Olympic Water and Sewer, Inc.
Water System Plan Update

DRAFT issued February 2024

FINAL issued _____

HDR

Acknowledgement

An undertaking of this magnitude is not possible without the efforts of numerous individuals and groups. HDR would like to pay particular tribute to those agencies and individuals listed below:

- Olympic Water and Sewer, Inc. staff
- Jefferson County Department of Community Development and its staff
- Staff of the Washington State Departments of Health and Ecology

Engineering Certificate

Olympic Water and Sewer, Inc.
Water System Plan Update

The material and data contained in this report were prepared under the direction and supervision of the undersigned, whose seal as a professional engineer licensed to practice in the State of Washington, is affixed below.

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Jeffrey M. Hansen, P.E.
Project Manager

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Section 1
Introduction

This section provides general information regarding the Olympic Water and Sewer, Inc. (OWSI) water system. Material is presented describing the water system's service area, history and development, and the current ownership and management of the system. An overview of system components is provided, water system policies are summarized, and other related planning efforts are also described in this section.

1.1 Introduction and Description of Service Area

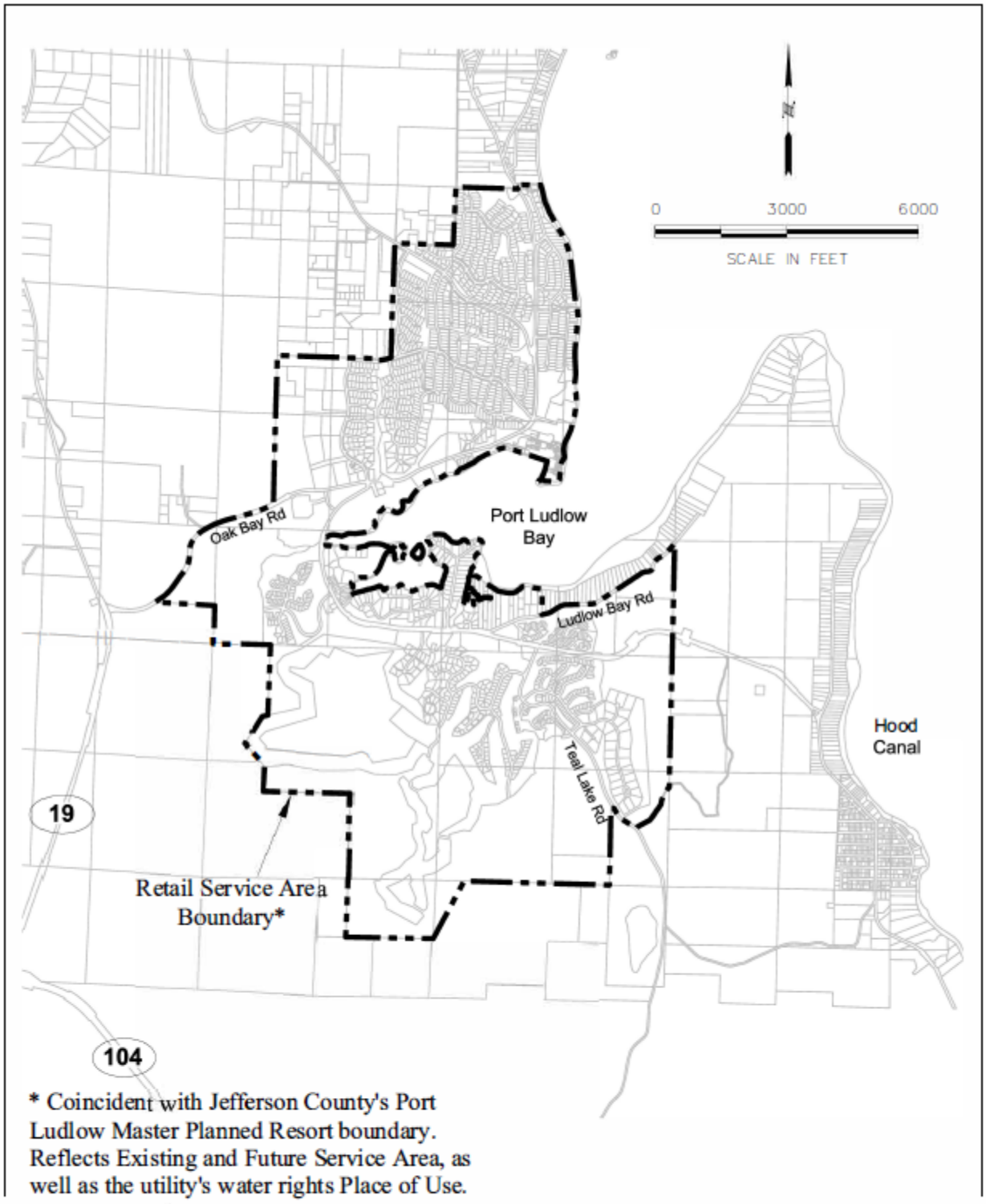
OWSI provides water service to the Port Ludlow Master Planned Resort (MPR) in unincorporated Jefferson County. OWSI's retail service area (which is also its existing and future service area) is coincident with the Port Ludlow MPR boundary, as defined in the Jefferson County Comprehensive Plan and as shown on Exhibit 1-1. OWSI may modify its service area in the future to serve areas outside of the MPR boundary, if water supply needs arise outside of the current service area that cannot be otherwise met.

The Port Ludlow community is located approximately five miles north of the Hood Canal floating bridge (SR 104) and 16 miles south of Port Townsend. Development in Port Ludlow began in 1967. At the end of 2022, there were a total of 1,882 residential lots developed within the MPR; 1,666 single family and 216 multi-family (condominiums). Of this total there were 1,701 residential connections to the water system; 1,485 single family and 216 multi-family. In addition, the MPR includes a marina, restaurant, two homeowner activity centers, conference center, commercial center, inn, and championship golf course.

The service area is comprised of two distinct service zones. Service Zone A refers to the developed area north of Port Ludlow Bay, and Service Zone B refers generally to the area south of the bay.

Growth is anticipated to be slow in the short-term, with full build-out of the water system likely occurring just beyond the 20-year planning horizon.

The only water system located adjacent to OWSI's service area is Olympus Beach Tracts (located to the north of OWSI's water service area boundary). There are other small water systems located near, though not adjacent to, OWSI including some owned and operated by Jefferson County Public Utility District No. 1.



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OLYMPIC WATER AND SEWER, Inc.
Water System Plan
Water Service Area

DATE
Sept 2023

FIGURE
EXHIBIT 1-1

1.2 Purpose and Objectives of Water System Plan

The purpose of a Water System Plan (WSP) is to provide a uniform process for water purveyors to:

- Identify present and future needs,
- Set forth the means for addressing those needs, and
- Demonstrate that the system has the operational, technical, managerial, and financial capability to achieve and maintain compliance with all relevant local, State, and federal plans and regulations.

OWSI is required to develop a WSP according to Washington Department of Health (DOH) regulations under Chapter 246-290 (Group A Public Water Supplies) of the Washington Administrative Code (WAC). As an investor-owned utility, OWSI is also regulated by the Washington Utilities and Transportation Commission (WUTC), which reviews rates, schedules of service, and tariff structures. This WSP update has been developed in accordance with Chapter 246-290 WAC and the DOH "Water System Planning Handbook," dated August 2020.

1.3 Ownership and Management

This WSP is developed for the public water system operated by OWSI. OWSI is privately owned by Port Ludlow Associates LLC. Former names of OWSI were Ludlow Water Company and Ludlow Utilities Company. The OWSI water system is considered a Group A community water system by DOH and has a Public Water System Identification Number of 68700L.

1.4 Natural Setting

The topography of the OWSI water service area is generally hilly, with service elevations ranging from just above sea level to approximately 470 feet in elevation. Future growth will fill in the Port Ludlow community within the existing service area boundary. There are no topographical or natural features that will significantly constrain or impact the operation and expansion of the water system.

1.5 Overview of Existing System

As mentioned above, the OWSI water system is comprised of two service zones. Service Zone A receives its water supply from three groundwater wells having a present combined pumping capacity of approximately 235 gallons per minute (gpm). Storage is provided by two ground-level steel reservoirs, with a combined capacity of approximately 450,000 gallons. Water is conveyed to two pressure zones within Service Zone A. Water treatment for the removal of iron and manganese is provided at two of this service zone's wells.

Service Zone B receives its water supply from two groundwater wells having a present combined pumping capacity of approximately 460 gpm. Storage is provided by two ground-level steel reservoirs, with a combined capacity of approximately 445,000 gallons. Water treatment for the removal of iron and manganese is provided for this service zone's wells. Water is conveyed to eight pressure zones within Service Zone B.

All components of the water system are described in greater detail in Section 5. Included in that section of the WSP is a full inventory of water system facilities, with detailed descriptions of the wells, storage reservoirs, distribution system, and other components that make up the system.

1.6 Summary of Water System Carrying Capacities

A key element of this WSP is the evaluation of the capacities of various water system elements and their abilities to support current and projected future water supply needs. Resulting from these evaluations are "carrying capacities," or the maximum number of equivalent residential units (ERUs) that existing (and/or planned) facilities can support. Such analyses aid in identifying capacity deficiencies and provide the foundation for some capital improvement projects. Table 1-1 summarizes the carrying capacities regarding OWSI's water rights, source pumping, and storage components. For the water system as a whole, OWSI's carrying capacity is 2,383 ERUs, based on current well pumping capacity as the limiting factor. Details of capacity analyses are presented in later sections of the WSP. In particular, ERU projections are described in Section 3. Water rights and source pumping analyses are presented in Section 7, and storage facilities are evaluated in Section 8.

Carrying capacities are not included in Table 1-1 for OWSI's treatment and distribution facilities, for the following reasons. The treatment systems have been sized commensurate with the pumping capacities at the applicable sources. For example, the Well 2 and Well 3 treatment systems were designed for flow rates of 150 gpm and 86 gpm, respectively. By contrast, Wells 2 and 3 are currently pumping at approximately 110 gpm and 25 gpm, respectively. Therefore, because they were designed to accommodate higher flow rates, there are no additional limitations imposed by the treatment systems.

Regarding distribution facilities, it is difficult to characterize carrying capacities in terms of piping, etc. Water mains are typically designed to convey fire flows, which in the case of OWSI means that they are also more than adequate to support the average and maximum day demands imposed by customers. Some deficiencies have been identified throughout the system regarding the capability of certain sections of distribution piping to convey required fire flows at minimum pressures. Such deficiencies, however, are not a function of the amount of current or proposed ERUs, and therefore do not factor into a carrying capacity analysis. OWSI has scheduled improvements to address noted distribution system deficiencies.

Table 0-1. Water System Physical Capacity Analysis

Note: *Capacity determinations are only for existing facilities that are operational for the water system.*

Specific Single-Family Residential Connection Criteria:

Average Day Demand (ADD): 175 (1) gpd/ERU

Maximum Day Demand (MDD) 350 (2) gpd/ERU

Water System Service Connections correlated to ERUs			
Service Classification	**Total MDD for the classification, gpd (3)**	**Total # Connections in the classification (3)**	**ERUs (3)**
Residential	484,905	1,701	1,385
Nonresidential	51,571	279	98
DSL	65,141 (4)	N/A	186
Other (identify)	39,102 (5)	N/A	112
Total existing ERUs (Residential + Nonresidential + Non-revenue + Other) = 1,831			

Physical Capacity as ERUs	
Water System Component (Facility)	**Calculated Capacity in ERUs for each component**
Source(s)	2,383 (6)
Treatment	NA (7)
Equalizing Storage	>16,500 (8)
Standby Storage	3,288 (at 20 psi) (9)
Distribution	NA (7)
Transmission	NA (7)
Other (water rights)	4,336 (Qi basis) 2,829 (Qa basis) (10)
Water System Physical Capacity (ERUs) = 2,383 (based on the limiting water system component shown above)	

Notes:

(1) See Section 3.3, based on recent average. As discussed in Section 3, actual per-ERU water use has averaged 155 gpd/ERU for the past 10 years. However, for planning purposes, the utility uses a higher ERU water use factor (175 gpd/ERU).
(2) Based on a peaking factor of 2.0 (see Section 3.1), based on recent average.
(3) Based on Table 3-6, for Year 2022. For ERUs, also see Table 3-6 footnote 2 regarding why number of ERUs is less than connections.
(4) Based on Table 3-6, Non-Revenue Water Unaccounted-For, for Year 2022.
(5) Based on Table 3-6, Non-Revenue Water Accounted-For, for Year 2022
(6) See Table 7-4. Based on capacity to meet MDD with sources operating 20 hours per day.
(7) Not calculated for reasons specified in the text.
(8) See Tables 8-1 and 8-2 for information on equalizing storage calculations. Capacity calculations based on equalizing storage limitations are not shown in those tables, as they are not limiting. However, spreadsheet calculations not included in the WSP indicate that existing equalizing storage volumes can support more than 8,000 ERUs in Service Zone A and more than 8,500 ERUs in Service Zone B.
(9) See Tables 8-1 and 8-2. Total of Max ERUs displayed on each table, with standby storage being the limiting factor.
(10) See Section 7.1 for details. Based on total Qi of 1,054 gpm and Qa of 555 afy, associated with existing water rights.

1.7 Water Utility Policies

OWSI's water utility policies have been established to ensure orderly operations through a variety of circumstances. Conditions of service are governed by Chapter 480-110 WAC (Water Companies) and the OWSI Operating Tariff, as approved by WUTC. Service is available to all properties and projects within the Port Ludlow MPR in accordance with WUTC regulations and Municipal Water Law requirements. OWSI's current Operating Tariff is provided as Appendix A.

Distribution extensions within new subdivisions are installed at the expense of the developer, while source, storage, and transmission facilities are paid for by OWSI. This method of cost allocation has proven to be successful in maintaining the capital/asset ratio required by WUTC. An example of OWSI's application for service is provided in Appendix B.

1.7.1 Duty to Serve

OWSI has a duty to provide service to all new connections within its retail service area, per the Municipal Water Law, when the following four conditions are met:

1) **Capacity**. OWSI must have sufficient capacity to provide water to a new connection in a safe and reliable manner.
2) **Consistent**. The requested service must be consistent with adopted local plans and development regulations.
3) **Water Rights**. OWSI must have sufficient water rights to provide service.
4) **Timely and Reasonable**. OWSI must be able to provide service in a timely and reasonable manner to authorize service per a request.

As noted above, OWSI is prepared to provide service to all properties in the MPR, within the four conditions set forth in the Municipal Water Law. At this time, OWSI does not foresee any reason related to the four above conditions that would preclude provision of service to any property within the MPR.

1.8 Related Plans

A number of development and water supply related plans and studies have shaped the development and operation of the OWSI water system throughout its history. These plans are described in OWSI's previous WSP.

This WSP update has been prepared in accordance with both the Jefferson County Comprehensive Plan (Comp Plan), and the Jefferson County Coordinated Water System Plan Regional Supplement - Update (CWSP). The Comp Plan was most recently updated in 2018. The Comp Plan is a tool for officials and citizens in guiding growth and development in Jefferson County on a 20-year planning horizon. As such, it contains policies and population

projections regarding the Port Ludlow MPR. These were used as the basis for WSP-related planning activities, as further described in Section 2.

The CWSP was most recently updated in May of 1997. The CWSP, and its update, was developed under the direction of the Jefferson County Water Utility Coordinating Committee (WUCC), which included representatives of local governments, fire protection districts, and water purveyors. Key elements of the CWSP that directly affect OWSI include definition of utility service areas, minimum standards and specifications, and minimum fire flow requirements. This WSP update has been developed so as to remain consistent with these and other CWSP elements.

1.9 Implementation

A key element in the implementation of the WSP is proper compliance with State and local requirements governing adoption of this document. As previously discussed, this WSP must be submitted to DOH for review and approval.

In addition, the State Environmental Policy Act of 1971 (SEPA), Chapter 43.21C, of the Revised Code of Washington (RCW), requires that a WSP must be accompanied by an appropriate environmental document. An Environmental Checklist has been prepared for the OWSI WSP and its planned activities. A Determination of Non-Significance (DNS) was issued by DOH, based upon review of the checklist and public comments. The checklist and DNS are included as Appendix O of the WSP.

Details of the WSP content are referenced in the Checklist. It is anticipated that both negative and positive impacts will occur to earth, water, land use, population, public services, and utilities as a result of implementing the WSP. However, this WSP has been developed to accommodate and plan for expected changes and not to dictate those changes. Therefore, scheduled implementation of this WSP and sound engineering and construction practices will minimize any adverse impacts.

The final environmental determination, approved OWSI construction specifications and details, and DOH approval combine to endorse the WSP contents and allow the construction of distribution mains listed in the WSP, without individual approval by DOH.

OWSI held a consumer information meeting regarding the WSP, including providing a time for public comments on Water Use Efficiency program goals, on October 30, 2023. The public notice for this meeting is provided in Appendix P, along with a copy of the presentation used at the meeting.

This WSP was adopted by the Olympic Water and Sewer, Inc. Board of Directors in (TBD). A copy of the Board meeting minutes documenting this adoption is provided in Appendix P.

File copies of this document will be furnished to DOH, Ecology, the Jefferson County Environmental Health Department, and Jefferson County Fire Protection District No. 3.

Section 2
System Planning Considerations

General planning data for OWSI are presented in this section. A discussion of the Growth Management Act and the Jefferson County Comprehensive Plan was discussed in prior WSP updates and will not be duplicated here. A summary of historic and projected growth within the OWSI service area, as well as a forecast of service area population is provided.

DOH requires that the planning effort address base year, 10-year and 20-year planning periods, which for this update are 2023, 2033, and 2043 respectively.

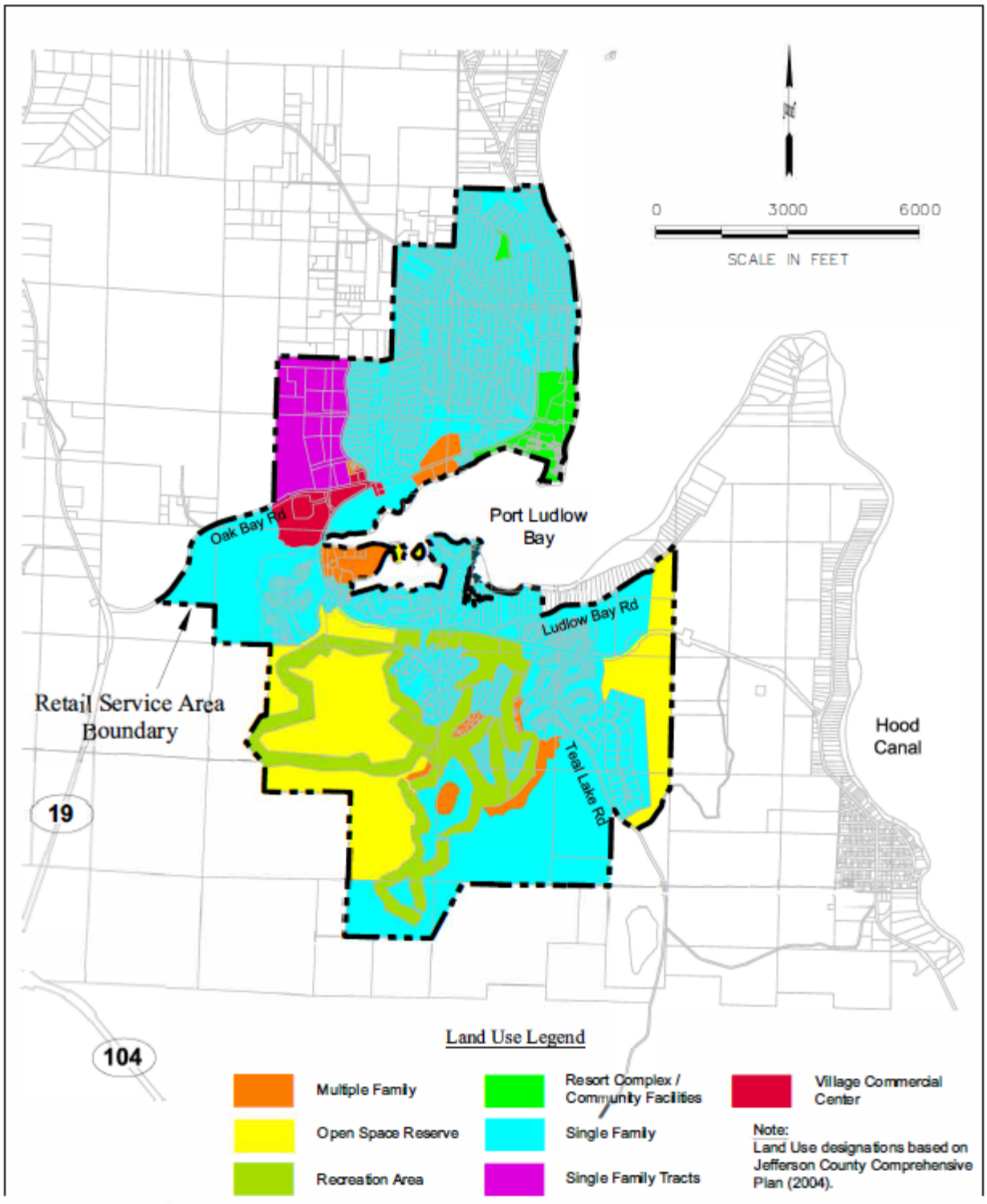
2.1 Relation to the Growth Management Act

The Jefferson County Comprehensive Plan (Comp Plan), last updated in 2018, designated Port Ludlow as a Master Planned Resort (MPR) and assigned a growth threshold of 2,250 residential units and an equivalent 325 commercial units. This Comp Plan was used as the basis for the planning criteria described in the following sections, which are consistent with the planning projections in the previous WSP.

2.2 Historic and Projected Growth

The OWSI water system serves existing development within the service area depicted on Exhibit 1-1, except for the golf course, which irrigates its grounds with water from Ludlow Creek. OWSI is planning to serve all future growth within its service area boundary, which encompasses the entire Port Ludlow Master Planned Resort (MPR). Comp Plan land use designations for this area are presented in Exhibit 2-1.

The following subsections describe OWSI's anticipated residential and commercial growth. These projections are used to develop the water demand forecast presented in Section 3.



HDR

OLYMPIC WATER AND SEWER, Inc.
Water System Plan
Land Use Designations

DATE
Sept 2023

FIGURE
EXHIBIT 2-1

2.2.1 Residential Growth

Historic

OWSI provides water service primarily to residential customers, both single-family lots and multi-family (condominium) units. "Lots" refer to platted or developed lots and units, while connections refer to the number of lots/units to which water service has been provided. At build-out of the MPR, it is assumed that all lots will also be water system connections, i.e. all properties within the MPR are required to be connected to the OWSI water system.

At the end of 2022, there were a total of 1,882 residential lots developed within the MPR; 1,666 single family and 216 multi-family (condominiums). Of this total there were 1,701 residential connections to the water system; 1,485 single family and 216 multi-family.

Growth in platted and developed lots was relatively slow from the economic downturn of 2006/2007 through the COVID-19 pandemic, though the number of water connections grew at a modest pace as developed properties were connected to the water system. The number of residential water system connections grew from 1,595 in 2016, to 1, 701 in 2022.

Projected

As discussed in Section 2.1, the Comp Plan defines the maximum number of residential lots allowed within the Port Ludlow MPR boundary as 2,250. Plans exist for new developments, with full build-out of the Comp Plan maximum number of allowable lots occurring by approximately 2040.

New connections to the water system are anticipated to occur at a rate similar to that observed since 2016. The total number of residential connections is projected to increase from 1,701 in 2023, to 2,022 in 2043. In Service Zone A, single-family residential connections are assumed to increase at a rate of approximately 3 per year. In Service Zone B, single-family residential connections are assumed to increase at a rate of approximately 11 per year. In addition, multi-family residential connections in Service Zone B are projected to increase to the planned maximum of 258 units by 2030. Projected system growth is summarized in Table 2-1.

