however, due to the wide variability in potential development. For the purpose of projecting future commercial, industrial, and public water consumption, a 3% growth rate equal to projected residential growth will be applied to non-residential ERU figures for each service classification as determined in the *December 2004 Water System Plan Update* (WSP Update). Large industrial water users, however, will be projected at a lower 1% growth rate. Operations engineers with the three large industrial water users do not expect a significant increase in water demand in the foreseeable future.

The following table outlines projected population and ERU growth over the 20-year planning period.

Table 10-1.3
POPULATION AND ERU PROJECTIONS

Year	Population	New Residential ERUs			Commercial/Industrial/Public ERUs				Total ERUs
		City	County	Res. ERU Total	Comm	Comm/ Industrial	Public	Large Ind.	
2005	11,800			3,668	54	881	141	1,556	6,300
2006	12,980	456	9	4,133	56	907	145	1,572	6,813
2007	14,272	954	19	4,642	57	935	150	1,587	7,370
2008	15,414	1,395	28	5,091	59	963	154	1,603	7,870
2009	16,338	1,752	35	5,455	61	992	159	1,619	8,285
2010	17,155	2,068	41	5,777	63	1,021	163	1,635	8,660
2011	17,842	2,333	47	6,047	64	1,052	168	1,652	8,984
2012	18,377	2,539	51	6,258	66	1,084	173	1,668	9,250
2013	18,927	2,752	55	6,475	68	1,116	179	1,685	9,523
2014	19,496	2,971	59	6,699	70	1,150	184	1,702	9,805
2015	20,081	3,197	64	6,929	73	1,184	189	1,719	10,094
2016	20,683	3,430	69	7,166	75	1,220	195	1,736	10,392
2017	21,303	3,669	73	7,410	77	1,256	201	1,753	10,698
2018	21,942	3,916	78	7,662	79	1,294	207	1,771	11,013
2019	22,600	4,170	83	7,921	82	1,333	213	1,789	11,337
2020	23,278	4,432	89	8,188	84	1,373	220	1,806	11,671
2021	23,976	4,701	94	8,463	87	1,414	226	1,825	12,014
2022	24,695	4,979	100	8,746	89	1,456	233	1,843	12,368
2023	25,463	5,275	106	9,049	92	1,500	240	1,861	12,742
2024	26,200	5,560	111	9,339	95	1,545	247	1,880	13,106

B. WATER DEMAND

Water production over the last several years has generally grown in step with new residential growth. Based on the detailed analysis completed in the WSP Update, residential water use accounts for between 50-60% of the total water consumption. The remaining water use is divided between industrial, commercial, and public water users. The largest water customer is Pendleton Woolen Mills, which averages 10-20% of the total yearly water consumption for the water system. Additional high water use industries include Kemira Chemical and Saint Gobain.

Future water demands shall be calculated based on ERU projections outlined in Table 10.1.3 and historical water production trends. In keeping with assumptions used in the WSP Update, the average daily water production (ADD) required to serve one ERU will be assumed to be 280 gpd and maximum day demand (MDD) to serve one ERU will be assumed to be 525 gpd.

Table 10-1.4
WATER DEMAND PROJECTIONS

Year	ERUs	ADD		MDD		Annual Production (mg)
		mgd	gpm	mgd	gpm	
2005	6,300	1.76	1,225	3.31	2,297	641
2010	8,660	2.42	1,684	4.55	3,157	885
2024	13,106	3.67	2,548	6.88	4,778	1,339

2.2 LEVEL OF SERVICE STANDARDS

The minimum Level Of Service (LOS) is governed by the standards presented in the Washington State Department of Health's "Sizing Guidelines for Public Water Systems." These standards, as applied to the City of Washougal water system, include the following:

A. DOH requires that the minimum production capability of the source and pumping equipment shall meet the maximum day demand of the system.

B. DOH requires that a minimum standby storage volume of twice the average daily demand be provided. This standard may be reduced for systems with multiple sources and a reliable power supply. The allowable reduction is based on the following equation. At a minimum, DOH recommends standby storage volumes not less than 200 gallons/EDU.

