WATER SYSTEM MASTER PLAN UPDATE

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City of Florence, Oregon

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FOR

CITY OF FLORENCE, OREGON

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EXECUTIVE SUMMARY

Introduction

The purpose of this Water System Master Plan Update (WSMP) is to provide the City of Florence (City) with a comprehensive planning document that provides basic information and guidance necessary for the sound stewardship of the municipal water system within its water service boundary. This plan is important because it:

- Compiles basic information relevant to the water system.
- Describes the basic functional parameters of the system.
- Presents planning and analysis criteria for system improvements and expansion.
- Highlights known system deficiencies.
- Describes and graphically illustrates recommended improvements.
- Presents basic cost information for general budgeting and the development of an adoptable 20-year capital improvements program (CIP).
- Provides a physical tool for informing customers and other interested parties of the existing system and proposed improvements.
- Serves as an invaluable resource for gaining public support for needed improvements.
- Facilitates logical planning decisions relative to other City programs.

How This Plan Should Be Used

This Water System Master Plan Update should be used in the following manner:

- This master plan should be viewed as a dynamic working document.
- The plan should be reviewed annually for the purpose of prioritizing and budgeting for needed improvements.
- Plan mapping should be updated periodically to reflect current development and constructed system upgrades.
- The plan hydraulic model may be used to coordinate and integrate developer-constructed system improvements.
- Specific recommendations set forth in this plan should be considered as conceptual only. Additional details and potential alternatives should be investigated and analyzed in the preliminary engineering phase of final project designs.
- Cost estimates should be considered as planning level only, and should be updated and refined with preliminary engineering and final project designs.
- This plan should be used as the guiding document for future water system improvements.

Authorization

In May 2009, the firm of Murray, Smith & Associates, Inc. was authorized by the City of Florence to prepare this Water System Master Plan Update.

Compliance

This plan complies with water system master planning requirements established under Oregon Administrative Rules (OAR) for Public Water Systems, Chapter 333, Division 61.

Planning Period

The planning period for this water system master plan is 20 years, through the year 2030. Water system improvements recommended for implementation within the planning period (through 2030) are presented in Section 6 of this report.

Water Service Areas

Existing Service Area

The City's water system currently provides potable water to approximately 9,580 people within the city limits through residential, commercial and industrial service connections. The current water service area lies entirely within the existing city limits. This area includes the Sand Pines and Ocean Dunes Golf Links which, for the purposes of this study, are currently considered undevelopable and are not included in the analysis.

Future Service Area

Although the City's Urban Growth Boundary (UGB) extends significantly further north of the existing city limits, customers in this area are currently served by the neighboring Heceta Water District (District). As land north of the City develops it is assumed that there will be some adjustment in water service area boundaries for both the City and District but the majority of new City water customers are anticipated to be within the city limits. The study area for this master plan includes the area within the City of Florence's existing city limits, areas on either side of Highway 101 between Munsel Lake Road and the UGB and areas west and south of Munsel Lake Road near Florentine Estates. Two recently annexed areas to the north, Driftwood Shores Resort and Conference Center and the Fawn Ridge subdivisions are not included in the study area and will continue to be served by the District. This study area represents the City's future water service area which extends beyond the existing service area boundary. Several alternatives were considered by the City for the study area of this Master Plan Update, these alternatives are discussed in more detail in Section 3.

Existing Water System

Currently, Florence's water is supplied by 12 groundwater wells owned and operated by the City. All water diverted from the wells is treated for manganese and iron concentrations at the City's water treatment plant prior to supplying the distribution system and storage reservoirs. The City also maintains two emergency interties with the Heceta Water District. The City's distribution system consists of four pressure zones served by three water storage reservoirs and three booster pumping stations. Figure 1, "Water System Map", in Appendix A illustrates the study area, pressure zones, water system facilities and distribution mains.

Supply Source

The City's 12 groundwater supply wells are located in a large well field on the eastern edge of Florence bordered by Willow Ridge Court to the south and 35th Street to the north. The wells produce water year round and serve as the City's sole water supply source. Currently the City holds three groundwater rights totaling 3.8 million gallons per day (mgd) (5.89 cubic feet per second (cfs)). Based on the City's recently completed Water Management and Conservation Plan (WMCP) the 12 existing City wells produce approximately 2.7 mgd (4.2 cfs) from a dunal aquifer with high levels of iron and manganese present in the native groundwater.

Groundwater from the wells is pumped to the approximately 3.0 mgd Water Treatment Plant (WTP) located adjacent to the City's well field near the intersection of Willow Street and 24th Street. The WTP uses pressurized biological reactors and pressurized green sand filters for iron and manganese removal and sodium hydroxide for pH adjustment. Sodium fluoride is added to the treated groundwater before it enters the distribution system.

Interties

The City maintains two metered emergency interties with the neighboring Heceta Water District at the northern boundary of the City's existing water service area. The first is an 8-inch diameter intertie on Rhododendron Drive between Treewood and Rhodowood Drives that can be used to supply water from the District to the City's system. At the second, 10-inch intertie on Highway 101 and Munsel Lake Road, water can be provided either from the District to the City or to the District from the City. The District's water is supplied from a surface water intake on Clear Lake northeast of Florence. An updated emergency water supply agreement between the City and the District was approved on July 6, 2010.

Pressure Zones

The City of Florence's existing water distribution system includes four service levels, or pressure zones. Pressure zones are generally defined by ground topography and designated by overflow elevations of water storage facilities or discharge hydraulic grades of pressure reducing or booster pumping facilities serving the zone. The Main Pressure Zone serves the majority of City of Florence water customers by gravity from storage facilities. The Main

Zone covers the area from 35th Street south to the Siuslaw River. The North Pressure Zone serves areas north of 35th Street from the constant pressure Sand Pines Booster Pump Station. The East and Ocean Dunes Pressure Zones each serve a small group of customers in the City's east hills from constant pressure booster pump stations. A summary of the City's pressure zones is presented in Table ES-1 below.

Table ES-1
Existing Pressure Zone Summary

Pressure Zone	Current Elevation Range Served (ft)	Supply Source	Pressure Control (Storage Reservoirs[1]/ Pump Station)	Controlling Hydraulic Grade (ft)	Approximate Pressure Range (psi)
Main	0 - 80	Water Treatment Plant	2.0 MG Sand Pines 1	167.5	40 - 73
			2.0 MG Sand Pines 2		
			0.5 MG 31st St./East		
North	35 - 120	Sand Pines Booster PS	Sand Pines Booster PS	261	61 - 98
East	100 - 285	31st St./East Booster PS	31st St./East Booster PS	390	45 - 125
Ocean Dunes	50 - 85	Ocean Dunes Booster PS	Ocean Dunes Booster PS	228	62 - 77

Note: 1. The Spruce Street Reservoir is currently offline and non-operational.

Storage Reservoirs

The City of Florence has three active storage reservoirs providing 4.5 million gallons (MG) of storage by gravity to the Main Pressure Zone. Emergency storage is also provided from these facilities by pumping to the North and East pressure zones through adjacent pump stations. The Sand Pines Reservoirs No. 1 and 2 are identical 2.0 MG welded steel tanks with an approximate overflow elevation of 167.5 feet. The 31st Street/East Reservoir is a 0.5 MG welded steel tank constructed in 1965 with an approximate overflow elevation of 167.5 feet.

A fourth Main Zone reservoir, the elevated, welded-steel Spruce Street Reservoir was taken offline approximately ten years ago. It has been reported by City staff that the reservoir experienced rapid uncontrolled fluctuations in water level. Based on discussions with City staff, the Spruce Street Reservoir may have a lower overflow elevation than the other three reservoirs which supply the Main Zone, this could cause it to overflow during low demand times when the other three reservoirs are full. A summary of the City's storage facilities is presented in Table ES-2.

Table ES-2
Storage Reservoir Summary

Reservoir Name	Reservoir Construction	Reservoir Capacity (MG)	Overflow Elevation (feet)	Floor Elevation (feet)	Pressure Zone Served
Sand Pines 1	welded steel	2.0	167.5	127.5	Main
Sand Pines 2	welded steel	2.0	167.5	127.5	Main
31st Street/East	welded steel	0.5	167.5	135.5	Main
Spruce Street[1]	elevated welded steel	0.25	167.5	N/A	Main

Note: 1. The Spruce Street Reservoir is currently offline. The actual overflow elevation of this reservoir is unknown. For analysis purposes, it is assumed to have the same overflow elevation as other reservoirs serving this zone.

Pump Stations

The City's distribution system includes three booster pump stations designed to deliver water from the Main Pressure Zone reservoirs and distribution mains up to customers in the North, East and Ocean Dunes Pressure Zones. The Sand Pines Pump Station, which serves the North Pressure Zone, draws suction supply from the adjacent Sand Pines Reservoirs.

The 31st Street/East Pump Station, which serves the small East Pressure Zone, draws suction supply from the adjacent 31st Street Reservoir. This station includes a hydropneumatic tank to prevent pumps from cycling on and off frequently during low demand periods. The hydropneumatic tank is currently out of service due to failure of the interior bladder separating the air and water chambers in the tank. As a result, frequent pump cycling and excessive pressure fluctuations occur during low demand periods.

The Ocean Dunes Pump Station is a Hydronix package pump station housed in a weather protective plastic shell rather than a free-standing building like those at the City's other two pump stations. This station serves a small gated community around the Ocean Dunes Golf Links on Munsel Lake Road on the east side of Florence.

A summary of each pump station is presented in Table ES-3, including pump capacity and pressure zones served.

Table ES-3
Existing Pump Station Summary

Pump Station	Pump No.	Capacity (gpm)	Zones Served
Sand Pines	1	180	North
	2	200	
	3	200	
	4	1,000	
31st Street/East	1	300	East
	2	600	
	3	600	
Ocean Dunes	1	75	Ocean Dunes
	2	175	
	3	500	

Population and Water Requirements

Population and water demand estimates were developed for the City's recently completed Water Management and Conservation Plan (WMCP) and these forecasts have been used in this Master Plan. The WMCP is included as Appendix B.

The term "water demand" refers to the City's total water production including; metered consumption for domestic, commercial, municipal and industrial purposes, unmetered uses, such as, fire fighting or hydrant flushing and water lost to leaks or reservoir overflow. Demands are discussed in terms of gallons per unit of time such as million gallons per day (mgd) or gallons per minute (gpm). Demands are also related to water usage per City customer as gallons per capita per day (gpcd).

Historical Population and Water Demand

Estimates of the City's historical population and water demand as presented in the current WMCP are summarized in Table ES-4. These estimates are supported by population projections from the Portland State University Population Research Center (PRC) that provides current and historical population estimates for the State of Oregon.

Table ES-4
Historical Population and Water Demand Summary[1]

Year	Water Service Area Population	Historical Water Demands			
		Average Day Demand (ADD)		Maximum Day Demand (MDD)	
		(mgd)	(gpcd)	(mgd)	(gpcd)
2004	7,830	1.23	157	2.32	296
2005	8,185	1.10	135	1.94	237
2006	8,270	1.23	149	2.16	261
2007[2]	8,270	1.11	135	2.17	262
2008	9,410	1.06	113	1.99	211

Note: 1. See Florence Water Management and Conservation Plan, Appendix B.
2. The population estimates are the same for 2006 and 2007 because the City did not submit data to the PRC in 2007.

Projected Population and Water Demand

The City of Florence's population forecasts are taken from the City's current WMCP supported by population estimates from the *Lane County Rural Comprehensive Plan: Coordinated Population Forecasts for Lane County and its Urban Areas*.

Future water demands are also taken from the current WMCP which estimates water demands using a constant per capita approach. Both population and water demand projections are established assuming growth will occur within the current city limits. In the WMCP, representative per capita water demands based on historical population and demand were determined to be:

Average Day Demand (ADD) = 120 +/- 11 gpcd
Maximum Day Demand (MDD) = 225 +/- 25 gpcd

Table ES-5 summarizes population and water demand projections as presented in the WMCP within the current city limits.

Table ES-5
Population and Water Demand Forecast Summary

Year	Water Service Area Population	Future Water Demand (mgd)	
		ADD	MDD
2010	9,783	1.2	2.2
2020	11,994	1.4	2.7
2030	14,251	1.7	3.2

Projected Water Demand by Pressure Zone

Evaluating the size of some water system facilities requires an estimated future maximum daily water demand within a particular pressure zone. To estimate future maximum day demand (MDD) by pressure zone, the total MDD for the system is multiplied by the ratio of the pressure zone's land area to the total land area within the city limits. Estimated future water demands by zone are summarized in Table ES-6 below.

Table ES-6
Projected Water Demand by Pressure Zone

Year	Total Future MDD (mgd)	Approximate MDD by Pressure Zone (mgd)			
		Main	North	East	Ocean Dunes
2010	2.0	1.3	0.7	<0.1	<0.1
2020	2.7	1.8	0.9	<0.1	<0.1
2030	3.2	2.1	1.1	<0.1	<0.1

Planning and Analysis Criteria

The following criteria are used to assess the water system's ability to provide adequate water service under existing conditions and to guide improvements needed to provide for future water needs.

- ***Water Supply and Treatment Criteria:*** The City's supply and treatment systems should be capable of providing estimated MDD through the end of the 20-year planning period.

- ***Distribution System Criteria:*** The distribution system should be capable of supplying the maximum day demand while maintaining a minimum service pressure at any meter in the system of approximately 35 pounds per square inch (psi). The recommended minimum pipe size for new mains is 12-inch in commercial and industrial areas and 8-inch in all other areas.

- ***Service Pressure Criteria:*** Minimum static system service pressures within each pressure zone should be at least 35 psi, with a recommended maximum upper limit of approximately 100 psi.

- ***Pump Station Capacity Criteria:*** Pump stations supplying constant pressure service without the benefit of storage, such as those in Florence, should have sufficient firm pumping capacity to meet the pressure zone's MDD while simultaneously supplying fire suppression flow for the largest recommended fire flow rate in the pressure zone. Firm pumping capacity is the station's capacity with the largest pump out of service. All constant-pressure pump stations should also be equipped with emergency backup

power generating facilities because water storage is not available to serve these areas by gravity flow alone.

- ***Storage Volume Criteria:*** Recommended storage volume capacity for the City is the sum of the operational, emergency and fire storage volume components. Recommended operational storage volume is 25 percent of maximum day demand. Recommended emergency storage is 100 percent of MDD. The fire storage volume is determined by multiplying the largest recommended fire flow rate by the duration of that flow as defined in the 2007 Oregon State Fire Code.

- ***Fire Flow Criteria:*** The distribution system should be capable of supplying the recommended fire flow rates while maintaining minimum residual pressures everywhere in the system of 20 psi.

Water Supply and Treatment Analysis

It is recommended that the City expand the existing groundwater supply system to provide an ultimate capacity of 3.2 mgd, the projected MDD in 2030. This is a supply increase of approximately 350 gpm (0.5 mgd). Florence holds sufficient groundwater right permits to allow this groundwater supply expansion but the existing WTP capacity is limited to approximately 3.0 mgd.

Distribution System Analysis

A hydraulic network analysis computer model was developed to evaluate the performance of the existing distribution system and to aid in the identification of proposed system improvements. The purpose of the model is to determine pressure and flow relationships throughout the distribution system for a variety of critical hydraulic conditions. System performance and adequacy is then evaluated on the basis of water demand projections presented in Table ES-5 and planning criteria defined above.

Hydraulic analysis reveals insufficient fire flow capacities under both existing and future demands for residential, commercial, industrial and mixed use areas of the City. Additional hydraulic capacity is needed in the system to correct these deficiencies. As discussed later in this section, greater pumping capacity is needed to improve supply to the North Pressure Zone, particularly to meet commercial fire flow requirements along Oak Street and Highway 101 north of 35th Street. Piping improvements are also needed in the North Pressure Zone to meet residential fire flow requirements east of Highway 101. The East Pressure Zone will also require additional pumping capacity to meet residential fire flow requirements and maintain minimum pressures. While storage in the Main Pressure Zone is sufficient, piping improvements in the Main Zone will be needed to provide adequate commercial fire flow to Old Town, the Highway 101 commercial corridor and Peace Harbor Hospital.

Pressure Zone Analysis

The City's existing four pressure zone configuration supplies water effectively within the recommended 35 psi to 100 psi static pressure range.

Ocean Dunes Pressure Zone

Current planning for the Ocean Dunes Planned Unit Development (PUD) includes connection of the PUD water distribution mains to the existing Ocean Dunes Pressure Zone. This would require capacity upgrades to and likely replacement of the existing Ocean Dunes Pump Station. Alternatively, the Ocean Dunes PUD area can be served effectively as part of the Main Pressure Zone, although static pressures will be lower than those in the existing Ocean Dunes Pressure Zone. For the purposes of this analysis, it is assumed that water service elevations in the Ocean Dunes PUD will not exceed approximately 80 feet as significant excavation of the sand dune should result in lower elevations at the high point of the development than currently exist. This assumption should be confirmed as detailed plans are developed for the PUD. It is recommended that the existing Ocean Dunes Pressure Zone, served solely by the Ocean Dunes Pump Station maintain its existing boundary.

Pump Station Capacity Analysis

The three pressure zones, North, East and Ocean Dunes, served by booster pump stations in the Florence system do not have storage facilities that supply the zone by gravity and can therefore, not be served except through pumping. Firm pumping capacity equal to the MDD for the zone plus the largest anticipated fire flow for the zone is recommended. Firm pumping capacity is defined as a pump station's capacity with the largest pump out of service. Recommended firm pumping capacities for each booster pump station are summarized in Table ES-7 below.

All constant-pressure pump stations should also be equipped with emergency backup power generating facilities because gravity supply from storage is not available to serve these zones in case of a power outage. The Sand Pines Pump Station, which serves the largest number of customers, has an existing back-up generator. The Ocean Dunes Pump Station does not have available space for a back-up generator but can be served from the Main Pressure Zone in an emergency as described below. The 31st Street Pump Station should be equipped with a standby generator.

Table ES-7
Pumping Capacity Recommendation Summary

Pump Station/ Pressure Zone	Estimated Firm Capacity (gpm)	Largest Fire Flow (gpm)	MDD (gpm)			Total Recommended Firm Capacity 2030 (gpm)	Additional Firm Capacity Needed (gpm)
			2010	2020	2030		
Sand Pines/ North	580	3,500	486	601	764	**4,264**	**3,684**
31st Street/ East	900	1,500[1]	<0.1	<0.1	<0.1	**1,600**	**700**
Ocean Dunes	250	1,500	-	-	-	**1,500**	**1,250**

1. Please see discussion above for alternative fire flow recommendations in the East Pressure Zone.

Sand Pines Pump Station - North Pressure Zone

The existing firm capacity of the Sand Pines Pump Station is insufficient to supply either the North Zone's largest anticipated fire flow or the zone's MDD in 2030. Replacing the existing pump station is recommended in order to provide the required demand and fire capacity to the North Zone. If the land in the North Pressure Zone continues to develop, or if the City extends future service further into the UGB, it is recommended that the City consider building a storage reservoir to serve customers by gravity and provide fire storage. However, due to the topography in the North Zone this new reservoir would either need to be an elevated tank, or a ground level tank located at an elevation that would also require lengthy transmission piping, and such construction is significantly more costly than replacing the Sand Pines Pump Station. If a reservoir is constructed to serve the North Zone, the Sand Pines Pump Station will still need to be expanded to meet the zone's 764 gpm (1.1 mgd) MDD in 2030 even with the much larger fire suppression needs being fulfilled by the new reservoir. In the short term, it is recommended that the Sand Pines Pump Station be replaced to supply required fire flows to the North Zone with a future reservoir to be considered as required for future development.

31st Street Pump Station - East Pressure Zone

The 31st Street Pump Station is insufficiently sized to supply a 1,500 gpm residential fire flow to the East Pressure Zone. However, as no further development is expected in this zone and existing development is composed of single-family residential homes with building square footages less than 3,600 square feet, it is recommended that the City allow a reduced fire flow requirement of 1,000 gpm in the East Pressure Zone. This is the fire flow required by the 2007 Oregon State Fire Code for single family residential development with homes under 3,600 square feet. Adjusting the fire flow requirement for this small pressure zone in accordance with State Fire Code will greatly reduce the piping improvements and pump

station upgrades needed to supply fire flow to the zone. Any future development, or redevelopment, in this area should then be restricted to a building construction type and size that does not require a fire flow of greater than 1,000 gpm.

Ocean Dunes Pump Station - Ocean Dunes Pressure Zone

Future growth is not anticipated within the Ocean Dunes Pressure Zone due to physical barriers such as the existing golf course and sand dunes. While the Ocean Dunes Pump Station is undersized to meet residential fire flow requirements within this pressure zone, analysis of the City's water system indicates that customers in the Ocean Dunes Pressure Zone could be served from the Main Pressure Zone if needed in an emergency. Although service pressures would be somewhat lower than those supplied by the Ocean Dunes Pump Station, pressure would be sufficient to meet minimum criteria.

Storage Volume Analysis

Table ES-8 illustrates the individual storage components and combined storage needs recommended for operational, fire and emergency purposes under 2008 demand conditions and projected demands in the years 2010, 2020 and 2030. Existing storage capacity does not include the elevated steel Spruce Street Reservoir which is currently out of service. Even without the Spruce Street Reservoir, the City's existing storage capacity is sufficient to meet projected demand through 2020 with a relatively small deficiency developing by 2030.

Table ES-8
Storage Volume Recommendation Summary

Year	Storage Components (MG)			Recommended Total Storage (MG)	Existing Storage (MG)	Storage Deficiency (MG)
	Operating	Fire	Emergency			
2008	0.5	0.6	2.0	3.1	4.5	--
2010	0.6	0.6	2.2	3.4	4.5	--
2020	0.7	0.6	2.7	4.0	4.5	--
2030	0.8	0.6	3.2	4.6	4.5	0.1

Note: 1. Largest fire flow demand is assumed to be industrial/commercial/mixed use at 3,500 gpm for a duration of 3 hours.

While overall storage capacity in Florence's system is sufficient, additional development in the North Pressure Zone will increase the risk of reduced levels of service due to a mechanical failure or other emergency involving the Sand Pines Pump Station, the single source of supply to this zone. Improvement of the existing interties with the Heceta Water District, including construction of facilities to allow automated operation of these interties, will provide supply redundancy to the North Pressure Zone in an emergency. The City may wish to consider building a storage reservoir to serve customers by gravity and provide fire storage to the North Zone as future expanded development warrants.

As stated above, the existing Spruce Street Reservoir is not needed to meet overall storage volume recommendations for the Florence Water System. Furthermore, bringing this reservoir back on-line may present some challenges. Based on conversations with City public works staff, information about this 1948 reservoir is limited but there is some consensus that the reservoir may have a lower overflow elevation than the Sand Pines and 31st Street/East Reservoirs which may cause rapid changes in reservoir level and frequent reservoir overflows. The reservoir would also likely require seismic retro-fitting and coating improvements. It is recommended that the City keep this reservoir off-line and consider either dismantling it or conducting a structural evaluation if it is maintained as a local landmark.

Recommended System Improvements

Described below are recommended water system improvements for water supply, pump stations, storage reservoirs and distribution system piping. Recommended improvements are prioritized as immediate, short-term, medium-term or long-term so that the annual capital requirement for water system improvements is distributed over the 20-year planning horizon. Immediate recommendations are those suggested to be completed in the next five years (2010-2014), short-term in the next five to 10 years (2015-2019), medium-term in the next 10 to 20 years (2020-2030) and long-term beyond 20 years in the future (2030+). It is recommended that the City's water system capital improvement program be funded at approximately 750,000 dollars annually for the next five years. Recommended improvement projects with their estimated costs are presented in Table ES-9 at the end of this section.

Cost Estimating Data

An estimated project cost has been developed for each improvement project recommendation. Cost estimates represent opinions of costs only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedule and other factors. The American Association of Cost Engineers (AACE) classifies cost estimates depending on project definition, end usage and other factors. The cost estimates presented here are considered Class 4 with an end usage being a study or feasibility evaluation and an expected accuracy range of -30 percent to +50 percent. As the project is better defined the accuracy level of the estimates can be narrowed. Itemized project cost estimate summaries are presented in Appendix D. Estimated project costs include approximate construction costs and an allowance for administrative, engineering and other project related costs.

The estimated costs included in this plan are planning level budget estimates presented in 2010 dollars. Since construction costs change over time, an indexing method to adjust present estimates in the future is useful. The Engineering News Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. For purposes of future cost estimate updating; the recent ENR CCI for Seattle, Washington is 8647 (February 2010).

Water Supply Improvements

It is recommended that the City expand the existing groundwater supply system by approximately 350 gpm (0.5 mgd) in order to provide a total supply capacity of 3.2 mgd at the end of the 20-year planning horizon in 2030. The City's projected MDD in 2020 will require all of the City's existing 2.7 mgd supply capacity, thus supply expansion is recommended between 2015 and 2020. The City holds sufficient groundwater rights to allow production of 3.8 mgd from existing and future wells. Existing WTP capacity is limited to approximately 3.0 mgd, thus further study is recommended to identify potential options for treating the recommended supply expansion. For the purposes of this plan it is assumed that the City will develop two new supply wells and associated treatment facilities. The proposed treatment facilities should be designed to accommodate future upsizing to allow treatment capacity to be expanded as needed beyond the 20-year planning horizon.

It is understood from previous work by the City that conditions in Florence's aquifer, including high concentrations of naturally occurring iron and fine sand reduce well productivity over time due to well screen clogging caused by iron bacteria and sediment. The City has established an annual well rehabilitation program with an annual budget of 45,000 dollars.

The need for an emergency power generator to operate the WTP and supply wells was previously identified by the City. A subsequent analysis by the City concluded that an approximately 300 kilowatt (kW) emergency power generator would be capable of operating the WTP facilities and Well Nos. 1 through 12, all of the existing groundwater production capacity. It is recommended that an emergency power generator be installed at the existing WTP. The cost to install a 300 kW generator at the WTP is estimated at approximately 120,000 dollars.

Pump Station Improvements

31st Street/East Pump Station

It is recommended that the 31st Street/East Pump Station be expanded to a firm capacity of approximately 1,100 gpm in order to deliver a 1,000 gpm fire flow with the largest pump out of service (firm capacity). The estimated project cost of expanding the 31st Street/East Pump Station is approximately 35,000 dollars. The required 31st Street/East Pump Station upgrades are recommended for completion in the immediate term prior to 2015. It is further recommended that the City take action to ensure that future development, or redevelopment, in this zone remains single-family residential structures that do not exceed 3,600 square feet, the 2007 Oregon State Fire Code maximum square footage for a 1,000 gpm fire flow, unless further water system improvements are made.

It is further recommended that the 31st Street/East Pump Station be retrofitted with variable frequency drives (VFDs). This will help prevent the frequent cycling of pumps on and off for small demands within the zone which began after the failure of the station's

hydropneumatic tank. The project cost for renovating the pumps with VFDs is approximately 100,000 dollars and it is recommended that this improvement be completed in the next five years. The 31st Street/East Pump Station should also have a standby power generator to power the station in an emergency. Project costs for installing a standby generator are approximately 20,000 dollars. Generator installation is recommended as an immediate improvement to be completed in the next five years.

Ocean Dunes Pump Station

While the Ocean Dunes Pump Station is undersized to meet residential fire flow requirements within this pressure zone, it is not feasible to add an additional pump to the existing Hydronix package pump station. To meet residential fire flow requirements in this zone, it is recommended that the City install a check valve vault to bypass the normally closed valve at the south end of Onadoone Court. Under fire flow conditions in the Ocean Dunes Pressure Zone, the check valve will open to allow supply to flow from the Main zone into the Ocean Dunes zone. The hydraulic grade in the Main Pressure Zone is only slightly lower than that of Ocean Dunes and the water distribution system analysis indicates that a check valve connection between these two zones would improve minimum service pressures under fire flow conditions. Project cost for installing the check valve, vault and associated piping is approximately 76,000 dollars. This improvement is recommended as an immediate improvement to be completed in the next five years.

Sand Pines Pump Station

It is recommended that the Sand Pines Pump Station be replaced with a new pump station with a firm capacity of 4,350 gpm to meet MDD in 2030 plus 3,500 gpm commercial fire flow demands in the North Zone. The estimated project cost for replacing the Sand Pines Pump Station is approximately 1.5 million dollars. This improvement should be considered a short-term improvement, to be completed in the next ten years, unless commercial and industrial development occur sooner requiring expanded facilities at an earlier date.

In order to improve supply reliability to this pressure zone and address near-term deficiencies it is recommended that the City evaluate the potential to develop an automated intertie facility with the Heceta Water District. This intertie would be an upgrade of the existing 10-inch diameter, manually operated, emergency intertie on Highway 101 near Munsel Lake Road. A budget of 100,000 dollars is included for this improvement.

Finished Water Storage Improvements

31st Street/East Reservoir

Based on conversations with City staff and related observations, there is significant corrosion to the steel roof and rafters at the 31st Street/East Reservoir. It is recommended that the reservoir roof, rafters and column support be replaced in the next five years. The estimated project cost for replacing the roof is 150,000 dollars. According to comments from City

staff, it can be challenging to maintain required chlorine residuals in the East Pressure Zone. This is likely due to poor mixing in the reservoir and relatively slow water turnover from the small number of customers and water demands within the zone. It is recommended that a mixing system be installed in the 31st Street/East Reservoir in coordination with roof, rafter and column replacement. The estimated project cost of installing a mixing system in the existing reservoir is approximately 60,000 dollars.

Future North Reservoir

As the North Pressure Zone continues to develop in the long term, a new storage reservoir should be considered to provide gravity supply for the zone and to provide fire suppression storage for existing and anticipated commercial and industrial customers. Adhering to the storage criteria outlined above, this proposed North Zone Reservoir would provide storage capacity equivalent to 100 percent of the zone's projected MDD for emergencies, plus 25 percent of the zone's projected MDD for operational storage and the zone's largest required fire flow (3,500 gpm) for a duration of 3 hours. Given the low risk of an emergency occurring during MDD with a simultaneous fire flow it is recommended that a future reservoir to serve the North Pressure Zone be sized to only provide operational storage plus adequate capacity for fire flow. Using this approach, the total recommended storage capacity for the proposed North Zone Reservoir is approximately 1.0 million gallons (MG).

A future North Zone Reservoir will need to be either an elevated reservoir or a ground level reservoir located some distance to the east, where ground elevations are higher, with transmission piping to connect to the distribution system. Site planning for an elevated reservoir would also require careful coordination with the Florence Realization 2020 Comprehensive Plan policies as they relate to view corridors within the City. The proposed North Reservoir's estimated project cost is approximately 2.2 million dollars, assuming an elevated reservoir is constructed close to the distribution system. This improvement should be considered a long term improvement beyond the 20-year planning horizon unless the City extends water service north to a large number of new customers making continued service with a continuous operation pump station less desirable.