Table 2-1
Olympic Water and Sewer, Inc.
Historic and Projected Future Growth of Residential Lots and Water Connections [1]

	Service Zone A [2]		Service Zone B [3]				Total System					
	Single-Family Residential		Single-Family Residential		Multi-Family Residential		Single-Family Residential		Multi-Family Residential		Total [10]	
Year	Lots	Conn. [5]	Lots [6]	Conn. [7]	Lots [8]	Conn. [9]	Lots	Conn.	Lots	Conn.	Lots	Conn.
Historic												
2016	822	605	844	774	216	216	1,666	1,379	216	216	1,882	1,595
2017	822	609	844	794	216	216	1,666	1,403	216	216	1,882	1,619
2018	822	615	844	807	216	216	1,666	1,422	216	216	1,882	1,638
2019	822	624	844	807	216	216	1,666	1,431	216	216	1,882	1,647
2020	822	624	844	810	216	216	1,666	1,434	216	216	1,882	1,650
2021	822	637	844	826	216	216	1,666	1,463	216	216	1,882	1,679
2022	822	651	844	834	216	216	1,666	1,485	216	216	1,882	1,701
Projected												
2023	822	651	881	834	216	216	1,703	1,485	216	216	1,919	1,701
2024	822	654	919	844	258	221	1,741	1,498	258	221	1,999	1,719
2025	822	658	919	854	258	223	1,741	1,512	258	223	1,999	1,735
2026	822	661	979	866	258	230	1,801	1,527	258	230	2,059	1,757
2027	822	664	979	880	258	237	1,801	1,544	258	237	2,059	1,781
2028	822	667	1,020	891	258	244	1,842	1,558	258	244	2,100	1,802
2029	822	671	1,020	902	258	251	1,842	1,573	258	251	2,100	1,824
2030	822	674	1,045	913	258	258	1,867	1,587	258	258	2,125	1,845
2031	822	677	1,045	922	258	258	1,867	1,599	258	258	2,125	1,857
2032	822	681	1,095	938	258	258	1,917	1,619	258	258	2,175	1,877
2033	822	684	1,095	948	258	258	1,917	1,632	258	258	2,175	1,890
2034	822	688	1,095	958	258	258	1,917	1,646	258	258	2,175	1,904
2035	822	691	1,120	968	258	258	1,942	1,659	258	258	2,200	1,917
2036	822	694	1,120	978	258	258	1,942	1,672	258	258	2,200	1,930
2037	822	698	1,145	988	258	258	1,967	1,686	258	258	2,225	1,944
2038	822	701	1,145	1,003	258	258	1,967	1,704	258	258	2,225	1,962
2039	822	705	1,145	1,018	258	258	1,967	1,723	258	258	2,225	1,981
2040	822	708	1,170	1,032	258	258	1,992	1,740	258	258	2,250	1,998
2041	822	711	1,170	1,037	258	258	1,992	1,748	258	258	2,250	2,006
2042	822	714	1,170	1,042	258	258	1,992	1,756	258	258	2,250	2,014
2043	822	717	1,170	1,047	258	258	1,992	1,764	258	258	2,250	2,022

Notes:
Lots = Platted and/or Developed Lots; Conn. = Active Water Connections
Bold entries indicate growth endpoints for each category.
Shaded rows indicate planning horizons of interest with regard to water system planning (i.e., Base, 10- and 20-year horizons).

(1) Does not include Commercial water connections.
(2) Includes all residential lots north of Port Ludlow Bay, except for the following areas along the bay that receive water from the South Bay wells: PL#1-A2, PL#2-A1, PL#5, Ludlow Bay Village, Ludlow Cove, Oak Bay Short Plat, and Scott Short Plat.
(3) Includes all residential lots south of Port Ludlow Bay, as well as the areas listed above located north of the bay.
(4) Footnote not used.
(5) Average connections over the planning period are estimated at 3 per year in Zone A and and will continue in that manner beyond the 20 year planning horizon.
(6) All new single-family residential plats will be located in Service Zone B, according to the following development schedule:
-Falls Terrace - 60 lots - 2026
-Olympic Terrace II Phase 2 - 38 lots in 2023/2024
-Admiralty III townhomes 38 units in 2024
-Additional lots will be platted but areas are not specified here.
(7) Average growth is estimated at 11 connections per year over 20 years.
(8) Re-platting of Ludlow Bay Village added 42 condominium and subtracted 32 single family (58 to 26).
(9) All new multi-family units (Ludlow Bay Village) are assumed to be connected by 2031.
(10 The maximum number of residential units allowed within the Port Ludlow Master Planned Resort boundary is 2,250, according to the Jefferson County Comprehensive Plan (2004). This analysis anticipates that number of lots will be platted within the 20 year planning horizon, however construction will extend beyond that time.

2.2.2 Commercial Growth

Historic

OWSI's commercial customers include a 36 room inn with restaurant, golf clubhouse, two homeowner activity centers, village shopping center, church, marina, and a variety of other professional offices including real estate brokers, dentist, a health clinic and similar customers. There has been no growth in commercial users in recent years. As of the end of 2022, OWSI had 39 commercial connections.

For land use planning purposes, Jefferson County has allocated a specific number of Measurement Equivalent Residential Units (MERUs) to each commercial connection. The MERU method of accounting was derived during the development of the County's Comprehensive Plan and is not the same as an ERU in the context of this water system plan. As such, MERUs are used only as a measurement of commercial connections. They are not directly used to derive commercial water usage. The current MERU allocations, associated with the 39 physical commercial connections, total 279 as stated in the Jefferson County Department of Community Development Official MERU Record dated February 6, 2018.

Projected

Title 17 of the Jefferson County Code (also referred to as the MPR Code) specifies the limits on development within the MPR. Section 17.45 discusses the development cap of 2,250 residential units and 325 equivalent commercial uses (or MERUs) for a total of 2,575 equivalent units. A list of allowed uses within the commercial zones is available in the MPR code. The MPR Code also allows that residential units can be converted to commercial uses; however that is not anticipated for purposes of this document.

Therefore, for the purposes of water system planning, OWSI projects that the total number of commercial MERUs served by the water system will increase from 279 to 325, within the ten-year planning horizon. These additional MERUs are then converted to water demand as described in Section 3 and Table 3-6.

2.3 Population Forecast

Exhibit 1-2 of the Comp Plan summarizes the population allocation and projections for specific sub-areas within Jefferson County. The 2010 population of the Port Ludlow MPR is documented there at 2,603. The projected population for 2038 is 3,547, reflecting a 1.11% compound annual growth rate over that 18-year period. For the sake of this WSP, that population projection is extended to the full 20-year planning horizon of 2043, by assuming an additional population of 90. This is calculated as the projected growth in residential connections between 2038 and 2043 (60), multiplied by 1.49 persons per household (from Page 1-6 of the Comp Plan). Therefore, the total population projected to be served by the system in 2043 is estimated to be 3,637.

2.4 Consistency with Local Planning

OWSI utilizes coordination with Jefferson County planning staff and DOH's Water System Plan Consistency Statement Checklist as means by which to ensure consistency between its efforts and those of the County. OWSI has forwarded information regarding its future service area and population growth to the County's Department of Community Development, and has obtained confirmation of these planning assumptions via completion by the County of the Consistency Statement Checklist, which is provided in Appendix C.

Section 3
Water Demand Forecast

This section provides a summary of historical water production and consumption for OWSI for years 2013-2022, as well as detailed forecasts of future water demand using 2023 as the "base year".

3.1 Water Production History

Water production is defined as the total volume of water withdrawn from groundwater supplies. OWSI's production history for 2013-2022 is presented in Table 3-1, based upon well meter records and shows variable annual totals, largely a result of weather patterns and related variation in summer irrigation volumes, and reflecting COVID-19 pandemic usage impacts in 2020 (see Table 3-3 for detailed use).

Table 3-1
Summary of Well Production History (in gallons)

	North Bay				South Bay				
Year	Well 2	Well 3	Well 4N	Sub-Total	Well 13	Well 14	Well 16	Sub-Total	System Total
2013	14,377,125	2,054,125	16,349,339	32,780,589	0	22,565,959	45,609,083	68,175,042	100,955,631
2014	15,900,043	156,838	16,513,980	32,570,861	0	23,322,330	47,256,977	70,579,307	103,150,168
2015	15,954,986	86,222	17,358,480	33,399,688	0	22,873,340	48,805,791	71,679,131	105,078,819
2016	16,771,948	0	15,535,867	32,307,815	0	21,527,737	51,553,703	73,081,440	105,389,255
2017	18,096,100	0	15,993,115	34,089,215	0	26,732,695	53,165,001	79,897,696	113,986,911
2018	19,549,258	0	17,192,978	36,742,236	0	27,000,871	51,747,083	78,747,954	115,490,190
2019	17,877,816	1,163,253	15,776,819	34,817,888	0	25,969,692	51,585,948	77,555,640	112,373,528
2020	11,172,801	2,691,276	17,230,343	31,094,420	0	24,201,488	45,966,649	70,168,137	101,262,557
2021	10,841,324	333,618	19,044,725	30,219,667	0	31,410,524	60,394,629	91,805,153	122,024,820
2022	11,749,035	987,857	20,397,578	33,134,470	0	24,156,314	57,372,664	81,528,978	114,663,448

Notes:
(1) Based on OWSI records of daily well production matched up to billing cycle dates. From "Billing Data" worksheets.

Table 3-2 provides a summary of average day and maximum day production. Maximum day production is defined as the highest amount of water produced on a single day in the calendar year, typically occurring in the summer. Included in Table 3-2 is the system's peaking factor, which is determined by dividing the maximum day production by the average day production.

In 2022, OWSI's average day production was approximately 314,000 gallons per day (gpd), while maximum day demand was 569,000 gpd. The average peaking factor over this entire period was 1.99. There is a general trend of the peaking factor decreasing from 2.3 in 2013 to being consistently below 2.0 in more recent years (with the exception of 2020, when the peaking factor was 2.11, due to overall low production that year that resulted in a low average day demand, which is attributable at least partially to COVID-19 pandemic effects related to reduced commercial demand). While it is likely the system will continue to have a peaking factor of less than 2.0, that value is used for demand forecast purposes, so as to be conservative (i.e., on the higher end of what is reasonable to expect).

Table 3-2 Well Production Statistics (in gallons)			
Year	Average Day Production [1]	Maximum Day Production [2]	Peaking Factor [3]
2013	276,591	643,002	2.32
2014	282,603	570,454	2.02
2015	287,887	613,886	2.13
2016	287,949	584,451	2.03
2017	312,293	625,511	2.00
2018	316,411	616,908	1.95
2019	307,873	555,380	1.80
2020	276,674	582,416	2.11
2021	344,315	605,858	1.76
2022	314,146	568,664	1.81
		Avg Peaking Factor (2013-2022):	**1.99**

Notes:
(1) Yearly production divided by 365 days per year.
(2) Production during day of maximum pumping.
(3) Maximum Day divided by Average Day.

3.2 Water Consumption History

Water consumption, or usage, is defined as the quantity of water drawn from the system and sold to customers, as measured by service meters located at customer connections. OWSI supplies water to a variety of customers. Table 3-3 presents the water system's usage history for years 2013-2022, organized by three major categories of use: single-family residential, multi-family residential, and commercial. The data show that in 2022, the total usage was 81 million gallons, which equates to an average day usage of 211,000 gpd. Single-family residences accounted for approximately 84 percent of total consumption in 2022, while multi-family water users accounted for approximately 7 percent of consumption and commercial customers represented the remaining 9 percent.

The difference between production and consumption is known as "non-revenue" water and results from both accounted-for and unaccounted-for uses for which no revenue is generated. Accounted-for water uses include well treatment system backwashing, fire department use (training and hydrant flow-testing), and annual or maintenance related water main flushing. Unaccounted-for water use results primarily from leaks in the system, inaccurate meters, etc. This category is also referred to as Distribution System Leakage (DSL). The historical amount of non-revenue water is listed in Table 3-4. On average, during 2013-2022, unaccounted-for non-revenue water use was 8.8 percent of total water production. The average over the most recent 3-year period was slightly higher at 9.4 percent.

Table 3-3
Summary of Consumption History [1]

Year	Connections Average	Water Usage (mg) Domestic	Irrigation	Yearly Total	Average Day, GPD [2]	GPD/Conn[3]
Single-Family Residential						
2013	1,322	71.886	2.662	74.547	204,239	154
2014	1,323	70.139	3.036	73.175	200,478	152
2015	1,329	72.998	4.423	77.421	212,111	160
2016	1,345	71.778	4.811	76.589	209,832	156
2017	1,366	76.635	4.887	81.522	223,348	164
2018	1,389	75.246	3.913	79.159	216,875	156
2019	1,401	74.285	3.514	77.800	213,150	152
2020	1,409	71.965	2.829	74.794	204,914	145
2021	1,437	77.557	4.210	81.767	224,020	156
2022	1,462	78.129	2.807	80.936	221,743	152
				Average (2013-2022):	**211,147**	**155**
Multi-Family Residential						
2013	216	5.964	1.230	7.194	19,709	91
2014	216	6.124	1.554	7.678	21,035	97
2015	216	5.655	1.701	7.356	20,153	93
2016	216	6.151	1.760	7.911	21,674	100
2017	216	6.121	1.763	7.885	21,602	100
2018	216	5.340	1.628	6.968	19,090	88
2019	216	5.030	1.638	6.668	18,268	85
2020	216	5.560	1.067	6.627	18,157	84
2021	216	5.378	1.451	6.829	18,709	87
2022	216	5.069	1.217	6.286	17,221	80
				Average (2013-2022):	**20,544**	**91**
Commercial						
2013	39	8.361	0.506	8.867	24,293	623
2014	39	8.284	1.101	9.385	25,714	659
2015	39	8.056	0.819	8.874	24,313	623
2016	39	8.486	0.437	8.923	24,447	627
2017	40	7.668	0.506	8.174	22,394	560
2018	40	8.084	0.468	8.551	23,428	586
2019	41	7.934	1.422	9.357	25,634	625
2020	41	6.382	0.312	6.694	18,339	447
2021	41	7.236	0.621	7.858	21,528	525
2022	39	8.668	0.744	9.412	25,785	661
Total				**Average (2013-2022):**	**23,343**	**594**
2013	1,577	86.211	4.398	90.608	248,241	157
2014	1,578	84.547	5.691	90.238	247,227	157
2015	1,584	86.708	6.943	93.651	256,577	162
2016	1,600	86.415	7.008	93.423	255,954	160
2017	1,622	90.424	7.156	97.580	267,344	165
2018	1,645	88.669	6.009	94.678	259,392	158
2019	1,658	87.250	6.574	93.824	257,052	155
2020	1,666	83.907	4.208	88.115	241,410	145
2021	1,694	90.171	6.282	96.454	264,257	156
2022	1,717	91.865	4.768	96.634	264,749	154
Average	1,699	87.145	6.030	93.175	255,273	150

Notes (for Table 3-3):
mg = million gallons; GPD = gallons per day
(1) Based on OWSI records of bimonthly water meter readings.
(2) Calculated as Total Yearly Usage divided by 365 days per year.
(3) Gallons per day per connection. Calculated as Average Day divided by average number of connections.

Table 3-4
Non-Revenue Water Analysis (all values in mg)

Year	Total Production[1]	Total Consumption[2]	Total Non-Revenue[3]	Non-Revenue: Accounted-For [4]	Non-Revenue: Unaccounted-For [5] (in mg)	Non-Revenue: Unaccounted-For [5] (as % of Production)
2013	100.96	90.61	10.35	3.79	6.56	6.5%
2014	103.15	90.24	12.91	3.89	9.03	8.8%
2015	105.08	93.65	11.43	3.06	8.37	8.0%
2016	105.39	93.42	11.97	3.02	8.95	8.5%
2017	113.99	97.58	16.41	7.38	9.02	7.9%
2018	115.49	94.68	20.81	7.97	12.84	11.1%
2019	112.37	93.82	18.55	8.38	10.17	9.1%
2020	101.26	88.11	13.15	3.65	9.50	9.4%
2021	122.02	96.45	25.57	14.10	11.47	9.4%
2022	114.66	96.63	18.03	7.14	10.89	9.5%
					Average (2013-2022):	8.8%
					Average (2020-2022):	9.4%

Notes:
mg = million gallons
(1) From Table 3-1.
(2) From Table 3-3.
(3) Total Production less Total Consumption.
(4) Non-revenue water used for purposes such as backwash of treatment systems, fire department use, and hydrant flushing (unmetered estimates).
(5) (aka Distribution System Leakage, DSL) Non-revenue water use resulting from leaks in the system, inaccuracies in meters, etc.

OWSI presently has no large, industrial-type water customers. There are, however, some commercial and multi-family connections that use a sizeable amount of water. Table 3-5 summarizes the 10 largest customers. The usage for these customers is included in the consumption totals presented in Table 3-3.

Table 3-5 Summary of Ten Largest Water Customers		
Name	2022 Consumption (gallons)	2022 Average Day (gpd)
Wastewater Treatment Plant	2,888,178	7,913
Marina	1,822,801	4,994
North Bay Condos	1,485,752	4,071
The Inn	1,190,891	3,263
Inner Harbor Village	1,185,430	3,248
Highland Greens	986,163	2,702
Admiralty I & II	954,149	2,614
Beach Club	611,490	1,675
Village Center/Office park	477,598	1,308
Fairway Village	457,103	1,252

3.3 Water Demand Forecast

The following water demand forecast was developed to ensure that adequate water supply is available to meet both current and future needs. The forecast considers growth in service connections from Section 2 and historical use patterns from earlier in this section.

For purposes of these demand estimates, all demand estimates are converted to the DOH-recommended method of an equivalent residential unit (ERU). The purpose of ERUs is to compare all categories of non-residential customer usage to that of a single-family residential account. Therefore, one large commercial customer may be assigned a large number of ERUs because it consumes as much water as several single-family residential customers.

Table 3-6 presents a summary of the OWSI water demand forecast. Demands for multiple categories of water use are calculated, including single-family and multi-family residential, commercial, and non-revenue (both accounted-for and unaccounted-for portions). The table footnotes provide details regarding the calculations and references to other data in the WSP.

The number of ERUs represented by the water use in each category is calculated by dividing OWSI's average ERU water use factor into each category's total water use. As depicted in Table 3-3, the average single-family residential water consumption over the past 10 years has been 155 gpd per household. In 2022, it was 152 gpd. However, for the purposes of taking a "conservative" approach, this WSP defines a planning-level ERU water factor as being 175 gpd per ERU. This is the amount of water usage assumed for each new single-family residential connection. It is also the value that is divided into water usage numbers to arrive at a number of ERUs represented by each water use category.

As presented in Table 3-6, the 10-year water system demand, at year 2033, is projected to be 358,000 gpd on an average day and 716,000 gpd on a maximum day. This level of demand increases by 2043 to 383,000 gpd and 765,000 gpd, on average and maximum days, respectively.

These 20-year projections reflect an increase over current water demands of approximately 20 percent.

Table 3-6 also shows a water demand forecast the incorporates the effects of future conservation efforts. More detail regarding those assumptions is provided in Section 4.

The water demand forecast presented in Table 3-6 has also been divided amongst pressure zones, for the purpose of system analysis. Existing system demand was apportioned to pressure zones based upon the locations of existing connections and their proportional distribution amongst the pressure zones. Additional future demand likewise was apportioned to pressure zones based upon the distribution of remaining lots to be served and locations of proposed future developments. Table 3-7 summarizes the demand breakdown by pressure zone.

Table 3-6
Olympic Water and Sewer, Inc.
Water System Demand Forecast (in gpd)

	Current (2022)				10-Year (2033)				20-Year (2043)			
	Conn. (1)	ERUs (2)	ADD	MDD (8)	Conn. (1)	ERUs (2)	ADD	MDD (8)	Conn. (1)	ERUs (2)	ADD	MDD (8)
Service Zone A												
Single-Family Res. (3)	651	564	98,738	197,476	684	597	104,537	209,075	717	630	110,256	220,512
Non-Rev, Accounted-For (4)	NA	56	9,775	19,551	NA	56	9,775	19,551	NA	56	9,775	19,551
Non-Rev, Unaccounted-For (5)	NA	70	12,281	24,562	NA	74	12,937	25,875	NA	78	13,585	27,169
Sub-Total	651	690	120,794	241,588	684.1405	727	127,250	254,500	716.8188	764	133,616	267,232
Service Zone B												
Single-Family Res. (3)	834	723	126,494	252,987	948	837	146,444	292,887	1,047	936	163,769	327,537
Multi-Family Res. (6)	216	98	17,221	34,442	258	120	21,043	42,086	258	120	21,043	42,086
Commercial (7)	279	147	25,785	51,571	325	172	30,037	60,073	325	172	30,037	60,073
Non-Rev, Accounted-For (4)	NA	56	9,775	19,551	NA	56	9,775	19,551	NA	56	9,775	19,551
Non-Rev, Unaccounted-For (5)	NA	116	20,289	40,579	NA	134	23,461	46,922	NA	145	25,422	50,843
Sub-Total	1,329	1,140	199,565	399,130	1,531	1,319	230,760	461,519	1,630	1,429	250,045	500,091
Total System												
Single-Family Res. (3)	1,485	1,287	225,231	450,463	1,632	1,434	250,981	501,962	1,764	1,566	274,025	548,050
Multi-Family Res. (6)	216	98	17,221	34,442	258	120	21,043	42,086	258	120	21,043	42,086
Commercial (7)	279	147	25,785	51,571	325	172	30,037	60,073	325	172	30,037	60,073
Non-Rev, Accounted-For (4)	NA	112	19,551	39,102	NA	112	19,551	39,102	NA	112	19,551	39,102
Non-Rev, Unaccounted-For (5)	NA	186	32,570	65,141	NA	208	36,398	72,797	NA	223	39,006	78,012
Total Demand, baseline (9)	1,980	1,831	**320,359**	**640,718**	2,215	2,046	**358,010**	**716,020**	2,347	2,192	**383,661**	**767,323**
Total Demand (with conservation) (10)	1,980	1,831	320,359	640,718	2,215	2,015	352,643	705,285	2,347	2,156	377,244	754,488

Notes:
gpd = gallons per day; Conn. = connections; ERU = equivalent residential unit; ADD = Average Day Demand; MDD = Maximum Day Demand

Assuming 2023 as a base year, the 10-year time horizon is 2033, and the 20-year time horizon is 2043.

(1) See Table 2-2 for residential connections. Measurement Equivalent Residential Units (MERUs) are used for commercial connections. See Section 2.2.2 for reference.

(2) ERUs are calculated as ADD divided by 175 gpd/ERU (i.e., the ERU factor used for planning). Note that for the single-family residential category this results in an ERU count that is lower than the number of connections. This is because the planning-level ERU factor is higher than the current average single-family use.

(3) Future additional demands are calculated as the number of new ERUs multiplied by 175 gpd/connection, even though recent/current use is 155 gpd/connection.

(4) The current annual volume of water used for non-revenue, accounted-for purposes is approximately 7.14 million gallons (see Table 3-4). Future projections of this category of use assume the total volume will remain constant. For analysis purposes, this amount is assumed to be evenly split between the two service zones.

(5) Non-revenue, unaccounted-for water use is calculated as 11.3 percent of total accounted-for consumption (which is the same as 9.4% of total production, the most recent 3-year average, as depicted in Table 3-4).

(6) Future additional demands are calculated as number of new connections multiplied by 91 gpd/connection, the current average use per connection (see Table 3-3).

(7) Current commercial demands equate to 279 MERU, based upon the County's current official record of MERUs (as of 2/6/2018). As set forth in the County's MPR Code, there is a cap of 325 commercial MERUs (see Section 2.2.2). Future commercial demand is escalated proportional to the increase in MERUs.

(8) MDD is calculated as ADD multiplied by the historic average peaking factor of 2.0.

(9) Total system-wide baseline water demand. The values for ADD and MDD are higher than actual, observed data for 2022, as these values are based on calculations that utilize averages over the past few years for certain factors, consistent with future demand calculations. As such, the depiction of baseline 2022 water demand is "conservative" (i.e., slightly higher than actual), which is appropriate as the foundation for long-range planning.

(10) Total demand, considering potential effects of future conservation gains. Reflects future single-family residential connections at 170 gpd (versus 175 in the baseline), and unaccounted-for non-revenue water at 9% of production (versus the current level of 9.4%, assumed in the baseline).