SBMS = (2 days) (ADD)(N) - tm (Qs - QL), where

ADD - Average Day Demand (gpd/EDU) - 400 gpd for Ridgefield per the 1996 plan
N - Number of Service Connections, EDU's
tm - Time that remaining sources are pumped on the day when largest source is not available, in minutes
Qs - Sum of all installed, continuously available source of supply capacities, gpm
QL - The largest source capacity source available to the system in gpm

C. Equalization storage is required when the maximum instantaneous demand exceeds the total capacity of the source pumping. Equalizing storage is calculated by the following equation:

ES = (PHD - Qs) * 150 minutes, where

ES - Equalizing Storage
PHD - Peak Hour Demand, in gpm as defined by DOH Equation 5.3 shown below.
Qs - Sum of all installed and active source of supply capacities

PHD = (MDD/1440)[(C)(N) + F] + 18, where

PHD - Peak Hourly Demand (gallons per minute)
C - Coefficient Associated with Ranges of EDU's (1.6 for systems > 500 EDU's)

N - Number of Service Connections, EDU's
F - Factor Associated with Ranges of EDU's (225 for systems > 500 EDU's)
MDD - Maximum Day Demand (gpd/EDU)

D. Fire storage requirements are based on the required fire flow rates and duration. The following minimum fire flow requirements for various zoning classifications are based on coordination with local fire officials:

Table 10-1.5
MINIMUM FIRE FLOW REQUIREMENTS

Zoning	Fire Flow Rate (gpm)	Duration (hours)
Residential - Standard	1,000	1
Steep Slope Areas	1,500	1
Commercial	1,500	1
Core City Commercial	2,500	2
Light Industrial	1,000	1
C-W Industrial Park	5,000	2

E. The City's Engineering Standards provide the minimum LOS standards required for water system design, construction, and materials. It is very important that the practicality of the Engineering Standards be stressed. The Engineering Standards provide the regulations that make the City's utilities acceptable for the entire community. For example, dead-end water mains decrease water quality, increase the vulnerability to service interruptions, and reduce fire flow capability. The Engineering Standards will encourage good design and construction practices, thus decreasing long-term operation, maintenance, and capital costs.

F. Water system pressures should be maintained in the range of 40 to 80 psi. The system must provide a normal operation pressure of 30 psi at all points in the system during peak hour demands and a minimum of 20 psi at all points in the system during combined fire flow and maximum day demands. This requirement governs the location of storage reservoirs, sizing of booster pumps and distribution mains, and installation of pressure-reducing and pressure-sustaining valves.

2.3 SOURCE OF SUPPLY ASSESSMENT

The City's well system must be able to meet the established production capability LOS standard for the 20-year planning period. The adequacy of the well source capacity can be determined by comparing the ERU projections / supply requirements with the available production capacity. A MDD of 525 gpd/ERU as utilized in the WSP Update will be utilized for the determination of well production requirements. The results are summarized in the following Table 10-1.6. As shown, the City will need to develop additional source production capacity to satisfy 6 and 20-year demands.

Table 10-1.6
SOURCE CAPACITY EVALUATION

Year	ERUs	Required Supply		Available Supply (gpm)	Add'l Supply Required (gpm)
		Inst. (gpm)	Annual (Mgal)		
2005	6,300	2,297	641	2,820	0
2010	8,660	3,157	885	2,820	337
2024	13,106	4,778	1,339	2,820	1,958

To evaluate the adequacy of the City's water rights, the water supply requirements are compared to both the instantaneous and annual water rights as outlined in the following Table 10-1.7. This analysis shows that the City has adequate water rights to satisfy projected 20-year water demands.

Table 10-1.7
WATER RIGHTS EVALUATION

Year	ERU's	Required Supply		Avail. Water Rights		Add'l Water Rights	
		Inst. (gpm)	Annual (Mgal)	Inst. (gpm)	Annual (Mgal)	Req'd Inst. (gpm)	Annual (Mgal)
2005	6,300	2,297	641	4,250	6,504	0	0
2010	8,660	3,157	885	4,250	6,504	0	0
2024	13,106	4,778	1,339	4,250	6,504	0	0

2.4 STORAGE CAPACITY NEEDS ASSESSMENT

For each pressure zone service area, the available storage capacity is evaluated with respect to level of service standards which include required fire flow, flow equalization, and stand-by storage requirements to determine the number of equivalent residential services that can be served. An analysis of each individual pressure zone was completed in detail for the WSP Update. The WSP Update reservoir storage analysis was revisited with respect to the proposed UGA expansion area, with additional ERUs allocated between pressure zones based on available development area.