Distribution System Piping Improvements

The water system analysis found that extensive distribution water main improvements are needed to provide sufficient fire flow capacities and accommodate system expansion. Piping improvements are recommended for large diameter loops to improve transmission from the WTP throughout the distribution system, for increased residential and commercial fire flow and to serve potential future development. Each of these water line improvements is detailed in Section 6. Brief project descriptions, a recommended timeframe for project completion and an estimated project cost are presented in Table ES-9.

It is also recommended that the City continue a program of replacing aging asbestos cement piping and undersized water mains. Funding for this program should be approximately 50,000 dollars annually.

Additional Recommendations

It is recommended that additional engineering studies be conducted to advance the planning work completed in this master plan. The City completed a cost-of-service (water rate) analysis in 2009 and anticipates conducting a System Development Charge (SDC) analysis upon completion of this master plan.

Planning Updates

Updates to the existing Water Management and Conservation Plan as well as this master plan will also be required within the 20-year planning horizon. The Water System Master Plan should be updated every ten years at a minimum, and more frequently if significant changes occur in the system, such as an expansion of the water system service area. A progress report must be submitted every five years for the Water Management and Conservation Plan, with full update of the plan required every ten years.

Financial Evaluation and Plan

A long-term financial planning evaluation and strategy is required to support the recommended capital improvement program. Revenue generated from water rates and system connection fees is typically used to fund operating and maintenance costs, renewal and replacement costs of existing facilities and capital improvement projects. Adequate SDCs should be established to collect funds from new customers to pay for improvements that expand the capacity of the system without placing an undue burden on existing customers. Additional funding available through government grant and loan programs and publicly issued debt are discussed in Section 6. It is recommended that approximately 20,000 dollars be budgeted in the next five years to complete the SDC study and 20,000 dollars every five years after that to review and update the financial plan including the water rate and SDC analyses.

Study Recommendations

It is recommended that the City take the following actions:

1. Formally adopt this study as Florence's Water System Master Plan Update.

2. Adopt the prioritized recommended system improvements summarized in Table ES-9 as the CIP for the City's water service area.

3. Review and update this plan within seven to 10 years to accommodate changes or new conditions.

Table ES-9
Capital Improvement Program Summary

Category	Project Description	Project Location	CIP Schedule and Project Cost Summary				Estimated Project Cost
			Immediate (2010 - 2014)	Short-Term (2015 - 2019)	Medium-Term (2020 - 2030)	Long-Term (2030+)	
Water Supply & Treatment	New Wells	Additional supply development at new wellfield site		$ 450,000			$ 450,000
	Back-up Power	300 kW Generator for Wells & WTP	$ 120,000				$ 120,000
	Well Rehabilitation	Rehab two wells annually	$ 225,000	$ 225,000	$ 450,000	$ 450,000	$ 1,350,000
	Treatment	Construct new treatment facilities		$ 2,000,000			$ 2,000,000
		Sub-Total	*$ 345,000*	*$ 2,675,000*	*$ 450,000*	*$ 450,000*	*$ 3,920,000*
Pumping Facilities	North Pressure Zone	Replace Sand Pines Pump Station		$ 1,500,000			$ 1,500,000
	East Pressure Zone	Stanby power for 31st St/East Pump Station	$ 20,000				$ 20,000
		Upgrade controls and install VFDs	$ 100,000				$ 100,000
		Upgrade pump station - increase firm capacity to 1,100 gpm	$ 35,000				$ 35,000
		Sub-Total	*$ 155,000*	*$ 1,500,000*	*$ -*	*$ -*	*$ 1,655,000*
Storage Facilities	North Pressure Zone	Proposed North Pressure Zone Reservoir				$ 2,200,000	$ 2,200,000
	East Pressure Zone	Replace roof of 0.5 MG 31st Street/East Hills Reservoir	$ 150,000				$ 150,000
		Install mixing system in 0.5 MG 31st Street/East Hills Reservoir	$ 60,000				$ 60,000
		Sub-Total	*$ 210,000*	*$ -*	*$ -*	*$ 2,200,000*	*$ 2,410,000*
Distribution System Piping and Control Valves	Main Pressure Zone Transmission Loop	Upgrade to 16-inch from Water Treatment Plant through Old Town to Kingwood Street	$1,974,000				$ 1,974,000
		Upgrade to 16-inch and 12-inch on Kingwood Street from Old Town to 35th Street		$ 1,329,000			$ 1,329,000
		Upgrade to 12-inch to complete loop from 35th Street to Water Treatment Plant			$ 440,000		$ 440,000
		Old Town - Bay Street Loop	$ 475,000				$ 475,000
		Highway 101 Westside Loop - 9th Street to 15th Street		$ 709,000			$ 709,000
		Rhododendron Drive - 9th Street Loop			$ 1,374,000		$ 1,374,000
		North Highway 101 Improvements for Commercial Fire Flow			$ 587,000		$ 587,000
		Main Pressure Zone Piping Improvements for Commercial Fire Flow			$ 1,432,000		$ 1,432,000
		Main Pressure Zone Piping Improvements for Residential Fire Flow				$ 736,000	$ 736,000
		Ocean Dunes Pressure Zone Fire Flow Improvements				$ 456,000	$ 456,000
		Piping to Serve Future Development in Main and North Zones				$ 3,721,000	$ 3,721,000
	Check Valves	Onadoone Court for fire flow from Main Pressure Zone to Ocean Dunes	$ 76,000				$ 76,000
		Ocean Dunes Drive for fire flow from Main Pressure Zone to north Ocean Dunes				$ 76,000	$ 76,000
	Pressure Reducing Facilities	North to Main Pressure Zone PRV at northern edge of Ocean Dunes			$ 90,000		$ 90,000
	Routine Pipe Replacement	Funds replacement of asbestos cement (AC) and undersized pipe at $50,000 per year	$ 250,000	$ 250,000	$ 250,000	$ 500,000	$ 1,250,000
	Intertie	Upgrade Intertie with Heceta WD	$ 100,000				$ 100,000
		Sub-Total	*$ 2,875,000*	*$ 2,288,000*	*$ 4,173,000*	*$ 5,489,000*	*$ 14,825,000*
Other	Planning Studies	Water Rate and SDC Study	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 80,000
		Water System Master Plan Update			$ 80,000		$ 80,000
		Water Management and Conservation Plan Update		$ 20,000	$ 40,000		$ 60,000
		Sub-Total	*$ 20,000*	*$ 40,000*	*$ 140,000*	*$ 20,000*	*$ 220,000*
Capital Improvement Plan (CIP) Total			***$ 3,605,000***	***$ 6,503,000***	***$ 4,763,000***	***$ 8,159,000***	***$ 23,030,000***
			$721,000	**$1,010,800**	**$743,550**		
			5 Year Annual Avg.	**10 Year Annual Avg.**	**20 Year Annual Avg.**		

SECTION 1
INTRODUCTION

Authorization

In May 2009, the firm of Murray, Smith & Associates, Inc. was authorized by the City of Florence (City) to prepare this Water System Master Plan Update (WSMP).

Purpose

The purpose of this study is to perform a comprehensive analysis of the City of Florence's water system to identify system deficiencies, to determine future water distribution system and supply requirements, and to recommend water system facility improvements that correct existing deficiencies and allow for future system expansion. This study will provide the City with the guidance needed for the sound stewardship of the water system over the next 20 years and beyond.

Compliance

This plan complies with water system master planning requirements established under Oregon Administrative Rules (OAR) for Public Water Systems, Chapter 333, Division 61.

Scope

The scope of work for this study includes the following work tasks:

Inventory of Existing Facilities – Develop an updated inventory of the City's existing water system facilities. Facilities inventoried will include wells, treatment plant, reservoirs, pump stations, pressure reducing stations and distribution system piping. Prepare an existing system map and a hydraulic profile (schematic) depicting all water system facilities and pressure zones. Compile and review all existing information relevant to this task, including previous water system master plan documents, water management and conservation planning materials, O&M records, recent ISO fire flow reports, distribution system water quality records, City public works standards, policies, record drawings of key facilities, and other pertinent information. Conduct a site visit with City staff to each existing, observable facility in the water system.

Water Demand Estimates – GSI Water Solutions, Inc. is currently preparing a Water Management and Conservation Plan for the City, including development of population and water demand forecasts for the 20-year planning horizon. MSA will coordinate directly with GSI to obtain water demand estimates for the service area and for each pressure zone, existing and proposed. GSI will provide preliminary water demand estimates for use in projecting future demand forecasts. Sub-elements of this task include:

- Review demand estimates prepared by GSI and, if needed, develop historical per capita water demand patterns on an average annual basis, peak month basis, peak day basis and peak hour basis. Review findings with City staff and confirm proposed water demand forecasting criteria.

- Develop short-term, long-term and ultimate overall water consumption demand forecasts (average day, peak month, peak day, peak hour).

Develop and Calibrate Water System Hydraulic Model – Develop a computerized water distribution system network analysis model based on GIS mapping data provided by the City, using the current version of MWH Soft InfoWater software. The water system model will be made up-to-date, verified that it reflects actual physical conditions and calibrated to confirm that operational performance matches actual City water system performance. All system facilities, such as reservoirs, groundwater wells, pumps and control valves, will be modeled.

Perform Distribution System Analysis – The City's water system will be analyzed using the updated, calibrated and verified water system model, water demand estimates, and approved planning and analysis criteria. Developed criteria will be in accordance with Oregon Administrative Rules (OAR) Chapter 333, Division 61, State of Oregon Water Resources Department, American Water Works Association's Standards and Insurance Services Office (ISO) guidelines. The model will be used to test system performance under a variety of supply and demand conditions. Specific subtasks of this analysis include the following:

- ***Distribution System/Reservoir Operations Analysis –*** The distribution system will be analyzed to determine deficiencies impacting fill and draw-down operations of the City's existing and proposed reservoirs. Improvements will be identified to remedy deficiencies associated with reservoir operations.

- ***Fire Flow Analysis –*** An analysis using the InfoWater hydraulic network analysis software will be conducted to evaluate the transmission and distribution system's ability to provide adequate fire flows for residential, commercial and industrial land uses throughout the water service area. System improvements needed to meet both current and future fire flow demands will be identified.

- ***Storage and Pump Station Capacity Analysis –*** Storage and pumping needs will be analyzed and improvements will be identified to remedy existing and future deficiencies. A storage capacity evaluation will be completed to determine the City's water storage needs using a three-component analysis of operational, fire flow and emergency water storage needs. The City's existing pump stations will be evaluated and analyzed to determine their adequacy in meeting estimated water demands as well as other planning and analysis criteria.

- ***Pressure Zone Analysis –*** This analysis component will include an evaluation of existing and anticipated water demands in each of the City's pressure zones. The

analysis will confirm and/or establish acceptable elevation limits and service pressure limits for each of the City's existing pressure zones.

Recommended System Improvements – System improvements required to serve the anticipated service area population through the study period will be identified. Planning level project cost estimates will be prepared for each proposed system improvement.

The system analysis and evaluation will assist in determining existing system adequacy to meet planning and analysis criteria. As system adequacy is determined, deficiencies will be identified and corrective system improvements developed. Corrective measures may include pipelines, reservoirs, pump stations, and/or modifications to existing facilities, system operations or other physical improvements found necessary for the water system to perform properly under the established criteria. Recommended system improvements will be characterized by type.

Capital Improvement Plan and System Plan Map – Recommended distribution system improvements will be organized and developed into a detailed and comprehensive water distribution system CIP. The recommended improvements will be categorized as meeting short-range (one to five years), medium-range (six to ten years) and long-range (beyond ten years) needs. Project cost estimates, based on an appropriate cost index such as the Engineering News Record construction cost index, will be developed for all recommended capital improvements.

Proposed water system capital improvements will be identified on a system plan map that will include pressure zones, City limits, urban growth boundary, streets and street names, major topographical features, and the existing water system. Proposed improvements will be clearly identified in a bold color that is different from existing facilities. The size and location of all facilities will be shown on the system plan map. Overall system mapping will be developed as a single "wall-map" style figure, printed in color at a scale that is easy to view and understand.

Prepare Water System Master Plan – Prepare a WSMP that documents and describes the planning and analysis work efforts, including a color map identifying all existing and proposed water system facilities.

SECTION 2
EXISTING WATER SYSTEM

General

This section inventories and describes the City of Florence's (City) existing water service area and water system facilities. Included in this section are discussions of water resources, existing pressure zones, storage reservoirs, pumping facilities and distribution system piping.

Study and Water Service Areas

The City's water system currently provides potable water to approximately 9,580 people within the city limits through residential, commercial and industrial service connections. Although the City's Urban Growth Boundary (UGB) extends significantly further north of the existing city limits, customers in this area are currently served by the neighboring Heceta Water District (District). As land north of the City develops it is assumed that there will be some adjustment in water service area boundaries for both the City and District but the majority of new City water customers are anticipated to be within the city limits. The study area for this master plan includes the area within the City of Florence's existing city limits, areas on either side of Highway 101 between Munsel Lake Road and the UGB and areas west and south of Munsel Lake Road near Florentine Estates. Two recently annexed areas to the north, Driftwood Shores Resort and Conference Center and the Fawn Ridge subdivisions are not included in the study area and will continue to be served by the District. This study area represents the City's future water service area which extends beyond the existing service area boundary. Several alternatives were considered by the City for the study area of this Master Plan Update, these alternatives are discussed in more detail in Section 3.

Water System Background

Currently, Florence's water is supplied by 12 groundwater wells owned and operated by the City. All water diverted from the wells is treated for manganese and iron concentrations at the City's water treatment plant prior to supplying the distribution system and storage reservoirs. The City also maintains two emergency interties with the Heceta Water District. An updated emergency water supply agreement between the City and the District was approved on July 6, 2010. The City's distribution system consists of four pressure zones served by three water storage reservoirs and three booster pumping stations.

Figure 1, "Water System Map", in Appendix A illustrates the study area, pressure zones, water system facilities and distribution mains. Figure 1 is also a digital representation of the computerized distribution system hydraulic model used for the water system analysis.

Supply Source

Water Rights

Currently the City holds three groundwater rights totaling 3.8 million gallons per day (mgd) (5.89 cubic feet per second (cfs)). Based on the City's recently completed Water Management and Conservation Plan (WMCP) the 12 existing City wells produce approximately 2.7 mgd (4.2 cfs). A summary of the City's water rights may be found in the City's current WMCP, included as Appendix B of this plan.

Groundwater Supply

The City's 12 groundwater supply wells are located in a large well field on the eastern edge of Florence bordered by Willow Ridge Court to the south and 35th Street to the north. The wells produce water year round and serve as the City's sole water supply source. The City's wells are approximately100-200 feet deep and draw groundwater from a dunal aquifer overlying the coastal plain beneath the City.

Treatment

The City's existing groundwater wells produce water from a dunal aquifer with high levels of iron and manganese present in the native groundwater. Groundwater from the 12 existing wells in the City's well field is pumped to the City's approximately 3.0 mgd Water Treatment Plant (WTP). The WTP is located adjacent to the City's well field near the intersection of Willow Street and 24th Street.

The WTP consists of pressurized biological reactors and pressurized green sand filters used to treat the water, primarily for removal of iron and manganese. The groundwater is first aerated and pumped through one of three 1.0 mgd biological reactors where bacteria oxidize the iron present in the water. Further oxidation of iron and manganese occurs after the biological reactors in an above-ground horizontal contact pipe located on the WTP site. Chlorine is injected at the entrance to the contact pipe and potassium permanganate is injected at the outlet to further oxidize the remaining iron and manganese and to regenerate the green sand filters. Sodium hydroxide is also added at the outlet of the contact pipe for pH adjustment. The groundwater then flows through one of six 0.5 mgd green sand pressure filters to remove the oxidized contaminants. Sodium fluoride is added to the filtered and treated groundwater before it enters the distribution system.

Interties

The City maintains two metered emergency interties with the neighboring Heceta Water District. The first is an 8-inch diameter intertie on Rhododendron Drive between Treewood and Rhodowood Drives that can be used to supply water from the District to the City's system. At the second, 10-inch intertie on Highway 101 and Munsel Lake Road, water can be provided either from the District to the City or to the District from the City. These

interties are at the northern boundary of the City's existing water service area. The Heceta Water District currently serves customers north of the City's service area. The District's water is supplied from a surface water intake on Clear Lake northeast of Florence.

According to City staff, the District's ability to provide a consistent supplemental water supply for the City of Florence during the peak summer season is limited by the capacity of the two transmission mains extending south to the interties. The City stopped purchasing water from the District in 2003 following the City's Water Treatment Plant expansion and development of Well Nos. 8 through 12. An updated emergency water supply agreement between the City and the District was approved on July 6, 2010.

Pressure Zones

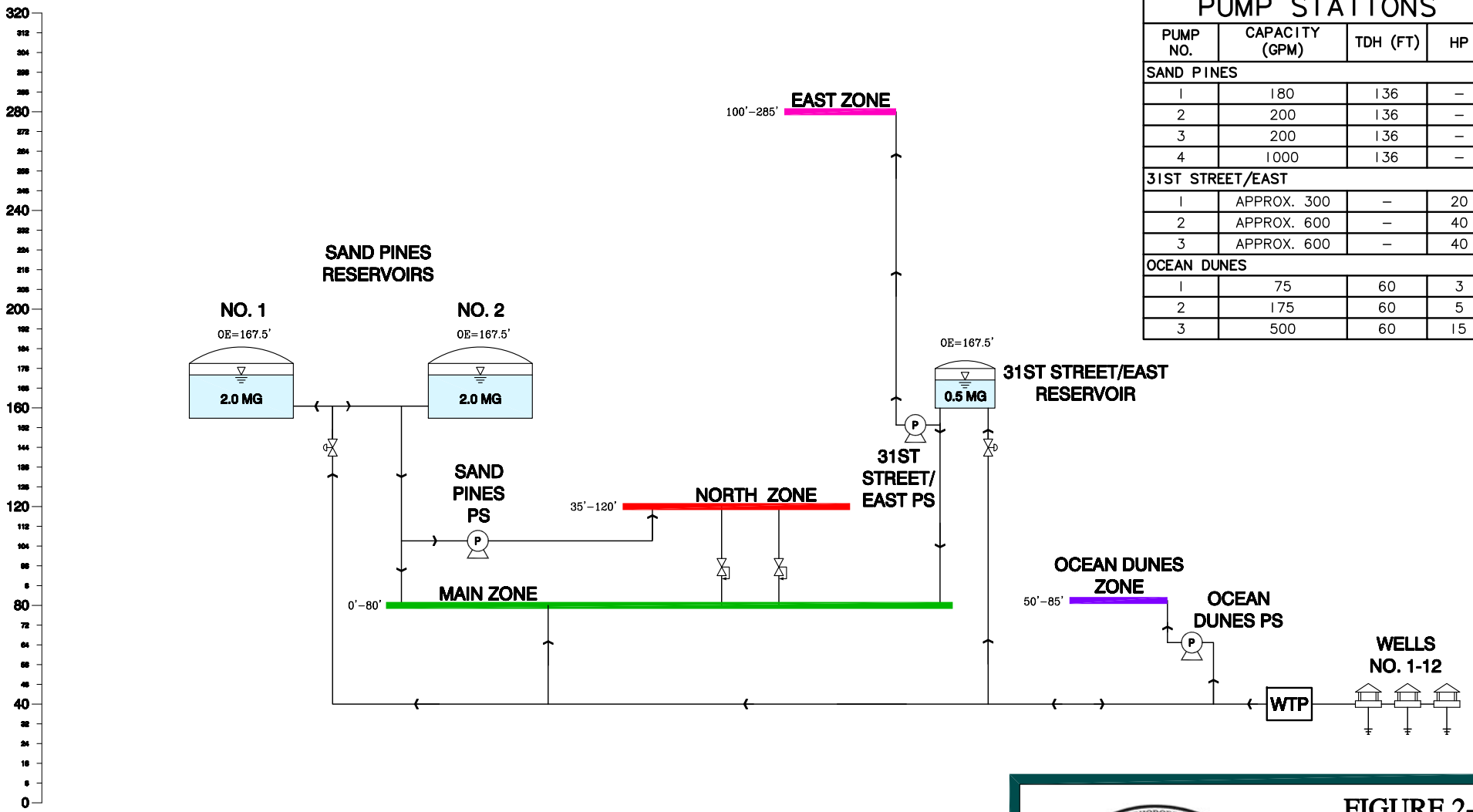
General

The City of Florence's existing water distribution system includes four service levels, or pressure zones. Pressure zones are generally defined by ground topography and designated by overflow elevations of water storage facilities or discharge hydraulic grades of pressure reducing or booster pumping facilities serving the zone. The hydraulic profile in Figure 2-1 illustrates the City's existing pressure zones and associated facilities. A summary of the City's pressure zones is presented in Table 2-1 and a brief discussion of each pressure zone is presented below.

Table 2-1
Existing Pressure Zone Summary

Pressure Zone	Current Elevation Range Served (ft)	Supply Source	Pressure Control (Storage Reservoirs[1]/ Pump Station)	Controlling Hydraulic Grade (ft)	Approximate Pressure Range (psi)
Main	0 - 80	Water Treatment Plant	2.0 MG Sand Pines 1	167.5	40 - 73
			2.0 MG Sand Pines 2		
			0.5 MG 31st St./East		
North	35 - 120	Sand Pines Booster PS	Sand Pines Booster PS	261	61 - 98
East	100 - 285	31st St./East Booster PS	31st St./East Booster PS	390	45 - 125
Ocean Dunes	50 - 85	Ocean Dunes Booster PS	Ocean Dunes Booster PS	228	62 - 77

Note: 1. The Spruce Street Reservoir is currently offline and non operational.



PUMP STATIONS			
PUMP NO.	CAPACITY (GPM)	TDH (FT)	HP
SAND PINES			
1	180	136	–
2	200	136	–
3	200	136	–
4	1000	136	–
31ST STREET/EAST			
1	APPROX. 300	–	20
2	APPROX. 600	–	40
3	APPROX. 600	–	40
OCEAN DUNES			
1	75	60	3
2	175	60	5
3	500	60	15

LEGEND

- WATER MAIN
- HIGHEST GROUND ELEVATION SERVED BY PRESSURE ZONE OR SUBZONE
- RESERVOIR (0E=1240' OVERFLOW ELEVATION; 1.0 MG CAPACITY)
- ALTITUDE VALVE
- PRESSURE REDUCING VALVE
- PUMP STATION
- WELL

ABBREVIATIONS

EL	ELEVATION
FT	FEET
GPM	GALLONS PER MINUTE
HP	HORSE POWER
MG	MILLION GALLONS
OE	OVERFLOW ELEVATION
PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
TDH	TOTAL DYNAMIC HEAD
WTP	WATER TREATMENT PLANT

FIGURE 2-1

CITY OF FLORENCE

Water System Master Plan Update

EXISTING WATER SYSTEM HYDRAULIC PROFILE

January 2011

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09-1045.410

G:\PDX_Projects\09\1045\410 Develop WMP & CIP\CAD\09-1045-410-OR-FIGURE 1.dwg FIG 1 1/4/11 14:38 (DKH)

Main Pressure Zone

The Main Pressure Zone serves the majority of City of Florence water customers. This pressure zone includes water services with ground elevations between sea level and approximately 80 feet above mean sea level (msl) from the Siuslaw River in the south to 35th Street in the north. Service to customers in the Main Zone is currently provided directly from the City's Water Treatment Plant, from the 2.0 million gallon (MG) Sand Pines 1 and 2 Reservoirs, the 0.5 MG 31st Street Reservoir and through pressure reducing valve (PRV) connections from the North Pressure Zone. Service pressures in the Main Zone are between approximately 38 and 73 pounds per square inch (psi). The Main Zone was previously served by the 0.25 MG Spruce Street Reservoir which has been offline for approximately ten years. This reservoir is discussed in more detail later in this section.

North Pressure Zone

The North Pressure Zone serves customers with ground elevations between approximately 35 and 120 feet in the area north of 35th Street to the city limits. Service to the North Pressure Zone is provided by the Sand Pines Booster Pump Station with a maximum nominal capacity of 1,580 gpm, an approximate discharge pressure of 60 psi and a discharge hydraulic grade of approximately 261 feet. Service pressures in the North Zone are between approximately 61 and 98 psi.

East Pressure Zone

The East Pressure Zone serves customers with ground elevations between approximately 100 and 285 feet along Ocean View Drive and Jake Mann Drive above the site of the 31st Street Reservoir in the City's east hills. Service to the East Pressure Zone is provided by the 31st Street/East Pump Station with a maximum nominal capacity of approximately 1,500 gpm, an approximate discharge pressure of 110 psi and a discharge hydraulic grade of approximately 390 feet. Pressures in the East Zone are between approximately 45 and 125 psi.

Ocean Dunes Pressure Zone

The Ocean Dunes Pump Station supplies water to a small pressure zone adjacent to the Ocean Dunes Golf Links in the east hills. The Ocean Dunes Pressure Zone serves customers with ground elevations between approximately 50 and 85 feet with service pressures between approximately 62 and 77 psi.

Storage Reservoirs

The City of Florence has three active storage reservoirs providing 4.5 MG of storage by gravity to the Main Pressure Zone. Emergency storage is also provided from these facilities by pumping to the North and East pressure zones through adjacent pump stations. The Sand Pines Reservoirs No. 1 and 2 are identical 2.0 MG welded steel tanks with an approximate

overflow elevation of 167.5 feet. The 31st Street/East Reservoir is a 0.5 MG welded steel tank constructed in 1965 with an approximate overflow elevation of 167.5 feet.

A fourth Main Zone reservoir, the elevated, welded-steel Spruce Street Reservoir was taken offline approximately ten years ago. It has been reported by City staff that the reservoir experienced rapid uncontrolled fluctuations in water level. Based on discussions with City staff, the Spruce Street Reservoir may have a lower overflow elevation than the other three reservoirs which supply the Main Zone (167.5 feet). A lower overflow elevation at this reservoir could cause it to overflow during low demand times when the other three reservoirs are full. Given the relatively small size of the reservoir it may tend to overflow quite rapidly as system demands increase; thereby, not allowing sufficient time for public works staff to make supply adjustments at the Water Treatment Plant to prevent overflow. The storage analysis presented in Section 5 assesses the value of bringing this reservoir back into service.

A summary of the City's storage facilities is presented in Table 2-2.

Table 2-2
Storage Reservoir Summary

Reservoir Name	Reservoir Construction	Reservoir Capacity (mg)	Overflow Elevation (feet)	Floor Elevation (feet)	Pressure Zone Served
Sand Pines 1	welded steel	2.0	167.5	127.5	Main
Sand Pines 2	welded steel	2.0	167.5	127.5	Main
31st Street / East	welded steel	0.5	167.5	135.5	Main
Spruce Street[1]	elevated welded steel	0.25	167.5	N/A	Main

Note: 1. The Spruce Street Reservoir is currently offline. The actual overflow elevation of this reservoir is unknown. For analysis purposes, it is assumed to have the same overflow elevation as other reservoirs serving this zone.

Pump Stations

The City's distribution system includes three booster pump stations designed to deliver water from the Main Pressure Zone reservoirs and distribution mains up to customers in the North, East and Ocean Dunes Pressure Zones. The Sand Pines Pump Station, which serves the North Pressure Zone, draws suction supply from the adjacent Sand Pines Reservoirs.

The 31st Street/East Pump Station, which serves the small East Pressure Zone, draws suction supply from the adjacent 31st Street Reservoir. This station includes a hydropneumatic tank to prevent pumps from cycling on and off frequently during low demand periods. The hydropneumatic tank is currently out of service due to failure of the interior bladder separating the air and water chambers in the tank. As a result, frequent pump cycling and excessive pressure fluctuations occur during low demand periods.

The Ocean Dunes Pump Station is a Hydronix package pump station housed in a weather protective plastic shell rather than a free-standing building like those at the City's other two pump stations. This station serves a small gated community around the Ocean Dunes Golf Links on Munsel Lake Road on the east side of Florence.

A summary of each pump station is presented in Table 2-3, including pump capacity and pressure zones served.

Table 2-3
Existing Pump Station Summary

Pump Station	Pump No.	Capacity (gpm)	Zones Served
Sand Pines	1	180	North
	2	200	
	3	200	
	4	1,000	
31st Street / East	1	300	East
	2	600	
	3	600	
Ocean Dunes	1	75	Ocean Dunes
	2	175	
	3	500	

Water System Piping

The City of Florence's water distribution system is composed of various pipe materials in sizes up to 12 inches in diameter. The total length of piping in the City's existing service area is approximately 56 miles. The majority of the piping in the system is 6-inch or 8-inch diameter. Table 2-4 presents a summary of pipe lengths by diameter.

Table 2-4
Water System Pipe Summary

Pipe Diameter (inches)	Pipe Length (miles)
2	0.8
4	1.0
6	29.8
8	14.1
10	7.5
12	2.5
Total	**55.7**

Summary

This section presents a summary of the City of Florence's existing water system, including supply, storage and pumping facilities, and water system piping. Also included is a discussion of the City's existing pressure zones. Section 3 summarizes future population and water demand projections.

SECTION 3
POPULATION AND WATER REQUIREMENTS

General

This section discusses the City of Florence's (City) existing and future service areas and summarizes population projections and water demand forecasts. Population and water demand forecasts were developed for the City's recently completed Water Management and Conservation Plan (WMCP) and these forecasts have been used in this Plan. The WMCP is included as Appendix B.

Service Area

The current water service area lies entirely within the existing city limits. This area includes the Sand Pines and Ocean Dunes Golf Links which are considered undevelopable and are not included in the analysis.

Future Water Service Area Alternatives

The City considered five alternatives for their future water service area anticipating a change in service area boundaries between the City and the Heceta Water District (District) to the north. These future service area alternatives and the estimated cost per acre to serve customers within them were presented to a meeting of the City Council on May 17, 2010. A representative of the District was also present at this meeting.

The future water service area presented in this plan is a combination of Alternatives 1 and 2. Alternative 1 expanded the City's water service area into undeveloped land between the Sand Pines Golf Links to the south and city limits to the north including the proposed Sand Ranch development. Alternative 2 focused on expanding water service north on both sides of Highway 101 from the existing service area boundary to the urban growth boundary (UGB) and areas south and west of Munsel Lake Road adjacent to Florentine Estates (see Figure 1 in Appendix A).

There were three additional water service area Alternatives presented to the City Council (3, 3A and 4). Alternative 3 proposed expanding the water service area to include the Driftwood Shores Resort and Conference Center and Fawn Ridge subdivisions. These areas have been annexed into the city but continue to receive water service from the District at this time as they are isolated several thousand feet north of the City's existing water distribution system on Rhododendron Drive. Alternative 3A proposed expanding the water service area to include Driftwood Shores, Fawn Ridge and the proposed Idylwood Phase 4 subdivision on Oceana Drive between the existing service area boundary and Fawn Ridge. The extensive, large diameter piping needed to extend water service north from the City's existing distribution system to the relatively small number of customers within these areas made Alternatives 3 and 3A overly expensive.