Table 3-7
Olympic Water and Sewer Inc.
Water System Demand Forecast by Pressure Zone (gpd)

	Current (2022)		10-Year (2033)		20-Year (2043)	
	ADD	**MDD**	**ADD**	**MDD**	**ADD**	**MDD**
Service Zone A						
443	78,516	157,032	85,258	170,515	89,523	179,046
348	42,278	84,556	41,993	83,985	44,093	88,187
Subtotal	**120,794**	**241,588**	**127,250**	**254,500**	**133,616**	**267,232**
Service Zone B						
Woodridge	14,178	28,357	15,350	38,529	15,350	38,529
542	3,991	7,983	8,739	17,160	13,757	27,053
452	15,965	31,930	17,888	35,125	18,445	36,273
367.5	65,064	130,128	62,750	123,220	66,053	129,893
272	7,724	15,448	6,547	12,856	6,421	12,627
252	29,608	59,216	27,498	53,996	28,455	55,956
212	3,862	7,724	3,274	6,428	3,211	6,314
248	59,819	119,639	88,715	174,205	97,380	191,498
Subtotal	**199,565**	**399,130**	**230,760**	**461,519**	**249,071**	**498,143**
Total System	**320,359**	**640,718**	**358,010**	**716,020**	**382,687**	**765,375**

Notes:
gpd = gallons per day; ADD = Average Day Demand; MDD = Maximum Day Demand

3.4 Fire Flow Requirements

Fire-fighting flow is required at a relatively high rate for a short period of time. Thus, a water system must have a supply, storage, and distribution system grid of sufficient capacity to supply fire-fighting requirements while maintaining adequate service to residential and commercial customers.

The fire flow requirements currently employed by OWSI for planning and design are as follows:

- Single-family Residential: 750 gallons per minute (gpm) for 30 minutes
- Multi-family Residential and Commercial: 1,000 gpm for 60 minutes

These requirements are consistent with the minimum design fire flows for application to water system design, presented in Table 4-1 of the Jefferson County Coordinated Water System Plan, June 1997 (CWSP).

It should be noted that these are planning and design targets. Actual fire-flow at any given point in the system may be higher or, in some cases, marginally lower than these standards. It is understood that these variations from planning data are to be expected and in some cases may not make economic sense to correct for minor variations. In these cases, the local fire authority will be consulted for a determination of fire fighting capabilities.

In addition to these general requirements, there are higher fire flow requirements associated with specific buildings served by OWSI. These requirements are:

- Golf Course Clubhouse: 1,500 gpm for 60 minutes
- The Inn: 1,750 gpm for 90 minutes
- Recreation Center: 1,500 gpm for 60 minutes
- Harbormaster Restaurant: 2,000 gpm for 60 minutes

These requirements were established during the planning and design of these facilities, and were used in previous WSPs (2007 and 2014)). As these facilities have not significantly changed, the fire flow requirements remain the same.

OWSI does not anticipate future fire flow requirements for specific buildings or projects to be higher than the above requirements, as development types will be similar to those currently in place (i.e., single- and multi- family residential development). New commercial uses will be evaluated as they are proposed. Therefore, the system analysis sections presented later in this WSP incorporate these requirements.

Appendix D provides documentation of correspondence with the Jefferson County Fire Marshall from a previous WSP (July 2007), including confirmation that the above fire flow requirements are appropriate for OWSI's water system planning purposes.

Section 4
Water Conservation

Water conservation consists of any beneficial reduction in water losses, waste, or use. Efficient water use benefits the environment, public health, and economy by helping to improve water quality, maintain aquatic ecosystems, and protect water resources. Through activities such as public education and leak detection, OWSI is committed to realizing water savings via conservation.

This section of the WSP summarizes OWSI's compliance with conservation planning requirements, actions the utility has taken to promote water use efficiency, and the conservation program OWSI will implement from 2024 through 2033.

4.1 Conservation Objectives

OWSI has established programs that strive to decrease the amount of non-revenue water and make efficient use of water. OWSI's commitment to conservation is reflected in the following objectives:

- Promote public awareness about the need for the wise use of water through an effective water conservation public education and technical assistance program;
- Decrease the level of non-revenue water use through implementation of proven supply-side demand management strategies such as leak detection and repair and replacement of inferior watermains;
- Achieve long-term reductions in average demands for water through effective implementation of feasible demand-side water conservation strategies.

4.2 Conservation Planning Requirements and Compliance Summary

The conservation planning requirements that must be addressed in water system plans are contained in the following DOH documents and State law:

- State of Washington Water Use Efficiency Rule (January 2007)
- Department of Health Water Use Efficiency Guidebook (January 2011)

The Water Use Efficiency (WUE) Rule has several requirements and corresponding compliance dates. Some of the requirements are associated with water system plans, while other requirements are independent of the six-year water system planning cycle.

Table 4-1 lists the requirements of the WUE Rule and shows that OWSI is in compliance with these requirements. There are seven main categories of requirements: 1) water meters, 2) data collection, 3) distribution system leakage, 4) water use efficiency goals, 5) water use efficiency program, 6) demand forecast, and 7) performance reports.

Table 4-1
Compliance with Water Use Efficiency Rule Requirements

Category	WAC[1] Section	Compliance Date	Requirement	OWSI in Compliance?
1. Meters	246-290-496	Fully metered by January 22, 2017. Submit metering plan by July 1, 2008.	1. Meter all sources.	Yes. All wells are metered.
			2. Meter all service connections.	Yes. All service connections are metered.
			3. For systems not fully metered: Create meter installation plan, perform activities to minimize leakage until fully metered, and report annually on installation and leak minimization actions.	N/A
2. Data Collection	246-290-100	WSPs submitted after January 22, 2008.	1. Provide monthly and annual production/purchase numbers for each source.	Yes. See Section 3.
			2. Provide annual consumption by customer class.	Yes. See Section 3.
			3. Provide "seasonal variations" consumption by customer class.	Yes. See Section 3.
			4. Evaluate reclaimed water opportunities.	Yes. OWSI has considered producing reclaimed water at its Wastewater Treatment Plant. A summary of this evaluation is provided in Appendix E. At this time, implementation of a reclaimed water program by OWSI is not cost-effective.
			5. Provide annual quantity supplied to other public water systems.	N/A
			6. Consider water use efficiency rate structure.	Yes. OWSI has implemented a conservation-based (inclining block) rate structure. See Section 14.
3. Distribution System Leakage	246-290-820	First report completed by July 1, 2008. First compliance determination made by July 1, 2010.	1. Calculate annual volume and percent using formula defined in the Rule.	Yes. OWSI has calculated water loss in WUE reports submitted annually to DOH.
			2. Report annually: annual leakage volume, annual leakage percent, and, for systems not fully metered, meter installation progress and leak minimization activities.	Yes. This information has been provided in WUE reports submitted annually to DOH.
			3. Develop water loss control action plan (if leakage is over 10% for 3 year average).	Yes. OWSI continually tracks water usage and compares that to water production. Average DSL is under 10%.

Table 4-1
Compliance with Water Use Efficiency Rule Requirements

Category	WAC[1] Section	Compliance Date	Requirement	OWSI in Compliance?
4. Goals	246-290-830	Goals established by January 22, 2008.	1. Establish measurable (in terms of water production or usage) conservation goals and re-establish every 6 yrs. Provide schedule for achieving goals.	Yes. Updated goals have been established in conjunction with this WSP update. Discussion in this section.
			2. Use a public process to establish the goals.	
			3. Report annually on progress.	
5. Efficiency Program	246-290-810	WSPs submitted after January 22, 2008.	1. Describe existing conservation program.	Yes. Included in this WSP section.
			2. Estimate water saved over last 6 years due to conservation program.	
			3. Describe conservation goals.	
			4. Describe how customers will be educated on efficiency practices.	
			5. Describe conservation programs for next 6 years including schedule, budget, and funding mechanism.	
			6. Describe how efficiency program will be evaluated for effectiveness.	
			7. Implement or evaluate 1-12 measures, depending on size. (5 measures for systems the size of OWSI, which currently has approximately 1,800 connections.)	Yes. OWSI's 2023-2033 Conservation Program includes more than the required 5 measures.
			8. Estimate projected water savings from selected measures.	
			9. Estimate leakage from transmission lines (if not included in distribution system leakage).	N/A
6. Demand Forecast	246-290-100	WSPs submitted after January 22, 2008.	1. Provide demand forecast reflecting no additional conservation.	Yes. See Section 3.3 for water demand forecast with and without additional conservation.
			2. Provide demand forecast reflecting savings from efficiency program.	
			3. Provide demand forecast reflecting all "cost effective" evaluated measures.	

Table 4-1
Compliance with Water Use Efficiency Rule Requirements

Category	WAC[1] Section	Compliance Date	Requirement	OWSI in Compliance?
7. Performance Reports	246-290-840	First report completed by July 1, 2008.	1. Develop annual report including: goals and progress towards meeting them, total annual production, annual leakage volume and percent, and, for systems not fully metered, status of meter installation and actions taken to minimize leakage. 2. Submit annually by July 1 to DOH and customers and make available to the public.	Yes. OWSI has submitted WUE performance reports as required.

[1] WAC = Washington Administrative Code

4.3 Existing Conservation Program

OWSI's current conservation program includes the following activities:

- ***Water Meters:*** All water sources and services within the water system are metered. In addition, several irrigation services in newer developments and commercial areas have separate meters. The data from these meters are logged in a spreadsheet and are used by OWSI staff to monitor usage throughout the course of a year, as well as to evaluate trends over longer periods of time. Old meters typically under register flow; subsequently, OWSI is currently undergoing a system wide replacement program. New electronic radio meters have a 25-year batter life and can be interrogated for historical data.
- ***Customer Outreach:*** The current billing system used by OWSI prints the customer's metered usage in cubic feet on the bill, and also depicts the consumption for the same period of the prior year. In addition, OWSI has conducted public education activities regarding conservation primarily during times when the risk of water shortages occurring is high. OWSI makes use of water conservation literature developed by DOH and Ecology when drafting such educational materials. OWSI also assists customers when requested to discuss landscape watering practices, investigate suspected leaks, and provide assistance in installing water conservation devices.
- ***Rate Structure:*** OWSI has an inclining block rate structure that charges customers a higher unit cost for increasing units of consumption.
- ***Landscape Management:*** Significant amounts of water are sometimes used for landscape irrigation in Port Ludlow during the relatively dry, summer months. To address irrigation efficiencies, Port Ludlow Associates has installed timers on irrigation systems in newly developed areas. During development and construction, the operations of the common area irrigation systems are controlled by OWSI staff. Once construction is complete, the irrigation systems are managed by professional landscapers. In this way, professional staff knowledgeable of irrigation needs and water conservation control irrigation use and help manage the systems efficiently.
- ***Water Loss Management:*** OWSI strives to reduce supply side water loss through leak detection and repair. OWSI responds to obvious leaks as soon as they are reported and confirmed. For suspected leaks, OWSI uses a listening device to attempt to confirm water leaks. When there are confirmed water leaks, OWSI expedites its resources to repair the leak in a timely manner.

4.4 Conservation Effectiveness Evaluation

It is difficult to fully quantify the actual impact of conservation efforts because of the number of factors that influence variations in water consumption by OWSI's customers. However, OWSI's tracking of water use has noted that water usage per connection has decreased in recent years. It was noted in the prior WSP that average single-family residential water consumption was 175 gpd per connection in 2007-2009. By contrast, as described in Section 3 of this WSP, the average single-family residential water consumption was 155 gpd per connection over the 10-year period of 2013-2022.

4.5 Conservation Goals 2024-2033

OWSI has established conservation goals applicable for the 2024-2033 planning horizon. These goals will be discussed during a public meeting in late 2023, during which the water system plan is presented and discussed.

The conservation goals previously adopted by OWSI, applicable for the 2015-2020 period, were:

- ***Maintain distribution system leakage (DSL) at less than 10 percent of total production, as calculated on a rolling 3-year average***.
- ***Maintain an average day demand Equivalent Residential Unit (ERU) water use factor of less than 185 gpd***.

The updated conservation goals adopted by OWSI, applicable for the 2024-2033 period, are:

- ***Maintain distribution system leakage (DSL) at less than 9 percent of total production, as calculated on a rolling 3-year average***. As discussed in Section 3, the most recent 3-year rolling average DSL is at 9.4 percent of total production. OWSI will strive to lower its 3-year rolling average to remain below 9 percent, as compared to the regulatory requirement of 10 percent.
- ***Maintain an average day demand Equivalent Residential Unit (ERU) water use factor of less than 170 gpd***. As discussed in Section 3, OWSI utilizes a planning-level water use factor of 175 gpd/ERU to plan for future growth in water demands and to ensure that system capacity is adequate. This conservation goal involves maintaining water use at levels lower than this; i.e., below 170 gpd/ERU, reflecting approximately a 3 percent decrease from the planning-level water use factor.

4.6 Conservation Measures 2024-2033

OWSI will continue to implement key customer-side conservation measures that are already in place. For the 2024-2033 period, those measures are listed below.

- **Conservation-based Rates.** OWSI has implemented an inclining block rate structure for all customer classes, which provides customers with a strong incentive to manage water use. This measure applies to the single-family, multi-family, and commercial sectors and therefore counts as three measures.
- **Information on Customer Bills**. OWSI provides consumption histories on customer bills, enabling customers to track and manage their water use. This measure applies to the single-family, multi-family, and commercial sectors and therefore counts as three measures.
- **Promotional Materials.** OWSI periodically provides conservation information to customers in the form of a conservation tip or leak education tip on the bi-monthly water bill to encourage efficient water use. This applies to the single-family, multi-family, and commercial sectors and therefore counts as three measures.

- **Water Loss Management.** Water loss management is a major focus area for OWSI and therefore it is include in this section, even though it is not counted toward the utility's minimum number of measures because it is a supply-side activity. Key activities include:
  - Testing for suspected leaks in the distribution system.
  - Ongoing cleaning and calibration of source meters.

Implementation of additional measures will continue to be considered by OWSI in the future, in the context of available resources and competing priorities. Program accomplishments and OWSI water demands will be reviewed annually in conjunction with preparation of the annual DOH Water Use Efficiency Performance Report.

Section 5
Existing System Description

This section provides a detailed description of OWSI's existing water system components, including an inventory of supply source, treatment, storage, and distribution system facilities. Exhibit 5-1 shows the general location of all major facilities, and Exhibit 5-2 provides a hydraulic schematic of the system.

5.1 Sources of Supply

OWSI relies entirely on groundwater for potable water supply. Table 5-1 summarizes the well sources used by OWSI.

Table 5-1
Water Supply Wells

Well Name	Current Pumping Capacity [1] (gpm)	Date Drilled
Service Zone A		
Well 1 (inactive)	NA	December 1941
Well 2	110	April 1967
Well 3	25	November 1968
Well 4N	100	April 1980
Service Zone B		
Well 4A (inactive)	NA	September 1972
Well 9 (inactive)	NA	October 1972
Well 13 (emergency)	130	August 1975
Well 14	150	October 1988
Well 16	310	October 2005

Notes:
(1) Based on OWSI pumping records as of fall 2023.

The wells start and stop to maintain specified storage reservoir levels, by way of pressure sensing switches. Service Zone A wells 2, 3 and 4N are controlled by switches located at the Well 4N pump house. Service Zone B wells 14 and 16 are controlled by a switch located at the Well 14 pump house which is sensing the Teal Lake reservoir level.

Both static and pumping water levels are measured on all wells at regular intervals – monthly at a minimum. These water levels are analyzed by hydrogeologists and are summarized in annual reports, the latest of which is included in Appendix J. OWSI conducts water level measurement on not only their own wells, but several others as part of a regional monitoring network that has been in place for twenty-one years.

5.1.1 Hydrocarbon Contamination at Walker Way

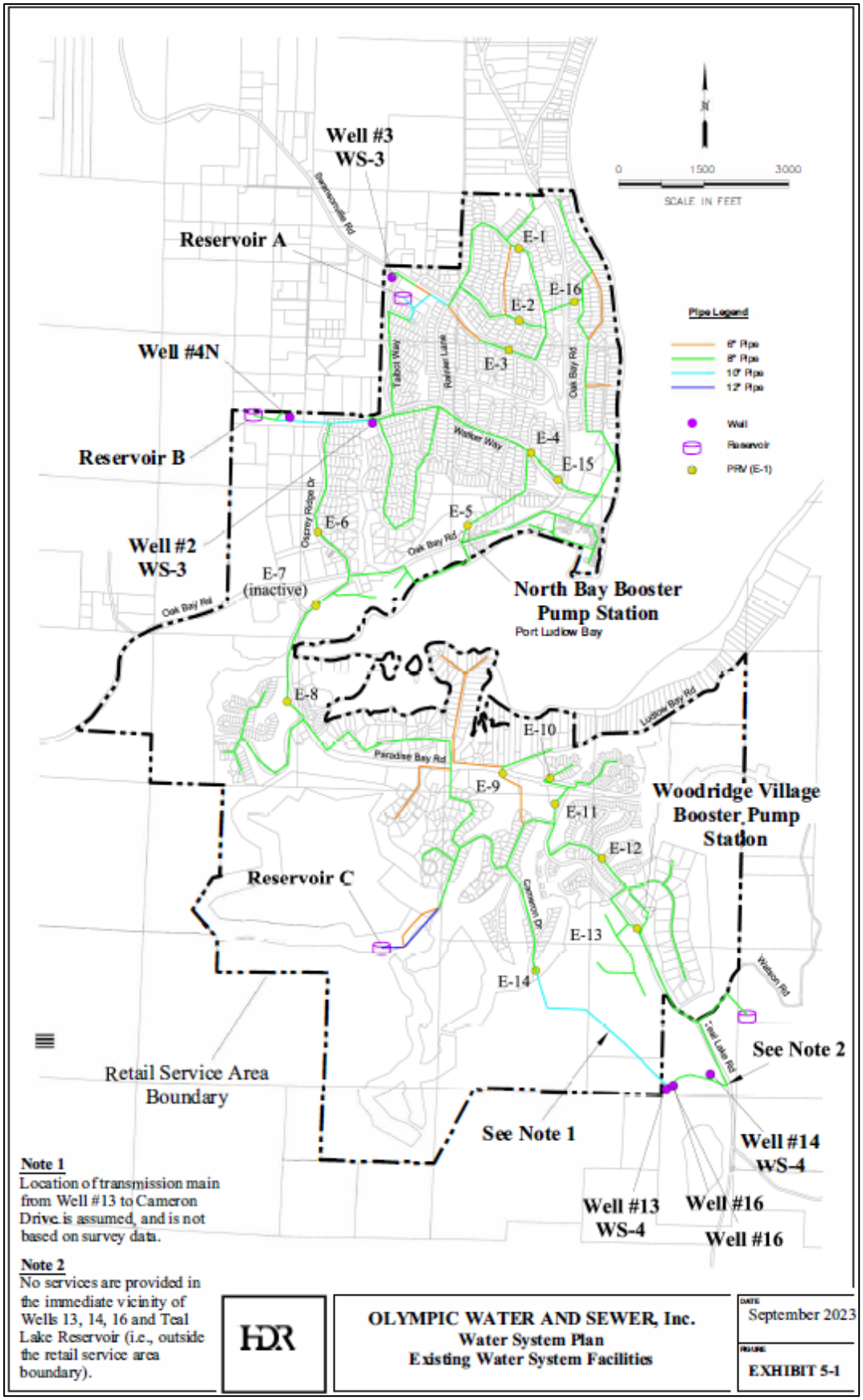
Well 2 is located at 781 Walker Way in Service Zone A. It was noted in the Robinson Noble 2005 Annual Report on the Port Ludlow Area Groundwater Monitoring Program that the well was becoming inefficient which led to the decision to drill a replacement well (designated Well 17) on the same site, approximately 150 feet away from the

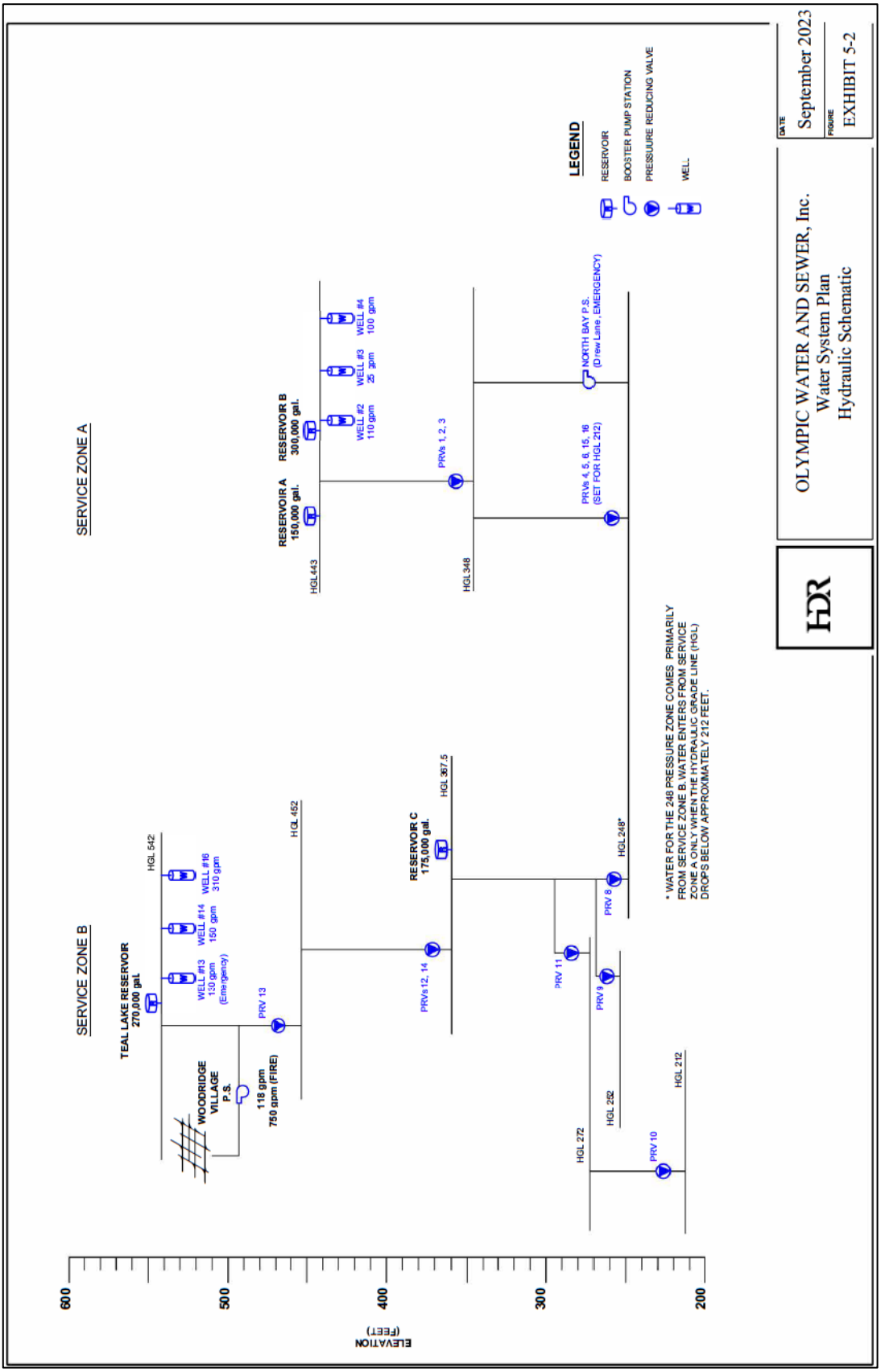
existing wellhead. Drilling commenced in early 2009 and proceeded without incidence to a depth of 50 feet where hydrocarbon odors were observed. Drilling ceased and an investigation was undertaken. It was determined that the source of the "contamination" was residual gasoline from underground storage tanks (USTs) that were removed in 1990. While the former presence of these tanks and small amount of contamination was documented, the conclusion of the geotechnical report for the tank removal indicated that there was little likelihood of the contamination migrating as it was contained beneath a building (the reason for the contaminated soil not being removed in 1990).

The investigation is detailed in Site Characterization Report, Olympic Water & Sewer Inc. Property, 781 Walker Way, Port Ludlow, Washington, SLR International Corp, December 17, 2010, wherein the aerial and vertical extent of the contamination was defined. The conclusion is that the existing Well 2 is upgradient of and not impacted by, the hydrocarbon contamination. Annual VOC analysis performed on the well since the discovery confirms this conclusion.

In 2013, an agreement was reached with the former property owner whereby the third party would enter the Department of Ecology Voluntary Cleanup Program (VCP) in order to obtain a No Further Action determination for the property. As of this writing, that effort is underway as agreed.

Because eventually a Well 2 replacement will likely be needed, OWSI commenced with drilling another replacement well (designated Well 18) in 2020. Details regarding construction and testing of the well are provided in a Robinson Noble Inc. report dated April 2022. The pump testing results indicate a long-term pumping rate of up to 40 gpm. Because of this relatively low flow rate, OWSI has not placed this well into permanent service.