Pressure Zone 1. The existing 1.5 MG Reservoir No. 1A and 1.0 MG Reservoir No. 1B have adequate storage capacity to serve projected ERUs though the 20-year planning period.

Pressure Zone 2. The combined storage provided by the 0.16 MG Reservoir No. 2A and 0.45 MG Reservoir No. 2B provide adequate storage capacity to serve projected ERUs though the 20-year planning period.

Pressure Zone 3. Pressure Zone 3 reservoir storage deficiencies are forecast near the end of the 6-year planning period. A new 1.0 MG reservoir is proposed to supplement the existing 0.42 MG Reservoir No. 3. Within the 20-year planning period, upgrades to the existing Booster Pump Station No. 3 will be required to increase pump capacity to satisfy projected maximum day demand conditions.

The proposed UGA expansion will include a narrow stretch of land at the crest of the hillside above the Pressure Zone 3 service area. This area is designated as Pressure Zone 3A and is discussed below.

Proposed Pressure Zone 3A. The proposed Pressure Zone 3A service area covers approximately 75 acres above the upper limits of the existing Pressure Zone 3 service area between elevation 570 and 620. Extending service to this area will require the construction of a new booster pump station and standpipe reservoir.

With approximately 500 ERUs estimated to be served in this upper elevation area (approximately half within 20-year planning period), and a reservoir base elevation of 610, a 30' dia x 100' tall standpipe is assumed with a total volume of 0.53 MG.

Pressure Zone 4. Pressure Zone 4 reservoir storage deficiencies are forecast in the 6-year planning period. A new 1.0 MG ground level reservoir constructed to the north at a higher elevation to match the effective storage range of the existing reservoir is proposed. The new reservoir will serve not only new growth forecast within the Pressure Zone 4 service area, but allow for the transfer of identified low pressure areas within Pressure Zone 2. Within the 6-year planning period, upgrades to the existing Booster Pump Station No. 4 will be required to increase pump capacity to satisfy projected maximum day demand conditions.

The northeast corner of the proposed UGA expansion is located above the upper service elevation of the existing Pressure Zone 4 service area. This area is designated as Pressure Zone 4A and is discussed below.

Proposed Pressure Zone 4A. The proposed Pressure Zone 4A service area covers nearly 200 acres between elevation 600 and 700 above the upper limits of the existing Pressure Zone 4 service area. The topography in this area rises at a steep grade to the east, allowing for the construction of a ground level reservoir in relatively close proximity. A new booster pump station will be constructed to provide reservoir fill.

With approximately 1,000 ERUs estimated to be served in this upper elevation area (approximately half within 20-year planning period), 0.45 MG ground level reservoir is proposed.

Pressure Zone 5. No new development is proposed for service by the Jordan Pointe Booster Pump Station No. 2. The abandonment of this facility is proposed following the construction of new development waterlines in close proximity to the existing facility.

2.5 WATER DISTRIBUTION SYSTEM NEEDS ASSESSMENT

As growth occurs, water mains will need to be extended to serve new development. The existing system generally meets the LOS requirements for pressure during normal operating conditions. Some of the older areas of the City cannot meet required minimum pressure while providing the required fire flows due to undersized and dead-end water mains.

The City's adopted WSP Update addressed those distribution system improvements necessary to

provide a solid grid for serving future growth. Of the many distribution system improvements that will be required to serve growth, only primary transmission mains and improvements to the existing system necessary to serve growth are included in the Capital Facility Plan. Additional extensions will be necessary, however, it is anticipated that these will be extended by developers in conjunction with the needs of the particular developments.

2.6 IMPROVEMENT ALTERNATIVES

There are numerous alternatives for meeting the deficiencies outlined above. The City's adopted WSP Update has evaluated those alternatives of substance. This CFP will not repeat that evaluation. The following paragraphs present the capital improvement program necessary to meet future water system needs. It follows the program outlined in the WSP Update, with the exception of updated projects and cost estimates to serve the UGA expansion.

2.7 CAPITAL IMPROVEMENT PROGRAM

The City must evaluate its existing system in order to determine the capital improvements that will be necessary to serve development within the 20-year planning period. Facilities that lack capacity to serve the estimated population must be upgraded in order to provide capacity concurrent with growth. The required capacity is determined using the City's level of service standards, described herein, to estimate future demand. The current capacity is then subtracted from the calculated future capacity, to determine the scope of improvements that will be necessary.