Future service area Alternative 4 proposed expanding city water service to all land within the City's UGB. While the estimated cost per acre to serve this large expansion area was relatively low compared to the other Alternatives discussed above, the City Council decided to defer such a large expansion of the service area at this time.

The City of Florence's future water service area and the study area presented in this master plan includes land within the existing city limits, areas on either side of Highway 101 between Munsel Lake Road and the UGB and areas west and south of Munsel Lake Road near Florentine Estates. Two recently annexed areas to the north of the existing city limits, Driftwood Shores Resort and Conference Center and the Fawn Ridge subdivisions are not included in the study area and will continue to be served by the neighboring Heceta Water District for the time being.

The planning period for this master plan is 20 years, through the year 2030.

Historical Population and Water Demands

The City of Florence's historical population and water demands are taken from the City's current WMCP, which is supported by population projections from the Portland State University Population Research Center (PRC) that provides current and historical population estimates for the State of Oregon.

The term "water demand" refers to the City's total water production including; metered consumption for domestic, commercial, municipal and industrial purposes, unmetered uses, such as, fire fighting or hydrant flushing and water lost to leaks or reservoir overflow. Demands are discussed in terms of gallons per unit of time such as million gallons per day (mgd) or gallons per minute (gpm). Demands are also related to water usage per City customer as gallons per capita per day (gpcd). Estimates of the City's historical population and water demand as presented in the current WMCP are summarized in Table 3-1.

Table 3-1
Historical Population and Water Demand Summary[1]

Year	Water Service Area Population	Historical Water Demands			
		Average Day Demand (ADD)		Maximum Day Demand (MDD)	
		(mgd)	(gpcd)	(mgd)	(gpcd)
2004	7,830	1.23	157	2.32	296
2005	8,185	1.10	135	1.94	237
2006	8,270	1.23	149	2.16	261
2007[2]	8,270	1.11	135	2.17	262
2008	9,410	1.06	113	1.99	211

Note: 1. See Florence Water Management and Conservation Plan, Appendix B.
2. The population estimates are the same for 2006 and 2007 because the City did not submit data to the PRC in 2007.

Population and Water Demand Forecasts

The City of Florence's population forecasts are taken from the City's current WMCP supported by population estimates from the *Lane County Rural Comprehensive Plan: Coordinated Population Forecasts for Lane County and its Urban Areas*.

Future water demands are also taken from the current WMCP which estimates water demands using a constant per capita approach. Both population and water demand forecasts are established assuming growth will occur within the current city limits. Since the anticipated water service area expansions are relatively small as a percentage of the total service area, demand forecasts generated for the WMCP appear to be sufficient for the purposes of this master plan. In the WMCP, representative per capita water demands based on historical population and demand were determined to be:

Average Day Demand (ADD) = 120 +/- 11 gpcd
Maximum Day Demand (MDD) = 225 +/- 25 gpcd

Table 3-2 summarizes population and water demand projections as presented in the WMCP within the current city limits.

Projected Water Demand by Pressure Zone

Evaluating the size of some water system facilities requires an estimated future maximum daily water demand within a particular pressure zone. To estimate future MDD by pressure zone, the total MDD for the system is multiplied by the ratio of the pressure zone's land area to the total land area within the city limits. The Main Pressure Zone accounts for approximately 67 percent of the land area within the city limits and the North Pressure Zone

Table 3-2
Population and Water Demand Forecast Summary

Year	Water Service Area Population	Future Water Demand (mgd)	
		ADD	MDD
2010	9,783	1.2	2.2
2020	11,994	1.4	2.7
2030	14,251	1.7	3.2

accounts for approximately 33 percent of the land area within the city limits with a similar mix of residential and non-residential land uses. Due to their extremely small service areas, this land area method is not particularly effective in evaluating either the East or Ocean Dunes Pressure Zones. However, future growth is not anticipated within these pressure zones due to physical barriers such as steep slopes in the East Zone and the existing golf course and sand dunes adjacent to the Ocean Dunes Zone. Estimated future water demands by zone are summarized in Table 3-3 below. Future MDD for the entire water system was taken from the City's current WMCP, as presented in Table 3-2 above. Land areas in each Pressure Zone were approximated using City and Lane County tax lot data. The existing Sand Pines and Ocean Dunes Golf Courses as well as the City's well field were excluded from these land area calculations as they are not expected to support further development.

Table 3-3
Projected Water Demand by Pressure Zone

Year	Total Future MDD (mgd)	Approximate MDD by Pressure Zone (mgd)			
		Main	North	East	Ocean Dunes
2010	2.0	1.3	0.7	<0.1	<0.1
2020	2.7	1.8	0.9	<0.1	<0.1
2030	3.2	2.1	1.1	<0.1	<0.1

Summary

Florence's historical and projected population and water demand are taken from the current WMCP. Current MDD is approximately 2.0 mgd. MDD is estimated to increase to 3.2 mgd by the end of the planning period in 2030. The population of Florence in 2030 is estimated to be 14,251 people. Section 4 develops planning and analysis criteria for evaluating existing water system facilities based on current and projected water demands established in this section.

SECTION 4
PLANNING AND ANALYSIS CRITERIA

General

This section develops the planning and analysis criteria used for analysis of the City of Florence's (City) water system. Criteria and planning assumptions are presented for the water distribution system, service pressure goals, and storage and pumping facilities. Recommendations for emergency fire suppression flow needs are also presented. The water demand forecasts summarized in Section 3 are used in conjunction with the criteria discussed in this section for the analysis of the City's water system presented in Section 5.

Supply and Treatment Criteria

The City's supply and treatment systems should be capable of providing estimated maximum day demands (MDD) through the end of the 20-year planning period. Based on water demand estimates presented in Section 3, the supply system will need to be expanded to supply a maximum day demand of approximately 3.2 million gallons per day (mgd) in the year 2030.

As described in Section 2 the City's sole water supply is from 12 groundwater production wells located in a large well field at the base of the City's east hills. From these production facilities water is pumped to the City's Water Treatment Plant (WTP) at the southern edge of the well field site. The current total capacity of the well field is approximately 2.7 mgd. The total existing WTP capacity is approximately 3.0 mgd.

Distribution System Criteria

The water distribution system should be capable of operating within certain system performance limits, or guidelines, under several varying demand and operational conditions. The recommendations of this plan are based on the following performance guidelines, which have been developed through a review of State requirements, American Water Works Association (AWWA) acceptable practice guidelines, operational practices of similar water providers and discussions with City water system operations staff.

The recommended analysis criteria are as follows:

1. The distribution system should be capable of providing the maximum day demand while maintaining a minimum service pressure at any meter in the system of 35 pounds per square inch (psi). The system should meet this criterion with the reservoirs approximately two-thirds full.

2. The distribution system should be capable of providing the recommended fire flow to a given location while, at the same time, supplying the maximum day demand to the system and maintaining a minimum residual service pressure at any meter in the

system of 20 psi. This is the minimum water system pressure required by the Oregon State Department of Human Services Drinking Water Program. Reservoirs are assumed to be approximately two-thirds full during fire flow events.

Typically, proposed or new water mains should be at least 8 inches in diameter in order to supply minimum fire flows. In special cases, 6-inch diameter mains are acceptable if no fire hydrant connection is required, there are limited services on the main, the main is dead-ended and looping or future extension of the main is not anticipated. For areas serving existing or planned industrial, commercial and mixed use development, the minimum recommended pipe size is 12-inch diameter.

Water Service Pressures and Zones

As discussed in Section 2, water distribution systems are typically separated into pressure zones or service levels to provide water service pressures within an acceptable range to all customers. Florence's existing water service area is divided into four pressure zones. Pressure zones are established by ground topography and designated by overflow elevations of water storage facilities, outlet settings of pressure reducing facilities or discharge pressures of booster pump stations serving the zone. Typically, water from reservoirs will serve customers by gravity within a specified range of ground elevations to maintain acceptable minimum and maximum water pressures at individual service connections. When it is not feasible or practical to have a separate reservoir serving each pressure zone, pumping facilities or pressure reducing facilities are used to serve customers in different pressure zones from a single reservoir.

Generally, 100 psi is considered the desirable upper pressure limit for any pressure zone and 35 psi the lower limit. Whenever feasible, it is desirable to achieve the 35 psi lower limit at the highest fixture within a given building being served. Conformance to this pressure range may not always be possible or practical due to topographical relief, existing system configurations and economic considerations. In some areas system pressures of up to 125 psi are allowed, anticipating the need for individual pressure reducing valves (PRV's) to be installed at each service connection to help satisfy maximum pressure requirements of the Uniform Plumbing Code. Table 4-1 summarizes the service pressure criteria used in the analysis of the water system.

Table 4-1
Recommended Service Pressure Criteria

Condition	Pressure (psi)
Minimum Service Pressure Under Fire Flow Conditions	20
Minimum Normal Service Pressure	35
Maximum Preferred Service Pressure	100
Maximum Service Pressure	125

Storage Volume

Water storage facilities should be in place to provide gravity fed supply to each pressure zone except in special cases where direct pumping can be justified. Storage facilities are provided for three purposes: operational storage (or "equalization storage"), emergency storage, and fire storage. The total storage required is the sum of these three elements. A brief discussion of each element is provided below.

Operational Storage

Operational storage is required to meet water system demands in excess of delivery capacity from the WTP to system reservoirs. Operational storage volume should be sufficient to meet normal system demands in excess of the maximum day demand and is generally considered as the difference between peak hour demand and maximum day demand (on a 24-hour duration basis). For Florence's water system, operational storage volume in the amount of 25 percent of maximum day demand is considered appropriate.

Emergency Storage

Emergency storage is intended to provide water during emergencies such as pipeline failures, equipment failures, power outages or natural disasters. The amount of emergency storage for a water system can be highly variable depending upon an assessment of risk and the desired degree of system reliability. Provisions for emergency storage in other systems vary from none to a volume that would supply several day's maximum flow (MDD) or higher. Although Florence maintains emergency interties with the Heceta Water District distribution system, as discussed in Section 2, these interties cannot currently provide a consistent supplemental water supply during the peak summer season. Therefore, a reasonable volume for emergency storage in Florence's water system is approximately one MDD.

Fire Storage

Fire storage should be provided to meet the single most severe fire flow demand within each zone. The fire storage volume is determined by multiplying the recommended fire flow rate by the expected duration of that flow. Specific fire flow and duration recommendations are discussed later in this section.

Recommended system-wide storage is the sum of the operational, emergency and fire storage volume components.

Pump Station Capacity

Pumping capacity requirements vary depending on how much storage is available and the number of pumping facilities serving a particular pressure zone. Pump stations supplying constant pressure service without the benefit of storage, such as those in Florence, should have sufficient firm pumping capacity to meet the pressure zone's maximum day demand

while simultaneously supplying fire suppression flow for the largest fire flow demand in the pressure zone. Firm pumping capacity is defined as a station's pumping capacity with the largest pump out of service, the most severe emergency operating condition. All constant-pressure pump stations should also be equipped with emergency backup power generating facilities because water storage is not available to serve these areas by gravity flow alone.

Fire Flow Recommendations

While the water distribution system provides water for domestic uses, it is also expected to provide water for fire suppression. The amount of water recommended for fire suppression purposes is based on the size and duration of the anticipated fire which is typically associated with the building type or land use of a specific location within the distribution system. Fire flow recommendations are typically much greater in magnitude than the normal maximum day demand present in any local area. Adequate hydraulic capacity must be provided for these potentially large fire flow demands.

Fire protection for the City's water service area is provided by Siuslaw Valley Fire & Rescue (SVFR). SVFR has adopted fire flow requirements as defined in the 2007 State of Oregon Fire Code. Based on the state fire code, fire flow criteria adopted by similar communities and fire flow guidelines as developed by the AWWA; it is recommended that all areas with residential zoning designations provide a 1,500 gallon per minute (gpm) fire flow and that all areas with a mixed use, commercial or industrial zoning designation provide a 3,500 gpm fire flow. As discussed above, water stored for fire suppression is typically provided to meet the single most severe fire flow demand within each pressure zone. The recommended fire storage volume is determined by multiplying the fire flow rate by the duration of that flow. According to the 2007 Oregon State Fire Code, the duration for a 1,500 gpm fire flow is 2 hours and the duration for a 3,500 gpm fire flow is 3 hours. Recommended fire flows and durations are summarized in Table 4-2.

Table 4-2
Summary of Recommended Fire Flows

Zoning Description	Recommended Fire Flow Rate (gpm)	Duration (hours)
Residential[1]	1,500	2
Commercial	3,500	3
Industrial	3,500	3
Mixed Use	3,500	3

1. Residential fire flow in the East Pressure Zone is recommended to be 1,000 gpm, consistent with the Oregon State Fire Code for the development type found in this area. See discussion is Sections 5 and 6 for further explanation.

Summary

The criteria developed in this section are used to assess the system's ability to provide adequate water service under existing conditions and to guide improvements needed to provide service for future water needs. Planning criteria for the supply and treatment facilities, distribution system, service pressures and storage and pumping facilities are presented herein. Section 5 presents the analysis of the water distribution system based on the criteria provided in this section. Section 6 identifies proposed water system improvement recommendations and presents a recommended improvement program, including project cost estimates, intended for adoption as part of the City's capital improvement program (CIP).

SECTION 5
WATER DISTRIBUTION SYSTEM ANALYSIS

General

This section describes the analysis of the City of Florence's (City) water distribution system. The analysis is based on water demands presented in Section 3 and the planning and analysis criteria outlined in Section 4. This section includes an evaluation of the City's water supply, and distribution system and presents findings of a computerized hydraulic network analysis of the system. Included in the analysis is an evaluation of the system's existing pressure zones, pump stations and storage facilities. The findings and recommendations of this water system analysis are developed into a capital improvement program which is summarized in Section 6.

Water Supply and Treatment Analysis

According to the current Water Management and Conservation Plan (WMCP), the City's well field produces approximately 2.7 million gallons per day (mgd) from Wells No. 1 through No. 12. As presented in Section 3, maximum daily demands (MDD) in 2020 is forecasted to be approximately 2.7 mgd and MDD in 2030 is forecasted to be approximately 3.2 mgd. Therefore, it is recommended that the City expand the existing groundwater supply system to provide an ultimate capacity of 3.2 mgd in 2030. This is a supply increase of approximately 350 gallons per minute (gpm) (0.5 mgd). Florence holds sufficient groundwater right permits to allow production of 3.8 mgd but the existing Water Treatment Plant (WTP) capacity is limited to approximately 3.0 mgd. Figure 5-1 presents forecasted water supply needs over the 20-year planning horizon.

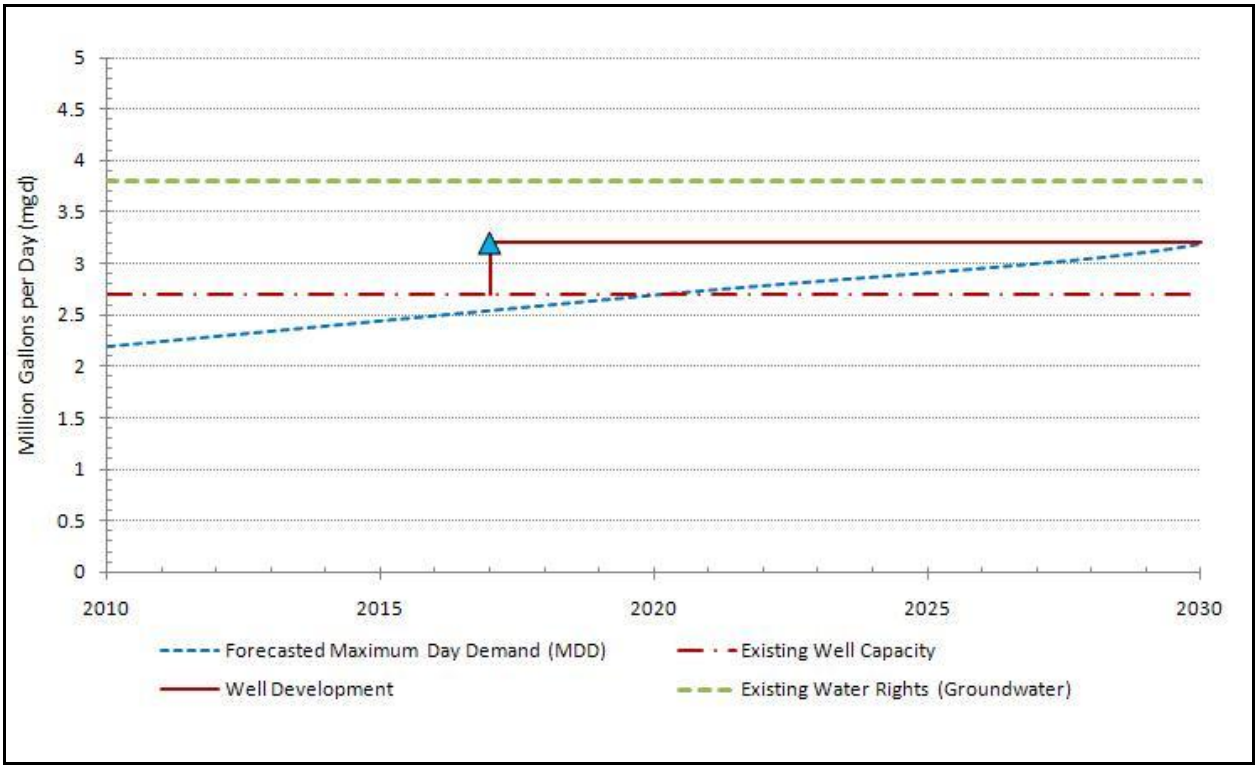
Distribution System Analysis

A hydraulic network analysis computer model was developed to evaluate the performance of the existing distribution system and to aid in the identification of proposed system improvements. The model of the City's water system uses a digital base map of the distribution system and InfoWater hydraulic network analysis software. The purpose of the model is to determine pressure and flow relationships throughout the distribution system for a variety of critical water demand and hydraulic conditions. System performance and adequacy is then evaluated on the basis of planning criteria presented in Section 4.

Hydraulic Network Analysis Model

For modeling purposes, the water distribution system was digitized onto a base map derived from geographical information systems (GIS) data provided by the City. This file and its supporting database were then used to perform the system analysis and to illustrate recommended improvements. A map of the water system is presented as "Water System Map", Figure 1 in Appendix A.

Figure 5-1
Water Supply Capacity Needs



All pipes are shown as "links" between "nodes" which represent pipeline junctions or pipe size changes. Diameter and length are specified for each pipe although only pipe diameters are illustrated for drawing clarity. Pipe lengths are drawn to approximate scale. An approximate ground elevation is specified for each node. Ground elevations were extracted from topographic data provided by the City. Hydraulic elements, such as pressure reducing valves, pump stations and reservoirs, are also illustrated and their operating parameters are incorporated into the model database.

Modeling Conditions

The analysis of the existing and proposed system was performed to assess the distribution system's ability to provide recommended fire flows throughout the system during MDD conditions. The system's adequacy under existing demand conditions was evaluated using 2008 historical water demands as presented in Section 3. The analysis was then extended to evaluate system performance under projected water demands at the end of the 20-year planning period in 2030.

Fire flow scenarios test the system's ability to provide the recommended fire flow to a given location while at the same time supplying the MDD and maintaining a minimum residual service pressure of 20 pounds per square inch (psi) at all services in the system. Fire flow

modeling assumes that the City's storage reservoirs are approximately two-thirds full and that the City's three pump stations are operating at firm capacity with the largest pump at each station out of service.

Modeling Results

Hydraulic analysis reveals insufficient fire flow capacities under both existing and future demands for residential, commercial, industrial and mixed use areas of the City. Additional hydraulic capacity is needed in the system to correct these deficiencies. As discussed later in this section, greater pumping capacity is needed to improve supply to the North Pressure Zone, particularly to meet commercial fire flow requirements along Oak Street and Highway 101 north of 35th Street. Piping improvements are also needed in the North Pressure Zone to meet residential fire flow requirements east of Highway 101. The East Pressure Zone will also require additional pumping capacity to meet residential fire flow requirements and maintain minimum pressures. While storage in the Main Pressure Zone is sufficient, piping improvements in the Main Zone will be needed to provide adequate commercial fire flow to Old Town, the Highway 101 commercial corridor and Peace Harbor Hospital.

Recommended distribution system piping improvements are shown on Figure 1 in Appendix A. Pumping and storage capacity improvements are described in the following paragraphs. Further description of recommended distribution system improvements and cost estimates for these improvements may be found in Section 6.

Pressure Zone Analysis

General

As discussed in Section 2, the City is currently divided into four pressure zones. Typically, municipal water systems are designed to normally operate at pressures ranging from 35 to 100 psi. The City's existing pressure zone configuration supplies water effectively within these pressure ranges.

North Pressure Zone

As discussed in Section 2, the North Pressure Zone is served by a continuous operation pump station without the benefit of gravity storage facilities. The pumping analysis presented later in this section identifies a need for expansion of the pump station serving this pressure zone to meet future system demands and the large industrial fire flow requirement for areas of the pressure zone. Given the size of the zone and the magnitude of system demands and fire flow requirements the City should plan to develop emergency supply facilities for this zone. Two approaches to improve fire flow availability and to provide emergency supply to the area are to develop gravity storage to serve this zone, or consider developing an automated emergency intertie with Heceta Water District (the existing intertie is a normally closed isolation valve).

Recommendations for development of intertie facilities in the short-term and long-term storage improvements are presented in Section 6.

Ocean Dunes Pressure Zone

Current planning for the Ocean Dunes Planned Unit Development (PUD) located southwest of the intersection of Munsel Lake Road and North Fork Road, illustrated on Figure 1 in Appendix A, includes connection of the distribution system facilities to serve this development to the existing Ocean Dunes Pressure Zone. This would require capacity upgrades to and likely replacement of the existing Ocean Dunes Pump Station. Alternatively, the Ocean Dunes PUD area can be served effectively as part of the Main Pressure Zone, although static pressures will be lower than those in the existing Ocean Dunes Pressure Zone. For the purposes of this analysis, it is assumed that water service elevations in the Ocean Dunes PUD will not exceed approximately 80 feet as significant excavation of the sand dune should result in lower elevations at the high point of the development than currently exist. This assumption should be confirmed as detailed plans are developed for the PUD. It is recommended that the existing Ocean Dunes Pressure Zone, served solely by the Ocean Dunes Pump Station maintain its existing boundary.

Pump Station Capacity Analysis

General

Florence's existing water system includes three booster pump stations, Sand Pines, 31st Street/East and Ocean Dunes. These stations serve customers in the three higher-elevation pressure zones, North, East and Ocean Dunes respectively. Two of these pump stations, Sand Pines and 31st Street/East draw their suction supply from an adjacent finished water storage reservoir. The third pump station, Ocean Dunes, draws suction supply from the distribution system and supplies customers in the Ocean Dunes Pressure Zone; a small residential community around the Ocean Dunes Golf Links.

The three pressure zones served by booster pump stations in the Florence system do not have storage facilities that supply the zone by gravity and can therefore, not be served except through pumping. Firm pumping capacity equal to the MDD for the zone plus the largest anticipated fire flow for the zone is recommended. As outlined in Section 4, firm pumping capacity is defined as a pump station's capacity with the largest pump out of service.

Maximum day demand for the North pressure zone was established in Section 3 using the ratio of the North Zone's land area to the total land area within the City's service area accounting for actual and anticipated development densities. As discussed in Section 3, future growth is not anticipated within the East or Ocean Dunes pressure zones due to physical barriers such as steep slopes in the East Zone and the existing golf course and sand dunes adjacent to the Ocean Dunes Zone. The recommended firm pumping capacities of the East and Ocean Dunes Zones are equal to the largest fire flow demand for each zone plus

MDD. Recommended firm pumping capacities for each booster pump station are summarized in Table 5-1 below.

Sand Pines Pump Station

The existing firm capacity of the Sand Pines Pump Station is insufficient to supply either the North Zone's largest anticipated fire flow or the zone's MDD in 2030. Replacing the existing pump station is recommended in order to provide the required demand and fire capacity to the North Zone. If the land in the North Pressure Zone continues to develop, or if the City extends future service further into the UGB, it is recommended that the City consider building a storage reservoir to serve customers by gravity and provide fire storage. However, due to the topography in the North Zone this new reservoir would either need to be an elevated tank, or a ground level tank located at an elevation that would also require transmission piping, and such construction is significantly more costly than replacing the Sand Pines Pump Station. If a reservoir is constructed to serve the North Zone, the Sand Pines Pump Station will still need to be expanded to meet the zone's 764 gpm (1.1 mgd) MDD in 2030 even with the much larger fire suppression needs being fulfilled by the new reservoir. In the short term, it is recommended that the Sand Pines Pump Station be replaced to supply required fire flows to the North Zone with a future reservoir to be considered as required for future development.

Table 5-1
Pumping Capacity Recommendation Summary

Pump Station / Pressure Zone	Estimated Firm Capacity (gpm)	Largest Fire Flow (gpm)	MDD (gpm)			Total Recommended Firm Capacity 2030 (gpm)	Additional Firm Capacity Needed (gpm)
			2010	2020	2030		
Sand Pines / North	580	3,500	486	601	764	**4,264**	**3,684**
31st Street / East	900	1,500[1]	<0.1	<0.1	<0.1	**1,600**	**700**
Ocean Dunes	250	1,500	-	-	-	**1,500**	**1,250**

1. Please see discussion below for alternative fire flow recommendations in the East Pressure Zone.

31st Street/East Pump Station

The 31st Street Pump Station is also insufficiently sized to supply a 1,500 gpm fire flow to the East Pressure Zone. In order to achieve a 1,500 gpm fire flow, expansion of the pump station to provide a firm capacity of approximately 1,600 gpm is needed. In addition, a 1,500 gpm fire flow cannot be transmitted through the existing 6-inch diameter water mains in this zone. Replacement of approximately 3,000 feet of 6-inch diameter mains with new 8-inch

and 12-inch diameter mains is required to achieve a 1,500 gpm fire flow throughout this pressure zone.

As no further development is expected in this zone and existing development is composed of single-family residential homes with building square footages less than 3,600 square feet, it is recommended that the City allow a reduced fire flow requirement of 1,000 gpm in the East Pressure Zone. This is the fire flow required by the 2007 Oregon State Fire Code for single family residential development with homes under 3,600 square feet. The existing pump station is capable of supplying an approximately 1,000 gpm fire flow throughout the zone with all pumps in service; however, it is recommended that the pump station be upgraded to a firm capacity of 1,100 gpm. Any future development, or redevelopment, in this area should then be restricted to a building construction type and size that does not require a fire flow of greater than 1,000 gpm.

It is further recommended that the 31st Street Pump Station be retrofitted with variable frequency drives (VFDs) to allow the station to effectively pump at lower flow rates to meet system demands during periods of low water usage. This function was previously performed by a hydropneumatic tank at the pump station. This tank has been taken out of service due to failure of the interior bladder separating the air and water chambers in the tank.

Ocean Dunes Pump Station

While the Ocean Dunes Pump Station is undersized to meet residential fire flow requirements within this pressure zone, analysis of the City's water system indicates that customers in the Ocean Dunes Pressure Zone could be served from the Main Pressure Zone if needed in an emergency. Although service pressures would be somewhat lower than those supplied by the Ocean Dunes Pump Station, pressure would be sufficient to meet minimum criteria established in Section 4. In order to meet fire flow demands in Ocean Dunes, the existing normally closed valve at Onadoone Court where it meets the 10-inch diameter distribution main connecting the WTP with the east hills could be replaced with a check valve which would open to meet a large fire demand in Ocean Dunes. This check valve would remain closed under normal demand conditions preserving existing service pressures within the Ocean Dunes Pressure Zone.

Back-up Power

All constant-pressure pump stations should also be equipped with emergency backup power generating facilities because gravity supply from storage is not available to serve these zones in case of a power outage. The Sand Pines Pump Station, which serves the largest number of customers, has an existing back-up generator. The Ocean Dunes Pump Station does not have available space for a back-up generator but can be served from the Main Pressure Zone in an emergency as described above. The 31st Street Pump Station should be equipped with a standby generator.

Section 6 describes recommended improvements to meet pumping capacity needs.

Storage Volume Analysis

As discussed in Section 4, the total volume of storage required for the City's distribution system includes operational storage, emergency storage and storage for fire suppression. Operational storage volume should be sufficient to supply demand fluctuations throughout the day resulting from typical customer water use patterns, 25 percent of MDD is a sufficient volume for the purposes of this plan. Emergency storage is provided to supply water during emergencies such as pipeline failures, power outages or natural disasters. A reasonable volume for emergency storage is approximately one MDD. Fire storage is provided to meet the single most severe fire flow demand within the service area.

Table 5-2 illustrates the individual storage components and combined storage needs recommended for operational, fire and emergency purposes under 2008 demand conditions and projected demands in the years 2010, 2020 and 2030. Existing storage capacity does not include the elevated steel Spruce Street Reservoir which is currently out of service. Even without the Spruce Street Reservoir, the City's existing storage capacity is sufficient to meet projected demand through 2020 with a relatively small deficiency developing by 2030.

While overall storage capacity in Florence's system is sufficient, additional development in the North Pressure Zone will increase the risk of reduced levels of service due to a mechanical failure or other emergency involving the Sand Pines Pump Station, the single source of supply to this zone. Improvement of the existing interties with the Heceta Water District, including construction of facilities to allow automated operation of these interties, will provide supply redundancy to the North Pressure Zone in an emergency. The City may wish to consider building a storage reservoir to serve customers by gravity and provide fire storage to the North Zone. Due to the topography in the North Zone this new reservoir would either need to be an elevated tank within the zone, or a ground level tank at an approximate ground elevation of 210 feet with transmission piping to connect to the distribution system. Reservoir construction is likely significantly more costly than expanding the Sand Pines Pump Station as recommended above. This future reservoir should only be considered as future expanded development warrants.

As stated above, the existing Spruce Street Reservoir is not needed to meet overall storage volume recommendations for the Florence Water System. Furthermore, bringing this reservoir back on-line may present some challenges. Based on conversations with City public works staff, information about this 1948 reservoir is limited but there is some consensus that the reservoir may have a lower overflow elevation than the Sand Pines and 31st Street/East Reservoirs which may cause rapid changes in reservoir level and frequent reservoir overflows. The reservoir would also likely require seismic retro-fitting and coating improvements. It is recommended that the City keep this reservoir off-line and plan to dismantle it in the long term. No additional storage need is anticipated in the 20-year

planning horizon unless the City expands service to a large number of new customers north of the current service area.