Well #3
WS-3
Reservoir A
Well #4N
Reservoir B
Well #2
WS-3
Reservoir C
E-1
E-2
E-3
E-4
E-5
E-6
E-7
(inactive)
E-8
E-9
E-10
E-11
E-12
E-13
E-14
E-15
E-16
North Bay Booster
Pump Station
Port Ludlow Bay
Woodridge Village
Booster Pump
Station
Retail Service Area
Boundary
See Note 1
See Note 2
Well #14
WS-4
Well #13
WS-4
Well #16
Well #16
Pipe Legend
Well
Reservoir
PRV (E-1)
0
1500
3000
SCALE IN FEET
Note 1
Location of transmission main from Well #13 to Cameron Drive is assumed, and is not based on survey data.
Note 2
No services are provided in the immediate vicinity of Wells 13, 14, 16 and Teal Lake Reservoir (i.e., outside the retail service area boundary).
HDR
OLYMPIC WATER AND SEWER, Inc.
Water System Plan
Existing Water System Facilities
DATE
September 2023
FIGURE
EXHIBIT 5-1


SERVICE ZONE A
SERVICE ZONE B
TEAL LAKE RESERVOIR
270,000 gal.
WOODRIDGE VILLAGE P.S.
118 gpm
750 gpm (FIRE)
WELL #13
150 gpm
(Emergency)
WELL #14
150 gpm
WELL #16
310 gpm
HGL 542
PRV 13
HGL 452
RESERVOIR A
150,000 gal.
RESERVOIR B
300,000 gal.
HGL 443
WELL #2
110 gpm
WELL #3
25 gpm
WELL #4
100 gpm
PRVs 1, 2, 3
HGL 348
NORTH BAY P.S.
(D'new Lane, EMERGENCY)
PRVs 4, 5, 6, 15, 16
(SET FOR HGL 212)
RESERVOIR C
175,000 gal.
HGL 367.5
PRVs 12, 14
PRV 11
PRV 8
HGL 248*
PRV 9
HGL 272
HGL 252
PRV 10
HGL 212
* WATER FOR THE 248 PRESSURE ZONE COMES PRIMARILY FROM SERVICE ZONE B. WATER ENTERS FROM SERVICE ZONE A ONLY WHEN THE HYDRAULIC GRADE LINE (HGL) DROPS BELOW APPROXIMATELY 212 FEET.
LEGEND
RESERVOIR
BOOSTER PUMP STATION
PRESSURE REDUCING VALVE
WELL
ELEVATION (FEET)
600
500
400
300
200
HDR
OLYMPIC WATER AND SEWER, Inc.
Water System Plan
Hydraulic Schematic
DATE
September 2023
FIGURE
EXHIBIT 5-2

5.2 Water Treatment

OWSI's wells have historically produced high quality water that complies with DOH regulations for all of the primary, or health related contaminants. Disinfection was not historically required at the existing sources.

Well 14 raw water has an arsenic concentration of 0.013 mg/L that exceeds the current maximum contaminant level (MCL) of 0.010 mg/L, also stated as 10 parts per billion (ppb) To address this issue, when Well 16 was constructed, OWSI installed piping to accomplish blending of water from Wells 14 and 16 to reduce the arsenic concentration to less than the MCL.

In 2017 and 2018, OWSI began to experience unsatisfactory bacteria samples in Service Zone B. The water quality issues were related to manganese levels in Wells 14 and 16. After repeated water quality events, OWSI voluntarily entered into an agreement with DOH to add chlorination to the water system to mitigate the bacteria. Chlorination alone was not an acceptable treatment option due to the elevated manganese levels in the water. Chlorination without manganese removal would cause the manganese to oxidize and come out of solution. The result would be colored water issues throughout the water distribution system.

In 2018 OWSI analyzed different treatment options for manganese removal for Service Zone B and decided upon filtration. There was an additional benefit of filtration as it also lowered the arsenic levels produced by Well 14. The arsenic levels had been within drinking water regulations, as a result of blending with Well 16, but were still a concern of many of the OWSI customer base and so further reduction in arsenic was identified as a benefit. As a result of the treatment design OWSI chose and implemented treatment listed in the previous water system plan as a capital improvement project. OWSI applied for and was awarded a State Drinking Water Revolving Fund low interest loan to finance the improvements.

In November of 2021, the filtration system and system-wide chlorination were put on-line. Manganese and arsenic levels have been lowered and no unsatisfactory bacteria samples have been recorded.

Wells 2 and 3 raw water exceeds DOH limits for iron and is therefore treated for iron removal to safe levels using manganese greensand. This process also removes high levels of manganese, and while not a health-related constituent of water its removal is beneficial from an aesthetic standpoint as it can stain plumbing fixtures. Service Zone A has also been chlorinated as of November 2021.

5.3 Storage

OWSI utilizes four ground-level steel storage reservoirs, with a total combined usable volume of approximately 882,000 gallons. Reservoirs A and B provide storage for Service Zone A. Reservoir C and the Teal Lake Reservoir provide storage for Service Zone B. Table 5-2 summarizes OWSI's reservoirs.

Table 5-2 Water Storage Reservoirs					
Name	Diameter (ft)	Overflow Height (ft)	Base Elev (ft)	Overflow HGL (ft)	Total Volume (gallons)
Reservoir A	28	32	411	443	147,386
Reservoir B	40	31.5	411.5	443	296,089
Reservoir C	27.5	38.5	329	367.5	171,048
Teal Lake Reservoir	32	44.5	497.5	542	267,702

Notes:
HGL = Hydraulic Grade Line

5.4 Distribution System

5.4.1 Distribution Lines

The transmission and distribution system consists of asbestos-cement and PVC water pipe, ranging in sizes from 4-inch to 12-inch in diameter. Four-inch pipe is generally used only in cul-de-sacs, to supply homes located beyond fire hydrants. Table 5-3 provides an estimate of the transmission and distribution piping in the water system, based on the hydraulic model of OWSI's system.

Table 5-3 Water System Transmission Piping	
Diameter (in.)	Length (ft)
6	12,169
8	83,353
10	7,203
12	1,326
Total	104,051

5.4.2 Pressure Zones

OWSI's water system is divided into 10 pressure zones, in order to provide acceptable pressures to services at a wide range of elevations and locations. Table 5-4 summarizes the pressure zones, and which storage reservoirs serve each. Pressure zone 248 receives supply primarily from Service Zone B; however, supply is available from Service Zone A if the zone's pressure drops too low. This is illustrated in Exhibit 5-2. Conversely, water can also be conveyed from Service Zone B to Service Zone A by means of the North Bay Booster Pump Station. This facility, completed in 2011 and located at the end of Drew Lane, consists of a single pump with a capacity of 125 gpm. The purpose of this pump is to move water into Service Zone A during times when the wells located in that zone are unable to meet demands. Due to the flattening of demands that has occurred in recent years, use of this pump has been intermittent.

Table 5-4 Pressure Zone Summary	
Pressure Zone	**Reservoirs**
Service Zone A	
443	A, B
348	A, B
Service Zone B	
Woodridge Village BPS	None
542	Teal Lake
452	Teal Lake
367.5	C, Teal Lake
272	C, Teal Lake
252	C, Teal Lake
212	C, Teal Lake
248	Primary - C, Teal Lake Supplemental - A, B

Sixteen pressure reducing valves (PRVs) are used to define the pressure zone boundaries. Table 5-5 summarizes the hydraulic settings of these PRVs. Locations are shown on Exhibit 5-1. PRVs E-5, E-6, E-15 and E-16 serve to make Service Zone A water available to pressure zone 248, but only if the hydraulic grade in this zone drops below 212 feet (e.g., due to an extended fire flow event).

Table 5-5 PRV Summary		
PRV Name	**Elevation (ft)**	**Downstream HGL Setting (ft)**
E-1	235.4	348
E-2	225	348
E-3	242	348
E-4	159	212
E-5	97.17	212
E-6	203.71	212
E-7	inactive	inactive
E-8	49	248
E-9	131.34	252
E-10	75	212
E-11	147	272
E-12	275	367.5
E-13	360	452
E-14	281	367.5
E-15	110	212
E-16	134	212

Notes:
PRV = Pressure Reducing Valve; HGL = Hydraulic Grade Line

5.5 Telemetry

For telemetry, OWSI facilities are monitored for alarm situations and have limited operational ability through cellular remote transmitter units and a web-based operator interface system by Mission Communications. One transmitter is located at Well No. 4N and monitors the level in Reservoir B. This reservoir level controls the wells in Service Zone A. The other transmitter is

located at, and monitors the level in, the Teal Lake Reservoir. This unit controls the wells in Service Zone B. Well pump and power status along with reservoir levels can be monitored and controlled on the dedicated OWSI telemetry site using computers or cellular smart phones. The site calls operators to provide notification of any alarm event monitored for in the water system.

Customers that witness any unusual water situation throughout the water system are encouraged to call the OWSI answering service at (877) 826-5787 at any time.

5.6 Auxiliary Power

Well 4 in Service Zone A and Wells 14 and 16 in Service Zone B are equipped with emergency generators to supply water during power outages. Well 16 has automatic transfer to generator power while Well 14 uses a manual transfer switch. The Well 16 generator also provides electricity to the filtration facility. The generators are exercised on a monthly basis to ensure operational readiness.

The Woodridge Village BPS is equipped with connections for a portable generator. However, OWSI's sole portable generator is typically used at Well 4 and sewage lift station 2 in the event of power outages.

Section 6
Design Standards and Construction Specifications

This section presents OWSI's Design Standards and Construction Specifications. The Design Standards have been developed to ensure that a consistent minimum level of service is maintained throughout the system and to facilitate planning, design, and construction of water system projects. Developed separately, but for use in conjunction with the Design Standards, the Construction Specifications present a detailed description of the design and materials specifications to be observed during any water system improvement project.

The purpose of the inclusion of Construction Specifications is such that by having them approved with this WSP and kept on file at DOH, construction documents do not need to be submitted for each project concerning distribution main construction. This is done in accordance with WAC 246-290-125 (project report and construction document submittal exceptions).

6.1 Design Standards

6.1.1 Supply

Supply facilities must be designed to meet the maximum day demand (MDD). Supply capacity will be sufficient to replenish storage within three days of fire or emergency drawdown during MDD conditions. The supply will be provided at a hydraulic grade line (HGL) that meets replenishment needs of storage facilities.

6.1.2 Storage

DOH requires public water systems to provide sufficient storage to meet any seasonal or diurnal variations in demand, fire flows, and emergency demands such as during power outages and equipment failures. These design standards utilize the DOH guidelines as criteria for determination of reasonable treated water storage required in each pressure zone, as well as for OWSI's system as a whole.

For a given reservoir design, each of the five storage components listed below must be considered:

- Operational Storage;
- Equalizing Storage;
- Standby (Emergency) Storage;
- Fire Suppression Storage; and
- Dead Storage, if any.

Only effective storage may be used in determining actual available, or design storage volume. Effective storage is equal to the total volume minus the dead storage built into

the reservoir. The required storage volume has been interpreted as the sum of Equalizing Storage, Standby (Emergency) Storage, and Fire Suppression Storage at an elevation sufficient to provide 20 psi (static) to the highest customer in any pressure zone. In addition, equalizing storage is evaluated with the requirement that 30 psi (static) is provided to the highest customer within the analyzed pressure zone. Operational storage is any surplus storage that is available after subtracting the other required storage components.

In most cases either the standby or fire suppression volume, whichever is smaller, can be excluded from a water system's storage requirement, a practice termed nesting. Local ordinances and fire authorities in Jefferson County allow the use of nesting in designing storage facilities. Appendix D provides documentation of correspondence with the Jefferson County Fire Marshall regarding the allowance of nesting.

Operational Storage

Operational storage is the volume of the reservoir devoted to supplying the water system while, under normal operating conditions, the sources of supply are in "off" status. Operational storage is additive to the other components of storage and provides an additional factor of safety. The volume of operational storage should be sufficient to prevent excess pump cycling. This volume is not directly calculated, but is taken into consideration when determining reservoir levels for hydraulic modeling.

Equalizing Storage

Equalizing storage capacity is utilized to meet the daily (diurnal) variations in demand. Peak use periods typically occur during the morning and evening hours, especially during times of landscape and lawn irrigation. Water is typically withdrawn from storage during these peak demand periods and replenished during low demand periods during late evening and early morning hours.

For systems like OWSI that supply water to storage based upon the reservoir water levels (on-call-demand), the DOH guidelines specify that the following equation be used to estimate equalizing storage:

Equalizing Storage (gal) = (PHD – Q_S)(150 min), where

PHD = Peak Hourly Demand (gpm)
Q_S = Source production rate (gpm)

In OWSI's situation, QS is greater than the PHD in some cases, resulting in a negative value for Equalizing Storage. In this case, a value of 10 percent of the Maximum Day Demand has been used as an assumed minimum.

Standby Emergency Storage

The purpose of standby storage is to provide a measure of reliability should sources fail or when unusual conditions impose higher demands than anticipated. The volume of emergency storage required is dependent upon the reliability of the source of supply and the ability to provide an alternative supply. If the system or zone has multiple sources of supply, the volume of water produced by the remaining supply sources (after assuming the largest source is out of service) can reduce the standby storage requirement.

The recommended standby storage should not be less than 200 gallons per equivalent residential units (ERU). For systems with multiple sources the standby storage is based on the following equation:

Standby Storage (gal) = $(2*ADD)(N) - t_m (Q_S - Q_L)$ where

ADD = Average Day Demand/ERU (gpd/ERU)
N = Number of ERUs
Q_S = Sum of all installed and available sources of supply in gpm
Q_L = the largest capacity source available to the system in gpm
t_m = Time that remaining sources are pumped on the day that the largest source is not available in minutes (assumed as 24 hours)

The larger of the amount calculated in the equation above, or 200 gallons per ERU, is used for Standby Emergency Storage in this analysis.

Fire Suppression Storage

Water systems are required to construct and maintain facilities capable of delivering fire flows in accordance with the determination of the fire flow requirements made by the local fire protection authority while maintaining 20 psi pressure throughout the distribution system. As discussed in Section 3.4, the fire flow requirements currently employed by OWSI for planning and design are 750 gpm for 30 minutes for single-family residential occupancies, and 1,000 for 60 minutes for multi-family and commercial occupancies. In addition, OWSI has higher fire flow requirements associated with specific buildings, as discussed in detail in Section 3.4. These flow requirements were used in hydraulic modeling and the development of capital improvements for OWSI's infrastructure.

The minimum fire suppression storage for systems is the product of the required flow rate multiplied by the flow duration and is based on the following equation:

Fire suppression storage (gal) = FF (t_m) where

FF = required fire flow rate
t_m = Duration of FF rate

Dead Storage

Dead storage is the volume of stored water not available to all customers at the minimum design pressures. Dead storage is excluded from the volumes provided to meet the effective storage. Dead storage is assumed as that volume which is at an elevation lower than the elevation necessary to provide 20 psi (static) at the meter of the highest customer in any pressure zone.

6.1.3 Distribution System

General

The function of the distribution system is to convey water to customers at adequate service pressures and to provide fire flows. During the peak-hour demand, the capacity of the distribution system must meet demands with a residual pressure of no less than 30 psi. During fire-fighting events, a minimum residual pressure of 20 psi must be maintained throughout the entire distribution system (under maximum day demand conditions).

Usually, the inability to meet the above demand conditions results from inadequate distribution capacity; that is, pipes are not large enough or pipeline gridding is poor. The capacity of the distribution system is greatly reduced when head loss is greater than about 10 feet per 1,000 feet of pipe length.

Sometimes increasing pipe diameters or pipeline grid spacing is not sufficient to significantly increase flows. In these cases, it is better to consider adjusting the hydraulic elevation of either the supply or storage facilities. When analyzing the distribution system, the capability to replenish equalizing storage volume must be considered. The equalizing volume must be replenished at a rate sufficient to refill the storage reservoirs during the late evening/early morning replenishment hours.

Pressure Zones

Pressure zones are determined by evaluating ground elevation as it relates to available hydraulic gradient. The static pressure at the lowest elevation will generally not be greater than 100 psi, while at the highest elevation of the zone, it must be sufficient to ensure that at peak demand conditions the pressure is not less than 30 psi. Pressure reducing valves (PRVs) are used to intertie pressure zones in order to utilize stored water at higher elevations and to lower pressures to acceptable service levels. PRV stations will be sized to provide the maximum instantaneous demand or the required fire flow, whichever is greater.

To the extent possible, OWSI will keep the number of pressure zones to a minimum. Wherever pressure zones are made, the system becomes fragmented, and the water

conveyance capacity can be affected because distribution mains cannot be interconnected at pressure zone boundaries.

Pump Stations

A minimum of two pumps are required at each pump station to provide flexibility and system redundancy. Each pump must be able to meet maximum day demand design conditions. Peak hourly demand may be met by both pumps operating together. Fire flow pumps are needed if no storage is provided.

Other Distribution System Components

Detailed design criteria for distribution system components (e.g., pipelines, valves, and fire hydrants) are provided in the construction specifications (see Appendix F).

6.2 Construction Specifications

OWSI maintains a complete set of water system construction specifications entitled "Olympic Water and Sewer, Inc. Standard Details and Specifications for Water Systems." A copy of the current guidelines is located in Appendix F. Discussed therein are the specific construction requirements for OWSI, as related to water system improvements. These documents govern the installation of new water infrastructure.

Section 7
Source of Supply Analysis

This section addresses existing water rights, and their ability to support current and projected future levels of water demand. A comparison is also made between source pumping capacity and demands.

7.1 Water Rights Evaluation

A summary of OWSI's existing water rights is provided in Table 7-1, organized by service zone. This includes existing rights associated with two wells (4A and 9) that are presently inactive due primarily to aesthetic water quality concerns (i.e., iron, manganese, and hydrogen sulfide). Appendix G contains completed Water Rights Self-Assessment forms.

Table 7-1
Water Rights Summary

	Water Right No.	Q_a (afy) (1)	Q_i (gpm) (2)
Service Zone A			
Well 2	G2-00194C	120	150
Well 3	G2-00193C	88	110
Well 4N	G2-25627C	122	150
Sub-Total		330	410
Service Zone B			
Active Wells(3)			
Well 13	G2-25816C	35 (45 S)	175
Well 14	G2-27492P	(161 S)	300
Well 13, 14, 16	G2-30442P	90	100
Sub-Total		125 (206 S)	575
Inactive Wells			
Well 4A	G2-21542C	30	23
Well 9	G2-21543C	70	46
Sub-Total		100	69
System Total		555	1,054

Notes: afy = acre-feet per year; gpm = gallons per minute
Information in this table is based on information in Department of Ecology's water right records.
(1) Annual quantity. Numbers in parentheses indicate supplemental quantities, which are not additive to primary quantities.
(2) Instantaneous quantities.
(3) The water rights for Wells 13 and 14 include Well 16 as an additional point of withdrawal.

7.1.1 Instantaneous Water Right Evaluation

Table 7-2 provides a summary comparison of instantaneous water rights and projected maximum day demands. As shown in the table, instantaneous water rights are sufficient to meet current and projected maximum day demands.

Table 7-2
Instantaneous Water Rights Analysis

	Current (2022)	20-Year (2043)
Service Zone A[1]		
Water Rights (gpm)[2]	410	410
Maximum Day Water Demand (gpm)[3]	168	186
Water Right Surplus (Deficiency) [4]	242	224
Service Zone B[5]		
Water Rights (gpm)[2]	575	575
Maximum Day Water Demand (gpm)[3]	277	347
Water Right Surplus (Deficiency)[4]	298	228
Total System[6]		
Water Rights (gpm)[2]	1,054	1,054
Maximum Day Water Demand (gpm)[3]	445	533
Water Right Surplus (Deficiency)[4]	609	521

Notes: afy = acre-feet per year
(1) Includes Wells 2, 3, and 4N.
(2) From Table 7-1.
(3) As obtained from Table 3-6. Maximum day water demand (gpm) = maximum day demand (gpd) / 1440 (conversion factor).
(4) Water Rights minus Maximum Day Water Demand.
(5) Includes Wells 13, 14, and 16.
(6) Accounts for all system wells, including inactive wells 4A and 9.

7.1.2 Annual Water Right Evaluation

Regarding annual water rights, OWSI holds a total primary annual quantity of 125 acre-feet per year (afy) for Wells 13, 14, and 16. In addition, there are 206 afy in supplemental water rights associated with these wells. These supplemental rights may be exercised only if the total amount of water withdrawn from all OWSI wells does not exceed 555 afy (i.e., the use of the supplemental rights from these wells decreases the amount of withdrawal available from the other wells). Because of the connectedness of these rights between the two service zones, an annual water right analysis must be conducted for the system as a whole. Table 7-3 presents such an analysis, comparing existing annual water right quantities with current and projected annual water demands. A key assumption in this summary is that Wells 13, 14, and 16 make use of their supplemental rights, which thereby decreases the annual water right associated with the Service Zone A wells.

As shown in the table, annual water rights are sufficient to meet current and projected annual water demands.

Table 7-3
Annual Water Rights Analysis

	Current (2012)	20-Year (2034)
Service Zone A [1]		
Water Rights (afy) [2]	224.0	224.0
Annual Water Demand (afy)[3]	135.4	149.8
Water Right Surplus (Deficiency)[4]	88.6	74.2
Service Zone B[5]		
Water Rights (afy)	331.0	331.0
Annual Water Demand (afy)[3]	223.7	280.3
Water Right Surplus (Deficiency)[4]	107.3	50.7
Total System[6]		
Water Rights (afy)	555.0	555.0
Annual Water Demand (afy)[3]	359.1	430.1
Water Right Surplus (Deficiency)[4]	195.9	124.9

Notes: afy = acre-feet per year
(1) Includes Wells 2, 3, and 4N.
(2) The total annual water right quantity associated with these wells is 330 afy, as depicted in Table 7-1. However, this amount is reduced to 224 afy when Service Zone B wells withdraw their total supplemental quantities. (I.e., the total annual quantity must not exceed 555 afy.)
(3) As obtained from Table 3-6. Annual water demand (afy) = average day demand (gpd) X 0.001121 (conversion factor).
(4) Water Rights minus Annual Water Demand.
(5) Includes Wells 13, 14, and 16 and supplemental water rights.
(6) Accounts for all system wells, including inactive wells 4A and 9.

7.2 Source Pumping Capacity Evaluation

In this section, source pumping capacities are compared with current and projected future maximum day water demands. Due to the nature of OWSI's system, this analysis is conducted first for the system as a whole, and then independently for Service Zones A and B. Capacity for the system as a whole is analyzed for the following four criteria:

- Ability to provide MDD with sources operating for 24 hours per day (DOH requirement)
- Ability to provide MDD with sources operating for 20 hours per day (DOH recommendation)
- Ability to provide ADD with sources operating 20 hours per day with the largest source offline (DOH recommendation)
- For open pressure zones, ability to provide fire storage replenishment during MDD with sources operating 24 hours per day (DOH recommendation)

The service zone specific analyses are conducted only according to the second criterion (provide MDD with sources operating 20 hours per day).

Closed pressure zones require the two following analyses:

- Ability to provide peak hour demand (DOH requirement)
- Ability to provide fire flows during MDD conditions (DOH requirement). (This is analyzed in the distribution system analysis; Section 9.)

Table 7-4 summarizes the analysis for the system as a whole, since water produced at any source can be used in either service zone. As depicted in the table, source capacities are sufficient to meet projected water demands in the system. The second evaluation criteria (provide MDD with sources operating 20 hours per day) is the most limiting. The maximum number of ERUs the current source capacities can support system-wide is approximately 2,383.

Table 7-5 summarizes the analysis for Service Zone A. As depicted in the table, capacities of sources that are physically located within this zone are sufficient to meet the zone's projected maximum day water demands. The maximum number of ERUs the current Service Zone A source capacities can support is approximately 806.

Table 7-5 summarizes the analysis for Service Zone B. As depicted in the table, capacities of sources that are physically located within this zone are sufficient to meet the zone's projected maximum day water demands. The maximum number of ERUs the current Service Zone B source capacities can support is approximately 1,577.