The following is a brief summary of the principal elements affected by growth and system renewal needs through the 20-year planning period. The proposed system improvements are shown on the following Figure 10-1.3.

A. SOURCE/WELLS

New source capacity is needed to supplement the Hathaway Park and Westside Wellfields based on future demand projections and existing source capacity. If the City's water system relies solely on its own sources, the probable future need is two additional wells with a minimum 1,000 gpm capacity.

S1 Westside Wellfield Expansion. A deficiency in source production capacity is forecast during the 6-year planning period. Following a dry test well at Elizabeth Park, the development of new well is proposed for the Westside Wellfield. The target capacity for the new well source is 1,000 gpm.

S2 New Production Well. The development of a second well is required to satisfy projected 20-year source requirements. A hydrogeologic investigation and feasibility analysis will be completed to identify a new well site outside the Westside Wellfield. Development of an exploratory well will be the first step in determining potential source production capacity and water quality. Sufficient capacity to satisfy 20-year source requirements is anticipated, with a target capacity of 1,000 gpm.

B. WATER TREATMENT

The City will continue its policy of providing each well with chlorination equipment to maintain minimum chlorine residuals for system disinfection. The need for pH adjustment for future wells will be determined by water quality testing completed in conjunction with the proposed exploratory well for future source development.

C. DISTRIBUTION/TRANSMISSION SYSTEM

Distribution system improvements include provisions for growth and for system renewal or upgrading.

D1 K / 4th / 9th Street Improvements. This project will improve east-west transmission capacity and pressures under peak demand conditions. Construction will include an estimated 3,700-lf of 8-inch and 6-inch water main.

D2 Shepherd Road Loop. The existing 10-inch Shepherd Road water main terminates at the City of Camas intertie. A water main extension from 3rd Avenue across the Washougal River Bridge will provide a secondary supply to Zone 1 north of the Washougal River. Construction will include an estimated 1,500-lf of 12-inch water main.

D3 W & 49th Street Improvements. Low static and residual pressures are experienced along 49th Street between 'W' Street and 'P' Street, as well as along 'P' Street east of 49th Street during peak demand conditions. These areas will be transferred from Zone 2-1 to the proposed Zone 4-3. A new 12-inch main and two new PRV stations are necessary to transfer pressure zones. The new 12-inch main will be extended from the existing 12-inch main in 'W' Street east, and then south along 49th Street to 'P'. A new PRV station will be installed at the intersection of 'P' and 49th Streets and a second PRV station near 'P' and 57th Street just south of Sunset Ridge Ph. IV. This will improve capacity and pressures for the eastern extents of the existing Zone 2-1 service area, as static pressures will increase significantly once transferred to the proposed Zone 4-3. Construction will include an estimated 3,700-lf of 12-inch water main and two PRV stations.

D4 36th & Truman Street Improvements. This project will improve capacity and pressure conditions to satisfy Port fire demands. Construction will include existing undersized main replacement and new 8-inch water main construction totaling an estimated 800-lf.

D5 34th Street Improvements. The existing 6-inch main in 34th Street between Evergreen Way and 'G' Street is undersized. Replacement with a 12-inch main will significantly improve north-south transmission capacity. Construction will include an estimated 1,300-lf of 12-inch water main.

D6 Addy Street West Improvements. The dead end Addy Street 8-inch water main extension to 27th Street will improve industrial area looping. Construction will include an estimated 500-lf of 8-inch water main.

D7 Truman & 35th Street Improvements. Construction of a new 10-inch main parallel to the existing line in Truman Street and 35th Streets will create a new loop between 32nd and Index Streets. There is a significant pressure drop across the existing 10-inch main in Truman Street between the existing 14-inch main in 32nd Street and the existing 12-inch main in Index Street during 5,000 gpm fire demands. The proposed improvement provides additional looping in this area. Construction will include an estimated 1,150-lf of 10-inch water main.

D8 Zone 1 Transmission Improvements. The capacity of the existing 14-inch main in 32nd Street will be inadequate to deliver future MDD plus 5,000 gpm fire demands at the Port. Reinforcing the existing 14-inch main along the upper segment of its route is recommended, with a 12-inch main beginning at Reservoirs 1A and 1B, continuing along 32nd Street to 'L' Street, along 'L' Street to 34th Street, and along 34th Street to a junction with an existing 12-inch main at Evergreen Way. Construction will include an estimated 6,500-lf of 12-inch water main.