Table 5-2
Storage Volume Recommendation Summary

Year	Storage Components (MG)			Recommended Total Storage (MG)	Existing Storage (MG)	Storage Deficiency (MG)
	Operating	Fire	Emergency			
2008	0.5	0.6	2.0	3.1	4.5	--
2010	0.6	0.6	2.2	3.4	4.5	--
2020	0.7	0.6	2.7	4.0	4.5	--
2030	0.8	0.6	3.2	4.6	4.5	0.1

Note: 1. Largest fire flow demand is assumed to be industrial/commercial/mixed use at 3,500 gpm for a duration of 3 hours. See Table 4-2.

The roof and rafter system of the existing 31st Street/East Reservoir is showing evidence of extensive coating failure and corrosion. In order to preserve this facility, protect water quality, and maintain the storage volume in this reservoir, this deficiency should be addressed. According to comments from City staff, it can be challenging to maintain required chlorine residuals in the East Pressure Zone. This is likely due to poor mixing in the reservoir and relatively slow water turnover from the small number of customers and water demands within the zone. It is recommended that a mixing system be installed in the 31st Street/East Reservoir in coordination with roof and rafter work.

Summary

This section presented an analysis of the City's water distribution system. Recommended piping, pump station and reservoir improvements discussed in this section are illustrated on Figure 1 in Appendix A. These facility improvements are needed to correct existing system deficiencies and to serve the City's projected water demand in 2030. Section 6 presents recommended capital improvements and estimates of project costs.

SECTION 6
RECOMMENDATIONS AND CAPITAL IMPROVEMENT PROGRAM

General

This section presents recommended water system improvements based on the analysis and findings presented in Section 5. These recommendations include proposed supply, treatment, storage reservoir, booster pump station and water line improvements. Also presented is a capital improvement program (CIP) schedule for recommended improvements. Proposed system improvements are illustrated on Figure 1 in Appendix A.

Cost Estimating Data

An estimated project cost has been developed for each improvement project recommendation presented in this section. Cost estimates represent opinions of costs only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedule and other factors. The American Association of Cost Engineers (AACE) classifies cost estimates depending on project definition, end usage and other factors. The cost estimates presented here are considered Class 4 with an end usage being a study or feasibility evaluation and an expected accuracy range of -30 percent to +50 percent. As the project is better defined the accuracy level of the estimates can be narrowed. Itemized project cost estimate summaries are presented in Appendix C. This appendix also includes a cost data summary for recommended water main improvements developed on a unit cost basis. Estimated project costs include approximate construction costs and an allowance for administrative, engineering and other project related costs.

The estimated costs included in this plan are planning level budget estimates presented in 2010 dollars. Since construction costs change over time, an indexing method to adjust present estimates in the future is useful. The Engineering News Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. For purposes of future cost estimate updating; the recent ENR CCI for Seattle, Washington is 8647 (February 2010).

Recommended System Improvements

Capital Improvement Program Funding

Presented below are recommended water system improvements for water supply, pump stations, storage reservoirs and distribution system piping. Project cost estimates are presented for all recommended improvements. It is recommended that the City's water system capital improvement program be funded at approximately 750,000 dollars annually for the next five years. As this plan is updated annual funding amounts should be revisited. Since the costs for certain water system improvements may exceed this amount, the proposed

improvements listed in Table 6-5 are phased and sequenced so that the annual capital requirement for water system improvements is distributed over the 20-year planning horizon.

Water Supply Improvements

It is recommended that the City expand the existing groundwater supply system by approximately 350 gallons per minute (gpm) (0.5 million gallons per day (mgd)) in order to provide a total supply capacity of 3.2 mgd at the end of the 20-year planning horizon in 2030. As discussed in Section 5, the City's projected maximum day demand (MDD) in 2020 will require all of the City's existing 2.7 mgd supply capacity, thus supply expansion is recommended between 2015 and 2020. The City holds sufficient groundwater rights to allow production of 3.8 mgd from existing and future wells. Existing Water Treatment Plant (WTP) capacity is limited to approximately 3.0 mgd, thus further study is recommended to identify potential options for treating the recommended supply expansion. For the purposes of this plan it is assumed that the City will develop two new supply wells and associated treatment facilities. The proposed treatment facilities should be designed to accommodate future upsizing to allow treatment capacity to be expanded as needed beyond the 20-year planning horizon.

It is understood from previous work by the City that conditions in Florence's aquifer, including high concentrations of naturally occurring iron and fine sand reduce well productivity over time due to well screen clogging caused by iron bacteria and sediment. Existing Well Nos. 1 and 4 were previously identified by City staff as needing rehabilitation in order to remove well screen clogging and restore well production capacity. This work was established by the City as part of an annual well rehabilitation program with an annual budget of 45,000 dollars that is included in the CIP presented herein.

The need for an emergency power generator to operate the WTP and supply wells was previously identified by the City. A subsequent analysis by the City concluded that an approximately 300 kilowatt (kW) emergency power generator would be capable of operating the WTP facilities and Well Nos. 1 through 12, all of the existing groundwater production capacity. It is recommended that an emergency power generator be installed at the existing WTP. The cost to install a 300 kW generator at the WTP is estimated at approximately 120,000 dollars.

Pump Station Capacity

31st Street / East Pump Station

In order to supply the recommended residential fire flow of 1,500 gpm to the East Pressure Zone, the 31st Street/East Pump Station must be expanded to a firm capacity of approximately 1,600 gpm and approximately 3,000 feet of 6-inch diameter main will need to be replaced with 8-inch and 12-inch diameter water mains. The estimated project cost of expanding the 31st Street/East Pump Station to deliver a 1,500 gpm fire flow is

approximately 120,000 dollars and the cost of replacing the 6-inch diameter mains in the East Pressure Zone is estimated at approximately 329,000 dollars. The total project cost to provide 1,500 gpm fire flow to the East Pressure Zone is approximately 449,000 dollars.

As discussed in Section 5, the East Pressure Zone is fully developed and the existing development in the pressure zone is composed of single-family residential structures with a building area of less than 3,600 square feet. According to the 2007 Oregon State Fire Code requirements, residential structures of this type and size require an available fire flow capacity of only 1,000 gpm. The existing 6-inch diameter water mains are capable of delivering this 1,000 gpm fire flow. The 31st Street/East Pump Station would need to be expanded to a firm capacity of approximately 1,100 gpm in order to deliver a 1,000 gpm fire flow with the largest pump out of service (firm capacity). The estimated project cost of expanding the 31st Street/East Pump Station is approximately 35,000 dollars. This is the total estimated cost required to deliver 1,000 gpm fire flow to the East Pressure Zone.

Due to the existing development conditions in the East Pressure Zone, with fully-developed single family homes under 3,600 square feet, and the requirements of the 2007 Oregon State Fire Code, it is recommended that the City consider providing a minimum fire flow of 1,000 gpm in the East Pressure Zone. The required 31st Street/East Pump Station upgrades to achieve this fire flow are recommended for completion in the immediate term prior to 2015. It is further recommended that the City take action to ensure that future development, or redevelopment, in this zone remains single-family residential structures that do not exceed 3,600 square feet unless further water system improvements are made.

It is further recommended that the 31st Street/East Pump Station be retrofitted with variable frequency drives (VFDs). This will help prevent the frequent cycling of pumps on and off for small demands within the zone which began after the failure of the station's hydropneumatic tank. The project cost for renovating the pumps with VFDs is approximately 100,000 dollars and it is recommended that this improvement be completed in the next five years. The 31st Street/East Pump Station should also have a standby power generator to power the station in an emergency. Project costs for installing a standby generator are approximately 20,000 dollars. Generator installation is recommended as an immediate improvement to be completed in the next five years.

Ocean Dunes Pump Station

While the Ocean Dunes Pump Station is undersized to meet residential fire flow requirements within this pressure zone, it is not feasible to add an additional pump to the existing Hydronix package pump station. To meet residential fire flow requirements in this zone, it is recommended that the City install a check valve vault to bypass the normally closed valve at the south end of Onadoone Court. Under fire flow conditions in the Ocean Dunes Pressure Zone, the check valve will open to allow supply to flow from the Main zone into the Ocean Dunes zone. The hydraulic grade in the Main Pressure Zone is only slightly lower than that of Ocean Dunes and the water distribution system analysis indicates that a check valve

connection between these two zones would improve minimum service pressures under fire flow conditions. Project cost for installing the check valve, vault and associated piping is approximately 76,000 dollars. This improvement is recommended as an immediate improvement to be completed in the next five years.

North Zone Pump Station Replacement and Emergency Supply

The North Pressure Zone is supplied directly from the Sand Pines Pump Station with no gravity feed from storage facilities and cannot currently be served except through pumping. With the existing configuration of this zone, the pump station requires a firm pumping capacity equal to the zone's MDD plus the zone's largest anticipated fire flow, a total of 4,350 gpm (approximately 6.24 mgd) in 2030. As discussed in Section 5, the existing firm capacity of the Sand Pines Pump Station is insufficient to supply either the zone's largest anticipated fire flow or the zone's MDD in 2030. It is recommended that the Sand Pines Pump Station be replaced with a new pump station with a firm capacity of 4,350 gpm to meet MDD plus 3,500 gpm commercial fire flow demands in the North Zone. The estimated project cost for replacing the Sand Pines Pump Station is approximately 1.5 million dollars. This improvement should be considered a short-term improvement, to be completed in the next ten years, unless commercial and industrial development occur sooner requiring expanded facilities at an earlier date.

In order to improve supply reliability to this pressure zone and address near-term deficiencies it is recommended that the City evaluate the potential to develop an automated intertie facility with the Heceta Water District. This intertie would be an upgrade of the existing 10-inch diameter, manually operated, emergency intertie on Highway 101 near Munsel Lake Road. A budget of 100,000 dollars is included for this improvement.

Finished Water Storage

31st Street/East Reservoir

Based on conversations with City staff and related observations, there is significant corrosion to the steel roof and rafters at the 31st Street/East Reservoir. It is recommended that the reservoir roof, rafters and column support be replaced in the next five years. The estimated project cost for replacing the roof is 150,000 dollars. According to comments from City staff, it can be challenging to maintain required chlorine residuals in the East Pressure Zone. This is likely due to poor mixing in the reservoir and relatively slow water turnover from the small number of customers and water demands within the zone. It is recommended that a mixing system be installed in the 31st Street/East Reservoir in coordination with roof, rafter and column replacement. The estimated project cost of installing a mixing system in the existing reservoir is approximately 60,000 dollars.

Future North Reservoir

As the North Pressure Zone continues to develop in the long term, a new storage reservoir should be considered to provide gravity supply for the zone and to provide fire suppression storage for existing and anticipated commercial and industrial customers. Adhering to the storage criteria outlined in Section 4, this proposed North Zone Reservoir would provide storage capacity equivalent to 100 percent of the zone's projected MDD for emergencies, plus 25 percent of the zone's projected MDD for operational storage and the zone's largest required fire flow (3,500 gpm) for a duration of 3 hours. Given the low risk of an emergency occurring during MDD with a simultaneous fire flow it is recommended that a future reservoir to serve the North Pressure Zone be sized to only provide operational storage plus adequate capacity for fire flow. Using this approach, the total recommended storage capacity for the proposed North Zone Reservoir is approximately 1.0 million gallons (MG).

As discussed in Section 5, a future North Zone Reservoir will need to be either an elevated reservoir or a ground level reservoir located some distance to the east, where ground elevations are higher, with transmission piping to connect to the distribution system. Site planning for an elevated reservoir would also require careful coordination with the Florence Realization 2020 Comprehensive Plan policies as they relate to view corridors within the City. The proposed North Reservoir's estimated project cost is approximately 2.2 million dollars, assuming an elevated reservoir is constructed close to the distribution system. Itemized project cost estimate summaries are presented in Appendix C. This improvement should be considered a long term improvement beyond the 20-year planning horizon unless the City extends water service north to a large number of new customers making continued service with a continuous operation pump station less desirable.

Distribution System Piping Improvements

The water system analysis found that extensive distribution water main improvements are needed to provide sufficient fire flow capacities and accommodate system expansion. Each of these water line improvements is detailed below including a recommended timeframe for project completion.

Transmission Loop from Old Town to 35th Street via Kingwood, Redwood and Spruce

This extensive pipe replacement project will provide capacity to meet commercial fire flow needs in Old Town, along Hwy 101 between Old Town and Sand Pines and at the Peace Harbor Hospital. It improves transmission from both the Sand Pines Reservoirs and the WTP. Each item below is a potential phase of the approximately 3.7 million dollar total project.

Phase 1: Immediate – WTP through Old Town to Kingwood

1. Replace approximately 1,700 LF of 10-inch diameter WTP outlet piping from Willow Street east to Spruce Street with 16-inch lines
2. Replace approximately 5,000 LF of 10-inch diameter pipe on Spruce Street from north of 24th Street south to Highway 126 with 16-inch lines
3. Replace approximately 700 LF of 10-inch diameter piping on Highway 126 between Spruce and Quince Streets with 16-inch lines
4. Replace approximately 3,100 LF of 6-inch diameter piping on Quince and 2nd Streets between Highway 126 and Maple Street with 16-inch lines
5. Construct a 16-inch diameter, approximately 700 LF crossing under Highway 101 on 2nd Street between Maple and Kingwood Streets

Phase 2: Short-Term – Kingwood from Old Town north to 35th

6. Replace approximately 2,200 LF of 4-inch and 6-inch diameter piping on Kingwood Street between 2nd Street and 9th Street with 16-inch lines
7. Replace approximately 3,600 LF of 6-inch and 8-inch diameter piping on Kingwood Street between 9th and 20th Streets with 12-inch lines
8. Replace approximately 4,100 LF of 10-inch diameter piping on Kingwood Street between 20th Street and Pacific View Drive with 12-inch lines

Phase 3: Medium-Term – Complete loop from 35th to WTP

9. Replace approximately 3,600 LF of 10-inch diameter piping on Redwood Street between 35th Street and 25th Street and on 25th Street between Redwood and Spruce Streets with 12-inch lines

Old Town – Bay Street Loop

This pipe replacement project, in conjunction with the transmission loop discussed above will provide improved fire flow to businesses in Old Town, as well as provide capacity for anticipated redevelopment in this area and replace aging and undersized water mains.

10. Replace approximately 800 LF of 6-inch diameter piping on Nopal Street between 2nd and Bay Streets with 12-inch lines
11. Replace approximately 1,400 LF of 6-inch diameter piping on Bay Street between Nopal and Kingwood Streets with 12-inch lines
12. Replace approximately 400 LF of 6-inch diameter piping on Bay Street between Kingwood and Juniper Streets with 8-inch line
13. Construct approximately 700 LF of 12-inch diameter piping on Kingwood Street between Bay and 2nd Streets
14. Replace approximately 650 LF of 6-inch diameter piping from 1st Street at Harbor Street east into the Port of Siuslaw Campground with 12-inch lines

It is recommended that the Old Town – Bay Street Loop be completed as an immediate improvement (2010-2014).

Highway 101 Westside Loop – 9th to 15th Streets

15. Replace approximately 2,200 LF of 6-inch diameter piping on 15th Street/Airport Road between Kingwood Street and Highway 101 with 12-inch lines
16. Construct approximately 2,100 LF of 12-inch diameter piping on Highway 101 between 9th and 15th Streets replacing 6-inch piping between 10th and 14th Streets
17. Construct approximately 1,500 LF of 12-inch diameter piping on 9th Street between Kingwood Street and Highway 101

It is recommended that the Highway 101 Westside Loop be completed as a short-term improvement (2015-2019).

Rhododendron Drive – 9th Street Loop

These piping improvements will increase fire flow availability to Peace Harbor Hospital and nearby commercial zones.

18. Construct approximately 1,200 LF of 16-inch diameter piping on Rhododendron Drive between Greenwood and Kingwood Streets
19. Replace approximately 3,300 LF of 8-inch diameter piping on Rhododendron Drive between Greenwood and 9th Streets with 16-inch lines
20. Replace approximately 3,300 LF of 8-inch diameter piping on 9th Street between Rhododendron Drive and Kingwood Street with 16-inch lines

It is recommended that the Rhododendron Drive – 9th Street Loop be completed as a medium-term improvement (2020-2030).

North Highway 101 Improvements for Commercial Fire Flow in North Zone

21. Replace approximately 700 LF of 8-inch diameter piping on 37th Street between Oak Street and Highway 101 with 12-inch lines
22. Replace approximately 4,100 LF of 10-inch diameter asbestos cement (AC) piping on Highway 101 between 37th Street and Munsel Lake Road with 12-inch lines

It is recommended that these north Highway 101 piping improvements for increased commercial fire flow availability be completed as a medium-term improvement (2020-2030).

Local Piping Improvements for Commercial Fire Flow in Main Zone

23. Replace approximately 1,000 LF of 6-inch diameter piping on 30th Street between Oak and Redwood Streets with 12-inch lines
24. Replace approximately 1,500 LF of 8-inch diameter piping on 27th Street between Kingwood and Oak Streets with 12-inch lines
25. Replace approximately 2,900 LF of 6-inch diameter piping on Airport Way between 20th Street and the dead end with 12-inch lines
26. Extend proposed 12-inch diameter main on Airport Way approximately 350 LF north to meet proposed 12-inch main on 27th Street
27. Construct approximately 1,300 LF of 8-inch diameter piping in the Oak Street right-of-way between 15th and 17th Streets and between 18th and 20th Streets
28. Replace approximately 1,000 LF of 6-inch diameter piping on 11th Street between Spruce Street and the Coastal Highlands Drive alignment with 12-inch lines
29. Replace approximately 1,700 LF of 6-inch diameter piping on 10th Street between Kingwood Street and Highway 101 with 8-inch lines
30. Replace approximately 2,100 LF of 6-inch diameter piping on 12th Street between Kingwood Street and Highway 101 with 8-inch lines
31. Replace approximately 800 LF of 6-inch diameter piping at Lane Community College between 30th and 31st Streets west of Oak with 12-inch lines

It is recommended that these local piping improvements for increased commercial fire flow availability be completed as a medium-term improvement (2020-2030).

Local Piping Improvements for Residential Fire Flow in Main Zone

32. Replace approximately 500 LF of 6-inch diameter piping on W 11th Street between Alder Court and Rhododendron Drive with 8-inch lines
33. Replace approximately 700 LF of 6-inch diameter piping on Wildwinds Street and Riverview Lane west of Rhododendron Drive with 8-inch lines
34. Replace approximately 1,300 LF of 6-inch diameter piping on 12th Street and Coastal Highlands Drive between Spruce Street and Primrose Lane with 8-inch lines
35. Replace approximately 800 LF of 6-inch diameter piping on Coastal Highlands Drive between Yew and Zebrawood Streets with 8-inch lines
36. Replace approximately 700 LF of 6-inch diameter piping on Yew Street south of Coastal Highlands Drive with 12-inch line
37. Replace approximately 1,100 LF of 6-inch diameter piping on Maple Street north of 15th Street with 8-inch line
38. Replace approximately 2,100 LF of 6-inch diameter piping on Willow Loop and East Willow Loop east of Willow Street with 8-inch line

It is recommended that these local piping improvements for increased residential fire flow availability be completed as a long-term improvement (beyond 2030).

Ocean Dunes Pressure Zone Fire Flow Improvements

In order to augment fire flow in the Ocean Dunes Pressure Zone and provide for long-term development within the Urban Growth Boundary (UGB) adjacent to the Ocean Dunes Golf Links, it is recommended that a 12-inch diameter water main be extended approximately 3,100 LF from Munsel Creek Loop in the North Pressure Zone east to Ocean Dunes Drive where a check valve will allow flow into Ocean Dunes from the North Pressure Zone in an emergency.

As development occurs in this area it is further recommended that this 12-inch water main be extended approximately 300 LF to the Main Pressure Zone at Munsel Lake Road with a pressure reducing valve (PRV) to control pressure supplied to the Main Zone.

39. Build an approximately 3,100 LF of 12-inch diameter water main extension from Munsel Creek Loop at 37th Street east to Ocean Dunes Drive
40. Construct approximately 400 LF of 8-inch diameter water main between Munsel Creek Loop water main extension described above and proposed check valve at the north end of Ocean Dunes Drive
41. Construct approximately 300 LF of 12-inch diameter water main between the north end of Ocean Dunes Drive and Munsel Lake Road

It is recommended that the Ocean Dunes pressure zone distribution system improvements be completed as a long-term improvement (beyond 2030).

Piping Improvements to Serve Potential Development in Main and North Zones

There are several large areas of land within Florence's water service area that have potential for future development but are not currently served by water distribution mains. Following are the recommended major distribution mains to serve these areas. It is anticipated that these water mains will be constructed as needed for development and that their construction will be funded in part by the developer.

42. Construct approximately 3,600 LF of 8-inch diameter piping across the northern boundary of the Sand Pines Golf Course between existing water mains east of Rhododendron Drive and Oak Street
43. Extend the water main in Pacific View Drive west with approximately 1,500 LF 12-inch diameter piping to Rhododendron Drive
44. Replace approximately 500 LF of 8-inch diameter piping on 27th Street west of Kingwood Street with 12-inch line
45. Extend 27th Street water main approximately 2,200 LF west to Rhododendron Drive with 12-inch line
46. Extend Park Village Drive water main north approximately 3,300 LF from the Greentrees Village northern boundary to Pacific View Drive with 12-inch line. Tie-in to 27th Street water main extension described above.

47. Extend Manzanita and Southridge Drive water mains with approximately 1,800 LF of 8-inch diameter line south from existing dead-ends to connect with the proposed east-west 12-inch line between the North and Ocean Dunes Pressure Zones
48. Extend proposed 12-inch diameter main from the Heceta Water District intertie on Highway 101 at Munsel Lake Road approximately 3,400 LF north just past Heceta Beach Road, then approximately 800 LF east to Spruce Street
49. Extend 12-inch diameter main on Spruce Street at 52nd Street approximately 1,800 LF north to meet the proposed 12-inch line at Spruce Street just north of Heceta Beach Road
50. Extend proposed 12-inch diameter main on Highway 101 just north of Heceta Beach Road approximately 900 LF north to the future water service area boundary, then approximately 700 LF east to Spruce Street
51. Extend 12-inch diameter main on Spruce Street just north of Heceta Beach Road approximately 900 LF north to meet the proposed 12-inch line at the northern future water service area boundary
52. Construct approximately 700 LF of 12-inch from Fred Meyer on the west side of Hwy 101 north to the proposed Munsel Lake Village development
53. Construct approximately 1,900 LF of 12-inch diameter main from Hwy 101 at Munsel Lake Road west to the proposed Sand Ranch development
54. Construct approximately 3,400 LF of 12-inch diameter main on Munsel Lake Road from Spruce Street to Munsel Lane
55. Construct approximately 900 LF of 8-inch diameter main on Munsel Lane from Munsel Lake Road to Manzanita Drive
56. Construct approximately 3,300 LF of 12-inch diameter main on Munsel Lake Road from Munsel Lane to connect to existing piping near Waterford Downs

It is recommended that these piping improvements be completed as development occurs in the surrounding land. They are included in the CIP as long-term improvements (beyond 2030).

Annual Water Main Replacement Program

It is recommended that the City continue a program of replacing aging asbestos cement piping and undersized water mains. Funding for this program should be approximately 50,000 dollars annually.

Distribution System Piping Improvement Summary

The total cost for recommended distribution piping improvements through the 20-year planning period is approximately 8.3 million dollars with an additional 4.9 million dollars in piping improvements recommended beyond the year 2030. Tables 6-1 through 6-4 summarize the transmission and distribution system piping improvements described above in order of priority.

Additional Recommendations

It is recommended that additional engineering studies be conducted to advance the planning work completed in this master plan. The City completed a cost-of-service (water rate) analysis in 2009 and anticipates conducting a System Development Charge (SDC) analysis upon completion of this master plan. Updates to the existing Water Management and Conservation Plan as well as this master plan will also be required within the 20-year planning horizon.

Financial Evaluation and Plan

A long-term financial planning evaluation and strategy is required to support the recommended capital improvement program. Revenue generated from water rates and system connection fees is typically used to fund operating and maintenance costs, renewal and replacement costs of existing facilities and capital improvement projects. Adequate SDCs should be established to collect funds from new customers to pay for improvements that expand the capacity of the system without placing an undue burden on existing customers. It is recommended that approximately 20,000 dollars be budgeted in the next five years to complete the SDC study and 20,000 dollars every five years after that to review and update the financial plan including the water rate and SDC analyses.

Planning Updates

The City should plan for future updates of this Water System Master Plan and the Water Management and Conservation Plan. The Water System Master Plan should be updated every ten years at a minimum, and more frequently if significant changes occur in the system, such as an expansion of the water system service area. A progress report must be submitted every five years for the Water Management and Conservation Plan, with full update of the plan required every ten years.

Water System Capital Improvement Program

A summary of all the recommended improvements identified in this plan is presented in Table 6-5 which provides for project sequencing by showing prioritized immediate, short, medium and long-term recommendations. Immediate recommendations are those suggested to be completed in the next one to five years, short-term in the next six to 10 years, medium-term in the next 11 to 20 years and long-term beyond 20 years in the future. Estimated project costs are also summarized in Table 6-5.

Table 6-1
Recommended Immediate Distribution Piping Improvements

CIP No.	Location	From	To	Diameter (inches)	Length (lf)	Estimated Project Cost
Immediate Improvements (2010 - 2014)						
1	WTP Outlet Piping	Willow Street	Spruce Street	16	1,700	$300,000
2	Spruce Street	north of 24th Street	Highway 126	16	5,000	$880,000
3	Highway 126	Spruce Street	Quince Street	16	700	$124,000
4	Quince and 2nd Streets	Highway 126	Maple Street	16	3,100	$546,000
5	2nd Street	Maple Street	Kingwood Street	16	700	$124,000
10	Nopal Street	2nd Street	Bay Street	12	800	$98,000
11	Bay Street	Nopal Street	Kingwood Street	12	1,400	$171,000
12	Bay Street	Kingwood Street	Juniper Street	8	400	$40,000
13	Kingwood Street	Bay Street	2nd Street	12	700	$86,000
14	1st Street	Harbor Street	Port of Siuslaw Campground	12	650	$80,000
Immediate Piping Improvements Total						**$2,449,000**

Table 6-2
Recommended Short-Term Distribution Piping Improvements

CIP No.	Location	From	To	Diameter (inches)	Length (lf)	Estimated Project Cost
Short-Term Improvements (2015 - 2019)						
6	Kingwood Street	2nd Street	9th Street	16	2,200	$388,000
7	Kingwood Street	9th Street	20th Street	12	3,600	$440,000
8	Kingwood Street	20th Street	Pacific View Drive	12	4,100	$501,000
15	15th Street/Airport Road	Kingwood Street	Highway 101	12	2,200	$269,000
16	Highway 101	9th Street	15th Street	12	2,100	$257,000
17	9th Street	Kingwood Street	Highway 101	12	1,500	$183,000
Short-Term Improvements Total						**$2,038,000**

Table 6-3
Recommended Medium-Term Distribution Piping Improvements

CIP No.	Location	From	To	Diameter (inches)	Length (lf)	Estimated Project Cost
Medium-Term Improvements (2020 - 2030)						
9	Redwood and 25th Streets	35th Street	Spruce Street at 25th Street	12	3,600	$440,000
18	Rhododendron Drive	Greenwood Street	Kingwood Street	16	1,200	$212,000
19	Rhododendron Drive	Greenwood Street	9th Street	16	3,300	$581,000
20	9th Street	Rhododendron Drive	Kingwood Street	16	3,300	$581,000
21	37th Street	Oak Street	Highway 101	12	700	$86,000
22	Highway 101	37th Street	Munsel Lake Road	12	4,100	$501,000
23	30th Street	Oak Street	Redwood Street	12	1,000	$122,000
24	27th Street	Kingwood Street	Oak Street	12	1,500	$183,000
25	Airport Way	Kingwood Street	dead end	12	2,900	$354,000
26	Airport Way	dead end	27th Street	12	350	$43,000
27	Oak Street R-O-W	15th Street	20th Street	8	1,300	$130,000
28	11th Street	Spruce Street	Coastal Highlands Drive	12	1,000	$122,000
29	10th Street	Kingwood Street	Highway 101	8	1,700	$170,000
30	12th Street	Kingwood Street	Highway 101	8	2,100	$210,000
31	Lane CC (30th Street at Oak Street)	Oak Street	west	12	800	$98,000
Medium-Term Improvements Total						**$3,833,000**

Table 6-4
Recommended Long-Term Distribution Piping Improvements

CIP No.	Location	From	To	Diameter (inches)	Length (lf)	Estimated Project Cost
Long-Term Improvements (2030+)						
32	W 11th Street	Alder Court	Rhododendron Drive	8	500	$50,000
33	Wildwinds Street and Riverview Lane	Rhododendron Drive	west	8	700	$70,000
34	12th Street and Coastal Highlands	Spruce Street	Primrose Lane	8	1,300	$130,000
35	Coastal Highlands Drive	Yew Street	Zebrawood Street	8	800	$80,000
36	Yew Street	Coastal Highlands Drive	south	12	700	$86,000
37	Maple Street	15th Street	north	8	1,100	$110,000
38	Willow Loop	Willow Street	east	8	2,100	$210,000
39	North Zone to Ocean Dunes	Munsel Creek Loop at 37th	Ocean Dunes Drive	12	3,100	$379,000
40	North Zone to Ocean Dunes check valve line	Munsel Creek Loop extension	north end Ocean Dunes Drive	8	400	$40,000
41	North Zone to Main Zone PRV at Ocean Dunes	Ocean Dunes Drive	Munsel Lake Road	12	300	$37,000
42	Sand Pines Golf Course	Rhododendron Drive	Oak Street	8	3,600	$360,000
43	Pacific View Drive extension	Dead-end	Rhododendron Drive	12	1,500	$183,000
44	27th Street	Kingwood Street	west	12	500	$61,000
45	27th Street extension	Rhododendron Drive	east	12	2,200	$269,000

CIP No.	Location	From	To	Diameter (inches)	Length (lf)	Estimated Project Cost
Long-Term Improvements (2030+) Continued						
46	Park Village Drive extension	Greentrees Village	Pacific View Drive	12	3,300	$403,000
47	Manzanita and Southridge Drive extensions	North Pressure Zone	Ocean Dunes Pressure Zone	8	1,800	$180,000
48	Highway 101 extension	Munsel Lake Road	north to Heceta Beach Road and east to Spruce	12	4,200	$513,000
49	Spruce Street extension	52nd Street	North to Heceta Beach Road	12	1,800	$220,000
50	Highway 101 extension	Heceta Beach Road	north to service area boundary, east to Spruce	12	1,600	$196,000
51	Spruce Street extension	Heceta Beach Road	north to service area boundary	12	900	$110,000
52	Munsel Lake Village	Fred Meyer	north	12	700	$86,000
53	Sand Ranch	Highway 101 at Munsel Lake Road	west	12	1,900	$232,000
54	Munsel Lake Road	Spruce Street	Munsel Lane	12	3,400	$415,000
55	Munsel Lane	Munsel Lake Road	Manzanita Drive	8	900	$90,000
56	Munsel Lake Road	Munsel Lane	Waterford Downs	12	3,300	$403,000
Long-Term Improvements Total						**$4,913,000**