Table 7-4
Evaluation of Source Adequacy for Entire System

	Year			
	2022	2033	2043	Max [4]
Projected ERUs and Demand [1]				
Equivalent Residential Units (ERUs)	1,831	2,046	2,192	2,383
Projected Demand (gpd)				
Average Day	320,359	358,010	383,661	417,000
Maximum Day	640,718	716,020	767,323	834,000
Fire Flow Requirements (gpd) [5]	157,500	157,500	157,500	157,500
Available Source (gpd, 24-hr capacity) [2]				
Well No. 2 (110 gpm)	158,400	158,400	158,400	158,400
Well No. 3 (25 gpm)	36,000	36,000	36,000	36,000
Well No. 4N (100 gpm)	144,000	144,000	144,000	144,000
Well No. 14 (150 gpm)	216,000	216,000	216,000	216,000
Well No. 16 (310 gpm)	446,400	446,400	446,400	446,400
Total Available Source (gpd) [3]	444,960	1,000,800	1,000,800	1,000,800
Source Surplus/(Deficiency) (gpd) [6]				
Meet MDD w/Sources at 24-hr capacity	360,082	284,780	233,477	166,800
Meet MDD w/Sources at 20-hr capacity	193,282	117,980	66,677	0
Meet ADD w/Largest Source Offline (20hr)	141,641	103,990	78,339	45,000
Fire Storage Replenishment during MDD (24 hr)	307,582	232,280	180,977	114,300

Notes:
(1) Projected ERUs and demand forecasts taken from Table 3-6 (Water Demand Forecast).
(2) Assumes source pumps are operating at the maximum production rate.
(3) Total available source = Total of Installed Pumping Capacities for all Sources (gpm * 60 min/hour * 24 hours/day).
(4) Maximum ERUs served with Available Source. Assumes all future ERUs have an Average Day Demand of 175 gpd/ERU, and the Maximum Day Peaking Factor is 2.0.
(5) Based on largest fire flow requirement in the system (1,750 gpm for 90 minutes).
(6) The four source evaluation criteria are:
1. Provide MDD with sources operating at 24 hours per day.
2. Provide MDD with sources operating at 20 hours per day.
3. Provide ADD with largest source offline and remaining sources operating at 20 hours per day.
4. Replenish fire flow storage over a 72-hour period during MDD with sources operating at 24 hours per day.

Table 7-5
Evaluation of Source Adequacy for Service Zone A

	Year			
	2022	2033	2043	Max [4]
Projected ERUs and Demand [1]				
Equivalent Residential Units (ERUs)	690	727	764	806
Projected Demand (gpd)				
Average Day	120,794	127,250	133,616	141,000
Maximum Day	241,588	254,500	267,232	282,000
Available Source (gpd) [2]				
Well No. 2 (110 gpm)	158,400	158,400	158,400	158,400
Well No. 3 (25 gpm)	36,000	36,000	36,000	36,000
Well No. 4N (100 gpm)	144,000	144,000	144,000	144,000
Total Available Source (gpd, 24-hr capacity) [3]	338,400	338,400	338,400	338,400
Total Available Source (gpd, 20-hr capacity) [5]	282,000	282,000	282,000	282,000
Source Surplus/(Deficiency) (gpd, 20-hr capacity)	40,412	27,500	14,768	0

Notes:
(1) Projected ERUs and demand forecasts taken from Table 3-6 (Water Demand Forecast).
(2) Assumes source pumps are operating at the maximum production rate.
(3) Total available source = Total of Installed Pumping Capacities for all Sources (gpm * 60 min/hour * 24 hours/day).
(4) Maximum ERUs served with Available Source. Assumes all future ERUs have an Average Day Demand of 175 gpd/ERU, and the Maximum Day Peaking Factor is 2.0.
(5) Total available source with wells operating 20 hours per day.

Table 7-6
Evaluation of Source Adequacy for Service Zone B

	Year			
	2022	2033	2043	Max [4]
Projected ERUs and Demand [1]				
Equivalent Residential Units (ERUs)	1,140	1,319	1,429	1,577
Projected Demand (gpd)				
Average Day	199,565	230,760	250,045	276,000
Maximum Day	399,130	461,519	500,091	552,000
Available Source (gpd) [2]				
Well No. 13 (130 gpm) [5]	0	0	0	0
Well No. 14 (150 gpm)	216,000	216,000	216,000	216,000
Well No. 16 (310 gpm)	446,400	446,400	446,400	446,400
Total Available Source (gpd, 24-hr capacity) [3]	662,400	662,400	662,400	662,400
Total Available Source (gpd, 20-hr capacity) [6]	552,000	552,000	552,000	552,000
Source Surplus/(Deficiency) (gpd, 20-hr capacity)	152,870	90,481	51,909	0

Notes:
(1) Projected ERUs and demand forecasts taken from Table 3-6 (Water Demand Forecast).
(2) Assumes source pumps are operating at the maximum production rate.
(3) Total available source = Total of Installed Pumping Capacities for all Sources (gpm * 60 min/hour * 24 hours/day).
(4) Maximum ERUs served with Available Source. Assumes all future ERUs have an Average Day Demand of 175 gpd/ERU, and the Maximum Day Peaking Factor is 2.0.
(5) Considered an emergency source; therefore, capacity is not included in total available supply.
(6) Total available source with wells operating 20 hours per day.

7.3 Booster Pump Station Capacity Analysis

There is one boosted pressure zone in the OWSI water system. The Woodridge Village Booster Pump Station (BPS) boosts pressure to 36 high elevation lots located in Service Zone B. Currently, 35 lots are developed and receive service, with the remaining lot likely to be developed in the near future. The BPS presently has two domestic pumps which can provide a combined flow of 118 gpm, and a fire pump capable of providing 750 gpm.

Table 7-7 summarizes the analysis of the Woodridge Village BPS, under both current and projected future pumping capacities. The BPS is able to support peak hour demands through build-out. The maximum number of ERUs the BPS can support is 44.

Table 7-6
Evaluation of Source Adequacy for Woodridge Village BPS

	Year			
	2012	2020	2034	Max [4]
Projected ERUs and Demand [1]				
Equivalent Residential Units (ERU's)	35	36	36	44
Projected Demand (gpd)				
Average Day	14,178	15,350	15,350	18,761
Maximum Day	35,588	38,529	38,529	47,090
Peak Hourly (gpm) [2]	85.79	98.27	98.27	116
Available Source (gpm) [3]				
BPS - Domestic (118 gpm)	118	118	118	118
Source Surplus/(Deficiency) (gpm)	32.21	19.73	19.73	1.90

Notes:
(1) Projected ERUs and demand forecasts associated with Woodridge Village (based on demand estimate from prior WSP).
(2) Maximum Day Demand converted to Peak Hourly Demand via DOH WSDM equation.
(3) Domestic booster pump station capacity. Fire pump capacity not included.
(4) Maximum ERUs served with Available Source.

Section 8
Storage Analysis

This section presents an analysis of OWSI's existing water storage facilities. The design standards for storage facilities presented in Section 6 were used to analyze the adequacy of OWSI's existing reservoirs for each zone where storage is currently provided. The ERU and demand forecasts utilized for these analyses are the same as those used for the source capacity analyses presented in Section 7.

8.1 Service Zone A Storage Analysis

Reservoirs A and B presently provide 443,475 gallons of storage to Service Zone A. As depicted in Table 8-1, this is more than sufficient to meet the storage needs of this zone within the 20-year time horizon. However, there are a number of homes located near the base of Reservoir A that experience low water pressures. These homes each presently have small booster pumps to elevate pressures. OWSI plans to examine this situation more closely to determine whether or not a new boosted zone is required to better serve these residences. This project is identified for implementation in Section 13.

8.2 Service Zone B Storage Analysis

Reservoir C and the Teal Lake Reservoir presently provide 438,750 gallons of storage to Service Zone B. As depicted in Table 8-2, this is more than sufficient to meet the storage needs of this zone within the 20-year time horizon.

8.3 Service Zone B Storage Analysis (Upper Zones)

The upper pressure zones in Service Zone B (i.e., Pressure Zones 542 and 452) are provided storage only by the Teal Lake Reservoir (267,702 gallons). Therefore, an independent analysis of these zones has been conducted to examine the adequacy of this tank in meeting the storage needs for these two zones. Table 8-3 summarizes this analysis. As shown in the table, the Teal Lake Reservoir is more than sufficient in meeting the storage needs of these two zones within the 20-year time horizon.

Table 8-1
Evaluation of Storage Adequacy for
Service Zone A

	Year			
	2022	2033	2043	Max [10]
Projected ERUs and Demand[1]				
Equivalent Residential Units (ERU's)	690	727	764	1,587
Projected Demand (gpd)				
Average Day	120,794	127,250	133,616	277,638
Maximum Day	241,588	254,500	267,232	555,276
Available Source (gpd)[2]				
Well No. 2 (110 gpm)	158,400	158,400	158,400	158,400
Well No. 3 (25 gpm)	36,000	36,000	36,000	36,000
Well No. 4N (100 gpm)	144,000	144,000	144,000	144,000
Total Available Source (gpd)	338,400	338,400	338,400	338,400
Required Storage Calculations				
Multi-Source Credit (gpd)[3]	180,000	180,000	180,000	180,000
Standby Storage (gal)[4]	138,051	145,429	152,704	375,276
Equalizing Storage (gal)[5]	24,159	25,450	26,723	68,199
Fire Flow Storage (gal)[6]	22,500	22,500	22,500	22,500
Required Storage				
Greater than 30 psi at highest meter (gal)[7]	24,159	25,450	26,723	68,199
Greater than 20 psi at highest meter (gal)[8]	162,209	170,879	179,427	443,475
Existing Storage Greater Than 30 psi (gal)				
Reservoir A	147,386	147,386	147,386	147,386
Reservoir B	296,089	296,089	296,089	296,089
Total Existing Storage (gal)	443,475	443,475	443,475	443,475
Storage Surplus/(Deficiency)	419,316	418,025	416,752	375,276
Existing Storage Greater Than 20 psi (gal)				
Reservoir A	147,386	147,386	147,386	147,386
Reservoir B	296,089	296,089	296,089	296,089
Total Existing Storage (gal)	443,475	443,475	443,475	443,475
Storage Surplus/(Deficiency)	281,266	272,596	264,048	0
Existing Available Storage (gal) [9]				
Reservoir A	147,386	147,386	147,386	147,386
Reservoir B	296,089	296,089	296,089	296,089
Total Existing Storage (gal)	443,475	443,475	443,475	443,475
Storage Surplus/(Deficiency)	281,266	272,596	264,048	0

Footnotes:

1. Projected ERUs and demand forecasts taken from Table 3-6 (Water Demand Forecast).
2. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
3. Multi-source credit assumes largest source is out of service.
4. Required standby storage for existing source = greater of (Peak day demand - Multi source credit) or 200 gallons per ERU
5. Required equalization storage = greater of DOH equation or 10% of MDD
   DOH equation = (Peak Hour Demand - Total Available Source) * (150 min.)
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH WSDM.)
6. Required fire flow storage = Flow * duration
7. Total required storage greater than 30 psi is equal to the required equalizing storage.
8. Total required storage greater than 20 psi is equal to the required equalizing storage plus the larger of standby and fire flow storage.
9. Available storage includes all storage within the system and is not adjusted for minimum pressures.
10. Maximum ERU's with Available Storage.

Table 8-2
Evaluation of Storage Adequacy for
Service Zone B

	Year			
	2022	2033	2043	Max [10]
Projected ERUs and Demand[1]				
Equivalent Residential Units (ERU's)	1,140	1,319	1,429	1,701
Projected Demand (gpd)				
Average Day	199,565	230,760	250,045	297,614
Maximum Day	399,130	461,519	500,091	595,227
Available Source (gpd)[2]				
Well No. 13 (150 gpm)	0	0	0	0
Well No. 14 (155 gpm)	216,000	216,000	216,000	216,000
Well No. 16 (320 gpm)	446,400	446,400	446,400	446,400
Total Available Source (gpd)	662,400	662,400	662,400	662,400
Required Storage Calculations				
Multi-Source Credit (gpd)[3]	216,000	216,000	216,000	216,000
Standby Storage (gal)[4]	228,074	263,725	285,766	379,227
Equalizing Storage (gal)[5]	39,913	46,152	50,009	59,523
Fire Flow Storage (gal)[6]	157,500	157,500	157,500	157,500
Required Storage				
Greater than 30 psi at highest meter (gal)[7]	39,913	46,152	50,009	59,523
Greater than 20 psi at highest meter (gal)[8]	267,987	309,877	335,775	438,750
Existing Storage Greater Than 30 psi (gal)				
Reservoir C	171,048	171,048	171,048	171,048
Teal Lake Reservoir	267,702	267,702	267,702	267,702
Total Existing Storage (gal)	438,750	438,750	438,750	438,750
Storage Surplus/(Deficiency)	398,837	392,598	388,741	379,227
Existing Storage Greater Than 20 psi (gal)				
Reservoir C	171,048	171,048	171,048	171,048
Teal Lake Reservoir	267,702	267,702	267,702	267,702
Total Existing Storage (gal)	438,750	438,750	438,750	438,750
Storage Surplus/(Deficiency)	170,763	128,872	102,974	0
Existing Available Storage (gal) [9]				
Reservoir C	171,048	171,048	171,048	171,048
Teal Lake Reservoir	267,702	267,702	267,702	267,702
Total Existing Storage (gal)	438,750	438,750	438,750	438,750
Storage Surplus/(Deficiency)	170,763	128,872	102,974	0

Footnotes:

1. Projected ERUs and demand forecasts taken from Table 3-6 (Water Demand Forecast).
2. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
3. Multi-source credit assumes largest source is out of service.
4. Required standby storage for existing source = greater of (Peak day demand - Multi source credit) or 200 gallons per ERU
5. Required equalization storage = greater of DOH equation or 10% of MDD
   DOH equation = (Peak Hour Demand - Total Available Source) * (150 min.)
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH WSDM.)
6. Required fire flow storage = Flow * duration
7. Total required storage greater than 30 psi is equal to the required equalizing storage.
8. Total required storage greater than 20 psi is equal to the required equalizing storage plus the larger of standby and fire flow storage.
9. Available storage includes all storage within the system and is not adjusted for minimum pressures.
10. Maximum ERU's with Available Storage.

Table 8-3
Evaluation of Storage Adequacy for Service Zone B - Upper Pressure Zones Only

	Year		
	2022	2033	2043
Projected ERUs and Demand[1]			
Equivalent Residential Units (ERU's)	195	240	272
Projected Demand (gpd)			
Average Day	34,135	41,976	47,686
Maximum Day	68,270	90,813	102,122
Available Source (gpd)[2]			
Well No. 13 (150 gpm)	0	0	0
Well No. 14 (255 gpm)	216,000	216,000	216,000
Well No. 16 (320 gpm)	446,400	446,400	446,400
Total Available Source (gpd)	662,400	662,400	662,400
Required Storage Calculations			
Multi-Source Credit (gpd)[3]	216,000	216,000	216,000
Standby Storage (gal)[4]	39,011	47,973	54,499
Equalizing Storage (gal)[5]	6,827	9,081	10,212
Fire Flow Storage (gal)[6]	22,500	22,500	22,500
Required Storage			
Greater than 30 psi at highest meter (gal)[7]	6,827	9,081	10,212
Greater than 20 psi at highest meter (gal)[8]	45,838	57,054	64,711
Existing Storage Greater Than 30 psi (gal)			
Teal Lake Reservoir	267,702	267,702	267,702
Total Existing Storage (gal)	267,702	267,702	267,702
Storage Surplus/(Deficiency)	260,875	258,621	257,490
Existing Storage Greater Than 20 psi (gal)			
Teal Lake Reservoir	267,702	267,702	267,702
Total Existing Storage (gal)	267,702	267,702	267,702
Storage Surplus/(Deficiency)	221,864	210,648	202,991
Existing Available Storage (gal) [9]			
Teal Lake Reservoir	267,702	267,702	267,702
Total Existing Storage (gal)	267,702	267,702	267,702
Storage Surplus/(Deficiency)	221,864	210,648	202,991

Footnotes:

1. Projected ERUs and demand forecasts associated only with pressure zones 542 and 425, including Woodridge Village.
2. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
3. Multi-source credit assumes largest source is out of service.
4. Required standby storage for existing source = greater of (Peak day demand - Multi source credit) or 200 gallons per ERU
5. Required equalization storage = greater of DOH equation or 10% of MDD
   DOH equation = (Peak Hour Demand - Total Available Source) * (150 min.)
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH WSDM.)
6. Required fire flow storage = Flow * duration
7. Total required storage greater than 30 psi is equal to the required equalizing storage.
8. Total required storage greater than 20 psi is equal to the required equalizing storage plus the larger of standby and fire flow storage.
9. Available storage includes all storage within the system and is not adjusted for minimum pressures.

Section 9
Distribution System Analysis

This section presents analysis of OWSI's distribution system. Hydraulic modeling was performed to evaluate the adequacy of existing facilities for conveying current and future flows, and to aid in determining improvements that would ensure future viability of the distribution system.

[NOTE: The hydraulic modeling analysis described in this section was conducted in 2006, as part of the development of a prior Water System Plan, dated July 23, 2007. Because the distribution system has not been modified significantly, fire flow requirements have not changed, and water demands have not changed substantially, this analysis was not revised during development of the 2014 Water System Plan Update and it was not revised during the 2024 Water System Plan Update. Therefore, the years have not been modified in the descriptions below, and the results have not been altered. Capital improvement projects remain on OWSI's capital improvement program to address specific situations described herein.]

9.1 Methodology

OWSI's water system was analyzed using the hydraulic modeling software program WaterCAD, version 7, Service Pack 2. The WaterCAD software is a Microsoft Windows-based program that interfaces with a graphics program to enter all of the system properties and display them on the monitor in a geographically accurate manner.

Pressure is the primary hydraulic parameter analyzed via computer modeling to identify system deficiencies. The target minimum system operating pressure is 30 psi during peak hour demand (PHD) conditions. During peak day demand (PDD) plus fire flow conditions, a residual pressure of 20 psi must be maintained throughout the system.

The general methodology of this hydraulic modeling analysis was to examine the current distribution system during various demand and fire flow conditions. According to the above pressure criteria, deficiencies were noted and distribution system improvements proposed. Further analysis was performed to verify that additional improvements associated with the growth of OWSI meet the minimum distribution system criteria. All distribution system improvements, relating either to remedy of current deficiencies or accommodation of future growth are presented in the capital improvement program (Section 13).

9.2 Calibration

No comprehensive calibration of the model was completed. However, discussions with operations personnel comparing model pressure results with field values were conducted.

The distribution system consists of a number of small pressure zones controlled by flows through Pressure Reducing Valves (PRVs). Settings of the PRVs (elevation and downstream pressure) were field-verified so that the pressure at those points in the model matched actual conditions. The length of flow through each pressure zone is fairly short, and the differential in head losses with various roughness factors is not very high. Thus, pressure in each pressure zone is primarily controlled by the settings of the PRVs and not by the dynamic head losses in the pipelines.

Because of the small size and method of operation of the individual pressure zones, it is believed that the model accurately represents the pressures in the system.

9.3 Modeling Scenarios

The WaterCAD model was constructed with a number of different modeling scenarios to reflect system demands and piping configurations in years 2005, 2011, and 2025. This section presents a description of the general setup of the modeling conditions, followed by discussion of each scenario and its results.

9.3.1 General Setup

OWSI's distribution system contains ten individual pressure zones. These ten individual pressure zones are grouped into two larger service zones; Zone A (pressure zones 443 and 348) and Zone B (pressure zones Woodridge Village BPS, 542, 452, 367.5, 272, 252, 212, and 248). The two zones have their own source and storage with water flowing from the high elevation to the low through PRVs. The two zones meet near the middle of the distribution system, but water can not pass from one Zone to all pressure zones of the other.

Steady-state simulations were run to determine the system's response to various demand conditions. In general, simulations were run under the following conditions (Table 9-1).

Table 9-1
System Hydraulic Analysis Scenarios

Model Scenario Number [1]	Type of Simulation[2]	Distribution System[3]	Peak Flow (year)	Account for fire flow requirements?[4]	Minimum pressure (psi) [5]	Purpose of Simulation
1	SS	Current	2005	No	30	Identify deficiencies
2	SS	Current	2005	Yes	20	Identify deficiencies
3	SS	2005 CIP	2005	Yes	20	Identify and Verify CIP
4	SS	2005 CIP	2005	No	30	Verify CIP
5	SS	2005 CIP	2025	No	30	Verify 2025CIP
6	SS	2005CIP	2025	Yes	20	Identify deficiencies
7	SS	2025 CIP	2025	Yes	20	Identify and Verify 2025 CIP
8	SS	2025 CIP	2025	No	30	Identify and Verify 2025 CIP
9	SS	2025 CIP (modified)	2011	Yes	20	Identify and Verify CIP 2025 (modified)
10	SS	2025 CIP (modified)	2011	No	30	Verify CIP 2025 (modified)

Notes:
(1) Each scenario is to be run for every identified pressure zone.
(2) SS = Steady-state.
(3) Current = Existing distribution system.
CIP = Distribution system with modifications necessary for model to meet fire and pressure requirements while running year 2006 flows.
CIP 2025 = Distribution system with modifications necessary for model to meet fire and pressure requirements while running year 2025 flows.
CIP 2025 (modified) = CIP 2025 minus upgrades that are unnecessary for model to meet fire and pressure requirements while running year 2011 flows.
(4) These simulations are to be run under the following conditions:
A. No Accounting for Fire Flow Requirements: PHD with reservoir levels at bottom of equalization storage.
B. Accounting for Fire Flow Requirements: PDD with reservoir levels at bottom of equalization storage and fire flow storage
C. Fire requirements for general residential areas: 750 gpm for 1 hour.
D. Fire requirements for specific locations: as specified by OWSI.
(5) Minimum pressure to be met only within modeled zone (not a minimum pressure requirement for entire system).

Reservoir elevations for the various scenarios listed above are contained in Table 9-2.

Table 9-2
Reservoir Levels for Model Simulations

Service Zone A			
Scenario	2005	2011	2025
Reservoir A (Overflow 443.00)			
PDD plus Fire Flow	439.71	439.04	437.83
PHD	438.11	437.43	436.22
Reservoir B (Overflow 443.00)			
PDD plus Fire Flow	439.71	439.04	437.83
PHD	438.11	437.43	436.22
Service Zone B			
Scenario	2005	2011	2025
Reservoir C (Overflow 367.50)			
PDD plus Fire Flow	360.30	359.47	358.27
PHD	342.57	341.74	340.55
Teal Lake Reservoir (Overflow 542.00)			
PDD plus Fire Flow	535.89	535.29	534.40
PHD	522.80	522.19	521.31

Note:
Elevations assume 3 feet of operational storage below overflow.

9.3.2 Modeling Results

Scenario 1 – 2005 Peak Hour Demand

The distribution system was analyzed at the year 2005 using the OWSI PHD to identify points where system pressure drops below 30 psi. The wells are operating as called by the reservoir levels and the North and South Reservoirs are operated under normal conditions.

Results: The distribution system experiences pressures in excess of 30 psi, except for the high elevation areas surrounding Reservoir A and the highest point in pressure zone 452 (i.e., upper end of the future Olympic Terrace II subdivision).

Scenario 2 – 2005 Peak Day Demand plus Fire Flow

The distribution system was analyzed at the year 2005 using the OWSI PDD plus fire flow at one location at a time throughout the distribution system to identify points where the minimum fire flow was not available. The definition of available fire flow is the amount of flow that can be obtained at a point with a minimum pressure of 20 psi maintained anywhere in the individual pressure zone. The wells are operating as called by the reservoir levels and the North and South Reservoirs are operated under normal conditions.

Results: Available fire flow for most of the distribution system is in excess of that required except for the two areas that are discussed above for PHD, high elevation areas near Reservoir B, and the high elevations in two subdivisions in the 367.5 pressure zone (Edgewood and Timberton Village). The hydraulic model calculates available fire flows in the highest elevations portions of the two subdivisions to be in the range of 50 to 75 gpm below the fire flow goal of 750 gpm. However, hydrant flow testing conducted by Port Ludlow Fire and Rescue in 2013 and 2014 indicates that actual available flows from existing hydrants are greater than 750 gpm. For example, the available flow from the highest elevation hydrant in Edgewood Drive was observed to be approximately 1,200 gpm in April 2014, and 1,350 gpm in September 2013. Therefore, no capital improvements are planned to address the slight modeled deficiencies in these areas, as the observed capability of the system is sufficient to meet the fire flow goal.

Scenario 3 – 2005 Peak Hour Demand with 2005 Capital Improvements

The distribution system was analyzed at the year 2005 using the OWSI PHD to identify points where system pressure drops below 30 psi. The wells are operating as called by the reservoir levels and the North and South Reservoirs are operated under normal conditions.