D9 Port Industrial Transmission Improvements. The need to reinforce flow to the eastern portion of the Port industrial area may be required dependant on future industrial development. Should this demand occur, the proposed improvements include the extension of a 12-inch main south across State Route 14 and along the western edge of the wastewater treatment plant, then along the refuge dike into the industrial park, along the east boundary of what is referred to as the BPA property and then joining an existing 12-inch main along this boundary at a point about 400 feet northwest of Index Street. Construction will include an estimated 3,200-lf of 12-inch water main.

D10 W Street Zone 2-1 Modification. Residential development south of 'W' Street between 37th Avenue and 43rd Court currently experiences low static and residual pressures during peak demand conditions. The transfer of service from Zone 2-1 to the proposed Zone 4-3 would eliminate low pressure problems. Improvements would maintain the 39th Street main as a Zone 2 transmission main, though transfer mains in the low pressure area to the new Zone 4-3 with isolation valves.

D11 Zone 4 Reservoir Transmission Main. This project will connect the proposed Zone 4 ground level reservoir with the existing Pressure Zone 4 distribution system. Construction will include an estimated 6,600-lf of 12-inch water main.

D12 Zone 4A Reservoir Transmission Main. This project will provide for the construction of the transmission main to link the proposed reservoir and booster pump station necessary to serve the Pressure Zone 4A service area. Construction will include an estimated 3,100-lf of 12-inch water main.

D13 362nd Avenue Transmission Main. This project will provide for the construction of a transmission main along 362nd Avenue to serve the area south of Campen Creek within the Pressure Zone 4A service area. Construction will include an estimated 9,050-lf of 12-inch water main and PRV intertie connection with the D3 improvements (Pressure Zone 4).

D14 'M' Street Loop. The proposed extension of approximately 1,500 lf of 12-inch water

main in conjunction with the Wastewater PS 4 force main improvements will provide a second link to the north side of the Washougal River.

D15 Pump Station No. 5 Extension. Proposed developer water main extensions adjacent to Pump Station No. 5 will provide for the opportunity to abandon this isolated hydropneumatic system. Construction will include an estimated 400-lf of 6 and 8-inch water main.

D. RESERVOIRS & BOOSTER PUMP STATIONS

The recent construction of a second Pressure Zone 2 reservoir satisfies 20-year demand projections for this service area. The existing Zone 4 reservoir was constructed under a developer agreement and the Zone 3 reservoir was constructed under a Local Improvement District financing agreement. The constructed reservoir capacity for these service areas was sufficient to satisfy initial development, though build-out will require additional capacity for each pressure zone. In addition, the proposed UGA expansion will extend the growth area into elevations above the upper limits of these service areas, requiring new booster pumps and reservoir storage.

R1 New Zone 3 Reservoir. Construct a new Zone 3 reservoir at the existing Woodburn Hill reservoir site or an alternate site more central to the existing service area which would benefit fire flow. Volume requirements are estimated at 1.0 MG assuming the reservoir base elevation matches the existing reservoir.

R2 Booster Pump Station No. 3 Improvements. Upgrade existing pump station or construct new pump station to provide capacity adequate to satisfy projected MDD conditions.

R3 New Zone 3A Reservoir and Pump Station. Construct a new booster pump station and standpipe to serve the high elevation areas above the upper service elevation of the existing Zone 3 reservoir. Volume requirements are estimated at 0.53 MG.

R4 New Zone 4 Reservoir. Construct a new ground level Zone 4 reservoir north of the existing Lehr Road reservoir site to satisfy projected growth related storage requirements. Volume requirements are estimated at 1.0 MG.

R5 Booster Pump Station No. 4 Improvements. Upgrade existing pump station to satisfy future projected MDD.

R6 New Zone 4A Reservoir and Pump Station. Construct a new booster pump station and ground level reservoir to serve the high elevation areas above the upper service elevation of the existing Zone 4 reservoir. Volume requirements are estimated at 0.45 MG.

E. 'W' STREET BENEFIT AREA DEBT REPAYMENT

As previously discussed, a significant portion of the water system infastructure for Pressure Zone 4, including reservoir storage, transmission mains, and booster pump station, was completed under a developer financing agreement. Under this agreement, the property owners who benefit from the project provide the financing for the project. The reimbursement of these expenses is provided from

future connection fees. The remaining debt from this project is approximately $600,000.