Table 6-5
Capital Improvement Program Summary

Category	Project Description	Project Location	CIP Schedule and Project Cost Summary				Estimated Project Cost
			Immediate (2010 - 2014)	Short-Term (2015 - 2019)	Medium-Term (2020 - 2030)	Long-Term (2030+)	
Water Supply & Treatment	New Wells	Additional supply development at new wellfield site		$ 450,000			$ 450,000
	Back-up Power	300 kW Generator for Wells & WTP	$ 120,000				$ 120,000
	Well Rehabilitation	Rehab two wells annually	$ 225,000	$ 225,000	$ 450,000	$ 450,000	$ 1,350,000
	Treatment	Construct new treatment facilities		$ 2,000,000			$ 2,000,000
		Sub-Total	*$ 345,000*	*$ 2,675,000*	*$ 450,000*	*$ 450,000*	*$ 3,920,000*
Pumping Facilities	North Pressure Zone	Replace Sand Pines Pump Station		$ 1,500,000			$ 1,500,000
	East Pressure Zone	Stanby power for 31st St/East Pump Station	$ 20,000				$ 20,000
		Upgrade controls and install VFDs	$ 100,000				$ 100,000
		Upgrade pump station - increase firm capacity to 1,100 gpm	$ 35,000				$ 35,000
		Sub-Total	*$ 155,000*	*$ 1,500,000*	*$ -*	*$ -*	*$ 1,655,000*
Storage Facilities	North Pressure Zone	Proposed North Pressure Zone Reservoir				$ 2,200,000	$ 2,200,000
	East Pressure Zone	Replace roof of 0.5 MG 31st Street/East Hills Reservoir	$ 150,000				$ 150,000
		Install mixing system in 0.5 MG 31st Street/East Hills Reservoir	$ 60,000				$ 60,000
		Sub-Total	*$ 210,000*	*$ -*	*$ -*	*$ 2,200,000*	*$ 2,410,000*
Distribution System Piping and Control Valves	Main Pressure Zone Transmission Loop	Upgrade to 16-inch from Water Treatment Plant through Old Town to Kingwood Street	$1,974,000				$ 1,974,000
		Upgrade to 16-inch and 12-inch on Kingwood Street from Old Town to 35th Street		$ 1,329,000			$ 1,329,000
		Upgrade to 12-inch to complete loop from 35th Street to Water Treatment Plant			$ 440,000		$ 440,000
		Old Town - Bay Street Loop	$ 475,000				$ 475,000
		Highway 101 Westside Loop - 9th Street to 15th Street		$ 709,000			$ 709,000
		Rhododendron Drive - 9th Street Loop			$ 1,374,000		$ 1,374,000
		North Highway 101 Improvements for Commercial Fire Flow			$ 587,000		$ 587,000
		Main Pressure Zone Piping Improvements for Commercial Fire Flow			$ 1,432,000		$ 1,432,000
		Main Pressure Zone Piping Improvements for Residential Fire Flow				$ 736,000	$ 736,000
		Ocean Dunes Pressure Zone Fire Flow Improvements				$ 456,000	$ 456,000
		Piping to Serve Future Development in Main and North Zones				$ 3,721,000	$ 3,721,000
	Check Valves	Onadoone Court for fire flow from Main Pressure Zone to Ocean Dunes	$ 76,000				$ 76,000
		Ocean Dunes Drive for fire flow from Main Pressure Zone to north Ocean Dunes				$ 76,000	$ 76,000
	Pressure Reducing Facilities	North to Main Pressure Zone PRV at northern edge of Ocean Dunes			$ 90,000		$ 90,000
	Routine Pipe Replacement	Funds replacement of asbestos cement (AC) and undersized pipe at $50,000 per year	$ 250,000	$ 250,000	$ 250,000	$ 500,000	$ 1,250,000
	Intertie	Upgrade Intertie with Heceta WD	$ 100,000				$ 100,000
		Sub-Total	*$ 2,875,000*	*$ 2,288,000*	*$ 4,173,000*	*$ 5,489,000*	*$ 14,825,000*
Other	Planning Studies	Water Rate and SDC Study	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 80,000
		Water System Master Plan Update			$ 80,000		$ 80,000
		Water Management and Conservation Plan Update		$ 20,000	$ 40,000		$ 60,000
		Sub-Total	*$ 20,000*	*$ 40,000*	*$ 140,000*	*$ 20,000*	*$ 220,000*
Capital Improvement Plan (CIP) Total			***$ 3,605,000***	***$ 6,503,000***	***$ 4,763,000***	***$ 8,159,000***	***$ 23,030,000***
			$721,000	**$1,010,800**	**$743,550**		
			5 Year Annual Avg.	**10 Year Annual Avg.**	**20 Year Annual Avg.**		

Funding Sources

The City of Florence may fund the water capital maintenance and improvement programs 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 sources are described below.

Government Loan and Grant Programs

Oregon State Safe Drinking Water Financing Program

Annual grants from the U.S. Environmental Protection Agency (EPA) and matching state resources support the Safe Drinking Water Fund. The program is managed jointly by the Department of Human Services (DHS) - Drinking Water Program and the Oregon Economic and Community Development Department (OECDD). The Safe Drinking Water Fund program provides low-cost financing for construction and/or improvements of public and private water systems. This is accomplished through two (2) separate programs; Safe Drinking Water Revolving Loan Fund (SDWRLF) for collection, treatment, distribution and related infrastructure, and Drinking Water Protection Loan Fund (DWPLF) for sources of drinking water improvements prior to the water system intake.

SDWRLF lends up to eight million dollar per project, with a possibility of subsidized interest rate and principal forgiveness for a Disadvantaged Community. The standard loan term is 20 years or the useful life of project assets, whichever is less, with interest rates at 80 percent of the current state/local bond rate. The maximum award for the DWPLF is 100,000 dollars per project.

Special Public Works Fund

The Special Public Works Fund program provides funding for the infrastructure that supports job creation in Oregon. Loans and grants are made to eligible public entities for the purpose of studying, designing and building public infrastructure that leads to job creation or retention. There are four major project categories eligible for funding under this program:

- Public infrastructure needed to support job creation
- Community facilities that support the local economy
- Essential Community Facilities Emergency Projects
- Railroads

Water systems are listed among the eligible infrastructure projects to receive funding. The Special Public Works Fund is comprehensive in terms of the types of project costs that can be financed. As well as actual construction, eligible project costs can include costs incurred in conducting feasibility and other preliminary studies and for the design and construction engineering.

The Fund is primarily a loan program. Grants can be awarded, up to the program limits, based on job creation or on a financial analysis of the applicant's capacity for carrying debt financing. The total loan amount per project cannot exceed 15 million dollars. The OECDD is able to offer discounted interest rates that typically reflect low market rates for very good quality creditors. In addition, the Department absorbs the associated costs of debt issuance thereby saving applicants even more on the overall cost of borrowing. Loans are generally made for 20-year terms, but can be stretched to 25 years under special circumstances.

Water/Wastewater Fund

The Water/Wastewater Fund was created by the Oregon State Legislature in 1993. It was initially capitalized with lottery funds appropriated each biennium and with the sale of state revenue bonds since 1999. The purpose of the program is to provide financing for the design and construction of public infrastructure needed to ensure compliance with the Safe Drinking Water Act or the Clean Water Act.

Eligible activities include costs for constructing improvements for expansion of drinking water, wastewater or stormwater systems. To be eligible a system must have received, or is likely to soon receive, a Notice of Non-Compliance by the appropriate regulatory agency, associated with the Safe Drinking Water Act or the Clean Water Act. Projects also must meet other state or federal water quality statutes and standards. Funding criteria include projects that are necessary to ensure that municipal water and wastewater systems comply with the Safe Drinking Water Act or the Clean Water Act.

In addition, other limitations apply including:

- The project must be consistent with the acknowledged local comprehensive plan.
- The municipality will require the installation of meters on all new service connections to any distribution lines that may be included in the project.
- The funding recipient shall certify that a registered professional engineer will be responsible for the design and construction of the project.

The Water/Wastewater Fund provides both loans and grants, but it is primarily a loan program. The loan/grant amounts are determined by a financial analysis of the applicant's ability to afford a loan including the following criteria: debt capacity, repayment sources and other factors.

The Water/Wastewater Fund financing program's guidelines, project administration, loan terms and interest rates are similar to the Special Public Works Fund program. The maximum loan term is 25 years or the useful life of the infrastructure financed, whichever is less. The maximum loan amount is 15 million dollars per project through a combination of direct and/or bond funded loans. Loans are generally repaid with utility revenues or voter-approved bond issuance. A limited tax general obligation pledge may also be required.

Certain entities may seek project funding within this program through the sale of state revenue bonds.

Public Debt

Revenue Bonds

Revenue bonds are commonly used to fund utility capital improvements. The bond debt is secured by the revenues of the issuing utility and the debt obligation does not extend to other City resources. With this limited commitment, revenue bonds typically require security conditions related to the maintenance of dedicated reserves referenced as bond reserves and financial performance measures which are added to the bond debt as service coverage. In order to qualify to sell revenue bonds, the City must show that the net revenue defined as total revenue less operating and maintenance expense, for the water fund is equal to or greater than a standard factor, typically 1.2 to 1.4 times the annual revenue bond debt service. This factor is commonly referred to as the coverage factor, and is applicable to revenue bonds sold on the commercial market. There is no bonding limit, except the practical limit of the utility's ability to generate sufficient revenue to repay the debt and meet other security conditions. In some cases, poor credit may impair a community's ability to acquire and use revenue bonds.

Revenue bonds incur relatively higher interest rates than government programs, but due to the highly competitive nature of the low-interest government loans, revenue bonds are assumed to be a more reliable source of funding as they typically can be obtained by most communities.

Water Fund Cash Resources and Revenues

The City's financial resources available for capital funding include rate funding, cash reserves, and SDCs.

SDCs are sources of funding generated through development and system growth and are typically used by utilities to support capital funding needs. The charge is intended to recover a fair share of the costs of existing and planned facilities that provide capacity to serve new growth.

Oregon Revised Statue (ORS) 223.297 – 223.314 defines SDCs and specifies how they shall be calculated, applied, and accounted for. By statue, an SDC amount can be structured to include one or both of the following two components:

- *Reimbursement Fee* – Intended to recover an equitable share of the cost of facilities already constructed or under construction.

- *Improvement Fee* – Intended to recover a fair share of future, planned, capital improvements needed to increase the capacity of the system.

The reimbursement fee methodology must consider such things as the cost of existing facilities and the value of unused capacity in those facilities. The calculation must also ensure that future system users contribute no more than their fair share of existing facilities costs. Reimbursement fee proceeds may be spent on any capital improvements or debt service repayment related to the system for which the SDC is applied. For example, water reimbursement SDCs must be spent on water improvements or water debt service.

The improvement fee methodology must include only the cost of projected capital improvements needed to increase system capacity. In other words, the cost of planned projects that correct existing deficiencies, or do not otherwise increase capacity, may not be included in the improvement fee calculation. Improvement fee proceeds may be spent only on capital improvements (or related debt service), or portions thereof, that increase the capacity of the system for which they were applied.

Summary

This section presents recommendations for improvements to the City's storage reservoirs, pump stations and distribution system. The total estimated project cost of these improvements is approximately 14.9 million dollars for the 20-year planning horizon. Of the improvements required in the 20-year planning horizon, approximately 10.1 million dollars of these improvements are required in the next ten years. Approximately 750,000 dollars per year should be budgeted annually over the next five years for improvement projects. Financial planning work is recommended to evaluate overall water system financial needs and to identify funding options and alternatives.

APPENDIX A
Water System Master Plan Map

FIGURE 1

Water System Master Plan Update

WATER SYSTEM MAP

January 2011

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09-1045.410

PACIFIC OCEAN

Driftwood Shores

Fawn Ridge

Heceta Water District Service Area

City of Florence

SUPPLY EXPANSION TO SECOND WELL FIELD AND WTP RECOMMENDED. LOCATION TO BE DETERMINED.

SERVICE AREA EXPANSION

SERVICE AREA EXPANSION

SAND PINES RESERVOIRS NO. 1 AND 2 CAP: 2.0 MG EA OE: 167.5 FT

SAND PINES PUMP STATION (REPLACE)

PROPOSED NORTH TO MAIN PRV

PROPOSED OCEAN DUNES DRIVE CHECK VALVE

OCEAN DUNES PUMP STATION

WELL FIELD

PROPOSED ONADOONE COURT CHECK VALVE

WATER TREATMENT PLANT

31ST STREET/EAST RESERVOIR CAP: 0.5 MG OE: 167.5 FT

31ST STREET/EAST PUMP STATION (UPGRADE)

FUTURE PLANNED UNIT DEVELOPMENT

FLORENCE MUNICIPAL AIRPORT

SPRUCE STREET RESERVOIR (OUT OF SERVICE) CAP: 0.25 MG OE: UNKNOWN

Collard Lake

Clear Lake

Munsel Lake

Siuslaw River

LEGEND

PROPOSED:

- PROPOSED PIPE
- PROPOSED PUMP STATION
- PROPOSED PRESSURE REDUCING VALVE
- PROPOSED CHECK VALVE
- PROPOSED GROUNDWATER WELL
- PROPOSED WATER TREATMENT PLANT

EXISTING:

- EXISTING RESERVOIR
- EXISTING ELEVATED RESERVOIR (OUT OF SERVICE)
- EXISTING PUMP STATION
- EXISTING INTERTIE
- EXISTING MASTER METER
- EXISTING PRESSURE REDUCING VALVE
- EXISTING GROUNDWATER WELL
- EXISTING WATER TREATMENT PLANT
- EXISTING PIPE
- PRIVATELY OWNED WATER MAINS
- FUTURE OCEAN DUNES PLANNED UNIT DEVELOPMENT (NOT IN CIP)
- CITY LIMITS
- URBAN GROWTH BOUNDARY (UGB)
- STREAM
- USGS 40-FT CONTOUR
- FUTURE WATER SERVICE AREA BOUNDARY
- SERVICE AREA EXPANSION
- EXISTING HECETA WATER DISTRICT SERVICE AREA

PRESSURE ZONES:

- EAST PRESSURE ZONE
- MAIN PRESSURE ZONE
- NORTH PRESSURE ZONE
- OCEAN DUNES PRESSURE ZONE

SOURCE: CITY OF FLORENCE (2009).

N

800 0 800

SCALE: 1" = 800'

\\ad.msa-ep.com\Portland\PDX_Projects\09\1045403 Develop & Calibrate Model\CAD\GIS\09-1045-403-OR-EXIST SYSTEM MAP.mxd 1/11/2011 2:04:48 PM HAS

APPENDIX B
Water Management and Conservation Plan

Water Management and Conservation Plan

September 2009

Prepared for

City of Florence, Oregon

Prepared by

GSI Water Solutions, Inc.

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Executive Summary

The City of Florence (City) submits this Water Management and Conservation Plan (WMCP) for review and approval by the Oregon Water Resources Department (OWRD). The City's water use permit G-15056 originally required submittal of a WMCP by April 18, 2005. However, the City requested and was granted an extension of this deadline to September 19, 2009.

On June 23, 2009, OWRD issued a final order approving an extension of time for development of permit G-15056. The final order provides that the City is limited to diversion of 2.4 cubic feet per second (cfs) under permit G-15056 until OWRD issues a final order approving the City's WMCP. As part of this WMCP, the City requests access to the remaining undeveloped portion (0.6 cfs) of extended permit G-15056, which is the most feasible and appropriate water supply alternative available to the City.

The City operates a public community water system that supplies drinking water to approximately 9,410 City residents. The City is committed to maintaining and improving existing water management and conservation measures, and will initiate a number of new measures within the next five years.

This WMCP satisfies the requirements of Oregon Administrative Rule (OAR) Chapter 690, Division 86. The Plan also presents existing and planned water conservation programs for the City. The Plan is organized according to the major sections of the Division 86 rules.

WMCP Section	**OAR Requirement**
Section 1 – Introduction	*OAR 690-086-0125*
Section 2 – Water Supplier Description	*OAR 690-086-0140*
Section 3 – Water Conservation	*OAR 690-086-0150*
Section 4 – Curtailment	*OAR 690-086-0160*
Section 5 – Water Supply	*OAR 690-086-0170*

Description of Municipal Water Supplier

As of 2008, the City provided water to a service population of approximately 9,410 within the City limits, and two residential accounts outside the City limits. The City's municipal water supply comes from groundwater supplied by Wells 1 through 12, located on the eastern margin of the City, which appropriate water from a dunal aquifer. Currently, these wells do not have the capacity to produce the full amount of water authorized by the City's water rights. Furthermore, the City's population and demand for water are increasing and likely will exceed the existing water supply within the 20-year planning period for this WMCP. The City also holds a water right to divert water from Munsel Creek, but this water right is not currently in use. The City has four aboveground reservoirs, one of which is currently offline. Water diverted under the City's groundwater rights is treated at the City's water treatment plant (WTP).

Water Conservation Element

Current Conservation Measures

The City is committed to wise water use and employs several existing water management and conservation measures, as summarized below.

- Inclining Block Water Rate Structure
- Monthly Water Billing Cycle (New as of August, 2009)
- System Development Charges
- Landscaping Code
- Housing Rehabilitation Grant Program
- Residential Water Conservation Partnership
- Water Quality Report
- Meter Testing and Maintenance
- Leak Detection and Repair
- Water Audits
- Public Education

Five-Year Benchmarks for Conservation and Management Measures

During the next 5 years, the City plans to initiate, continue, or expand the following programs:

- Conduct an annual City-wide water audit using a systematic and documented methodology for estimating water produced and consumed, unaccounted-for water, and unmetered authorized and unauthorized uses.
- Separate the data and tracking of multi-family accounts from the commercial accounts to better characterize those user categories. This will help clarify the extent of commercial and residential use.
- Maintain City utility billing records for at least 5 years to provide historical water consumption data.
- Continue to require meters for all development within the City.
- Continue to conduct annual meter testing and maintenance for 3-inch and larger meters.
- Continue to use an inclining block water rate structure that supports and encourages water conservation.
- Continue routine water system surveillance and response to reported leaks.
- Provide more detailed conservation messages and tips in monthly water bills, including reminders to turn off irrigation systems during the winter.
- Expand the City's website to include tips and techniques for indoor, outdoor, and commercial water conservation.
- Host a water conservation booth at annual City events and festivals.
- Provide informative materials (brochures, samples) in the City's building department where people come to apply for permits.
- Post "how-to" technical information about conservation on the City's website for residential and commercial users.

- Conduct property manager workshops on conservation at multi-family residences.
- Conduct an evaluation of conservation opportunities at multi-family residential facilities, and conduct water audits of the three largest water users in that category.
- Make available indoor conservation kits. Kits could include faucet aerators, low-flow shower heads, toilet leak detectors, and a list of other indoor water conservation options and techniques.
- Make available outdoor conservation kits. Kits could include lawn watering measuring cans, rain gauges, hose nozzles with variable spray, and packages of drought-resistant plant seeds.
- Evaluate opportunities to reuse water and use non-potable water.

Water Curtailment Element

The City proposes a water curtailment plan that contains four stages:

Stage 1 - Water Shortage Alert

Stage 2 - Serious Water Shortage

Stage 3 - Severe Water Shortage

Stage 4 - Critical Water Shortage

The "triggers" for each stage, and the actions taken during each stage, are described in Section 4 of this WMCP. In general, the actions taken progress from voluntary to mandatory and from minor to major in response to the severity of the water shortage.

1. Introduction

This section satisfies the requirements of OAR 690-086-125.

Overview

OAR 690-086-0125

The City of Florence (City) is located on Highway 101 and along the north bank of the Siuslaw River on the central Oregon coast. The City, located in the southern third of the western edge of Lane County, is approximately 172 miles southwest of Portland and 61 miles west of Eugene. Florence is the major coastal town in Lane County. The City hosts several events and festivals throughout the year and has an increased resident and visitor population during the summer months.

As of 2008, the City provided water to a service population of approximately 9,410. The City also serves two residential accounts outside of the City limits, but the population represented by these accounts is within the error of the population estimates for the City, so the service area population is not adjusted to include these two accounts.

The City's municipal water supply is from groundwater supplied by Wells 1 through 12, located along the eastern margin of the City, that appropriate water from a dunal aquifer. Currently, these wells do not have the capacity to produce the full amount of water authorized by the City's water rights. Furthermore, the City's population and demand for water are increasing and will likely exceed the existing water supply within the 20-year planning period for this water management and conservation plan (WMCP). The City also holds a water right to divert water from Munsel Creek, tributary to the Siuslaw River, but this water right is not currently in use. Historically, the City purchased a portion of its water supply from Heceta Water District (HWD); however, the City stopped purchasing water from HWD in 2003 after the expansion of the water treatment plant (WTP) and wellfield that included Wells 8-12.

The City has four aboveground reservoirs: an elevated 250,000-gallon tank near the City shop (currently offline and not in use); a 500,000-gallon steel tank on the east hills; and two 2,000,000-gallon tanks near the Sand Pines Golf Course. Water diverted under all of the City's groundwater rights is treated at the City's WTP. Currently, he WTP has a capacity of 4.6 cubic feet per second (cfs) or 3 million gallons per day (mgd). This capacity is 1.24 cfs (0.8 mgd) less than the full value of the City's existing groundwater rights.

Plan Organization

This WMCP fulfills the requirements of Oregon Administrative Rule (OAR) Chapter 690, Division 86. The WMCP describes water management, conservation, and curtailment measures that will assist the City in the wise management of its water resources. The WMCP is organized according to the major sections of the Division 86 rules, as follows:

Section	*Requirement*
Section 1 – Introduction	***OAR 690-086-0125***
Section 2 – Water Supplier Description	***OAR 690-086-0140***
Section 3 – Water Conservation	***OAR 690-086-0150***
Section 4 – Curtailment	***OAR 690-086-0160***
Section 5 – Water Supply	***OAR 690-086-0170***

Affected Local Governments

The following entity is an "affected local government," according to OAR 690-005-0015:

- Lane County

Thirty days before submitting this WMCP to OWRD, the draft plan was made available for review by the affected local government listed above along with a request for comments related to consistency with the local government's comprehensive land use plan (if any). The letter requesting comments is included in **Appendix A.** Lane County did not submit any comments during the 30-day comment period. Although not an "affected local government" as defined by the rule cited above, a courtesy copy of this draft WMCP was also sent to Heceta Water District (HWD). HWD did not provide any informal comments.

Plan Update Schedule

The City plans to submit an update of this WMCP within 10 years of receiving the final order approving the WMCP. As required by OAR Chapter 690, Division 86, a progress report will be submitted within 5 years of receiving a final order approving this WMCP.

2. Water Supplier Description

This section satisfies the requirements of OAR 690-086-0140.

Source and Facilities

OAR 690-086-0140(1), (8)

The City's water source is groundwater. City wells are completed in dunal sand deposits that cover much of the coastal plain along the central Oregon coast. The thickness of the sand dunes in this area varies from approximately 100 to 200 feet. The quality of water pumped from the dunal wellfield is generally good, with the exception of high concentrations of naturally occurring iron that creates taste and staining problems. To remove the iron, the City operates a biological treatment system that treats the groundwater before disinfection and distribution.

The City holds three groundwater rights totaling 5.89 cfs (3.8 mgd). Currently, the City's wellfield (Wells 1 through 12) does not have the capacity to produce the full amount of water allowed by its water rights. Based on observed production capacity in August 2007, the City wells produce only 4.2 cfs (2.7 mgd). Historically, the City purchased a portion of its water supply from HWD; however, the City stopped purchasing water from HWD in 2003 after the expansion of the WTP and completion of the wellfield including Wells 8-12.

The City has four aboveground reservoirs: an elevated 250,000-gallon tank near the City shop (currently offline and not in use); a 500,000-gallon steel tank on the east hills; and two 2,000,000-gallon tanks near the Sand Pines Golf Course. Water diverted under all of the City's groundwater rights is treated at the City's WTP. The WTP currently has a capacity of 4.6 cfs or 3 mgd. This capacity is currently 1.24 cfs (0.8 mgd) less than the full face value of the City's existing groundwater rights.

Appendix B depicts the City's water system, including sources of water, storage facilities, treatment facilities, major transmission and distribution lines, pump stations, interconnections with other municipal water supply systems, and the existing and planned future service area.

In recent years, the City has made several improvements to its water system infrastructure. In 1994-1995, green sand filters 4, 5, and 6 were installed, along with Wells 4, 5, and 6. In 2003-2004, Wells 8 through12 were constructed and biological filters (for iron removal) were installed. In 2004, the City stopped using chlorine gas and changed to sodium hypochlorite and added a chlorine contact chamber. As part of the WTP expansion with the biological filters, the City installed pumps to transfer the backwash water from the biological filters to settling ponds. This included the installation

of air compressors for the biological filter process and replacement of the existing air blower with two new air blowers.

The City's distribution system has expanded to accommodate new subdivisions. The City recently installed a 12-inch water main beginning just south of the intersection of Highway 101 and Munsel Lake Road, crossing easterly across Highway 101 and continuing east to Spruce Street. The 12-inch water main then extends from Munsel Lake Road north along the recently constructed Spruce Street to its terminus. Additionally, a new 8-inch water main was extended along the east side of Highway 101 from Munsel Lake Road to the current City limits to approximately 52nd Street.

Interconnections with Other Systems

OAR 690-086-0140(7)

The City has two metered interconnections with HWD, located as follows:

- Rhododendron Drive. Water can flow through an 8-inch-diameter pipe from HWD to the City.

- Highway 101 and Munsel Lake Road. Water can flow through a 10-inch-diameter pipe either way between HWD and the City.

Intergovernmental Agreements

OAR 690-086-0140(1)

In 1997, the City, Lane County (County), and HWD entered an intergovernmental agreement (IGA) regarding cooperative planning for public water services. The purpose of the 1997 IGA was improved planning coordination and efficient provision of necessary public water services for residents and businesses in the Florence area. The 1997 IGA included provisions for mutual exchange of information, development of an Urban Services Agreement, notice to HWD of land use actions being considered by the City and/or County, and notice to the County and City of new long-range or capital improvement plans or amendments considered by HWD.

In 2003, the City and HWD signed an IGA for Sale of Surplus Water to Out-of-District Customers for Municipal Use. This IGA allows the City to purchase surplus water from HWD.

Service Area Description and Population

OAR 690-086-0140(2)

The City is located on Highway 101 and along the north bank of the Siuslaw River on the central Oregon coast. The City, located in the southern third of the western edge of Lane County, is approximately 172 miles southwest of Portland and 61 miles west of Eugene, and is the major coastal town in Lane County. The City hosts several events and festivals throughout the year and has an increased resident and visitor population during the non-winter months.

The current service area, shown in **Appendix B,** consists of the area within the City limits and two residential accounts outside the City limits but within the UGB. As of 2008, the City provided water to a service population of approximately 9,410. The City uses population estimates developed annually by Portland State University's (PSU) Population Research Center for the population within City limits to estimate its service population. The City also serves two residential accounts outside the City limits, but the population represented by these accounts is within the error of the population estimates for the City, so the service area population is not adjusted to include these two accounts.

Exhibit 2-1 presents City population estimates from U.S. Census data in 1990 and 2000, and PSU's annual estimates.

EXHIBIT 2-1
City of Florence Service Population Estimates

	PSU (July 1)	U.S. Census
1990	ND	5,171
2000	7,340	7,263
2001	7,460	ND
2002	7,600	ND
2003	7,780	ND
2004	7,830	ND
2005	8,185	ND
2006*	8,270	ND
2007*	8,270	ND
2008	9,410	ND

ND = no data
*** The population estimates for 2006 and 2007 are the same because the City did not submit data to PSU in 2007.**

The City has experienced growth since 1990. The average annual growth rate between 1990 and 2000 was approximately 3.5 percent, and from 2000 to 2008 was approximately 3.3 percent.

Records of Water Use

OAR 690-086-0140(4) and (9)

Terminology

Demand refers to total water production, or the sum of metered consumption (residential, commercial, industrial, and municipal), unmetered uses (for example, fire fighting or hydrant flushing), and water lost to leakage and reservoir overflow. For the City, demand (production) is the total amount of water entering the distribution system.

Metered use or *consumption* refers to the portion of water use that is recorded by customer meters.

Connection refers to a metered connection of a customer to the distribution system.

Unaccounted-for water (sometimes known as unbilled or non-revenue water) refers to the difference between production and billed consumption. Unaccounted-for water includes unmetered hydrant use, other unmetered uses, water lost to reservoir overflow, and leakage. Meter inaccuracies (both production and customer), and data handling errors also contribute to unaccounted-for water.

Specific *demand* terms include:

- *Average day demand (ADD):* total annual production divided by 365 days.
- *Maximum day demand (MDD):* the highest daily production during a calendar year.
- *3-day maximum day demand (3-d MDD)*: the average of the daily demand the day before, the day of, and the day after the maximum day event. This parameter gives an indication of the duration of a high water demand period.
- *Maximum monthly demand (MMD):* the average daily demand during the calendar month with the highest total demand.
- *Monthly demand:* The volume of water produced during each of the 12 calendar months. Monthly demand is expressed either as a total volume produced per month or as an average daily demand per month by dividing the monthly volume by the number of days in the month.
- *Maximum day per month demand:* the highest daily production during each of the 12 calendar months.
- *Peaking factor:* a ratio of one demand to another. The most common is MDD to ADD.

MDD is an important value for water system planning. The City's supply facilities and water rights must be capable of meeting the MDD. If the MDD exceeds the combined supply capacity on any given day, finished water storage levels will be reduced. Consecutive days at or near the MDD will result in a water shortage.

The most common units for expressing demands are mgd. One mgd is equivalent to 695 gallons per minute (gpm) or 1.55 cfs. Units of million gallons (MG) also are used.

Demand

Annual Demand: Overall and Per Capita

Overall demands reflect the amount of water produced or purchased from another water provider during a given period and are expressed in units of gallons per day (gpd) or mgd. Overall per capita demands are overall demands normalized to a community's population and are presented in units of gallons per capita per day (gpcd). Because overall demand includes all use by commercial, industrial, and municipal customers as well as residential customers, the calculated per capita demand values exceed the amounts of water actually used by a typical individual, residential customer. Estimates of residential per capita demand are presented later in this section.

Exhibit 2-2 summarizes the City's average day, maximum day, and maximum month demand data for the period 2004 through 2008. **Exhibit 2-3** presents the overall per capita demands, or the total demand from all sources divided by the service area population. **Exhibit 2-4** graphically displays overall demand values, and **Exhibit 2-5** displays per capita values.