Results: The two CIP projects identified below during Scenario 4 bring the PHD pressures to a level in excess of that required throughout the distribution system, with the exception of the high elevation locations. These locations are so high that static pressure (with no demand) is less than 30 psi near Reservoir A, and only slightly above 30 psi in Olympic Terrace II, an area not yet developed. The low static pressures in these two high elevation areas will be addressed by OWSI in the following manner:

- A more detailed evaluation will be conducted of the high elevation area near Reservoir A, with specific improvements (e.g., construction of a booster station to serve the area) identified by the study. This analysis and subsequent improvements are included in the capital improvement program (Section 13).

- As Olympic Terrace II is developed, the developer will be instructed by OWSI to connect the subdivision to the transmission system in such a way that it operates on a pressure zone higher than that of Olympic Terrace I (i.e., at a hydraulic grade higher than 452 feet). This will involve installation of the necessary PRVs to move water from the transmission system into Olympic Terrace II, and through to Olympic Terrace I. Detailed modeling of such facilities was not conducted, as they are presently under design.

Scenario 4 – 2005 Peak Day Demand plus Fire Flow with 2005 Capital Improvements

The distribution system was analyzed at the year 2005 using the OWSI PDD plus fire flow at one location at a time throughout the distribution system to identify points the minimum fire flow was not available. The definition of available fire flow is the amount of flow that can be obtained at a point with a minimum pressure of 20 psi anywhere in the individual pressure zone. The wells are operating as called by the reservoir levels and the North and South Reservoirs are operated under normal conditions.

Results: Available fire flow during this simulation is adequate throughout the entire distribution system except for the high elevation areas previously discussed. However as also previously mentioned, no improvements are planned to address the small modeled deficiencies in the Edgewood and Timberton Village subdivisions, as the observed capability of the system in these areas is sufficient to meet the fire flow goal.

Scenario 5 – 2025 Peak Hour Demand with 2005 Capital Improvements

The distribution system was analyzed at the year 2005 using the OWSI PHD to identify points where system pressure drops below 30 psi. The wells are operating as called by the reservoir levels and the North and South Reservoirs are operated under normal conditions.

Results: Pressures throughout the distribution system are in excess of 30 psi except for the high elevation areas near Reservoir A.

Scenario 6 – 2025 Peak Day Demand plus Fire Flow with 2005 Capital Improvements

The distribution system was analyzed at the year 2005 using the OWSI PDD plus fire flow at one location at a time throughout the distribution system to identify points the minimum fire flow was not available. The definition of available fire flow is the amount of flow that can be obtained at a point with a minimum pressure of 20 psi anywhere in the individual pressure zone. The wells are operating as called by the reservoir levels and the North and South Reservoirs are operated under normal conditions.

Results: Available fire flow during this simulation is adequate throughout the entire distribution system except for the high elevation areas previously discussed. However as also previously mentioned, no improvements are planned to address the small modeled deficiencies in the Edgewood and Timberton Village subdivisions, as the observed capability of the system in these areas is sufficient to meet the fire flow goal.

Scenario 7 – 2025 Peak Hour Demand with 2025 Capital Improvements

The distribution system was analyzed at the year 2005 using the OWSI PHD to identify points where system pressure drops below 30 psi. The wells are operating as called by the reservoir levels and the North and South Reservoirs are operated under normal conditions.

Results: No additional Capital Improvements are needed to meet 2025 demands.

Scenario 8 – 2025 Peak Day Demand plus Fire Flow with 2025 Capital Improvements

The distribution system was analyzed at the year 2025 using the OWSI PDD plus fire flow at one location at a time throughout the distribution system to identify points the minimum fire flow was not available. The definition of available fire flow is the amount of flow that can be obtained at a point with a minimum pressure of 20 psi anywhere in the individual pressure zone. The wells are operating as called by the reservoir levels and the North and South Reservoirs are operated under normal conditions.

Results: No additional Capital Improvements are needed to meet 2025 demands.

Scenario 9 – 2011 Peak Hour Demand with modified 2025 Capital Improvements

The distribution system was analyzed at the year 2005 using the OWSI PHD to identify points where system pressure drops below 30 psi. The wells are operating as called by the reservoir levels and the North and South Reservoirs are operated under normal conditions.

Results: No additional Capital Improvements are needed to meet 2011 demands.

Scenario 10 – 2011 Peak Day Demand plus Fire Flow with modified 2025 Capital Improvements

The distribution system was analyzed at the year 2005 using the OWSI PDD plus fire flow at one location at a time throughout the distribution system to identify points the minimum fire flow was not available. The definition of available fire flow is the amount of flow that can be obtained at a point with a minimum pressure of 20 psi anywhere in the individual pressure zone. The wells are operating as called by the reservoir levels and the North and South Reservoirs are operated under normal conditions.

Results: No additional Capital Improvements are needed to meet 2011 demands.

Section 10
Water Quality Compliance

This section provides a summary of OWSI's compliance with applicable water quality regulations and monitoring requirements.

10.1 Regulatory Framework

The quality of drinking water in the United States is regulated by the Environmental Protection Agency (EPA). Under provisions of the Safe Drinking Water Act (SDWA), the EPA is allowed to delegate primary enforcement responsibility for water quality control to each state. In the State of Washington, the Department of Health (DOH) is the agency responsible for implementing and enforcing the drinking water regulations. For the State of Washington to maintain primacy (delegated authority to implement requirements) under the SDWA, the State must adopt drinking water regulations that are at least as stringent as the federal regulations. In meeting these requirements, the State has published drinking water regulations that are contained in Chapter 246-290 of the Washington Administrative Code (WAC). According to WAC 246-290, a Group A public water system is defined as serving 15 or more residential connections or 25 or more people per day for 60 or more days per year. As a Group A public water system, the District is required to satisfy drinking water quality regulations and conform to monitoring and reporting requirements as described by WAC 246-290.

10.2 Water Quality Monitoring Program

OWSI conducts water quality monitoring in compliance with EPA and DOH requirements. Annually OWSI reviews its Water Quality Monitoring Schedule (WQMS), as issued by DOH, and communicates any issues, or asks for clarification, with the State.

The approaches to monitoring for various parameters are outlined below, along with a summary of any recent or current monitoring violations. Details regarding OWSI's water quality results are contained with DOH's Sentry database system, accessible online at DOH's website.

Inorganic Chemicals (IOCs)

a. OWSI samples for the full suite of inorganics in each well as specified by its WQMS. Currently IOCs are required to be sampled for once between 2019 and 2028, for all wells.
b. Nitrates are sampled for each well once per year.
c. Currently OWSI has no primary maximum contaminant level (MCL) violations.
d. As noted in Section 5.2, Well 14 receives treatment for manganese removal.

e. As also noted in Section 5.2, raw water from Wells 2 and 3 exceeds DOH limits for iron and is therefore treated for iron removal to safe levels using manganese greensand. This process also removes high levels of manganese, and while not a health-related constituent of water, its removal is beneficial from an aesthetic standpoint as it can stain plumbing fixtures.

Volatile Organic Chemicals (VOCs)

a. OWSI samples wells for VOCs as specified in its WQMS. Most recently VOCs were sampled between 2018-2022 for each well.

b. No source has tested positive for a VOC contaminant.

Synthetic Organic Chemicals (SOCs)

a. OWSI's historical sampling record indicates no presence of SOCs in its groundwater wells.

b. OWSI is not currently required to sampled for SOCs in any source.

Radionuclides

a. OWSI has had no MCL violations with respect to radionuclides.

Lead and Copper

a. OWSI conducted its latest lead and copper monitoring during the compliance period of January 2021 – December 2023. Sample results were below the established action levels.

Coliform Monitoring Program

a. OWSI conducts coliform monitoring as outlined in its Coliform Monitoring Plan. Based on its size, OWSI is required to collect three representative samples throughout the system each month.

b. From 2018-2023, OWSI had six samples that tested positive for the presence of Total Coliform.

10.3 Water Quality Monitoring Plans

OWSI's Coliform Monitoring Plan, which contains a Triggered Source Monitoring Plan pursuant to the Groundwater Rule, is provided in Appendix I.

10.4 Consumer Confidence Report

The final rule for the Consumer Confidence Report (CCR) was published in the Federal Register on August 19, 1998, and became effective on September 18, 1998. Minor revisions were posted in the Federal Register on May 4, 2000. The CCR is the centerpiece of the right-to-know provisions of the 1996 Amendments to the SDWA. All community water systems, like OWSI,

were required to issue the first report to customers by October 19, 1999. The annual report must be updated and re-issued to all customers by July 1 of each year thereafter.

The CCR is a report on the quality of water that was delivered to the system during the previous 12 months. The reports must contain certain specific elements; but may also contain other information that the purveyor deems appropriate for public education. Some, but not all of the information that is required in the reports, include the source and type of the drinking water, type of treatment, contaminants that have been detected in the water, potential health effects of the contaminants, identification of the likely source of contamination, violations of monitoring and reporting, and variances or exemptions to the drinking water regulations.

OWSI is in compliance with the CCR Rule. Annual CCRs have been published as required.

Section 11

Source Protection Program

This section provides a summary of OWSI's Wellhead Protection Program (WHPP).

11.1 Wellhead Protection Program Requirements

The Safe Drinking Water Act (Section 1428) established a WHPP to protect groundwaters that contribute to public water systems. DOH has expanded those Federal source protection regulations to include all Group A community and non-community water systems, including groundwater, GUI (groundwater under the influence), and filtered and non-filtered surface water sources. Accordingly, DOH has developed regulations that require all Group A water systems that maintain and operate their own sources to implement a WHPP (WAC 246-290-135(3)), or a Watershed Control Program (WCP) (WAC 246-290-135(4)), or any combination thereof, as deemed appropriate by the State.

Source water protection programs are planning tools to be used by water utilities to identify potential sources of water contamination, and to protect existing and future drinking water supplies. OWSI has prepared and implemented a WHPP for its groundwater sources. The objective is to minimize risk of accidental releases of contaminants in areas contributing water to the public water supply system. The three basic elements of a source water protection plan are:

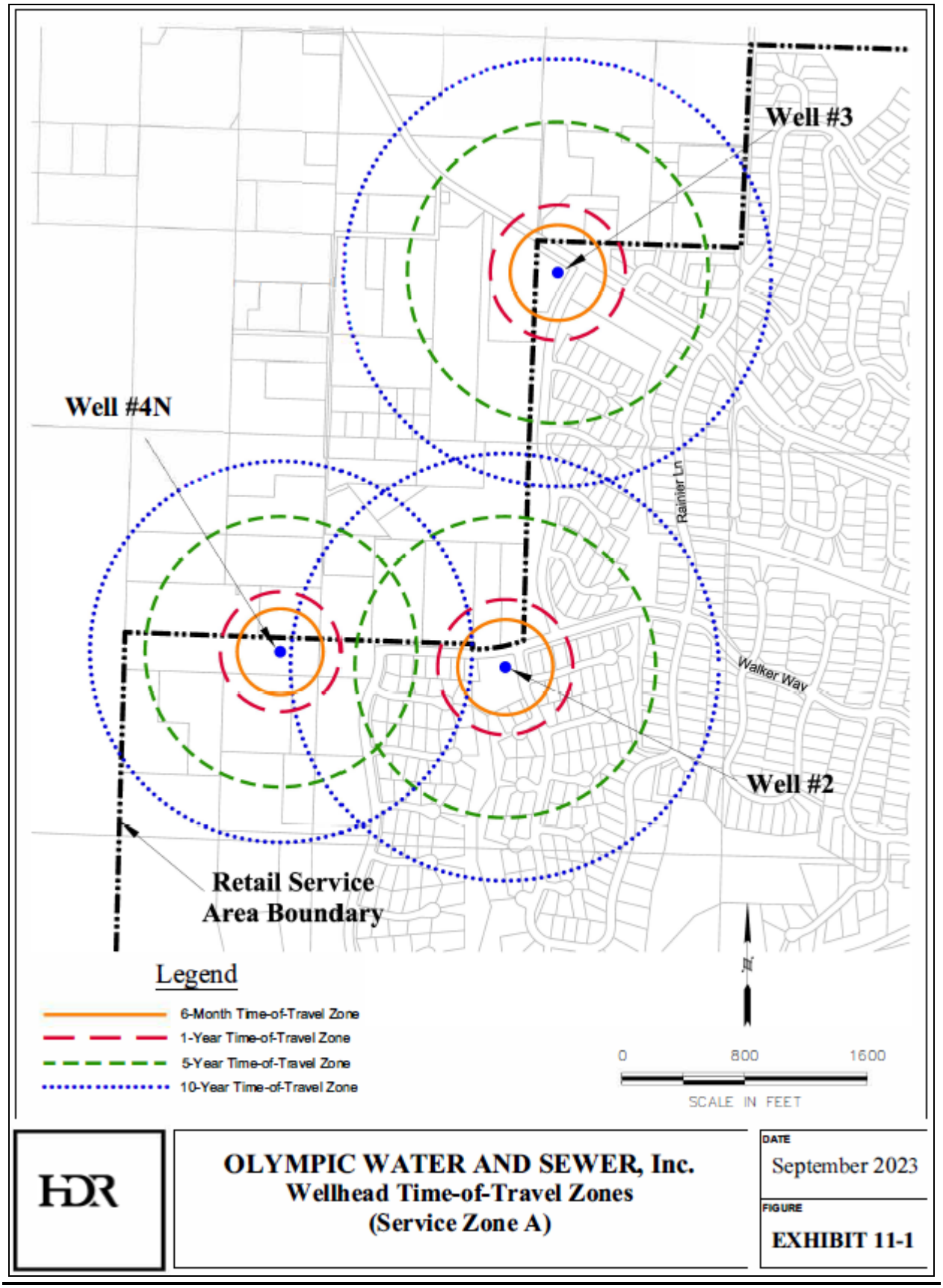
- Definition of the area, either a Wellhead Protection Area (WHPA) or a watershed, that directly contributes to a water supply. A WHPA is defined as an area contributing to a source within a specified amount of time.
- Inventory of land uses and identification of potential sources of contamination within the WHPA or watershed.
- Management strategies including emergency spill response and contingency plans to minimize or eliminate the possibility of potential contamination of the water supply.

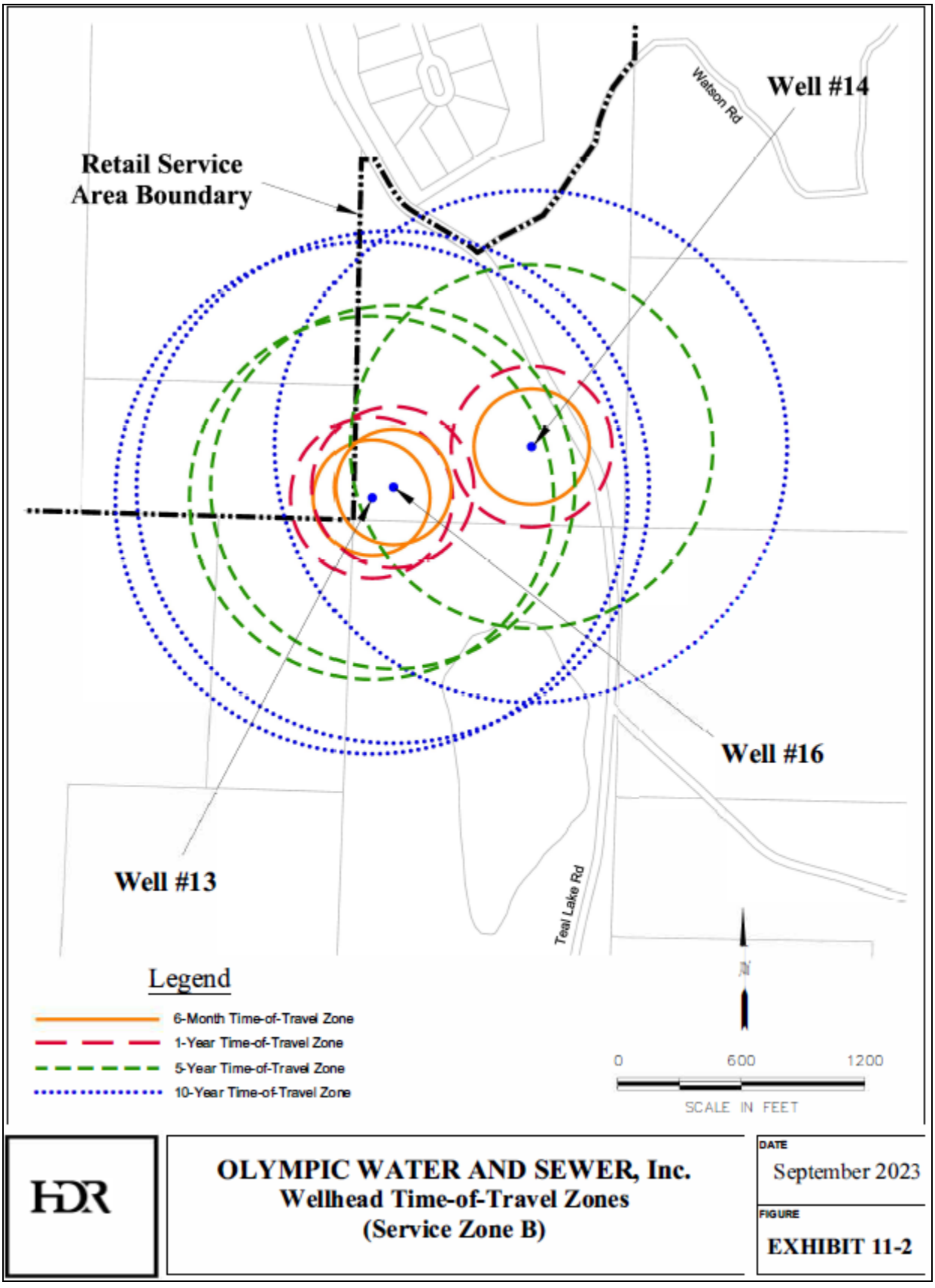
Each of these items is discussed in more detail below.

11.2 Wellhead Protection Area Definition

The WHPAs for OWSI's wells are defined by their 6-month and 1-, 5-, and 10-year estimations of time-of-travel zones. These zones have been delineated based upon the calculated fixed radius (CFR) method. Exhibit 11-1 shows the time-of-travel zones for Wells 2, 3, and 4N in Service Zone A. Exhibit 11-2 shows the zones for Wells 13, 14, and 16 in Service Zone B. The zone

radii for each well are described in the completed susceptibility assessments, which are provided in Appendix J.


Well #3
Well #4N
Well #2
Rainier Ln
Walker Way
Retail Service
Area Boundary
Legend
6-Month Time-of-Travel Zone
1-Year Time-of-Travel Zone
5-Year Time-of-Travel Zone
10-Year Time-of-Travel Zone
N
0
800
1600
SCALE IN FEET
HDR
OLYMPIC WATER AND SEWER, Inc.
Wellhead Time-of-Travel Zones
(Service Zone A)
DATE
September 2023
FIGURE
EXHIBIT 11-1


Well #14
Watson Rd
Retail Service Area Boundary
Well #16
Well #13
Teal Lake Rd
Legend
6-Month Time-of-Travel Zone
1-Year Time-of-Travel Zone
5-Year Time-of-Travel Zone
10-Year Time-of-Travel Zone
N
0
600
1200
SCALE IN FEET
HDR
OLYMPIC WATER AND SEWER, Inc.
Wellhead Time-of-Travel Zones
(Service Zone B)
DATE
September 2023
FIGURE
EXHIBIT 11-2

11.3 Potential Contaminant Source Inventory

All six approved and operating wells (2, 3, 4N, 13, 14, and 16) are rated by DOH as having "Low" susceptibility to contamination.

In the 1990s, OWSI conducted a thorough review of land uses and property ownership within the time-of-travel zones of its wells. Due to the water system's remote location, and the rural/residential nature of the setting, there were few identified potential sources of wellhead contamination. There are no commercial or industrial activities taking place near the wells. In Service Zone A, Wells 2, 3, and 4N are located in close proximity to many single-family residences, some of which had (or continue to have) operating septic systems, and in a few cases, private water supply wells. In Service Zone B, there are only a few such property owners located near wells 13, 14, and 16. Property owners located within the 10-year time-of-travel zones of OWSI's wells having septic systems and/or private wells were notified by OWSI of their location relative to the public water supplies and informed of the system's WHPP activities.

Land uses have not changed since the initial review in the 1990s, so the prior assessment remains valid. In addition, Ecology's database regarding potentially contaminated and toxic sites has also been reviewed to confirm the locations of any pre-existing potential contaminant within the WHPAs. All such information of this nature is compiled into a single database (i.e., the Facility Site Identification System), which is accessible via the Internet. This database was searched, using Port Ludlow's zip code of 98365, to obtain all sites located within the WHPA. This includes sites such as underground storage tanks, leaking underground storage tanks, hazardous waste generators, hazardous waste management activities, and State clean-up sites. The database search identified one site, located within Well 2's 6-month time-of-travel zone. This site, which is located at 781 Walker Way and has "OWSI" as its site name, is listed as being in Ecology's toxics program and as having a leaking underground storage tank. This site, which is associated with historical hydrocarbon contamination, is described in more detail in Section 5.1.1. As discussed in that section, it has been concluded that Well 2 is upgradient of and not impacted by the contamination.

Additional potential sources of contamination to OWSI's wells are accidental spills on roadways. Well 14 has the greatest risk to this type of contamination, due to its proximity to Teal Lake Road, a secondary access route to Port Ludlow from Highway 104.

Salt-water intrusion also poses a potential source of contamination for the wells. However, OWSI currently has a monitoring program that includes tracking of water levels, chlorides, and conductivity (see Section 11.6 for detail). It is anticipated that OWSI will have adequate notice if saltwater intrusion were to occur in the south aquifer. The lag in time from identifying salt-water intrusion to the time chlorides and conductivity levels reach State MCLs would allow for the reduction in withdrawals from the south aquifer, and the attainment of an alternate source.

As part of this WSP update, OWSI updated its inventory of property owners located within the WHPA. Notification letters were sent to each property owner prior to the end of 2015, as some have septic systems or their own water supply wells, which can potentially be sources of contamination to OWSI's wells. Updated notification letters were also sent to local regulatory agencies and first responders. Copies of these updated letters are provided in Appendix J.

11.4 Spill Response Planning

If a spill were to occur that affects or has the potential to affect a well or wells, the following actions would be taken by OWSI:

- Contact the Jefferson County Department of Emergency Management to initiate containment and cleanup actions.
- Consult engineer and hydrogeologist to determine source and extent of contamination and the vulnerability of other wells to contamination.
- Immediately test water supply of well and nearby wells, and the distribution system for contaminants.
- Immediately notify all customers of the spill or contamination and institute a water conservation program if it appears that the other wells cannot meet demands. The first element of such a program would be a request to significantly reduce residential water use such as stopping all irrigation or outside water use. OWSI can reduce or suspend irrigation in all resort properties.

An emergency contact list is provided in the Emergency Response Plan (Table 12-2 in Section 12.4.2 of the WSP).

11.5 Contingency Planning

A contingency plan describes options available to OWSI in the event that some well supplies become contaminated or are otherwise unavailable. Possible contamination scenarios and associated alternate supply options are described below:

11.5.1 Contamination of a Service Zone A Well

If Well 2, 3, 4N, or a combination thereof are contaminated, other uncontaminated northern wells could be relied upon in conjunction with water conservation to meet a base level of demand. If any remaining northern wells are not sufficient to meet demands, then OWSI will consider the following actions depending upon the level of additional supply needed and the duration for which it would be required:

- Transfer water from Service Zone B to Service Zone A through the use of the North Bay Booster Pump Station (125 gpm).

- If a more permanent, replacement supply is required, the development of Well 1 could be completed. This 50 gpm well is located north of the other Service Zone A wells, and was used in previous years for the Port Ludlow supply. OWSI presently holds no water rights for Well 1. However, it withdraws water from a different aquifer than the other Service Zone A wells, and there are no other known wells that withdraw from the same source. Therefore, OWSI would likely be granted an emergency permit by Ecology for its use. The well is located near a section of distribution piping, so connecting the supply to the system would not take very long. As this well is located at a lower elevation than the Service Zone A wells, water would have to be pumped to reach the 443 pressure zone.

- Determine type of contaminant and potential for treatment. A temporary water treatment plant could be installed at the contaminated source. Chemical analysis of the water and a pilot treatment study would be considered prior to implementation. This entire process would likely take several weeks to implement.