F. AUXILIARY POWER

The City has significantly improved the reliability of all critical facilities with standby emergency generator upgrades as outlined in Section 1. All new wells and booster stations are to be equipped with emergency generators.

2.8 PROJECT COSTS

Project cost estimates are made on the basis of Preliminary Capital Cost (PCC). PCC is further defined as an estimate prepared from factored costs such as square foot, rate of flow, population density, etc. It also assumes some knowledge of the size and configuration of the project in the absence of partial plans or other defining documents. The project cost estimates are based on 2006 dollars and include a 40% allowance for engineering, tax, and contingency.

2.9 6-YEAR AND 20-YEAR CAPITAL IMPROVEMENT PROGRAMS

The 20-Year Capital Improvement Plan is summarized in Table 10-1.8. This program includes all projects identified during the 20-year planning period.

Numerous plan elements are needed within the next six years. Table 10-1.9 provides an outline of the improvements and general time schedule for 6-Year Improvement Plan projects.

Table 10-1.8
20-YEAR CAPITAL IMPROVEMENT PLAN

Item #	Improvement	Purpose	Item Cost ($ 1,000) Per Planning Period			
			2005-2010	2010-2014	2014-2019	2019-2024
Source Improvements						
S1	Westside Wellfield Expansion	Determine Well Potential	$1,200			
S2	New Production Well	Establish Existing Claims and Secure New Rights			$1,200	
Storage Improvements						
R1	New Zone 3 Reservoir	Serve Future Storage Req. 1.0 MG Est. Capacity	$2,100			
R2	Booster PS 3 Improvements	Increase PS Capacity			$500	
R3	New Zone 3A Reservoir and Booster PS	Serve New High Pressure Zone 0.53 MG Est. Capacity		$2,000		
R4	New Zone 4 Reservoir	Serve Future Storage Req. 1.0 MG Est. Capacity	$2,100			
R5	Booster PS 4 Improvements	Increase PS Capacity	$150			
R6	New Zone 4A Reservoir and Booster PS	Serve New High Pressure Zone 0.72 MG Est. Capacity		$1,505		
Distribution/Transmission System Improvements						
D1	K / 4th / 9th Street Improvements	Increase System Capacity 3,700 lf 8-inch DI	$775			
D2	Shepherd Road Loop	Improve Reliability / Capacity 1,500 lf 12-inch DI			$360	
D3	W Street & 49th Street Improvements	Improve System Pressures 3,700 lf 12-inch DI & 2 PRV Stations	$1,040			
D4	36th & Truman Street Improvements	Increase System Capacity 800lf 8-inch DI			$130	
D5	34th Street Improvements	Increase System Capacity 1,300 lf 12-inch DI			$240	
D6	Addy Street West Improvements	Increase System Capacity 500 lf 8-inch DI			$80	
D7	Truman & 35th Street Improvements	Increase System Capacity 1,150 lf 10-inch DI			$185	
D8	Zone 1 Transmission Improvements	Improve FF Capacity 6,500 lf 12-inch DI				$1,125
D9	Port Transmission Improvements	Improve FF Capacity 3,200 lf 12-inch DI				$610
D10	W Street Zone 2-1 Modification	Improve System Pressures	$155			
D11	Zone 4 Reservoir Transmission Main	Serve New Reservoir 6,600 lf 12-inch DI	$1,060			
D12	Zone 4A Reservoir Transmission Main	Serve New Reservoir 3,100 lf 12-inch DI		$510		
D13	362nd Ave Transmission Main	Serve East End of UGA 9,050 lf 12-inch DI			$1,500	

Item #	Improvement	Purpose	Item Cost ($ 1,000) Per Planning Period			
			2005-2010	2010-2014	2014-2019	2019-2024
D14	M Street Loop	Improve Reliability / Capacity 1,500 lf 12-inch DI	$250			
D15	PS #5 Extension	Abandon PS 400 lf 6/8-inch DI	$40			
Planning Period Totals			$8,870	$4,015	$4,195	$1,735
20-Year Plan Total			**$18,815**			