EXHIBIT 2-2
City of Florence Historic Average, Maximum and 3-day Maximum Day Demand, and Maximum Month Demand

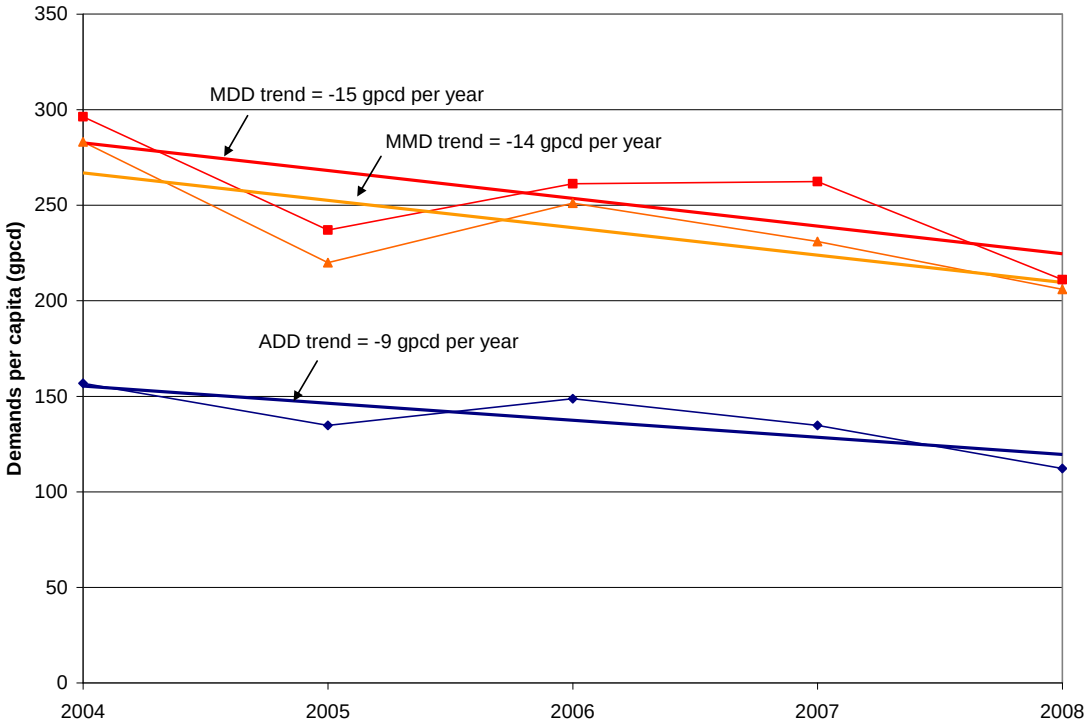
Year	ADD (mgd)	Date of MDD	MDD (mgd)	3-d MDD (mgd)	Month of Maximum Demand	MMD (mgd)
2004	1.23	13-Aug	2.32	2.22	July	2.03
2005	1.10	31-Aug	1.94	1.80	August	1.79
2006	1.23	28-Jun	2.16	2.08	July	1.98
2007	1.11	20-Jun	2.17	1.91	July	1.68
2008	1.06	11-Jul	1.99	1.94	July	1.68
Average	1.15		2.12	1.99		1.83

EXHIBIT 2-3
City of Florence Historic Overall Per Capita Demands (gpcd), 2004–2008

Year	Population	ADD	MDD	MMD
2004	7,830	157	296	283
2005	8,185	135	237	220
2006	8,270	149	261	251
2007	8,270	135	262	231
2008	9,410	112	211	206

EXHIBIT 2-4
City of Florence Historic Overall Demands, 2004–2008

EXHIBIT 2-5
City of Florence Historic Overall Per Capita Demands, 2004–2008



Between 2004 and 2008, ADD ranged from 1.06 mgd to 1.23 mgd, and averaged 1.15 mgd. While the City's overall ADD was relatively constant from 2004 to 2008, the per capita ADD decreased at a rate of approximately 9 gpcd per year. Similar trends were observed for MMD and MDD. These trends may be partially the result of increased conservation awareness, but also may result from building codes requiring more water-efficient appliances for new dwellings.

Overall system MDD ranged from 1.94 mgd to 2.32 mgd, with the highest value occurring on August 13, 2004. Per capita MDD decreased approximately 15 gpcd per year between 2004 and 2008. The MDD occurred in June two years, in July one year, and in August two years.

Overall system 3-d MDD ranged from 1.80 mgd to 2.22 mgd, and averaged 1.99 mgd. The 3-day MDD averaged 94 percent of the MDD during the period.

MMD ranged from 1.68 mgd to 2.03 mgd, and averaged 1.83 mgd. Per capita MMD decreased at a rate of approximately 14 gpcd per year. During the 5-year period, MMD occurred in July four years and in August one year.

MDDs often fluctuate from year to year because they are strongly influenced by weather patterns such as the following:

- Maximum temperatures
- The number of consecutive days at high temperatures
- When the high temperatures occur during the summer. (For example, if high temperatures occur early in the summer, the demand may be higher because residents are more consistent in their outdoor irrigation. Later in the summer, customers may not be as inclined to maintain green landscapes.)
- Overall rainfall levels during the summer
- Consecutive days without rainfall
- Number of new homes with new landscapes because owners generally will keep newly installed landscapes thoroughly watered

Furthermore, the City's economy is partially supported by tourism. Economic factors that affect tourism can influence water demand. **Exhibit 2-6** lists regularly scheduled events and estimated visitor population.

EXHIBIT 2-6
City of Florence Annual Events

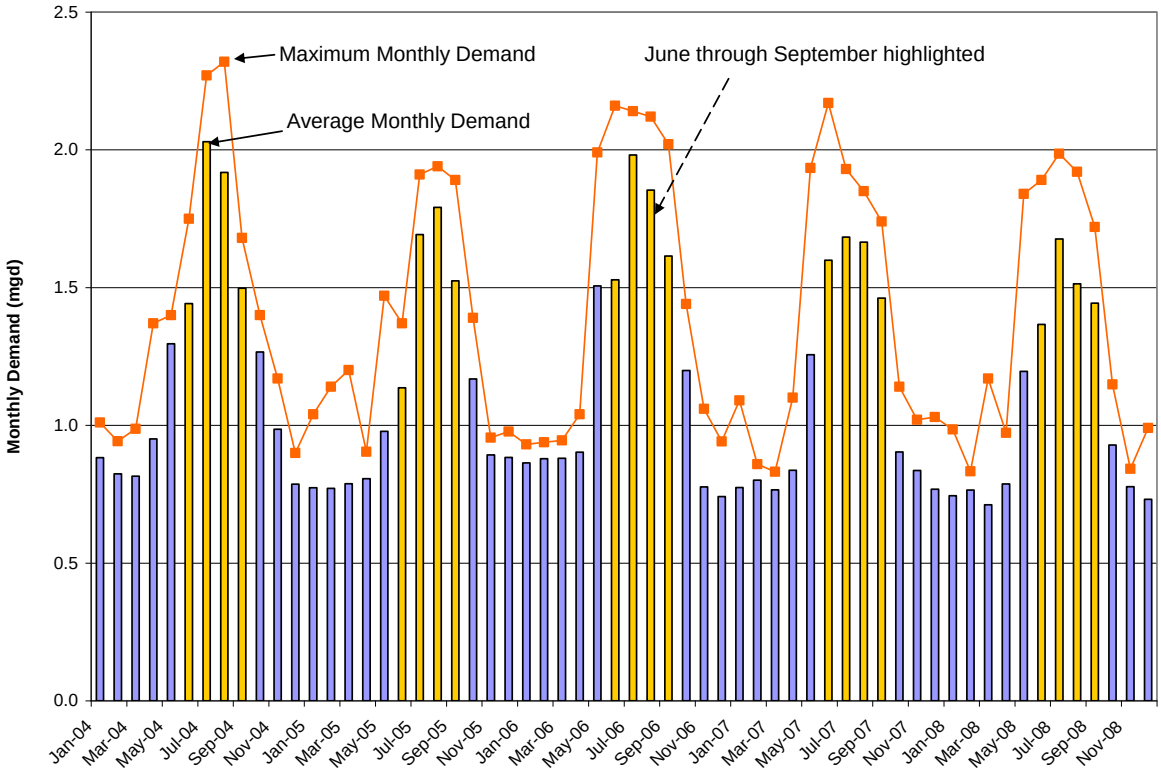
Event	Month	Visitor Population
Winter Folk Festival	**January**	**3,500**
Home and Garden Show	**March**	**3,500**
Rhododendron Festival[1]	**May**	**15,000 to 20,000**
Quilt Show[2]	**August**	**1,500**
Chowder Blues & Brews	**October**	**3,500**

[1] This is a 3-day event.
[2] Occurs only in odd-numbered years.

Monthly Demands

The City experiences considerably higher demands during the summer months. These higher demands likely are related to irrigation of landscapes and increased resident and tourist populations. **Exhibit 2-7** shows the City's monthly demand pattern from January 2004 to December 2008. Both average monthly demand and maximum day per month demand are shown. The peak summer demand period of June through September for each year also is indicated. This peak demand period has accounted for an average of 47 percent of total annual demand for the City, with the remaining 53 percent of demand distributed across the remaining two-thirds (8 months) of the year.

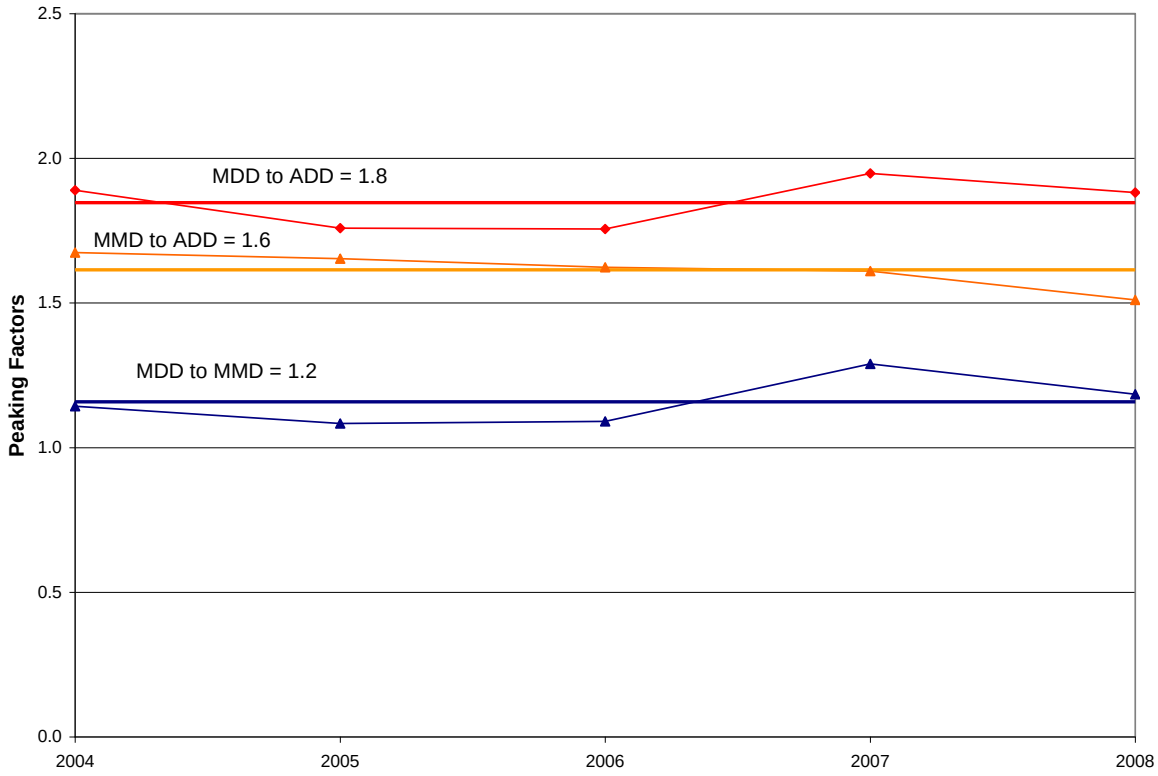
EXHIBIT 2-7
City of Florence Historic Monthly Demands, 2004-2008



Peaking Factor

Peaking factors are useful for estimating peak demands when only average day or maximum month demands are known or measured. The maximum to average day demand (MDD/ADD) peaking factor helps describe peak summer demand within the system**. Exhibit 2-8** shows several peaking factors. The system MDD to ADD peaking factor has averaged 1.8 during the period 2004 through 2008. The system-wide MDD to MMD peaking factor averaged 1.2 during the same period, and the MMD to ADD peaking factor averaged 1.6.

EXHIBIT 2-8
City of Florence Historic Peaking Factors, 2004-2008



Consumption

Consumption is equal to the metered water use within the system. Consumption data from billing records are used to analyze and describe the ways in which water is used within the City. All customers served by the City have water meters.

Customer Characteristics and Use Patterns

The City has four general customer categories: Residential, Commercial, Irrigation, and City Owned. The Residential category refers to single-family residences. The Commercial category includes service to multi-family apartments and complexes, and is subdivided by meter size from ¾-inch to 8 inches in diameter. The ¾-inch Commercial meters are further subdivided by typical volume used. Irrigation accounts are accounts

that are not associated with a sewer account, and City Owned accounts are used for public buildings and irrigation of public parks and landscaping. **Exhibit 2-9** summarizes the billed customer categories and the number of accounts per category in December 2008.

Water use for hydrant flushing currently is not included in consumption data.

EXHIBIT 2-9
Customer Categories and Numbers of Accounts, December 2008

Customer Category	No. of Accounts	Percent of Total
Residential		
¾-inch meter	**3,252**	**84.9**
Commercial		
¾-inch meter (Low Volume)	**266**	**6.9**
¾-inch meter (Large Volume)	**83**	**2.2**
1 1/2-inch meter	**13**	**0.3**
2-inch meter	**56**	**1.5**
3-inch meter	**8**	**0.2**
4-inch meter	**3**	**0.1**
6-inch meter	**2**	**0.1**
8-inch meter[1]	**1**	**0.02**
Irrigation	**133**	**3.5**
City Owned	**15**	**0.4**
Total	**3,832**	**100**

[1] *This meter serves a community of approximately 480 people in a development called Greentrees East.*

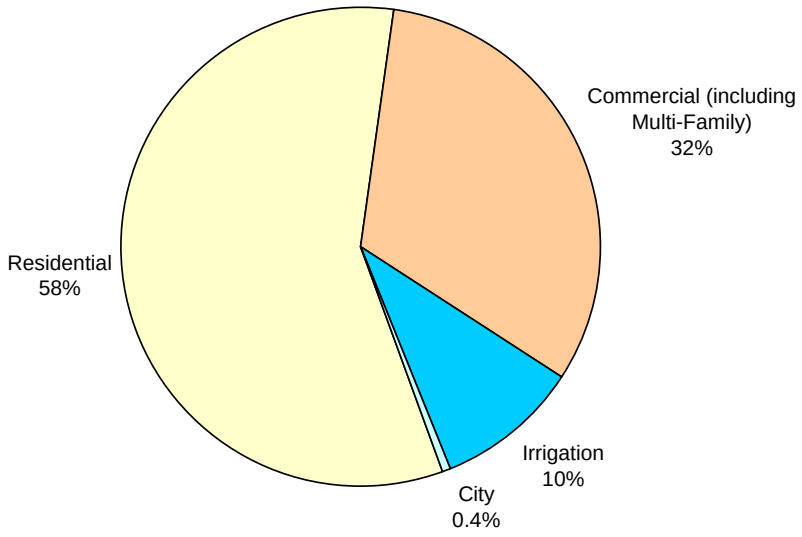
Annual Consumption

The City maintains 3 years of billing records. **Exhibit 2-10** summarizes annual consumption data by customer category for the period 2006 through 2008. **Exhibit 2-11** presents a pie chart that indicates the percentage of water used by each customer category in 2008.

EXHBIT 2-10
City of Florence Annual Metered Consumption by Customer Category, MG

Year	Residential	Commercial (including Multi-Family)	Irrigation	City	Total
2006	227	136	51	2	416
2007	208	114	47	2	371
2008	205	112	35	2	353

EXHIBIT 2-11
Percentage of Annual Water Use by Customer Category, 2008



As shown in Exhibits 2-10 and 2-11, most annual water consumption was in the Residential category, which is primarily single-family residences. In 2008, the Residential category accounted for approximately 58 percent of total metered water use. The combined Commercial and Multi-Family category accounted for the next highest percentage of use, at 32 percent. Irrigation use accounted for 10 percent of total metered use, and City use for irrigation and public buildings accounted for 0.4 percent of annual metered water use.

Top Water Users

Exhibit 2-12 presents the largest 15 individual water accounts for 2008. These accounts represented approximately 20 percent of all metered consumption in 2008. Ten of the 15 accounts were for multiple-family residential accounts. The highest water-using account is for the community of Greentrees East. This community of approximately 480 people accounted for approximately 5 percent of annual consumption.

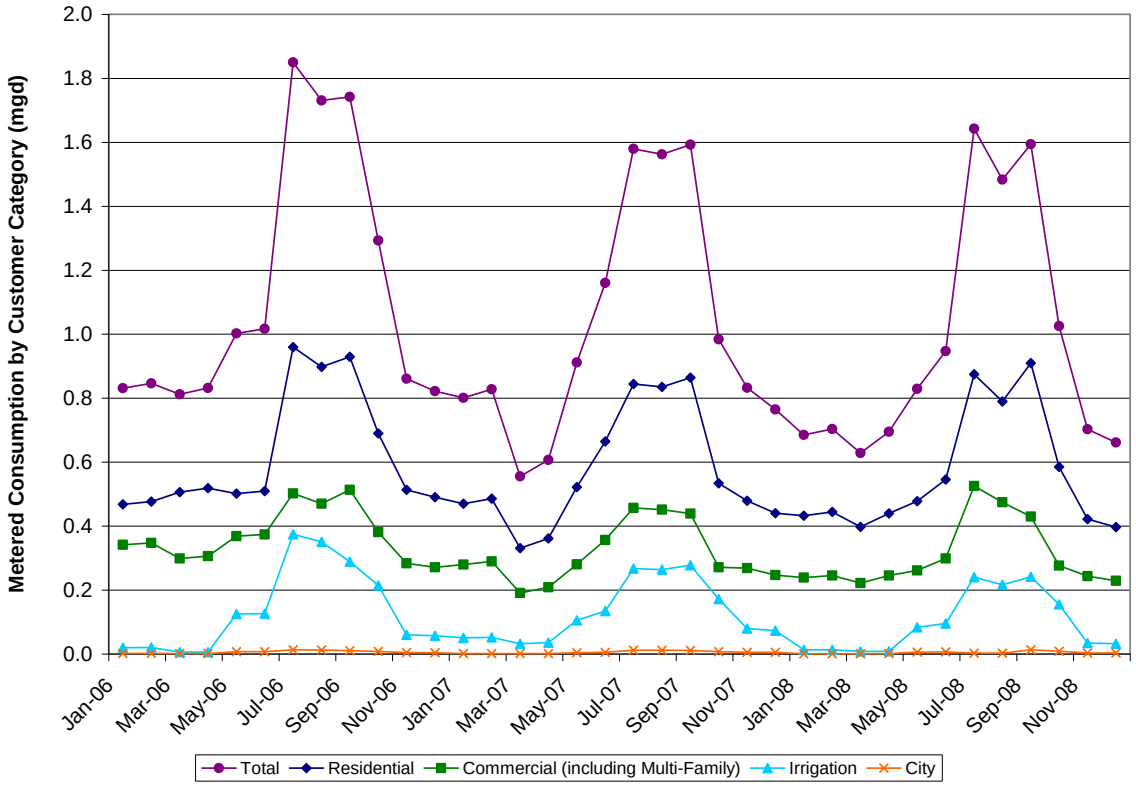
EXHIBIT 2-12
City of Florence Largest Individual Water Accounts Annual Consumption, 2008

	Total (MG)	Percent of Annual Consumption
Greentrees East	**19.2**	**5.4%**
Coast Village	**10.9**	**3.1%**
Greentrees VCC	**9.3**	**2.6%**
School	**9.2**	**2.6%**
Safeway	**3.4**	**1.0%**
Hospital	**3.1**	**0.9%**
Siuslaw Appt	**2.7**	**0.8%**
Coast Guard	**2.2**	**0.6%**
Lane County Housing – Housing and Community Services Agency of Lane County	**2.1**	**0.6%**
Viking Redi Mix	**1.9**	**0.5%**
Oak Terrace	**1.8**	**0.5%**
Shorewood Retirement	**1.8**	**0.5%**
Spruce Point	**1.8**	**0.5%**
Timbers Apt	**1.6**	**0.5%**
Elderberry Square	**1.2**	**0.3%**
Total	**72.3**	**20.4%**

Monthly Consumption

All meters are read bimonthly during even-numbered months. Bimonthly data were converted to monthly data based on production data for each bimonthly period. Beginning in August 2009, the City will be implementing monthly meter reading and billing. **Exhibit 2-13** shows the estimated monthly metered consumption by customer category from 2006 through 2008. As shown, metered consumption increased for all categories during the summer months. The large increase in Residential and Commercial use during the summer months likely can be attributed to a combination of water for irrigation, increased resident population, and increased tourist presence in motels, summer homes, and restaurants. December through March likely represent the period during which no outdoor use occurs, and the "shoulder" months of April, May, October, and November reflect transitions between seasons. Water use during these transitional periods may reflect some irrigation, or seasonal changes in commercial and industrial water requirements.

EXHIBIT 2-13
Monthly Metered Consumption by Category for Customers within the City of Florence, 2006-2008



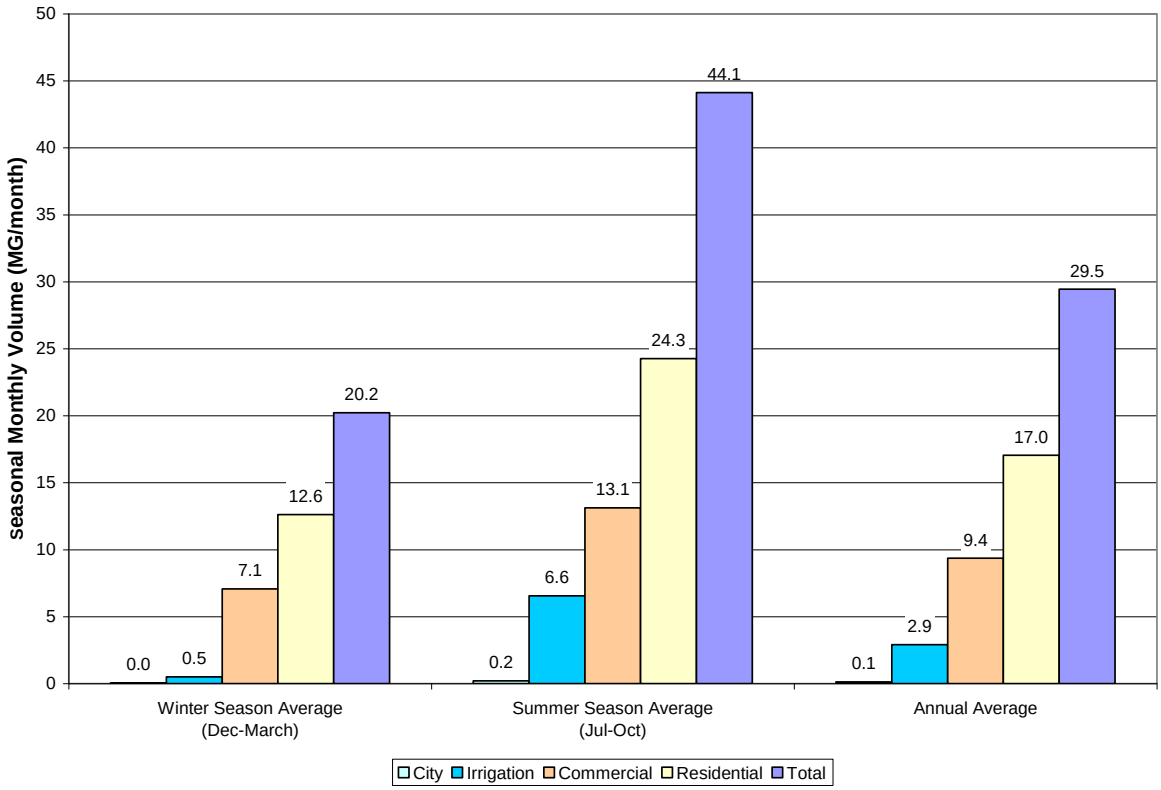
Seasonal trends are further illustrated in **Exhibit 2-14,** which shows the average monthly consumption for City, Irrigation, Residential, and Commercial customer categories by season for 2008. The summer season was defined as the 4 months with the highest overall metered consumption. In 2006 and 2008, these months were July through October, and in 2007 these months were June through September.

Annual consumption for City uses is relatively small in comparison to other customer categories, accounting for only 0.4 percent of total metered consumption in 2008.

Some water use from Irrigation accounts (averaging 500,000 gallons per month) occurred during the winter months. This water may represent a conservation opportunity for the City to investigate. If, for example, this use results from customers' failure to turn off automated sprinkler systems, the City could work with customers to ensure appropriate irrigation uses.

Residential consumption rates were approximately two times greater during the summer than during the winter.

EXHIBIT 2-14
City of Florence Average Monthly Consumption by Season and Customer Category, 2008



The total average monthly consumption for the summer months was 44 MG per month (1.4 mgd) compared to an annual average of 29.5 MG per month (1.0 mgd) and a winter

season average of 20.2 MG per month (0.7 mgd). A summer season to winter season ratio of approximately two to one is typical of many communities in western Oregon.

Indoor and Outdoor Water Use

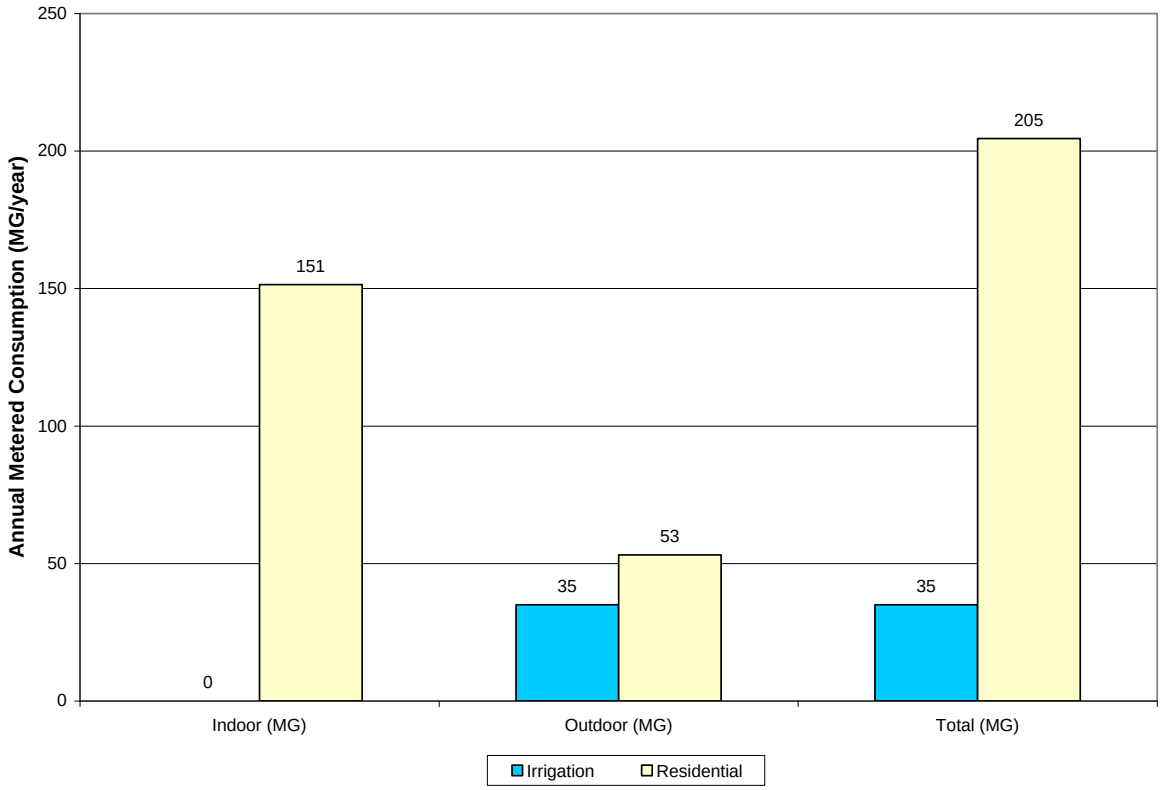
To estimate the amount of indoor versus outdoor water use for select customer categories, the following assumptions were made:

- Irrigation use was all assigned to outdoor use even though some of the use occurred during winter months.
- Residential account wintertime use was assumed to be representative of annual indoor water use.
- An estimated 1 percent decrease (approximately 100 people) in the residential population was assumed to occur during the winter months.[1] To estimate the indoor use for the summer population, winter consumption plus 1 percent was assumed to be representative of annual indoor water use for the residential category. (This does not account for increased tourist occupancy of residences.)

[1] Estimate by City of Florence staff.

Exhibit 2-15 presents the estimated average annual indoor and outdoor use by category for the Irrigation and Residential categories in 2008. Outdoor use represented approximately 26 percent of annual use by single-family residences, which is a relatively modest rate of outdoor use. Based on these data, conservation efforts targeting indoor water consumption of residences may prove beneficial.

EXHIBIT 2-15
City of Florence Average Annual Indoor and Outdoor Metered Consumption; Select Customer Categories, 2008



Use by Commercial and Multi-family customers was not included in this analysis because of the varied types of customers included in the Commercial category. The City may want to consider separating the Multi-family accounts from the Commercial accounts to better characterize this water consumption.