11.5.2 Contamination of a Service Zone B Well

If Well 13, 14, 16, or a combination thereof are contaminated, other uncontaminated southern wells could be relied upon in conjunction with water conservation to meet a base level of demand. Well 16 is the largest supply in Service Zone B. If Well 16 is unavailable, Well 13 can be used as an emergency supply in conjunction with Well 14. Options for additional supplies for Service Zone B include:

- Temporarily pump or truck water from Service Zone A to Service Zone B. This is short-term measure, and would be costly to implement for a long period of time.

- If a more permanent, replacement supply is required, Wells 4A and 9 could be used to supply a portion of Service Zone B demands. These wells are located in a shallow aquifer near the golf course (different than the one tapped by the other Service Zone B wells). They were previously used by the water system, but their use was discontinued due to poor water quality (i.e., presence of iron and manganese). However, OWSI does hold water rights for these sources, and could use them if needed on a temporary basis. Depending upon the duration of their use, treatment for iron and manganese removal may be required. This would require the design of a treatment system and would add to the time necessary to bring the source on-line for any appreciable amount of time.

- Determine type of contaminant and potential for treatment. Similar to the option discussed for the Service Zone A wells, a water treatment plant could be installed at

the contaminated source. This would require weeks of preparation prior to the source(s) being available for use.

11.5.3 Trucked Water

In the event that an alternative water supply is needed on a short-term basis for one of the service zones, and none of the options described above are feasible, then OWSI will consider the use of trucked water in meeting needs on a temporary basis. When conditions necessitate trucked water, OWSI will first consult with DOH to ensure that proper steps are taken. When a provider is then contacted for trucked water, OWSI will ensure that their procedures are consistent with DOH's trucked water guidelines, which are included in Appendix K.

11.6 Groundwater Monitoring Program

As a condition of plat approval, Jefferson County required that Port Ludlow Associates, LLC conduct a groundwater resource monitoring program. Such a program was initiated in April 1994. The monitoring program concentrates on the North and South Aquifers (i.e., those that serve Service Zones A and B, respectively). The groundwater monitoring network is comprised of 18 wells owned and maintained by seven participants, including the OWSI wells.

The goal of the monitoring program is to assess the long-term condition of the aquifers by collecting data regarding five basic parameters: 1) static water levels, 2) pumping water levels, 3) quantity of pumping, 4) water quality, and 5) rainfall. Water level measurements are made on a quarterly basis, with water quality sampling occurring on an annual basis.

Over the past two decades, the monitoring program has collected a strong baseline of data and has provided an initial, long-term trend analysis. There are no definitive indications of declining water levels related to groundwater production or rising chloride and conductivity levels in any of the aquifers. OWSI intends to continue the monitoring program to ensure proper management of the groundwater resource.

Appendix J contains a copy of a recent annual groundwater monitoring report.

Section 12
Operations and Maintenance Program

This section presents OWSI's operations and maintenance program. Included is a description of OWSI's organizational structure, personnel certification, and routine operations and preventive maintenance. Also presented is the utility's emergency response plan and details regarding OWSI's public notification, recordkeeping, and customer complaint response procedures. Summaries of the utility's cross connection control and safety programs conclude the section.

12.1 Organizational Structure

OWSI is privately owned by Port Ludlow Associates, LLC (PLA). Exhibit 12-1 depicts the operational structure of OWSI.

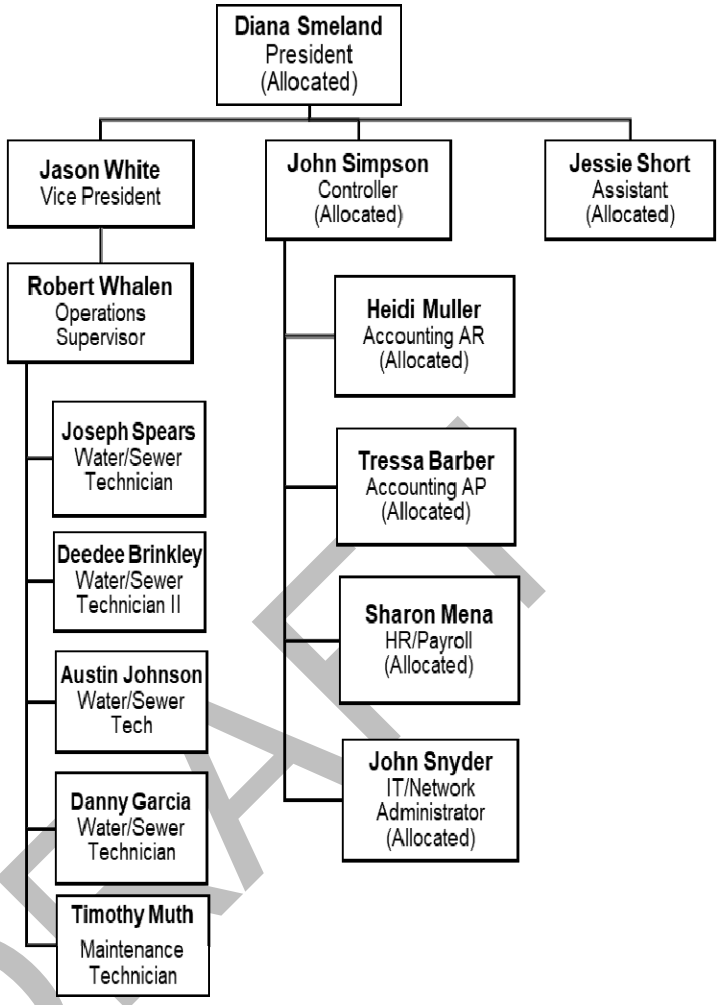
The president of OWSI is responsible for managing the water system, including overall management of operations, implementation of OWSI policy, and liaison with PLA.

The Operations Supervisor is responsible for the day-to-day operation of OWSI. As such, he performs the following:

- Coordinates daily work assignments with Water Technicians and inspect jobs upon completion.
- Maintains records.
- Remains current with all regulations affecting water purveyors, assuring OWSI is in compliance.
- Assists in developing operational budgets, and ensures efficient and accurate man-hour accounting.
- Assures prompt and efficient response to customer complaints and emergency situations.
- Orders supplies and maintains parts inventory.
- Evaluates all aspects of the system to ensure efficient and economical operations and maintenance.
- Identifies the needs for capital improvements and system upgrades.
- Ensures that personnel attain and retain proper state certifications.
- Ensures that safe working practices are followed.

Water Technicians are responsible for performing routine operations and maintenance activities, as assigned by the Operations Supervisor.

Exhibit 12-1. Organizational Chart



12.2 Personnel Certification

Pursuant to Chapter 246-292 WAC, OWSI is required to have certified operators. Certified personnel are required for positions that are in direct charge of a public water system or major segments of the system and are responsible for monitoring or improving water quality.

Some level of certification is required for all OWSI water system operator positions. All certified personnel must renew their certificates annually. They must demonstrate their continued professional growth in the field by accumulating three related college credits or continuing education units (CEUs) every three years. OWSI will continue training and assistance for all staff in obtaining their certification and in meeting the three-year CEU requirements. This will assist both the operators and OWSI in maintaining an efficient level of water system operations. A listing of water system operations personnel and their level of certification, as of August 2023, is included in Table 12-1.

Table 12-1
Personnel Certification

Staff Person	Title	Certification
Jason White	VP/Manager	WDM-3, WTPO-2, CCS
Robert Whalen	Operations Supervisor	WDM-2, CCS
Joseph Spears	Water Technician	WDM-1, WTPO-1
Dorothy Brinkley	Water Technician	WDM -2, WTPO-2

Notes:
WDM: Water Distribution Manager
CCS: Cross Connection Specialist
WTPO: Water Treatment Plant Operator

12.3 Routine Operations and Preventive Maintenance

Good preventive maintenance is both cost-effective and a deterrent to emergency conditions. By following a set schedule of maintenance activities, OWSI can ensure efficient and reliable system operation, extend life of equipment, and provide an early warning of mechanical breakdown.

12.3.1 Wells

Wells are inspected for operational readiness five days per week. Inspections include control system operation, treatment system chemical levels, and the recording of production levels. Monday morning water meter and hour meter readings are compared with Friday readings and averaged to arrive at weekend daily totals. More frequent readings are taken at the discretion of operations personnel, and typically occur during high demands periods.

Aquifer level measurements are taken once per month during October through April, and twice per month during May through September. The measurement procedure is as follows:

- Wells are shut off for two hours to allow the water level to equilibrate.
- At the end of the shut off period, the static water level is measured and recorded.
- A two-hour pumping cycle is initiated.
- At the end of the pumping cycle, the pumping rate and water level are measured and recorded.
- The results are compared to previous measurements to analyze any changes in water levels or pumping rates.

12.3.2 Reservoirs

Reservoir water levels are read and recorded five days per week. More frequent readings are taken during periods of high demand or as directed by the Operations Supervisor.

Reservoirs are checked for sediment accumulation every six months and drained off as necessary. Paint condition is checked annually and repainted as needed. Experience has shown that repainting is required on an eight-to-ten-year cycle.

Reservoir yards are kept in a neat, clean condition.

12.3.3 Hydrants

Hydrant inspections and maintenance are performed by OWSI and Jefferson County Fire Protection District No. 3, as detailed in an agreement included as Appendix L.

12.3.4 Service Meters

Application for new service or change of service is made through the customer service representative in accordance with WUTC regulations. An example of OWSI's application for water service is provided as Appendix B.

Meters are read for billing purposes on a bi-monthly schedule, with each billing cycle covering approximately 61 days.

Meter accuracy tests are made in accordance with WAC 480-110 or as necessary in response to customer complaints. Repair or replacement is made as needed to maintain accuracy as close as possible, in the range of 98 to 102 percent.

The area around meter boxes is maintained in a neat condition to ensure visibility.

12.3.5 Pressure Reducing Valves

Pressure reducing valves (PRVs) are inspected every six months to ensure that valves and pressure gauges are operating properly. More frequent inspections are made at the discretion of the Operations Supervisor. Associated piping is kept free of rust and leaks. Valve vaults, access hatches, ladders, and the surrounding areas are maintained to ensure safe access and egress.

12.3.6 Booster Pump Stations

The Woodridge Village BPS is inspected for operational readiness five days per week. The pumps and pressure tanks are checked to ensure proper operation. Pump start meters are read and usage is recorded.

The Drew Lane BPS is inspected weekly during seasons of low flow and more often as the water demand increases for operational readiness. Water meter reading and pump run hours are recorded.

The Walden Lane BPS is inspected five days per week. The pump and pressure tanks are checked to ensure proper operation. A pump hour meter is read and recorded.

12.3.7 General Distribution System

Air/vacuum valves are inspected annually and cleaned or repaired as needed to maintain proper functioning.

Main line valves are exercised twice per year and the valve box and operating nut kept accessible. Valve lids are kept free of corrosion and marker posts are painted as needed for visibility.

Dead end lines are flushed monthly using blow-off valves, based on staff availability. Entire system flushing is performed annually using blow-off valves and hydrants as necessary.

Any leaks in the system, regardless of size, are repaired as soon as practicable.

12.3.8 General Maintenance

All buildings, appurtenances, and grounds associated with OWSI operations are kept in a neat, clean condition.

All tools, equipment, and vehicles are kept clean, lubricated, properly stored, and otherwise maintained to ensure the highest degree of operational readiness.

An adequate stock of parts, lubricants, etc. will be maintained in the maintenance shop and updated as necessary.

12.4 Emergency Response Plan

WSPs must include an Emergency Response Plan (ERP) in the Operations and Maintenance Program. The purpose of an ERP is to guide personnel through system malfunctions, natural disasters, and other events affecting routine system operation.

OWSI's ERP contains the following components:

- Vulnerability assessment
- Emergency contact list
- Priority lists
- General field response procedures
- Emergency response procedures for specific situations
- Contingency plan
- Emergency chlorination procedures.

12.4.1 Vulnerability Assessment

Water system vulnerability is defined as the degree to which facilities are adversely affected under different emergency and disaster situations. It is practical for small water system purveyors to forecast likely emergency and disaster situations and establish mitigation and prevention measures to minimize disruption to service.

Pursuant to the Federal Bioterrorism Act, community water systems serving more than 3,300 people are required to conduct vulnerability assessments (VAs) according to a prescribed process. OWSI has not yet developed a VA per this regulation, as the system does not serve more than 3,300 people. However, the vulnerabilities of key system components have been examined and are discussed below. While this list is by no means all-inclusive, the intention is to provide a basis for emergency planning that OWSI will follow.

Wells

Wells are vulnerable to mechanical failure, vandalism, contamination, power and telephone outages, and earthquakes. Such concerns are addressed in OWSI's wellhead protection program (WHPP) described in Section 11. Wellhouses are constructed to reduce the potential for vandalism by being locked structures. In addition, the wellhouse yards are fenced and locked to deter access. In the event of accidental or purposeful contamination of some wells, OWSI has contingency plans to utilize other wells and/or import trucked water until its sources are back online.

Power outages are best addressed by the availability of auxiliary power. In Service Zone B, Wells 14 & 16 have an emergency generator, which maintains the operation of that source in the event of power loss. Well #4 in Service Zone A has a manual transfer switch with a pig tail for use with a portable generator. Currently the portable generator will be shared among several other critical locations.

Reservoirs

Vulnerability concerns for reservoirs center on the potential for damage to the structure and/or contamination of its contents. Storage reservoirs are constructed to reduce the potential for vandalism by being completely sealed with locked hatches. However, reservoirs are susceptible to natural and manmade disasters such as earthquakes and vandalism. Vandalism cannot be totally prevented, but can be deterred. Reservoir areas are fenced and locked where appropriate. Reservoir sites are inspected frequently to ensure security.

Booster Pump Stations

Similar to well sources, booster pump stations (BPSs) are vulnerable to mechanical failure, vandalism, power and telephone outages, and earthquakes. OWSI's Woodridge Village BPS is outfitted with a pig-tail connection that can be connected to a portable generator in the event of a power outage. OWSI presently only owns one portable generator, which is used at wastewater lift stations during power outages. Therefore, the CIP includes the purchase of an additional portable generator to provide auxiliary power to the Service Zone A wells. An additional generator to power the BPS will be evaluated. Security of the BPS is provided in the form of locked access.

Transmission and Distribution System

The transmission and distribution systems are susceptible to both manmade and natural disasters such as vandalism, pressure surges, contamination, corrosion, erosion, earthquake, and material failure. To reduce the number of breaks to the system, standards for pipeline construction and materials have been established and must be followed. In addition, standards are in place to require the strategic placement of valves and looping lines so broken pipes can be isolated while continuing water service.

OWSI has a mapping system of pipes and valves, and performs its own underground facilities locates to prevent accidental dig ups. OWSI has also developed and implemented a Cross Connection Control Program so foreign substances are not accidentally back-siphoned into the water system.

12.4.2 Emergency Contact List

A list of Emergency Contacts for the OWSI is provided in Table 12-2. This list is posted at the utility's maintenance facilities.

Table 12-2
OWSI Emergency Contacts

Contact	Phone Number
OWSI President – Diana Smeland	(360) 437-8342
OWSI VP/Manager – Jason White	(360) 437-7839
OWSI Operations Supervisor- Robert Whalen	(360) 437-7898
Fire/Police/Medical	911
DOH Regional Engineer	(360) 236-3030
DOH Emergency Contact (after hours)	1-877-481-4901
Department of Ecology Spill Response	(360) 407-6000
Jefferson County Emergency Mgmt	(360) 385-3831
Jefferson County Environmental Health	(360) 385-9400
Call Before You Dig	1-800-424-5555
Engineering Consultant (HDR)	(360) 570-4400

12.4.3 Priority Lists

All water served by OWSI must meet all applicable State and Federal drinking water quality standards. If the supply of water is not adequate to meet all of the water system demands, the water that is available should be allocated based on the following usage rankings, which are listed from highest to lowest priority:

- Fire Fighting (Life Threatening)
- Drinking
- Fire Fighting (Property Threatening)
- Sanitary
- Industrial
- Commercial
- Recreational

This usage priority ranking is a general guideline only. Decisions by OWSI staff regarding water allocation during emergencies may vary from this on the basis of prevailing conditions.

OWSI also maintains a Priority Service List, to protect individuals and/or organizations who are dependent upon an uninterrupted supply of water and/or strict water quality requirements. Public information and education concerning this service is important to encourage those in need of special water service to contact OWSI for inclusion on the

list. Possible candidates for this service include individuals on home-care kidney dialysis equipment (of which there are presently none) or other medical facilities and organizations requiring uninterrupted water for specialized commercial or industrial processes (of which there are presently none, with the exception of a dentist office).

12.4.4 General Field Response Procedures

The OWSI President or Operations Supervisor will immediately notify the DOH Regional Engineer (or call the DOH Emergency After-Hours phone number) in the event that a water break occurs which causes a loss in pressure, an outage occurs that affects a significant number of customers, water shutdown is threatened or required for more than 24 hours, water quality is determined to be unacceptable, or whenever a public health risk associated with the water system is detected.

The initial reaction by OWSI personnel to an emergency is to take prompt action to remove any immediate threat to public health or safety. Where appropriate, bystanders may be warned, traffic diverted, valves shut off, dangerous materials removed, or other necessary action taken, provided it can be done without further risk to the public or OWSI staff.

Next, the Operations Supervisor is contacted and informed as to the damage and apparent cause. This individual can then dispatch a crew to isolate the problem or damaged facility. Meanwhile, the damage is more thoroughly assessed and a determination made as to the materials and equipment necessary for correction. It may be necessary to decide between a temporary solution that can be accomplished quickly and a permanent one that may take more time. It is essential that OWSI's repair supplies inventory and a list of materials suppliers are kept up-to-date and readily accessible to avoid unnecessary delay in restoration of service.

Throughout the emergency, radio contact is maintained between work crews, the Operations Supervisor, and other key participants to enhance coordination of the corrective effort. It is important that the OWSI President and administrative staff are kept appraised of the emergency to permit proper public notification.

12.4.5 Emergency Response Procedures for Specific Situations

OWSI has developed specific response procedures relating to particular emergency situations. These are described below. These procedures serve as guidelines, with specific actions taken as necessary to most efficiently address each given situation.

Earthquake Response

A major earthquake, with the magnitude of 5.0 or greater on the Richter scale, could disrupt the source, transmission, pumping, storage and distribution components of a water system. In addition, power failures and interruption to conventional transportation and communication systems may occur.

OWSI staff will anticipate critical water use needs for firefighting or medical facilities resulting from an earthquake. These are given due priority in assessing the emergency, preparing damage reports, and organizing repair efforts.

Pipelines and other buried facilities are hidden from view but are at least as susceptible to ground movement as aboveground structures, so these facilities must be closely examined after an earthquake for any unexplained drop in line pressure, reduction in flow rate, pump failure, leakage, or other damage. Crews are equipped to:

- Maintain constant contact with dispatch and other field personnel,
- Barricade hazardous areas,
- Shut off valves to isolate broken mains,
- Turn off water services,
- Make repairs, and
- Help residents secure a safe supply of drinking water.

Power Failure Response

Short- and long-term interruptions in power can occur for a variety of reasons, which may or may not be associated with emergencies. The facilities most affected by this type of emergency are the well pumps and the Woodridge Village BPS.

In addition to their field response, OWSI staff will immediately contact the appropriate electrical service provider (Puget Sound Energy) to determine the nature, extent, and expected duration of the power outage. Portable emergency generators will be used as necessary to maintain operation of key system components. See Section 12.4.1 for a description of facilities already equipped with backup power, and those for which emergency power is planned in the CIP.

Water Transmission Line Failure Response

Rupture or leakage in transmission lines from any source could result from an earthquake, pressure surge, vandalism, bomb blast, construction, soil scour, and corrosion or material failure. A major break could interrupt the water source and present a flood and erosion threat to adjacent landowners.

Such an event requires prompt action by OWSI staff to isolate the damaged section of line and minimize the impacts to the rest of the system. The size and nature of the rupture must be evaluated promptly to ensure that adequate repair materials, excavation equipment, de-watering facilities, and proper personnel are deployed.

Loss of transmission lines could present a water supply shortage. If deemed absolutely necessary, trucked water could be imported (see Section 12.4.6).

Distribution Line Break Response

Water distribution line breaks could result from an earthquake, pressure surge, vandalism, bomb blast, construction, soil scour, corrosion, or material failure. Due to strategically placed valves and looped systems, most line breaks can be isolated to minimize service outages.

Such an event requires prompt action by OWSI staff to isolate the damaged section and minimize impacts to the rest of the system. Water line repairs will be made in accordance with standard procedures. OWSI has procedures in place and materials on hand to address line break emergencies. Such materials include repair clamps for all types of pipe materials and sizes that are in the system, ductile iron pipe, various sizes of water main valves, chlorine for disinfection, bedding and backfill material, copper tubing, and service fittings. Looping of distribution lines will minimize the areas out of service.

12.4.6 Contingency Plan

In the event that one or more sources of water supply are unavailable due to natural, accidental, or vandalism-related causes, OWSI's remaining well sources can be used to serve the system. Details regarding example scenarios and potential procedures to be taken are included in the contingency planning section of the WHPP (see Section 11).

If all sources are unavailable or contaminated, OWSI will consider the use of trucked water as an emergency source of supply. This may be a necessity in some situations, due to the system's remote location and an inability to readily obtain water from other sources and/or providers. When conditions necessitate trucked water, OWSI will first consult with the DOH regional Office of Drinking Water, to ensure proper steps are taken. When providers are contacted for trucked water, OWSI will ensure that their procedures are consistent with DOH's trucked water guidelines, which are included as Appendix K of this WSP.

12.5 Water Quality Public Notification, Record Keeping, and Customer Complaint Procedures

12.5.1 Public Notification

OWSI is required to provide periodic reports to DOH which summarize the results of water quality testing. If any maximum contaminant levels (MCLs) are exceeded, both DOH and the public must be notified in accordance with methods specified in WAC 246-290-71001 through 246-290-71007. OWSI uses DOH templates for public notification. Examples of these DOH notification materials are provided in Appendix M.

OWSI also communicates to its customers through the utility's website (https://ows-inc.com). The website provides contact information and news/announcements, as well as

links to key forms and documents, such as applications for new or modified service. In addition, OWSI recently implemented a new emergency communication tool called AlertMedia. This allows OWSI to send multi-channel alerts to impacted individuals via email, text, voice call, and an app push. OWSI is implementing this as a way to quickly communicate with customers during events such as "boil water" or "do not drink" notices. Customers sign up to participate in this service through the website.

DOH, through WAC 246-290-71001 (which in turn references 40 CFR 141.201 through 208) has defined situations that require water purveyors to notify customers of what the circumstances are and what actions are being taken to address certain acute issues. Violations and other situations are categorized into three tiers, based upon the degree of potential adverse impacts to human health. The most common situations listed in the three tiers are as follows:

Tier 1 (details found in Table 1 of 40 CFR 141.202 (a))

a) Violation of the MCL for total coliforms when fecal coliform or E. coli are present in the system, or when there is a failure to test for fecal coliform or E. coli when required.

b) Violation of the MCL for nitrate, nitrite, or total nitrate and nitrite, or failure to perform required confirmation sampling.

c) Certain situations when there is a violation of the MRDL for chlorine dioxide.

d) Certain situations when there is a violation of the turbidity MCL.

e) Certain situations when there is a violation of the Surface Water Treatment Rule, Interim Enhanced Surface Water Treatment Rule, or Long Term 1 Enhanced Surface Water Treatment Rule treatment technique requirement.

f) Occurrence of a waterborne disease outbreak or other waterborne emergency.

g) Other violations or situations with significant potential to have serious adverse effects on human health.

Tier 2 (details found in Table 1 of 40 CFR 141.203 (a))

a) All MCL, MRDL, and treatment technique requirement violations, except those classified as Tier 1.

b) Violations of the monitoring and testing procedure requirements, where DOH determines that a Tier 2 notice is required rather than a Tier 3 notice.

c) Failure to comply with the terms and conditions of any variance or exemption in place.

Tier 3 (details found in Table 1 of 40 CFR 141.204 (a))

a) Monitoring violations that do not fall under Tiers 1 or 2.

b) Failure to comply with a testing procedure that does not fall under Tiers 1 or 2.

c) Operation under a variance or exemption.

d) Availability of unregulated contaminant monitoring results.

e) Exceedance of the fluoride secondary MCL.

In addition, WAC 246-290-71001 requires that purveyors notify customers when the system is issued a departmental order, fails to comply with a departmental order, or is issued a category red operating permit.