Table 10-1.9
6-YEAR CAPITAL IMPROVEMENT PLAN

Item #	Improvement	Purpose	Item Cost ($1 ,000) Per Year					
			2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
Source Improvement								
S1	Elizabeth Park Test Well	Determine Well Potential		1,200				
R1	New Zone 3 Reservoir	Serve Future Storage Req. 1.0 MG Est. Capacity					$2,100	
R4	New Zone 4 Reservoir	Serve Future Storage Req. 1.0 MG Est. Capacity		$2,100				
R5	Booster PS 4 Improvements	Increase PS Capacity		$150				
D1	Westside Well Field Improvements	Increase Transmission Capacity 3,400 lf - 12-inch DI			$775			
D3	W Street & 49th Street Improvements	Improve System Pressures 3,700 lf 12-inch DI & 2 PRV Stations			$1,040			
D10	W Street Zone 2-1 Modification	Improve System Pressures			$155			
D11	Zone 4 Reservoir Transmission Main	Serve New Reservoir 6,600 lf 12-inch DI		$1,060				
D14	M Street Loop	Improve Reliability / Capacity 1,500 lf 12-inch DI		$250				
D15	PS #5 Extension	Abandon PS 400 lf 6/8-inch DI				$40		
Yearly Totals				$4,760	$1,970	$40	$2,100	
6-Year Total			**$8,870**					

Section 3 Financing Water System Improvements

3.1 INSTITUTIONAL RESPONSIBILITY

The City of Washougal presently owns and operates all of the water system facilities in operation within the UGA. At the western limits of the City the water system is intertied with the City of Camas system at two locations. The respective service areas of the City of Washougal, City of Camas, and Clark Public Utilities are coordinated through the Coordinating Water System Planning process, and the entire UGA is within the City's designated water service area. The City intends to continue to own and operate the system, and any expansion to it, within the 20-year planning period.

3.2 RECOMMENDED FINANCING PLAN

For the recommended improvements, financing by System Development Charges (SDC) and developer financed improvements should be considered as the most appropriate to the current political and economic environment. Over the next twenty years, $18.82 million will be needed for the proposed capital improvement program. With 6,806 new water system ERUs projected, this equates to a water system development charge of $2,765. The current in-city single family water system connection charge ranges between $1,800 - $2,100.

For the 6-year capital improvement program, $8.87 million will be needed. With 2,360 new ERUs projected over the next six years, this equates to a water system development charge of $3,758.

Growth and thus revenue needs are uncertain on a year by year basis. If a project is dependent upon the capital improvement before system connections can be made, the City must have enough money in its reserve funds to front the costs later to be reimbursed by the system development charges. If not, the City may need some alternative funding mechanism to support the capital improvement project until the system connections are made. Although there is a respectable long-term surplus in the estimated revenue and estimated project costs, the City should not transfer this anticipated surplus budget to other projects. Variance in the construction market, and other factors, could alter the estimated construction costs and amount of development. The conservative margin is therefore important.

3.3 BENEFIT AREA EVALUATION

A geographic assessment of cost differentials for the provision of public services concludes that one area of the city does not cost more or less to serve than any other. The proposed facilities included in the 6-year plan serve only proposed expansion areas within the 20-year growth boundary.

While there is a single benefit area, for purposes of near-term implementation of the City's SDC program, it was deemed prudent to identify appropriate SDCs for the currently approved UGA. The current UGA boundary is outlined in the 2003 Comprehensive Plan. The 20-year population for this boundary is 17,580. This population corresponds to a 2023 ERU total of 10,430 as outlined in the WSP Update.

The proposed capital improvement projects are required to serve both the currently approved and proposed UGA expansion with the exception of the following:

Source/Wells
S2 New Production Well – The Westside Wellfield Expansion (S1) project is forecast to satisfy 20-year water production requirements.

Reservoirs & Booster Pump Stations
R3 New Zone 3A Reservoir and Pump Station – The higher elevation service area above Pressure Zone 3 is not included in the currently approved UGA.

R6 New Zone 4A Reservoir and Pump Station – The higher elevation service area above Pressure Zone 4 is not included in the currently approved UGA.

Distribution / Transmission System
D12 Zone 4A Reservoir Transmission Main – The higher elevation service area above Pressure Zone 4 is not included in the currently approved UGA.

D13 362nd Avenue Transmission Main - The higher elevation service area above Pressure Zone 4 is not included in the currently approved UGA.

The combined capital improvement cost for these projects is estimated at $6,715,000. Subtracting this total from the 20-year Capital Improvement Cost in Table 10-1.9 results in $12,100,000. Dividing this total by 4,130 new ERUs projected within the currently approved UGA boundary, equates to a water system development charge of $2,930.