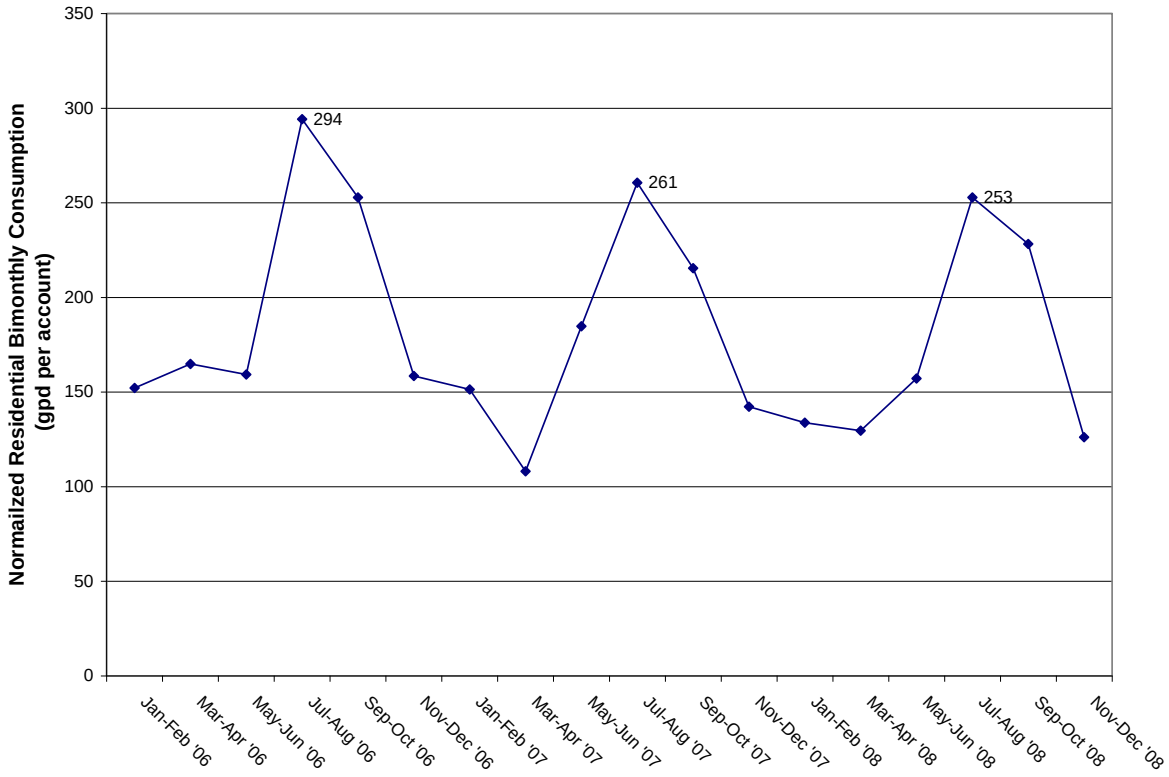
As noted above, non-summer season use of irrigation accounts may provide an opportunity for conservation. Individual seasonal use analyses for the largest volume water users may be justified to help further identify areas to target for conservation.

Single-Family Residential and Commercial Water Use Trends

Normalizing different categories of water use data by the number of accounts per category is helpful for determining trends in water use.

Exhibit 2-16 presents normalized single-family residential water use data. During the period 2006 to 2008, peak normalized single-family residential bimonthly water consumption declined from 294 gpd per account to 253 gpd per account in 2008. The reduction in peak water use per account may be partially the result of heightened interest in water conservation and more efficient landscape irrigation in new residences. Winter season normalized use also showed a decline from approximately 155 gpd per account in 2006 to 135 gpd per account in 2007-2008. Additional data will help confirm whether these reductions are trends or the result of normal variation.

EXHIBIT 2-16
City of Florence Historic Monthly Single-family Residential Water Bimonthly Use per Account, 2006-2008



Residential Per Capita Demand

Indoor, outdoor, and overall single-family residential per capita demands were estimated on the basis of overall annual demand in 2008, the fraction of demand for the residential customer category based on billed consumption, and an estimate of the proportion of single-family resident population to total population as follows:

- 2008 overall ADD per capita from trendline = 120 gpcd
- Single-family portion of total use = 58 percent
- Single-family portion of total population = 60 to 74 percent

Based on these data, single-family average daily per capita demand ranged from 94 to 116 gpcd. Of this, 74 percent, or between 70 and 86 gpcd, was for indoor use and 26 percent, or between 24 and 30 gpcd, was for outdoor use.

Typical indoor per capita residential demand ranges from 60 to 80 gallons per person per day.[2] Typical outdoor per capita residential demand ranges from 10 to 80 gpcd for single-family residences.[3] Based on these typical ranges, indoor and outdoor residential per capita demand for the City residents were within the typical range for indoor consumption and on the low end of the typical range for outdoor consumption.

Unaccounted-for Water

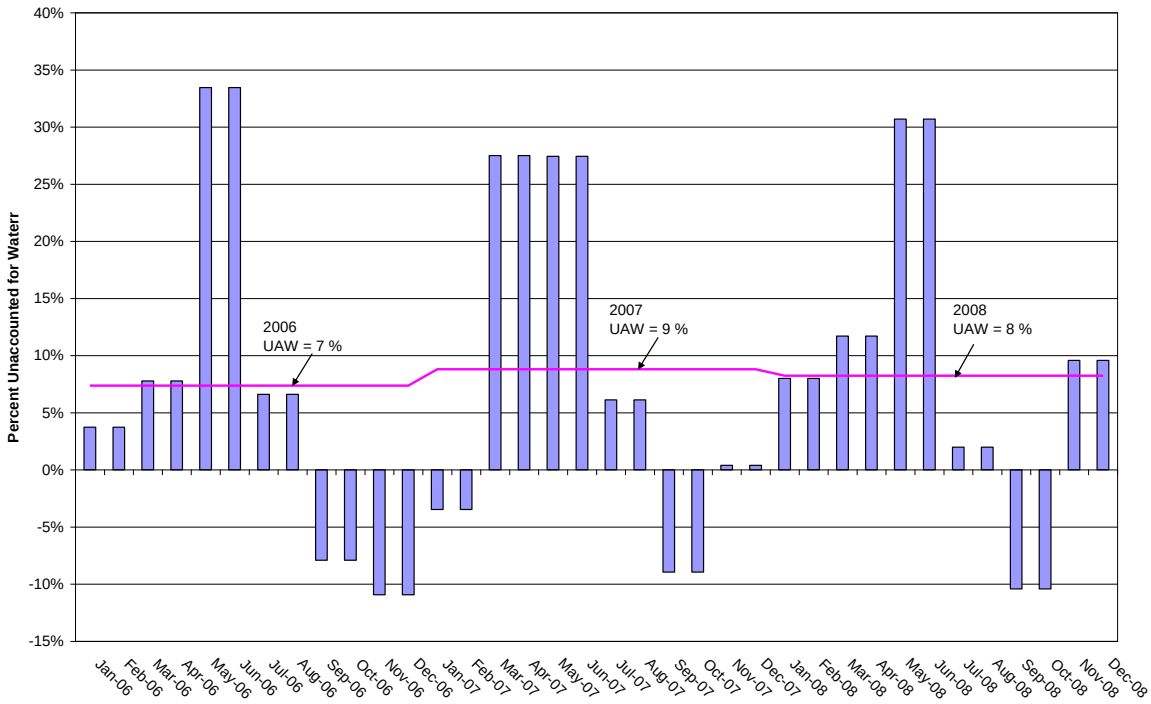
OAR 690-086-0140(9)

The difference between production and metered consumption divided by production equals the percent of unaccounted-for water (also known as non-revenue water) for the system. The causes of unaccounted-for water may include meter inaccuracies, reservoir overflows because of operational constraints, unmetered use, and leakage.

[2] AWWA, *Water Conservation Programs – A Planning Manual: Manual of Water Supply Practices M52*, 1st Edition, 2006.
[3] *Ibid.*

Exhibit 2-17 graphically displays the monthly percentage of unaccounted-for water and the annual average unaccounted-for water for 2006 through 2008. Unaccounted-for water rates often vary from month to month because the timing of meter reading for production and consumption meters is not synchronized. This sometimes leads to larger consumption values than production values for a given period, and a calculated negative unaccounted-for water rate. Variations are reduced when the data are averaged for longer periods, such as an entire year. In Florence, production meters were read monthly while customer meters were read bimonthly before August 2009. The transition from bi-monthy to monthly billing in August 2009, described under "Annual Water Audit" will allow comparison of water production and consumption monthly. This should make the monthly rates of unaccounted-for water more consistent in the future.

EXHIBIT 2-17
Monthly and Annual Rates of Unaccounted-for Water, 2004-2008



The City's annual unaccounted-for water rates have been below the OWRD goal for municipal systems. The OARs set a goal for municipal system leakage (a potential portion of unaccounted-for water) of 15 percent or less, and, if feasible, 10 percent.

City Water Rights

OAR 690-086-0140(5)

The City holds four water rights totaling 6.69 cfs or 4.3 mgd. **Appendix C** provides detailed information about each of the City's water rights. Of these water rights, three are for the use of groundwater totaling 5.89 cfs (3.8 mgd) and one is for the use of 0.8 cfs (0.5 mgd) of surface water. Currently, the surface water right is not in use.

Groundwater

The City's three groundwater rights for 5.89 cfs (3.8 mgd) are evidenced by a certificate (certificate 81398), a final order following a transfer of certificate 50606 (T-9301), and a permit (G-15056). Each right is described in more detail below.

Certificate 81398 has a priority date of September 16, 1965, and authorizes the use of up to 2.0 cfs (1.3 mgd) of groundwater from Wells 1 through 7 for municipal use.

The water right currently evidenced by transfer T-9301 (previously certificate 50606) has a priority date of July 1, 1976, and authorizes the use of up to 0.89 cfs (0.57 mgd) of groundwater from Wells 1 through 7 for municipal use. This right was previously certificated with Well 2 (now referred to as Well 1) as the only point of appropriation. The City requested a transfer (T-9301) to add the additional wells to this water right. OWRD issued a final order for T-9301, authorizing use of the additional points of appropriation and cancelling certificate 50606. The transfer order required the City to complete the change before October 1, 2008. The City requested, and OWRD approved, an extension of time to complete the change until October 1, 2013.

Permit G-15056 has a priority date of February 2, 2001, and authorizes the use of up to 3.0 cfs (1.9 mgd) of groundwater from Wells 8 through 12 for municipal use. The City filed an application for an extension of time for permit G-15056. OWRD issued a final order extending the time limits for development of this permit until October 1, 2025. The City submitted a Claim of Beneficial Use (COBU) requesting to partially perfect permit G-15056 for 2.4 cfs of the 3.0 cfs total authorized by the permit. Currently, the City is limited to using 2.4 cfs of permit G-15056 until a final order is issued approving the City's WMCP. Permit G-15056 contains conditions for mitigating impacts to surface water, which require delivery of water to the wetlands in late October and diversion of clarified backwash from the City's WTP to the wetlands.

Surface Water

The City's surface water right is evidenced by certificate 32115, which authorizes the use of up to 0.8 cfs (0.5 mgd) of surface water from Munsel Creek for municipal use. The certificate has a priority date of August 6, 1948. The point of diversion for this water right is more than a mile downstream from the City's WTP and the water under this certificate currently is not being used. Different water treatment systems would be required to treat water from Munsel Creek. Furthermore, there are sensitive and threatened fish species in Munsel Creek.

Aquatic Resource Concerns

The City's current water supply is from groundwater. The dunal sand aquifer that is developed by the City's wells is not in an OWRD-designated Critical Groundwater Area or Groundwater Limited Area, however, the wells are located within the only Environmental Protection Agency designated Sole Source Aquifer in Oregon. In addition, the City holds a water right to divert water from Munsel Creek. **Exhibit 2-18** shows the listed fish species that occur in Munsel Creek. Munsel Creek is not on the Oregon Department of Environmental Quality's (DEQ) 303(d) list as water quality limited for any parameters.

EXHIBIT 2-18
Listed Fish Species in Munsel Creek

Species	Evolutionarily Significant Unit (ESU)	Federal Listing	State Listing	Notes
Coho salmon (*Oncorhynchus kisutch*)	Oregon Coast	Threatened	Sensitive – Vulnerable	
Steelhead trout (*O. mykiss*)	Oregon Coast	Sensitive	Sensitive – Vulnerable (winter runs)	State listed winter runs, federal did not list the specific seasonal runs
Western brook lamprey (*Lampetra richardsoni*)		N/A	Sensitive – Vulnerable	
Pacific lamprey (*L. tridentate*)		N/A	Sensitive - Vulnerable	

- Federal ESA listed species (threatened and endangered) were obtained from www.nmfs.noaa.gov/pr/species/esa/fish.htm
- Federal Sensitive species were obtained from the Interagency Special Status/Sensitive Species Program (Oregon and Washington) at www.fs.fed.us/r6/sfpnw/issssp/agency-policy/
- State ESA listed species (threatened and endangered) were obtained from www.dfw.state.or.us/wildlife/diversity/species/threatened_endangered_candidate_list.asp
- State Sensitive species were found at www.dfw.state.or.us/wildlife/diversity/species/docs/SSL-by-taxon.pdf

Evaluation of Water Rights/Supply

OAR 690-086-0140(3)

As described above, the City holds groundwater rights that authorize the use of up to 5.89 cfs (3.8 mgd) of groundwater, and these water rights have never been regulated (curtailed) by OWRD. The dunal sand deposits have a relatively high effective porosity and permeability that creates an aquifer with a high capacity to store and transmit groundwater. The characteristics of the sand deposits coupled with the high annual recharge rates from rainfall along the Oregon Coast create a productive and reliable municipal water supply. Based on a recent aquifer recharge analysis, it is likely that the City could sustainably appropriate approximately 4.34 to 7.6 cfs (2.8 to 4.9 mgd) from the sand deposits without causing long-term declines in groundwater levels.

Infrastructure Improvements to Maximize Water Rights

The City's water supply is limited by the current capacity of its wells. Based on recent field observations, the production capacity of the City's wells is insufficient to produce

the full rate of 5.89 cfs (3.8 mgd) authorized by the City's groundwater rights. In August of 2008, the City's wells produced approximately 2.7 mgd. For the period 2004 through 2008, the City's ADD averaged 1.15 mgd, and its MDD averaged 2.12 mgd. The City recently took steps to improve water production at its existing wells, but additional actions may be needed. In addition, the City has allocated funding for, and is evaluating submittal of a transfer application and construction of new Wells 13 and 14.

Another constraint is that the City's WTP has a capacity of only 3 mgd, which is less than the 5.89 cfs (3.8 mgd) of groundwater rights held by the City. The City will need to upgrade its WTP in order to treat the full quantity of water authorized by its groundwater rights.

Need for New Water Rights

As described in later chapters, the City's water rights are reliable and adequate to meet current demand, but the City may need additional water rights near the end of the 20-year planning period considered in this WMCP.

A key concern for the City is that its entire water supply relies on a sole source, consisting of a number of wells located in a small area. In the event of an emergency, such as a chemical spill or malicious attack, the City may not be able to use its current wellfield. To provide for water supply redundancy and expand water supply, the City is evaluating a potential additional wellfield site located northwest of the existing wellfield. It is likely that new water rights would be required for the additional well field.

As noted above, the City does not divert water under its surface water right for Munsel Creek, and it is unlikely that new water rights would be approved for the use of surface water. Thus, the City may need to pursue new groundwater rights to help meet future demand and water supply redundancy needs.

3. Water Conservation

This section satisfies the requirements of OAR 690-086-0150.

Current Conservation Measures

OAR 690-086-0150(1) and (3)

The City does not have a previously approved WMCP. The City recognizes that conservation measures are needed to maximize the efficient use of water and thereby help to slow the growth of demand for water. The City's current water management and conservation measures are described below.

Inclining Block Water Rate Structure

One of the highlights of the City's current water conservation measures is its recently updated water billing structure. The City is proud to be one of the few Oregon municipalities that have adopted a water rate structure that strongly encourages water conservation. In June 2009, the City Council adopted several resolutions amending fees for water, waste water, and stormwater. The inclining block water rate structure has a base rate with no allowance and three rate blocks that increase the cost per unit of water as more water is used. This provides a direct financial incentive for the City's water customers to maximize conservation. The current block rates are as follows:

- Zero to 1,000 cubic feet: $0.0136 per cubic foot
- 1,001 to 1,500 cubic feet: $0.0149 per cubic foot
- 1,501+ cubic feet: $0.0178 per cubic foot

The City plans to continue using this rate structure as a key component of its water conservation measures.

Monthly Water Billing Cycle

In the past, the City billed customers for water every other month. In August, 2009, the City adopted a new billing schedule so that customers receive monthly water bills. This provides the customer with much more direct and timely feedback on their water use. As a result, customers are more likely to be aware of increases in their water use, and can take more timely action to conserve water and keep their water bill as low as possible. The monthly billing cycle is an important component of the City's current conservation efforts.

System Development Charges

The City assesses a water system development charge for commercial uses based on the area to be landscaped and irrigated. As of July 1, 2009, the City will charge $3,268.48 per 2,500 square feet of turf landscaping with conventional irrigation and $3,268.48 per 4,000 square feet of landscaping with drip irrigation or very low-spray emitting heads.

Landscaping Code

The City encourages the use of native vegetation. Currently, proposed code amendments are being reviewed in a public hearing process that includes a landscaping preservation credit. One obtains a "preservation credit" in the form of a reduction of the overall landscape area and planting requirements if existing significant vegetation on the site is preserved. This approach will save on water use because existing native vegetation will not require irrigation and less landscaping and irrigation will be required if a preservation credit is granted.

Housing Rehabilitation Grant Program

The City is involved in a housing rehabilitation grant program. While this program does not specifically focus on reducing water usage, rehabilitation and renovations often include measures that improve water use, such as replacing existing fixtures and appliances with more efficient ones.

Residential Water Conservation Partnership

In the early 1990s, the City partnered with Central Lincoln People's Utility District (PUD), which provides electrical service, to encourage water conservation. This program included shower head, toilet tank, and faucet aerator replacement, as well as written communication about these conservation opportunities through the PUD's billing system.

Water Quality Report

The City's annual Water Quality Report contains a section devoted to water conservation tips. This document is posted on the City's webpage and is mailed to water customers.

Meter Testing and Maintenance

The City conducts regular meter testing and maintenance for large meters (3-inch or greater). These large meters are typically found in multi-family residential complexes, hotels, other businesses, and schools.

Leak Detection and Repair

City staff routinely inspects elements of the City's water system and strives to detect leaks as soon as possible to minimize water loss. The City responds promptly to leaks reported by customers and makes appropriate repairs.

Water Audits

Beginning in August 2009, the City began to track and compare water production and metered consumption data monthly. This practice helps City staff to determine the amount of unaccounted-for water.

Public Education

The City's water bills include messages encouraging conservation. In addition, City staff members have participated in radio talk shows to discuss the City's water system and conservation.

Use of Non-Potable Water

The City currently irrigates Miller Park with non-potable water from a well.

Use and Reporting Program

OAR 690-086-0150(2)

The City collects its water use data at an in-line master meter going into its water treatment plant. The City's water measurement and reporting program complies with the measurement standards in OAR Chapter 690, Division 85. The City's water use records can be found at http://apps2.wrd.state.or.us/apps/wr/wateruse_report/.

Required Conservation Programs

OAR 690-086-0150(4)

OAR 690-086-150(4) requires that all water suppliers establish 5-year benchmarks for implementing the following water management and conservation measures:

- Annual water audit
- System-wide metering
- Meter testing and maintenance
- Unit-based billing
- Leak detection and repair (if system leakage exceeds 10 percent)
- Public education

Five-Year Benchmarks for Required Existing or Expanded Conservation Measures

During the next 5 years, the City plans to initiate, continue, or expand the following programs that are required of all municipalities:

- **Annual Water Audit.** In August, 2009, the City transitioned from bi-monthly billing to monthly billing, and began to compare water production and consumption monthly. These measures will help the City, its residents, and its businesses to monitor and conserve water, and will aid in the water auditing process. Unlike many other municipalities, Florence has a very low percentage of unaccounted for water. The City is committed to expanding its water auditing to further maximize the efficiency of its water system.

  5-Year Benchmarks:

  - Conduct an annual City-wide water audit using a systematic and documented methodology for estimating water produced and consumed, unaccounted for water, and unmetered authorized and unauthorized uses.

- Separate the data and tracking of multi-family accounts from the commercial accounts to better characterize those user categories. This will help clarify the extent of commercial and residential use.

- Maintain City utility billing records for at least 5 years to provide historical water consumption data.

- **System Metering.** All customers served by the City are metered.

  5-Year Benchmark:

  - Continue to require meters for all development within the City.

- **Meter Testing and Maintenance.** Currently, the City conducts annual meter testing and maintenance for large meters (3-inch or greater). These large meters are typically found in multi-family residential complexes, hotels, other businesses, and schools that use relatively large amounts of water. In addition, the City has been replacing its residential manual read meters with radio read meters during the last several years,. Approximately 50 percent of the City's residential meters have been converted to radio read at this point. While retrofitting the residential meters, the City staff has been checking the existing meters to ensure that the meters are not older than the manufacturers suggested longevity. If the meters are older or are found to be malfunctioning, they shall be replaced.

  5-Year Benchmark:

  - Continue to conduct annual meter testing and maintenance for 3-inch and larger meters.
  - Continue to retrofit meters to radio read. Over the next 5 years, approximately 500 residential meters will be retrofitted and checked for age and function.

- **Inclining Block Water Rate Billing Program.** One of the highlights of the City's current water conservation measures is the recently updated water billing structure. The inclining block water rate structure has a base rate with no allowance and three rate blocks that increase the cost per unit of water as more water is used. This provides a direct financial incentive for the City's water customers to maximize conservation.

  5-Year Benchmark:

  - The City will continue to use an inclining block water rate structure that supports and encourages water conservation.

- **Leak Detection and Repair.** While the City's unaccounted for water is less than 10%, the City will continue its current leak detection and repair activities.

  5-Year Benchmark:

  - Continue routine water system surveillance and response to reported leaks.

- **Public Education.** Currently, the City's water bills include messages encouraging conservation. In addition, City staff has participated in radio talk shows to discuss the City's water system and conservation.

  5-Year Benchmarks:

  - Provide more detailed conservation messages and tips in monthly water bills, including reminders to turn off irrigation systems during the winter.
  - Expand the City's website to include tips and techniques for indoor, outdoor, and commercial water conservation.
  - Host a water conservation booth at annual City events and festivals.
  - Provide informative materials (brochures, samples) in the City's building department where people come to apply for permits.

Expanded Use under Extended Permits

OAR 690-086-0150(5)

Although the City plans to expand or initiate diversion of water under an extended permit, the City does not plan to do so with any permit for which resource issues have been identified under OAR 690-086-0140(5)(i). Therefore, the requirements of OAR 690-086-0150(5) are not applicable. Nonetheless, the City's unaccounted-for water, and therefore its system leakage, is less than 15 percent, as described in Section 2.

Requirements Based on Water Service Population in Excess of 7,500

OAR 690-086-0150(6)

OAR 690-086-0150(6) requires municipal water suppliers serving a population greater than 7,500 to implement an additional set of conservation measures or to provide documentation showing that implementation of the measures is neither feasible nor appropriate. Because the City serves a population of more than 7,500, a discussion of implementation to date and 5-year benchmarks for these measures follows:

- **System-wide leak repair program or line replacement program.** *The City's unaccounted-for water, and therefore its system leakage is less than 10 percent. The City will continue its leak detection and repair activities, as described above.*

- **Technical and financial assistance programs to encourage and aid residential, commercial and industrial customers in implementation of conservation measures.**

  5-Year Benchmarks:

  - Post "how-to" technical information about conservation on the City's website for residential and commercial users.

  - Conduct three property manager workshops on conservation at multi-family residences.

  - Conduct an evaluation of conservation opportunities at multi-family residential facilities, and conduct water audits of the three largest water users in that category.

- **Supplier financed retrofitting or replacement of existing inefficient water using fixtures, including distribution of residential conservation kits and rebates for customer investments in water conservation.**

  5-Year Benchmarks:

  - Make available 100 indoor conservation kits. Kits could include faucet aerators, low-flow shower heads, toilet leak detectors, and a list of other indoor water conservation options and techniques.

  - Make available 100 outdoor conservation kits. Kits could include lawn watering measuring cans, rain gauges, hose nozzles with variable spray, and packages of drought-resistant plant seeds.

  - The City does not intend to provide rebates for replacing water using fixtures at this time for the following reasons:

    - A large proportion of the housing stock in the City is relatively recent and outfitted with modern efficient appliances.
    - The City recently implemented a tiered water rate structure to provide an incentive for its customers to reduce their water consumption, which should provide an incentive to replace inefficient fixtures.
    - Current budget constraints prevent the City from developing such a program at this time.

- **Adoption of rate structures, billing schedules, and other associated programs that support and encourage water conservation.**

  5-Year Benchmarks:

  - The City will continue to use an inclining block rate water billing system that supports and encourages water conservation.
  - The City will continue to use a monthly water billing cycle.
  - The City will provide more detailed conservation messages and tips in monthly water bills, including reminders to turn off irrigation systems during the winter.

- **Water reuse, recycling, and non-potable water opportunities.** The City currently irrigates Miller Park with non-potable water from a well. Although the City does not currently have any water reuse programs, the City will investigate opportunities to do so.

  5-Year Benchmark:

  - Evaluate opportunities to reuse water and expand use of non-potable water.

- **Any other conservation measures identified by the water supplier that would improve water use efficiency.**

  5-Year Benchmark:

  - Provide messages in water bills during the winter reminding customers to make sure that automated irrigation systems are turned off during the winter.

4. Curtailment Plan

This section satisfies the requirements of OAR 690-086-0160.

Introduction

Curtailment planning is the development of proactive measures to reduce demand during supply shortages resulting from prolonged drought, or system failure from unanticipated events including catastrophic events (flooding, landslides, earthquakes, and contamination), mechanical or electrical equipment failure, or events not under the control of the City (for example, localized or area-wide power outages and intentional malevolent acts).

The goal of this curtailment plan is to have objective criteria that trigger actions that will ensure sufficient water to meet the water demands of the water supply system, without jeopardizing the health, safety, or welfare of the community.

History of System Curtailment Episodes

OAR 690-086-0160(1)

Although the City has not needed to impose mandatory water curtailment measures, the City placed ads in the newspaper encouraging residents to voluntarily conserve water during a drought in the early 1990s. The City has limited in-line storage. In the event of a major water supply disruption, the City's 4.5 million gallons (maximum) of stored water would need to be managed carefully, and major restrictions could be needed on all types of municipal water use. In the event of a drought, reduced aquifer recharge could reduce the City's ability to access groundwater from its wellfield. The provisions of the City's curtailment plan, as described below, are intended to address what would happen during such events.

Curtailment Stages and Event Triggers
OAR 690-086-0160(2) and OAR 690-086-0160(3)

Exhibit 4-1 summarizes the stages and initiating triggers for the City's water curtailment plan.

EXHIBIT 4-1
Water Shortage Stages and Initiating Conditions

Shortage Stage	Initiating Conditions
Stage 1: Water Shortage Alert	1. General recognition of drought conditions in Lane County; or 2. Demand reaches 80 percent of water supply capacity as determined by the City Manager for a period of 3 or more consecutive days; or 3. Water supply approaches the minimum required for fire protection or other essential needs as determined by the City Manager.
Stage 2: Serious Water Shortage	Governor has declared a drought in Lane County and the continuation of hot, dry weather is predicted, or if the City's water demand is 81 to 90 percent of water supply capacity for 3 or more consecutive days as a result of a natural or human-caused event.
Stage 3: Severe Water Shortage	Water demand is more than 90 percent of water supply capacity for 3 or more consecutive days for any reason, whether natural or human-caused.
Stage 4: Critical Water Shortage	Failure of a system component or non-drought emergency conditions results in an immediate shortage of water. Examples include: failure of main transmission lines, failure of the intake or WTP, chemical spills, or a malevolent attack on the system that introduces a contaminant at some point in the system.

Stage 1: Water Shortage Alert

Stage 1: Water Shortage Alert will activate a program to inform customers of the potential for drought and water shortages, and reasons to voluntarily conserve water. Stage 1 will be activated by the City Manager and will be triggered when any of the following conditions exist:

1. General recognition of a drought in Lane County

2. Demand reaches 80 percent of water supply capacity as determined by the City Manager for a period of 3 or more consecutive days

3. Water supply approaches the minimum required for fire protection or other essential needs as determined by the City Manager.

Under Stage 1, the City will issue a written notice requesting voluntary reduction in water use by all customers. The notice will include a description of the current water situation, the reason for the requested conservation measures, and a warning that mandatory

restrictions will be implemented if voluntary measures are not sufficient to achieve water use reduction goals. A similar notice could be issued through local media (such as newspaper, radio, or TV). However, if the drought is regional, the media already may be alerting users of water supply concerns. Therefore, the City's Stage 1 plan does not automatically involve press releases or paid media announcements.

When Stage 1 is triggered, the City will ask customers to voluntarily comply with the following:

- Minimize landscape watering between 10 a.m. and 6 p.m., the period of highest water loss resulting from evaporation.

- Water landscapes on alternate days (even-numbered addresses water on even-numbered days and odd-numbered addresses on odd-numbered days).

Stage 2: Serious Water Shortage

Stage 2 is similar to Stage 1 except the voluntary measures regarding outdoor water use will be made compulsory by the City Manager, and additional non-essential water use will be prohibited. Stage 2 will be initiated by the City Manager if the Governor has declared a drought in Lane County and the continuation of hot, dry weather is predicted, or if the City's water demand is 81 to 90 percent of water supply capacity for 3 or more consecutive days as a result of a natural or human-caused event.

Under Stage 2, City customers will be notified of the following water restrictions:

1. Water landscapes only between 6 p.m. and 10 a.m.

2. Water landscapes only when allowed by the odd/even schedule.

3. No water use for washing motorbikes, motor vehicles, boat trailers, or other vehicles except at a commercial washing facility that practices wash water recycling. (Exceptions include vehicles that must be cleaned to maintain public health and welfare, such as food carriers and solid waste transfer vehicles.)

4. No water use to wash sidewalks, walkways, driveways, parking lots, tennis courts, and other hard-surfaced areas.

5. No water use to wash building structures, except as needed for painting or construction.

6. No water use for a fountain or pond for aesthetic or scenic purposes, except where necessary to support fish life.

7. Discourage serving water to customers in restaurants unless water is requested by the customer. This action does not provide significant water savings, but is useful for generating awareness of the need to curtail use.

8. No water use for dust control unless absolutely necessary, as determined by the City Manager.

Stage 3: Severe Water Shortage

Stage 3 will be initiated by the City Manager when water demand is more than 90 percent of water supply capacity for 3 or more consecutive days for any reason, whether natural or human-caused. Stage 3 measures include the following:

1. Perform actions indicated for Stage 2.

2. Replace the restriction of odd/even watering from Stage 2 with a prohibition on all outdoor watering (exceptions include new lawn, grass, or turf planted after March 1st of the calendar year in which restrictions are being imposed; sod farms; high-use athletic fields; or park and recreation areas specifically designated by the City Council.)

3. No water use to fill, refill, or add to any indoor or outdoor swimming pools or hot tubs, except if one of the following conditions is met: the pool is used for a neighborhood fire control supply, the pool has a recycling water system, the pool has an evaporative cover, or the pool's use is required by a medical doctor's prescription.

4. No water use from hydrants for construction purposes (except on a case-by-case basis approved by the City Manager), fire drills, or any purpose other than fire fighting.

5. Implement limitations on commercial uses of water, depending on the severity of the shortage.

6. Issue public service announcements to notify customers of the severity of the conditions.

Stage 4: Critical Water Shortage

Stage 4 will be initiated by the City Manager when failure of a system component or non-drought emergency conditions results in an immediate shortage of water. Examples include failure of main transmission lines, failure of the WTP, chemical spills, or a malevolent attack on the system that introduces a contaminant at some point in the system. If the emergency causes, or is expected to cause, a shortage of water, the City will implement the curtailment measures of Stage 2 or Stage 3, as appropriate, in addition to the steps outlined below.

If water in the system is unsafe to drink (such as in the event of a chemical spill or malevolent attack) the City Manager will direct staff to notify customers as quickly as possible using local radio, print media, the City's website, and any other appropriate means. In addition, the City Manager will implement the following:

1. Contact the Oregon Drinking Water Program, Department of Human Services, and request its assistance in responding to the problem.

2. Notify the local news media, if appropriate, to ask for their assistance in notifying customers.

3. Call an emergency City Council meeting.

4. Contact the Oregon State Police and County Sheriff to obtain help in contacting customers.

5. Determine whether to use water system interties with other water providers, such as HWD.

The City will continue to investigate and develop specific backup plans for a Stage 4 emergency. These plans may include renting a water hauling truck and purchasing water from neighboring communities, sending customers to a pre-designated water distribution location, or supplying bottled water.

5. Water Supply

This section satisfies the requirements of OAR 690-086-0170.

Delineation of Service Areas

OAR 690-086-0170(1)

The current water service area for the City is within the City limits, as shown in **Appendix B.** Several small areas within the City limits are currently served by HWD. Water customers outside the City limits, but within the UGB, also are served by HWD.

As the City limits expand, discussions and agreements between the City and HWD will determine the evolving service areas of each entity. For planning purposes, two scenarios were considered for the limits of possible future service area for the City. The first scenario assumes that the City's future service area would be limited to the existing City limit boundary and areas outside the City limits that already are served by the City. The second scenario assumes that the City's future service area would be the current UGB. Most likely, the City's future service area will be greater than the area bounded by the current City limits and less than the area bounded by the UGB. The assumption that the City may need to serve the area bounded by the UGB is included for planning purposes because it reflects the largest area that the City might be required to serve in the future. Also, the City must be prepared to serve the entire UGB if HWD is unable to serve areas outside the City limits for any reason, such as by agreement with the City, or because of an emergency, such as an infrastructure failure, chemical spill, or malicious attack.

Population Projections

OAR 690-086-0170(1)

Data and planning estimates from PSU's Population Research Center, the *City of Florence Comprehensive Land Use Plan* (2004), the *Lane County Rural Comprehensive Plan: Coordinated Population Forecasts for Lane County and its Urban Areas* were used to estimate future populations within the City limits and within the UGB.

When population projections from the two comprehensive land use plans differed, the *Lane County Rural Comprehensive Plan* was used. Projected populations for 2010, 2020, and 2030 are presented in **Exhibit 5-1.**

EXHIBIT 5-1
City of Florence Population Projections

Year	Population Within City Limits	Population Between City Limits and UGB	Total Population Within UGB[1]
2010	**9,783**	**1,429**	**11,212**
2020	**11,994**	**1,753**	**13,747**
2030	**14,251**	**2,072**	**16,323**

[1] *Lane County Rural Comprehensive Plan: Coordinated Population Forecasts for Lane County and its Urban Areas*

Demand Forecast
OAR 690-086-0170(3)

Approach for Developing Demand Projections

Future demands for the City were projected using a constant per capita demand approach. This method of projecting demand assumes that per capita demand factors remain constant throughout the 20-year projection period.

Historical demand and population estimates were used to determine representative average day per capita demands and maximum day per capita demands for the City. Linear regression analyses of per capita demands from 2004 through 2008 were used to determine the following overall demand factors and standard errors.

- ADD per capita = 120 ± 11 gpcd
- MDD per capita = 225 ± 25 gpcd

These per capita demand values represent all types of water use within the City's service area including residential, commercial, and public water uses, and were assumed to remain constant through 2030. The per capita demand values were multiplied by the future populations to project future ADD and MDD.

Demand Projection Summary

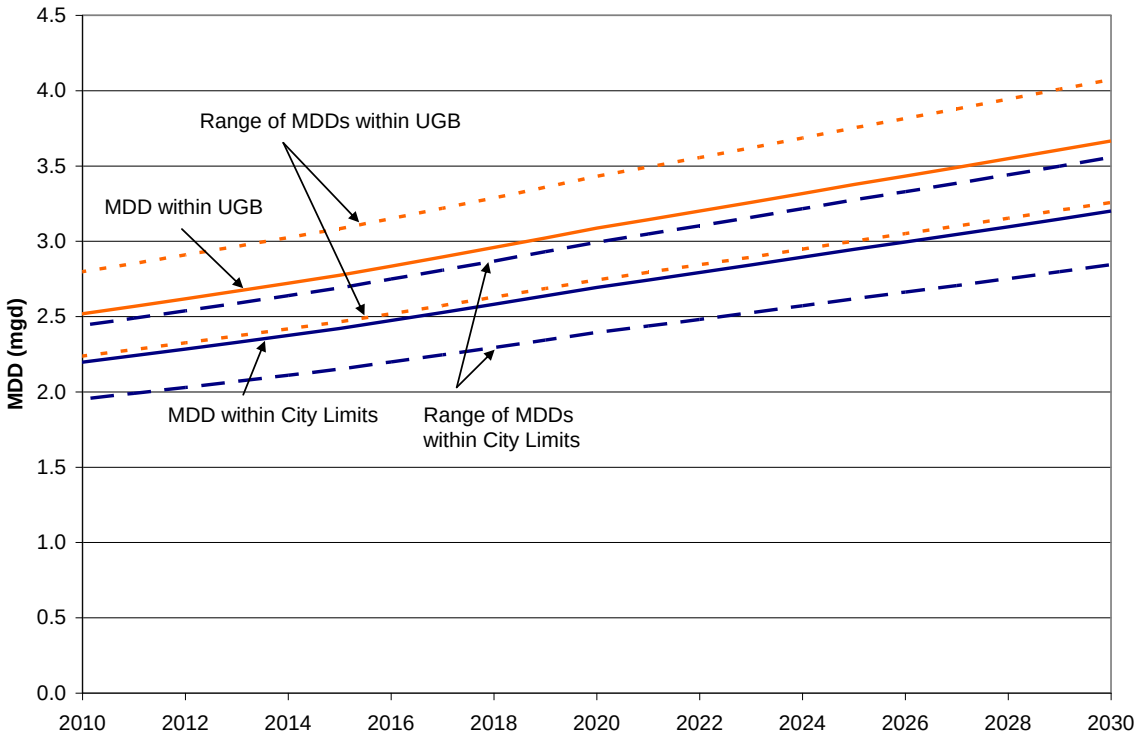
Average and maximum day demand projections for 2020 and 2030 for the potential City water service areas are summarized in **Exhibit 5-2**.

EXHIBIT 5-2
Average and Maximum Day Demand Projections for Limits of City of Florence Water Service Area, mgd

	City Limits		UGB	
Year	**ADD**	**MDD**	**ADD**	**MDD**
2020	**1.4**	**2.7**	**1.6**	**3.1**
2030	**1.7**	**3.2**	**2.0**	**3.7**

Because a city's infrastructure and water rights must be adequate to meet a system's MDD, projected MDD values are critical for planning purposes. **Exhibit 5-3** depicts the City's MDD projections. Also shown is the range of MDDs forecasted on the basis of variation in the per capita demand factor. The range of MDD in Exhibit 5-3 incorporates opportunities for increasing conservation at the lower end of the range and recognizes anomalies that may occur in demand due to weather, special events, and economic growth at the upper end. Although smooth demand curves are shown in Exhibit 5-3, the actual pattern of demand increase will vary depending on when expansion of water service within the UGB occurs. As shown in Exhibit 5-3, the difference between the two scenarios, which represents the MDD associated with the area between the City limits and the UGB, ranges from 0.3 mgd in 2010 to 0.5 mgd in 2030. Overlapping ranges of expected MDD for either scenario also are apparent in Exhibit 5-3. By 2030, the total MDD within the UGB is expected to range from 3.26 mgd to 4.07 mgd, and the MDD within the current City limits is expected to range from 2.84 mgd to 3.56 mgd

EXHIBIT 5-3
Projected Maximum Day Demands for the City of Florence City Limits and UGB



Schedule to Exercise Permits and Comparison of Projected Need to Available Sources

OAR 690-086-0170(2) and (4)

Regardless of whether the City's future service area is limited to the current City limits and areas already served by the City outside the City limits but within the UGB, or the entire UGB, the City likely will need access to the entire undeveloped portion of water right permit G-15056 within 20 years. Thus, the City requests access to the remaining 0.6 cfs undeveloped portion ("green light water") of permit G-15056.

The City holds 5.89 cfs (3.8 mgd) of water rights from groundwater and 0.8 cfs (0.52 mgd) of water rights on Munsel Creek. As noted above, the City does not divert water from Munsel Creek. The authorized point of diversion for Munsel Creek is approximately 1 mile downstream of the WTP. The City's current infrastructure does not allow access to, or treatment of, Munsel Creek water, and there are sensitive and threatened fish species in Munsel Creek. The City's largest MDD to date was 3.43 cfs (2.22 mgd) in 2004

Exhibit 5-4 shows the projected MDD and the upper range of the projected MDD for a water service area bounded by the current City limits, superimposed upon the City's groundwater water rights in units of cfs. As shown in Exhibit 5-4, by 2030 the City may need to supply approximately 5.0 cfs, and up to 5.5 cfs. This may require accessing more than 2.4 cfs of permit G-15056 by approximately 2027. However, this scenario is not used for planning purposes because it assumes the smallest service area and water use.

EXHIBIT 5-4
Projected Maximum Day Demands within the City of Florence City Limits, and Groundwater Rights, cfs

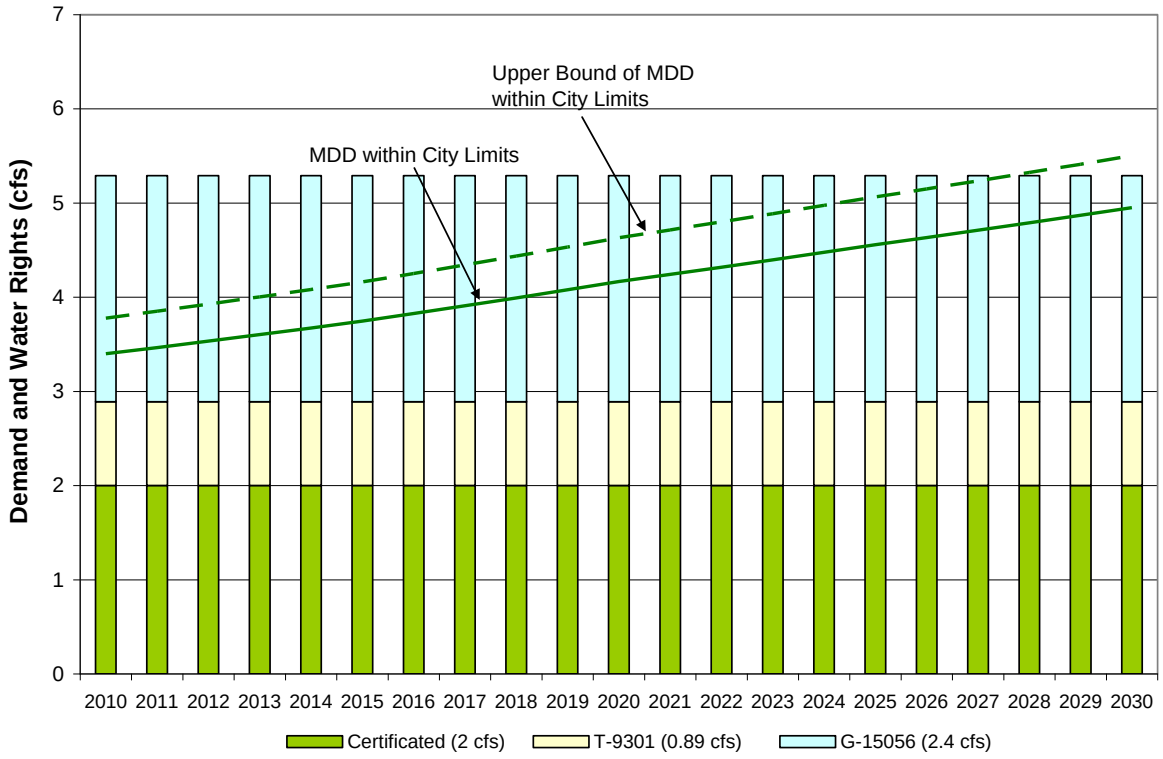
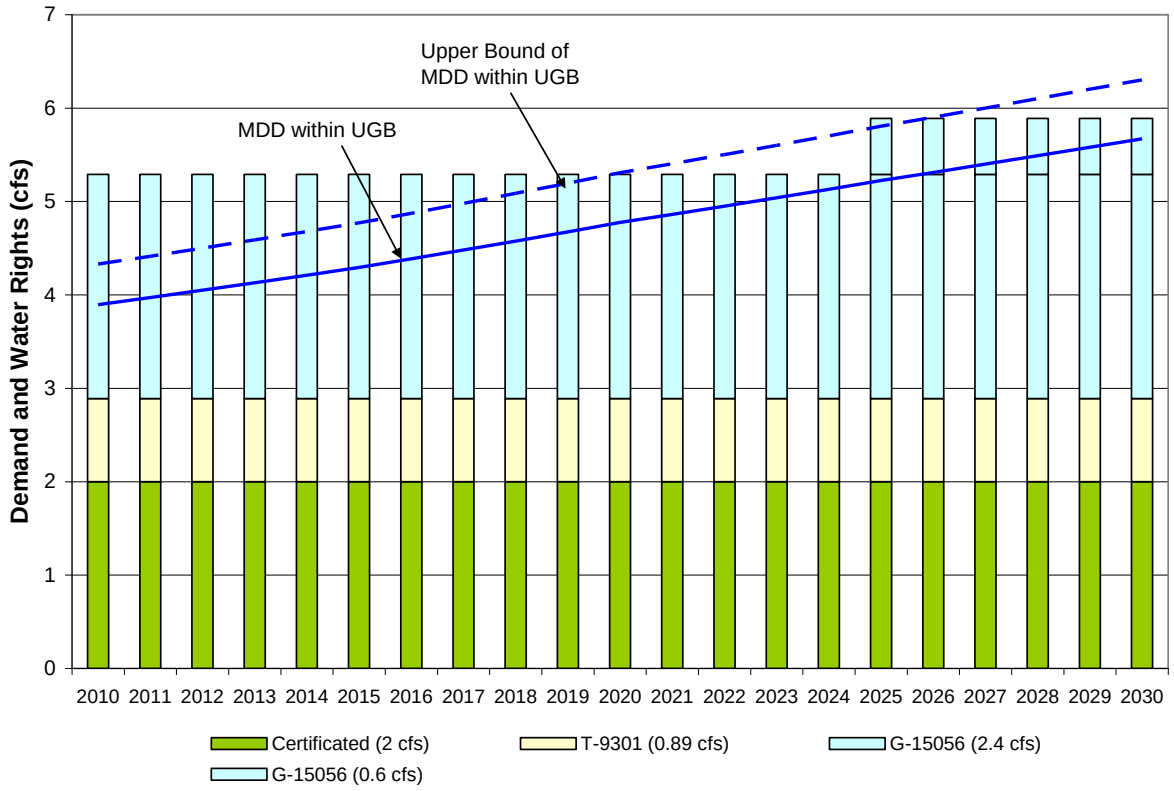


Exhibit 5-5 shows the projected MDD and the upper range of the projected MDD for a water service area bounded by the City's UGB, superimposed upon the City's groundwater rights in units of cfs. As shown in Exhibit 5-5, by 2030 the City may need to supply approximately 5.7 cfs, and up to 6.3 cfs to meet the community's MDD. This will require accessing more than 2.4 cfs of permit G-15056 by approximately 2025, or as early as 2020. Exhibit 5-5 also highlights the need for the City to seek additional water rights as described below. The City must also be prepared to serve water to the entire UGB. Based on these projections, the City requests access to the remaining undeveloped portion of permit G-15056 ("green light water"), which is 0.6 cfs.

EXHIBIT 5-5
Projected Maximum Day Demands within the City of Florence UGB, and Groundwater Rights, cfs



Alternative Sources

OAR 690-086-0170(5), (8)

As described above, the City relies exclusively on its groundwater supply from Wells 1 through 12. The City does not use its water right on Munsel Creek, and it is unlikely that the City could obtain new surface water rights.

The City's water conservation and management measures can be a significant factor in slowing the growth of demand for water, but are not likely to eliminate all such growth. As previously described, the majority of the City's water use is for residential and multifamily use, which has a very low average per capita use. Moreover, the City has an overall average daily per capita use of 120 gpcd, which has slowly declined over the last 4 years. These low values and trends are likely to continue given the City's conservation efforts such as its rate structure and landscape ordinance. These low values and assumed trends are incorporated into the demand projections in Exhibit 5-3 and 5-5. The City intends to implement the various water management and conservation practices outlined in this WMCP in an effort to maximize the benefits of conservation, as well.

The City can purchase surplus water supply from HWD pursuant to an IGA using the existing infrastructure interties. However, the amount of water the City could obtain from HWD is limited by the capacity of the interties and by the amount of "surplus"

water that HWD decides is available for sale. HWD may be able to provide a portion of the City's demand, but is unable to sustain a long-term supply for the City. For example, HWD's ability to receive water under its water rights is limited by easements that restrict the flow of water across the easement lands.

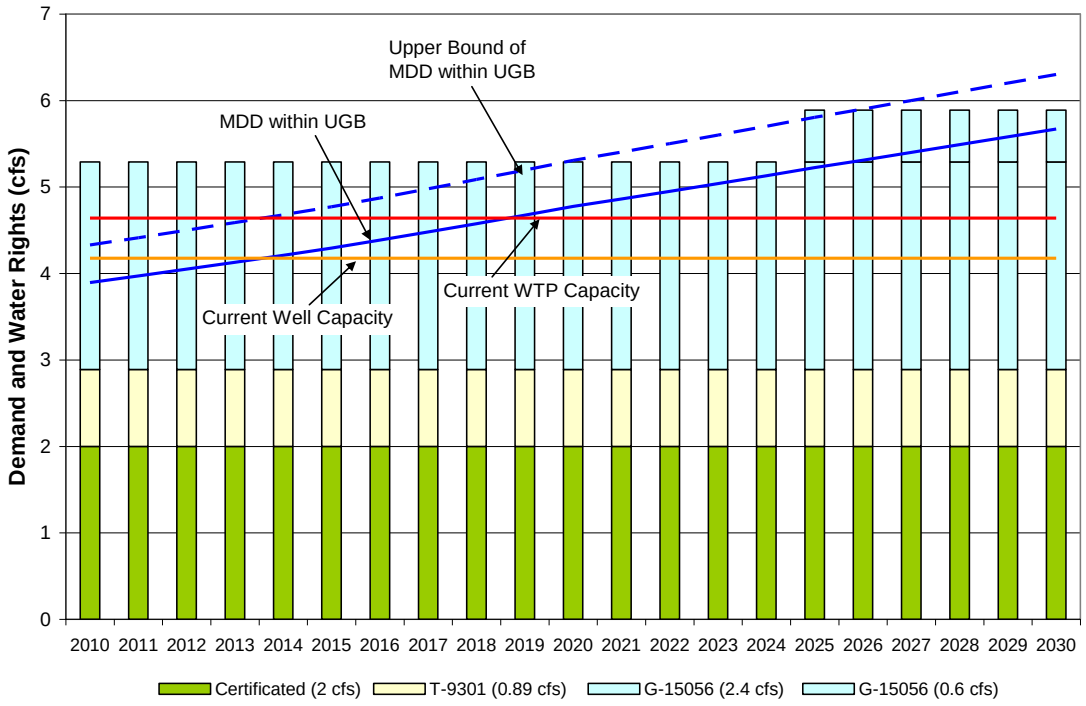
The City's most feasible and economical alternative is to develop the remaining portion of groundwater permit G-15056 (0.6 cfs), which is the amount of "green light water" that the City requests access to in this WMCP.

It is likely that the City's groundwater rights authorize enough water to meet the City's MDD through the end of this WMCP's 20-year planning period. However, the City's actual water production is significantly less than its authorized water rights. The City needs to take immediate action to address its water infrastructure constraints.

The City may need to pursue additional water rights within the 20-year planning period of this WMCP. Exhibit 5-5 provides a range in MDD over the next 20 years. A lower limit representing conservation was also shown in Exhibit 5-3. Projections indicate a potential for demand to exceed the City's water rights by approximately 2026. Moreover, Exhibit 5-6 shows that the City's infrastructure may not be sufficient to fully utilize the City's existing water rights, conveying the need for a new water right. While conservation measures may help Florence avoid the need to have a new water right to meet MDDs, conservation measures will not eliminate the need for Florence to provide water supply/water right redundancy. Currently, Florence depends on a single source and a single well-field to supply water to the community. Florence needs, first and foremost, a new water right for redundancy that will provide security for its water supply, a need which conservation measures cannot avoid, It is unlikely that the City could obtain additional water rights for surface water sources in light of fish protection issues, regulatory requirements, and infrastructure constraints.

Exhibit 5-6 shows the projected MDD within the City's UGB along with current well production capacity and WTP capacity. The City's MDD may equal the actual well production in 2013, and may equal the WTP capacity by 2019. The upper bound value of the projected MDD within the UGB indicates that MDD could equal actual well production as early as 2010, and could be equal to WTP capacity by 2013.

EXHIBIT 5-6
Projected Maximum Day Demands within the City of Florence UGB, Groundwater Rights, and Current Water System Capacities, cfs



Thus, the City's actual well production and WTP capacity quickly could become critical constraints on water supply. The City must take immediate action to address those constraints and ensure its ability to meet growing water demand, and is doing so through the development of a Water System Master Plan.

The City is investigating options to maximize its ability to divert groundwater under its existing water rights. Options include well rehabilitation, drilling new wells, and pursuing water right transfers to allow for use of water from additional wells. For instance, the City is evaluating submittal of a transfer application and construction of a new well (Well 13), and may pursue new water rights for a potential additional wellfield site north of the current wellfield.

Because the City's entire water supply relies on a sole source, the City is focused on trying to provide a redundant supply. In an emergency, such as an infrastructure failure, chemical spill, or malicious attack, the City may not be able to use its current wellfield. The addition of a second wellfield could provide the City with additional source flexibility.

Quantification of Projected Maximum Rate and Monthly Volume

OAR 690-086-0170(6)

OAR 690-086-0170(6) requires a quantification of the maximum rate of withdrawal and maximum monthly use if initial diversion of water allocated under an existing permit is

necessary to meet demands in the 20-year planning period. As described above, the City may need access to the entire amount of water authorized by its groundwater rights to provide system flexibility and to meet demand as soon as 2025. The maximum projected rate of withdrawal would be the full rate authorized by the City's groundwater permits (5.89 cfs, or 3.8 mgd). The maximum projected monthly volume, based on a 24-hour daily pumping cycle for 1 month, is 114 mgd.

Mitigation Actions under State and Federal Law

OAR 690-086-0170(7)

The City's water use permit G-15056 contains conditions for mitigating impacts to surface water, which require delivery of water to the wetlands in late October and diversion of clarified backwash from the City's WTP to the wetlands. The permit states the following:

- ***Mitigation Condition #1:*** *During the period October 16 through October 31 of each year after this permit is first exercised, the City will deliver to the wetlands adjacent to Munsel Creek the equivalent of 26% of the average pumping rate under this permit for the previous June, July, August, and September.*

- ***Mitigation Condition #2:*** *Any time this permit is being exercised, all clarified backwash water from the City's water treatment plant will be diverted to wetlands adjacent to Munsel Creek.*

The City is in compliance with these mitigation conditions. Currently, the City is not subject to any other state or federal mitigation requirements.

Appendix A

Letter to Affected Local Government

Appendix B
City of Florence Water System Map

Appendix C
City of Florence Water Right Table

Appendix C
City of Florence Water Right Table

App.	Permit	Certificate	Transfer	Source	Priority Date	Deadline for Completion Date	Type of Beneficial Use	Maximum Instantaneous Rate Allowed (cfs)	Maximum Annual Quantity of Water Allowed (MG)	Maximum Instantaneous Rate Diverted to Date (cfs)	Maximum Annual Quantity Diverted to Date (MG)	Average Monthly Diversions for 2008 (MG)	Average Daily Diversions for 2008 (MG)	Streamflow-dependent Species listed by State or Federal Agency as Sensitive, Threatened, or Endangered that are Present in the Source	Listed Water Quality Limitations and Parameters	Source in Critical Groundwater Area?
G-3234	G-3040	81398	None	Groundwater Wells 1-7	9-16-1965	N/A	Municipal	2.0 cfs	N/A	2.0 cfs	449 MG for Wells 1-12	32.1 MG for Wells 1-12	1.06 MG for Wells 1-12	N/A	N/A	No
G-7319	G-6864	50606 (cancelled)	T-9301	Groundwater Wells 1-7	7-1-1976	10-1-2013	Municipal	0.89 cfs	N/A	Inchoate	449 MG for Wells 1-12	32.1 MG for Wells 1-12	1.06 MG for Wells 1-12	N/A	N/A	No
G-15295	G-15056	None	None	Groundwater Wells 8-12	2-5-2001	10-1-2025	Municipal	3.0 cfs	N/A	2.4 cfs	449 MG for Wells 1-12	32.1 MG for Wells 1-12	1.06 MG for Wells 1-12	N/A	N/A	No
S-23345	S-24525	32115	None	Munsel Cr.	8-6-1948	N/A	Municipal	0.8 cfs	N/A	0.8 cfs	Information not available	None	None	See Exhibit 2-18 (in Section 2 of the WMCP)	None	N/A

APPENDIX C
Cost Allocation for Facilities and Piping Improvements

APPENDIX C
COST ALLOCATION FOR FACILITIES AND PIPING IMPROVEMENTS

Appendix C contains cost data for recommended improvements to pump stations, storage facilities, pressure reducing valves and system piping. Improvement project cost estimates presented in this appendix are based upon recent experience with construction costs for similar work in the area and assume improvements will be accomplished by private contractors. Estimates include provisions for approximate construction costs plus an aggregate 45 percent allowance for contingencies, engineering, administration and other project-related costs. Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News-Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. For purposes of future cost estimate updating; the current ENR CCI for Seattle, Washington is 8647 (February 2010).

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

Table C-1
Ocean Dunes PRV Station Project Cost Estimate Summary

PRV station project cost estimates are based on the following assumptions:

- No rock excavation.
- No property acquisition costs included.
- Construction by private contractors.

Item No.	Description	Estimated Project Cost[1]
1.	Vault	$6,000
2.	Valves	$15,000
3.	Fittings	$5,000
4.	Piping	$5,000
5.	Supports/Restraint	$2,500
6.	Excavation/Backfill/Surface Restoration	$4,000
7.	Testing/Calibration	$2,000
8.	Labor/Equipment	$20,000
	Total Construction Cost	$59,500
	45% Contingency, Administration & Engineering	$26,775
	Total Project Cost	$86,275
	SAY	$90,000

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

Table C-2
Onadoone Court Check Valve Project Cost Estimate Summary

PRV station project cost estimates are based on the following assumptions:

- No rock excavation.
- No property acquisition costs included.
- Construction by private contractors.

Item No.	Description	Estimated Project Cost[1]
1.	Vault	$6,000
2.	Valves	$7,500
9.	Fittings	$5,000
10.	Piping	$5,000
11.	Supports/Restraint	$2,500
12.	Excavation/Backfill/Surface Restoration	$4,000
13.	Testing/Calibration	$2,000
14.	Labor/Equipment	$20,000
	Total Construction Cost	$52,000
	45% Contingency, Administration & Engineering	$23,400
	Total Project Cost	$75,400
	SAY	$76,000

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

Table C-3
Ocean Dunes Drive Check Valve Project Cost Estimate Summary

PRV station project cost estimates are based on the following assumptions:

- No rock excavation.
- No property acquisition costs included.
- Construction by private contractors.

Item No.	Description	Estimated Project Cost[1]
1.	Vault	$6,000
2.	Valves	$7,500
15.	Fittings	$5,000
16.	Piping	$5,000
17.	Supports/Restraint	$2,500
18.	Excavation/Backfill/Surface Restoration	$4,000
19.	Testing/Calibration	$2,000
20.	Labor/Equipment	$20,000
	Total Construction Cost	$52,000
	45% Contingency, Administration & Engineering	$23,400
	Total Project Cost	$75,400
	SAY	$76,000

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

Table C-4
Booster Pump Station Project Cost Estimate Summary
Sand Pines Pump Station Replacement

Pump station project cost estimates are based on the following assumptions:

- No rock excavation included.
- No property acquisition costs included.
- Construction by private contractors.

Item No.	Description	Estimated Project Cost[1]
1.	Mobilization/Demobilization	$25,000
2.	Site Work	$20,000
3.	Structure	$325,000
4.	Yard Piping	$65,000
5.	Mechanical	$335,000
6.	Controls	$70,000
7.	Electrical	$45,000
8.	Back-up Power	$80,000
9.	Existing Pump Station Demolition	$35,000
	Total Construction	$1,000,000
	45% Contingency, Administration & Engineering	$450,000
	Total Project Cost	$1,450,000
	SAY	$1.5 million

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

Table C-5
Reservoir Project Cost Estimate Summary
North Zone Storage Reservoir (1.0 MG)

Reservoir project cost estimates are based on the following assumptions:

- No rock excavation included.
- No property acquisition costs included.
- Construction by private contractors.

Item No.	Description	Estimated Project Cost[1]
1.	Reservoir Structure	$1,250,000
2.	Site Work	$100,000
3.	Drainage System	$25,000
4.	Geotextiles	$20,000
5.	Access/Parking	$20,000
6.	Yard Piping	$60,000
7.	Electrical	$15,000
8.	Landscaping/Fencing	$25,000
	Total Construction	$1,515,000
	45% Contingency, Administration & Engineering	$681,750
	Total Project Cost	$2,196,000
	SAY	$2,200,000

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

Table C-6
Piping Unit Project Cost Summary

Pipe Diameter	Cost per Linear Foot
8-inch	$100
12-inch	$122
16-inch	$176

Basic Assumptions:

- Native sand trench backfill
- PVC pipe
- No rock excavation
- No dewatering
- No property or easement acquisitions
- No specialty construction included
- A 45% contingency, administration and engineering allowance included
- Construction by private contractors
- An Engineering News Record (ENR) construction cost index CCI for Seattle, Washington of 8647 (February 2010)
- Add an additional 60% for construction with rock excavation the entire depth of trench

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

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