Public notification distribution requirements are set forth according to the Tier system. In general, the timing and manner of public notifications are as follows:

Tier 1 (details found in 40 CFR 141.202 (b) and (c))

a) Public notice shall be provided as soon as possible but no later than 24 hours after the system learns of the violation.

b) DOH shall be contacted as soon as possible but no later than 24 hours after the system learns of the violation.

c) At a minimum, one of the following forms of delivery is to be used:

   a. Broadcast media (radio, television).

   b. Conspicuous posting.

   c. Hand delivery of notice.

   d. Another method approved by DOH.

Tier 2 (details found in 40 CFR 141.203 (b) and (c))

a) Public notice shall be provided as soon as possible but no later than 30 days after the system learns of the violation.

b) The public notice must be repeated every three months as long as the violation or situation persists, unless DOH determines that another frequency is warranted.

c) At a minimum, the form of delivery must meet the following:

   a. Mail or direct delivery.

   b. Any other method reasonably calculated to reach other persons regularly served by the system, such as publication in a local newspaper, posting in public places, etc.

Tier 3 (details found in 40 CFR 141.204 (b) and (c))

a) Public notice shall be provided no later than one year after the system learns of the violation or situation.

b) The public notice must be repeated every year as long as the violation or situation persists.

c) Instead of individual Tier 3 notices, an annual report may be used to detail all violations and situations that occurred during the year.

d) The form of delivery is to meet the same requirements as that for Tier 2 notices.

12.5.2 Recordkeeping

OWSI is also responsible for maintaining certain records for specified periods. These requirements are listed in Table 12-3. OWSI maintains the majority of its records (including water production and water quality testing results) in digital format on a computer. Records on most parameters go back more than 10 years.

Table 12-3
Retention of Records of Operation and Analysis

Event	Period of Retention
Bacteriological Analysis	5 years
Chemical Analysis	10 years
Records of Action Taken to Correct MCL Violations	3 years after last violation.
Records Regarding a Variance or Exemption	10 years following expiration of Variance or Exemption.
Records Concerning Public Notification	3 years after Date of Notification.
Chlorine Residual	3 years (copies sent to DOH monthly)

12.5.3 Customer Complaints

Customer complaints are recorded as received and necessary actions are taken to address the complaint. The response is approached on a case-by-case basis depending on the nature of the complaint. The response may consist of consumer education, either verbal, email, or visiting the residence if more information is needed. In certain cases, we enlist the assistance of the Port Ludlow Village Council Utility Committee to provide consumer-to-consumer assistance. As an example, the PLVC hosted the water system plan consumer information meeting in October 2023 where we presented an overview of the water system plan and other current activities, as presented in Appendix P. OWSI has also established effective lines of communication with our local fire district as their hydrant flushing operations can sometimes precipitate localized water quality complaints.

By utilizing these resources, OWSI has many avenues available to assist us in satisfactory complaint resolution.

12.6 Cross Connection Control Program

As stipulated by WAC 246-290-490, all cross connections between OWSI's water system and a non-potable supply of water are prohibited. It is the purveyor's responsibility to prevent contamination of the public water system by cross connections. An effective program requires coordination between the purveyor, customer, building inspector, and health department. Basic to an effective program is enabling local ordinances and trained personnel to enforce and monitor the elimination of cross connections.

OWSI's cross connection control regulations are established by the OWSI Policy Regarding Cross Connection Control. This policy prohibits the presence of cross connections and directs that water service be discontinued or refused to customers which fail to comply.

OWSI's complete Cross Connection Control Program is provided in Appendix N. This document contains the details regarding how the cross-connection program is implemented.

12.7 Safety Program

The Operations Supervisor is the designated safety officer for OWSI and is responsible for implementing and ensuring compliance with all PLA policies. Routine safety training is provided at weekly staff meetings, during which general construction-related issues and safety concerns are discussed.

Detailed written safety procedures for certain activities, such as confined space entries, are available in the maintenance office.

12.8 Asset Management

OWSI maintains a database of water system asset data in order to track depreciation and inform the financial structure required to adequately fund repair and replacement. Excerpts from this database are provided in Appendix Q, indicating the type of information that is logged, including: asset listing, age, expected service life, and depreciation schedule. In the future, OWSI will consider incorporating condition assessment data from system observation into this database to further enhance renewal and replacement planning.

Section 13
Capital Improvement Program

The purpose of this section is to summarize the water system improvements required to address the deficiencies identified in previous sections of this WSP. Necessary improvements are prioritized, justified, and placed in a reasonable schedule for implementation over near-term (next 10-year) and longer-term improvement program periods.

13.1 Capital Improvements and Management Projects

Table 13-1 presents a summary of system improvements identified in this WSP, organized by year of implementation and project cost. Each improvement has been assigned a project number and an anticipated year of construction; however, the actual schedule of implementation may change if and as utility priorities change over time.

The necessary improvements fall into two main categories: capital improvements and management improvements. Capital improvements are new capital-intensive water system improvements such as new water source, storage, and distribution system improvements. Operational and management improvements cover changes in the way the system is operated, additions to staff, equipment replacement, etc.

In addition to construction costs, project costs for capital improvements include allowances for construction contingency, design and construction engineering, administration, legal/permitting, surveying/geotechnical support, and taxes.

The project descriptions provided in Table 13-1 are self-explanatory for some capital projects. Select, more complex projects are described in more detail below.

Near-Term Projects

- ***CIP-1; Distribution System Water Quality Maintenance:*** This project involves the implementation of one or more approaches to improve distribution system water quality be removing legacy mineral (mainly manganese) deposits. One strategy OWSI intends to employ is a form of pressurized pipeline cleaning called “ice pigging” in which an ice/liquid slurry is forced through pipelines by pressure and removes deposits through a scouring action. If conducted, this would be implemented in phases, first targeting those portions of the distribution system that have the highest amount of mineral deposits that need to be managed. OWSI will also research other approaches which may be implemented if budgetary resources allow.
- ***CIP-2; Treatment for Well 4:*** With limited production capacity currently at Well 3, this project involves repurposing existing treatment facilities at that well to Well 4 to improve water quality produced at that site.

- ***CIP-3; Service Zone A New Source Development:*** This project involves the planning, design, and construction of a replacement source in Service Zone A. With the most recent replacement well (Well 18) not yielding a long-term production rate that is sensible to invest further in, other options are being considered. No specific project has yet been defined, but OWSI is budgeting for planning and design of a new source(s) to bolster reliability in supply to Service Zone A.
- ***CIP-4; Service Zone A Storage Improvements:*** This project is related to CIP-3, and involves the potential to modify or add storage to Service Zone A, in conjunction with source improvements in that area. While no regulatory deficiencies exist regarding storage in Service Zone A, storage improvements may be sensible if they can be implemented concurrent with source-related projects.
- ***CIP-5; Meter Replacement Program:*** This project refers to ongoing replacement of old meters with new versions that are resulting in increased metering accuracy and providing greater resolution of water consumption data, which supports enhanced management of water use.
- ***CIP-6; Pipe Replacement:*** This project refers to the phased replacement of distribution system piping, with areas prioritized that have higher rates of historical breakage/leaks and/or instances of degraded water quality due to legacy mineral deposits.
- ***Other Near-Term Projects:*** The remaining projects on the near-term CIP are comprised mostly of building, equipment, and vehicle replacement.

Longer-Term Projects:

- ***CIP-20; Wells 4a and 9 Improvements:*** These two wells have been inactive for a long time, due primarily to aesthetic water quality concerns (i.e., iron, manganese, and hydrogen sulfide). In the event the water system requires additional supply in the future, this project involves water quality improvements (e.g., planning, design, and construction of treatment) in order to place these assets back into service.
- ***CIP-21; Reservoir A – High Elevation Area Improvements:*** This project involves further evaluation of the high elevation area surrounding Reservoir A. As described in Section 9.3, portions of this area experience static pressures less than 30 psi. Pressures are significantly reduced during modeled fire flow events. Presently, residences have individual, private booster pumps to maintain pressures during normal operating conditions. OWSI plans to study this situation and analyze potential remedies, such as the construction of a booster pump station to serve this discreet area, which is comprised of approximately 100 parcels. The costs in Table 13-1 include an analysis, followed by construction of the identified remedy in subsequent years.
- ***CIP-22; Water System Plan Updates:*** This consists of the periodic (i.e., every ten years) update to the water system plan. This also incorporates the periodic updates to the wellhead protection plan (e.g., updates to the inventory of potential contaminant

sources). Potential contaminant inventory updates are typically required once every two years; however, due to the remoteness and character of the Port Ludlow area, it is highly unlikely that additional contaminants will be identified, so conducting such reviews in concert with WSP updates is reasonable.

13.2 Improvement Schedule

Those projects listed in Table 13-1 that are of higher priority are scheduled to be implemented by 2033, while those of lower priority are set aside for implementation beyond this WSP's 10-year planning horizon.

Given the fact that growth may be faster or slower than what is anticipated in this plan, the implementation schedule is subject to change, with the possibility that some projects may be implemented prior to their target date, while others may be constructed after the target established in this plan. To facilitate such flexibility, with this plan OWSI has a referenced project cost that can be quickly located and adjusted to make management decisions and schedule or budget adjustments.

Table 13-1
Summary of Capital Improvement Projects ($000s)

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Longer-Term CIP
Near-Term Capital Projects											
CIP-1: Distribution System Water Quality Maint.	$100	$100	$150	$150	$0	$0	$0	$0	$0	$0	
CIP-2: Treatment for Well #4	0	50	0	0	0	0	0	0	0	0	
CIP-3: Service Zone A New Source Development	50	110	50	750	0	0	0	0	0	0	
CIP-4: Service Zone A Storage Improvements	0	0	300	0	0	0	0	0	0	0	
CIP-5: Meter Replacement Program	50	50	55	55	60	60	65	0	0	100	
CIP-6: Pipe Replacement	0	0	0	0	0	0	200	200	200	200	
CIP-7: GIS System	0	0	0	0	50	0	0	0	0	0	
CIP-8: Pole Building - vehicle & equip. storage	0	0	30	0	0	0	0	0	0	0	
CIP-9: VacTrailer	35	0	0	0	0	0	0	0	0	0	
CIP-10: Trackhoe & Trailer	0	0	0	0	80	0	0	0	0	0	
CIP-11: Vactor Truck	0	0	0	0	0	200	0	0	0	0	
CIP-12: Replace 2008 GMC	0	0	0	0	80	0	0	0	0	0	
CIP-13: Replace 2012 Silverado	0	0	0	0	0	0	80	0	0	0	
CIP-14: Replace 2021 F150	0	0	0	0	0	0	0	90	0	0	
Total Near-Term Capital Costs	**$235**	**$310**	**$585**	**$955**	**$270**	**$260**	**$345**	**$290**	**$200**	**$300**	
Longer-Term Capital Projects											
CIP-20: Wells 4A and 9 Improvements											1,500
CIP-21: Res A – High Area Improvements											300
CIP-22: Water System Plan Update											100
Total Longer-Term Capital Costs											**$1,900**

Section 14
Financial Plan

14.1 Introduction

The effective implementation of a WSP – and more specifically the funding of the capital improvement plan (CIP) presented in Section 13 of this plan – is dependent on solid financial performance. This includes adequately funding operations and maintenance (O&M) expenses, capital improvement projects in the CIP, meeting State and local regulatory requirements, meeting prudent financial planning metrics, and providing financial flexibility to deal with unforeseen changes. Olympic Water and Sewer Inc. (OWSI) is a private water company which is regulated by the Washington Utilities and Transportation Commission (WUTC). In developing a financial plan for the water utility, it was assumed that the utility must "stand on its own" financially. As a result, the financial plan developed in this section assumes the full and proper funding needed to operate and maintain the water system on a financially sound and prudent basis.

The financial plan was developed using the "utility basis" approach which includes the utility's operating and maintenance expenses, taxes, annual depreciation expense, and return on rate base as components of the total revenue requirement. The "utility basis" approach is typically used by the utilities regulated by the Washington State Utility Commission (WUTC) during rate reviews.

This section presents a financial plan that reviews the water revenues and expenses for the OWSI water system. The financial plan includes projected operating and capital costs of the system for the 10-year time horizon of 2024 – 2033 which matches the time period of the CIP in Section 13. The revenues and expenses used in the financial plan were obtained from OWSI's 2022 expense information, and the capital costs as presented in this WSP (Section 13). The results of the financial plan outline the annual operating and capital needs of the water system and determine if the current water revenues are sufficient to cover costs.

This analysis is not sufficient to provide a detailed review of cost of service or alternative rate designs. If OWSI considers raising water rates it will need to perform a comprehensive rate study independent of this planning effort and work through the WUTC rate setting process. At this time, the results of the financial plan are strictly to provide OWSI with the impacts of funding water operating and capital expenditures over the next ten-year period.

14.2 Past Financial History

As part of the financial plan for OWSI's water utility, it is important to gain an understanding of past financial performance. The past five years of financial information for OWSI's water utility was evaluated to gain an understanding of the past performance of the utility and gain perspective of the current financial status. Table 14-1 provides a summary of the past five-year financial history (2018 – 2022) for OWSI.

Table 14-1
Summary of Historical Revenues and Expenses

	2018	2019	2020	2021	2022
Revenues					
Rate Revenues	$710	$709	$686	$779	$825
Misc Revenues	0	71	101	103	84
Total Revenues	**$710**	**$780**	**$787**	**$881**	**$908**
Expenses					
O&M Expenses	$533	$528	$502	$612	$790
Taxes	133	130	121	141	46
Rate Funded Capital	91	94	95	114	160
Total Expenses	**$756**	**$752**	**$719**	**$867**	**$996**
Balance / (Deficit)	**($47)**	**$28**	**$68**	**$15**	**($88)**

As Table 14-1 illustrates, the annual operating results are primarily a balance of funds over the past five-year period. As with all utilities, minor balances or deficiencies of funds may happen for a number of reasons including the timing of expenses and revenues being realized.

14.3 Development of the Financial Plan

A financial plan is developed to calculate the level of revenue required to fully fund OWSI's water utility's annual O&M and CIP (Section 13) needs over the ten-year review period. The result provides recommendations for annual rate revenue adjustments in order to adequately fund the expenses identified in the financial plan. The starting point for the financial plan is the 2022 year-end expenses. The expenses are the same for 2023 and were then escalated annually in order to develop a review of the projected revenues and expenses of the water system for 2024 - 2033.

14.3.1 Revenues

The first component of the financial plan is a review of the sources of revenues of OWSI's water system. The revenues received from operations are water sales to customers as well as hook-up fees and other income. Projections for future year revenues were developed by applying a projected growth rate of 0.1% per year which was calculated based on Section 2.

Metered water sales for 2024 is estimated at $980,000 and increases to $989,000 by 2033 based on the assumed growth in customers. Miscellaneous revenues are estimated at $22,000 in 2024 and remain at that level for the entire period. Total revenues are projected to be approximately $1.0 million in 2024 and with growth applied the total revenue increase slightly, although the rounded figure does not show a change through 2033.

14.3.2 Expenses

The next component of the financial plan is a review of the annual O&M expenses and capital projects identified in the CIP. In developing the financial plan, four main cost components were reviewed:

- O&M Expenses
- Taxes
- Annual Depreciation Expense
- Return on Rate Base

Operation and Maintenance Expenses

The first expense component is the annual O&M expenses incurred to operate and maintain OWSI's water utility. Using the 2022 year-end estimates as the starting point, expenses were projected based on escalation factors representing assumed inflationary rates. Escalation factors range from labor at an average annual increase of 4%, materials & supplies at 3%, and miscellaneous items at 2%. Each budgeted expense line item was reviewed and projected based on the appropriate escalation factor. O&M expenses ranged from approximately $861,000 in 2024 and increases to $1.1 million by 2033.

Taxes

The water system currently has tax obligations in the form of sales or utility excise tax, property tax, and federal income tax. Each has a unique basis and methodology for projecting forward. Utility excise tax is based on the total revenues for the water utility and is taxed at a rate of 5.029% for B.O. tax and 0.200% for the UTC regulatory tax. Property taxes are based on the assessed value of land and the mil rate and are projected to increase at 2% per year. Federal income tax is 21% of the net operating income. For 2024 these tax payments total approximately $92,000 and decrease to approximately $63,000 by 2033. It should be noted that any additional income due to any proposed rate adjustments is also taxed. The model used as the basis for the financial plan as included this component and ranges from $102,000 in 2024, to approximately $1.5 million by 2033 based on the anticipated rate adjustments.

Annual Depreciation Expense

The next component of the revenue requirement was annual depreciation expense. This is based on the current assets on the system and the useful life assumed for each asset. The reflects the annual amount of asset value that is lost due to aging infrastructure. Annual depreciation expense for 2024 is $110,000 and was based on the 2023 value and increased base on the CIP values and assuming an average life of 30 years. Based on this process and assumptions, annual depreciation expense is projected to be approximately $731,000 by 2033.

Capital improvement projects are related to the replacement or improvement of the infrastructure of a utility. Capital improvement projects are generally divided into two categories: capital improvements related to renewal and replacements of existing plant facilities, and growth-related projects including system expansion and upgrades to accommodate new customers. One of the

main goals of the financial plan is to develop an assessment of the impact to OWSI's water utility from the funding of the capital projects from the CIP provided in Section 13 of the WSP.

As mentioned previously, the utility basis is being used in the financial plan to determine the future projected water rate impacts to OWSI's customers. Under this approach, capital is not funded annually but rather impacts the revenue requirement through including the constructed assets once they have been booked and then OWSI can earn a fair rate of return based on that value. It is important to note that the rate base is not impacted by the capital project's value until the following year of construction and therefore, the impacts to the utility are delayed.

A summary of the capital projects is provided in Table 14-2.

Table 14-2
Summary of Capital Improvement Projects ($000s)

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Capital Projects										
Distribution System Water Quality Maint.	$100	$100	$150	$150	$0	$0	$0	$0	$0	$0
Treatment for Well #4	0	50	0	0	0	0	0	0	0	0
Service Zone A New Source Development	50	110	50	750	0	0	0	0	0	0
Service Zone A Storage Improvements	0	0	300	0	0	0	0	0	0	0
Meter Replacement Program	50	50	55	55	60	60	65	0	0	100
Pipe Replacement	0	0	0	0	0	0	200	200	200	200
GIS System	0	0	0	0	50	0	0	0	0	0
Pole Building - vehicle & equip. storage	0	0	30	0	0	0	0	0	0	0
VacTrailer	35	0	0	0	0	0	0	0	0	0
Trackhoe & Trailer	0	0	0	0	80	0	0	0	0	0
Vactor Truck	0	0	0	0	0	200	0	0	0	0
Replace 2008 GMC	0	0	0	0	80	0	0	0	0	0
Replace 2012 Silverado	0	0	0	0	0	0	80	0	0	0
Replace 2021 F150	0	0	0	0	0	0	0	90	0	0
Total Capital Costs	**$235**	**$310**	**$585**	**$955**	**$270**	**$260**	**$345**	**$290**	**$200**	**$300**

14.4 Return on Rate Base

As noted in the development of the capital improvement plan section, a key aspect of maintaining a financially healthy utility is providing adequate funding for capital for renewal and replacement items. This mechanism is not as immediate as with the cash basis approach, however, there is still an impact to the revenue requirement based on the CIP. It is assumed that OWSI will fully fund the CIP as proposed in the Plan, but the manner in which it is funded is not explored. Often, this will occur for utilities such as OWSI from either cash reserves, long-term debt, or direct investment from shareholders. If OWSI is to utilize long-term debt as a funding source, care should be given to the debt Service coverage ratio. Meeting debt service coverage (DSC) ratio is an important financial indicator for well managed utilities. DSC is a financial metric of an entity's ability to repay debt and helps to signal financial health. A debt service coverage ratio is a comparison of net income before debt service payments to the total debt service. When evaluating OWSI's water utility under a cash basis there is another difference with debt verses how OWSI sets water rates under the utility basis. Under the utility basis, capital funding from debt is not included. Instead, when the capital improvements are constructed and book as an asset, they then earn a return for the water utility.

The last component of the revenue requirement under the utility basis approach is the return on rate base. This represents the amount of return the utility earns on the net value of assets on the water utility. The original cost of assets is adjusted by the accumulated depreciation expense and then any contributions to determine total rate base. This rate base is then multiplied by OWSI's return calculation. The most recent WUTC filing was 1.0% which is lower than what is often observed for a return component in an investor-owned utility. Typically, rates of return are anywhere from 5% to 10% depending on the utility's specific cost of capital which includes the cost of debt and the cost of equity. As part of the financial analysis, it was assumed that in future filings the WUTC will include a rate of return that is higher than the prior filing. It was assumed that the rate of return will be a modest 3.0% in 2024 and increase annually to reach a more typical level of 10.0% starting in 2030. This is by no means a recommendation as to what the rate of return should be used, but rather a recognition of the fact that the investors will likely require a higher rate of return in order to finance the capital improvements identified by the Plan. OWSI will need to go through an analytical exercise to review in more detail the cost of capital and rate of return as part of the next WUTC filing. In order to project the rate base component, the CIP was added to the prior years' total assets. The depreciation was then assumed at 30 years on average. The return on rate base, based on the assumptions regarding the rate of return discussed above, is $46,000 in 2024 and increases to $438,000 by 2033.

OWSI may also include a surcharge component in the rate schedule in order to fund a specific cost. This was recently done in 2019 in order to fund the annual debt service related to a loan secured to fund capital improvements. This funding mechanism can be a powerful and transparent funding source in which the proceeds or uses of funding is clearly identifiable.

14.5 Summary of the Financial Projections

All of the above assumptions come together to develop a financial plan for the utility. A summary of the financial plan for OWSI's water system is provided in Table 14-3.

Table 14-3 shows the projected revenues and expenses for OWSI's water utility based on the 2022 year end O&M expenses as well as the CIP from Section 13 of the WSP. The proposed rate adjustment line shows the level that rates will need to be increased to fully fund the anticipated expenses of the water utility. The analysis shows that there will be a minor surplus in most years of the study – based on the assumed rate adjustments – which is moved into the cash reserves to either pay for future capital projects or to provide contingency to mitigate future risk. The fluctuations in the surplus or deficit are driven by the capital projects contained in each year. Annually, OWSI would attempt to level load the capital projects to try to produce a more even level of capital to minimize impacts on funding needs. With more predictable and structured CIP's, OWSI will have a clearer understanding of what the financial situation will be like at the end of a test period and help the utility make more informed decisions. It is also important to note that as a private utility, OWSI collects the cost of capital funding in arrears and OWSI assumes the risk associated with annual capital funding needs and future revenue levels as determined by the WUTC.

It is important to note that the financial plan presented in this section is predicated upon assumptions related to the level of revenue growth, inflation of expenses, and others. Should the assumptions change, the balance/deficiency of funds would also be affected.

Table 14-3
Summary of Projected Revenues and Expenses

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Revenues										
Total Rate Revenue	$980	$981	$982	$983	$984	$985	$986	$987	$988	$989
Total Misc Revenues	22	22	22	22	22	22	22	22	22	22
Total Revenues	**$1,002**	**$1,003**	**$1,004**	**$1,005**	**$1,006**	**$1,007**	**$1,008**	**$1,009**	**$1,010**	**$1,011**
Expenses										
Total O&M	$834	$861	$889	$918	$948	$979	$1,011	$1,044	$1,078	$1,113
Total Taxes	92	86	81	75	70	64	63	63	63	63
Depreciation Expense	110	118	136	174	244	322	409	508	616	731
Return on Rate Base	46	71	103	157	252	325	387	411	429	438
Total Revenue Requirement	**$1,083**	**$1,137**	**$1,210**	**$1,325**	**$1,513**	**$1,690**	**$1,869**	**$2,026**	**$2,187**	**$2,346**
Bal. / (Def.) of Funds	($81)	($134)	($206)	($320)	($507)	($683)	($861)	($1,017)	($1,177)	($1,335)
Federal Income Tax	(17)	(28)	(43)	(67)	(107)	(143)	(181)	(214)	(247)	(280)
Additional Taxes	(4)	(7)	(11)	(17)	(27)	(36)	(45)	(53)	(62)	(70)
Net Bal. / (Def.) of Funds	($102)	($169)	($260)	($404)	($641)	($862)	($1,087)	($1,284)	($1,485)	($1,685)
Proposed Rate Adjustment	**10.5%**	**6.2%**	**7.9%**	**11.5%**	**17.0%**	**13.6%**	**12.1%**	**9.4%**	**8.9%**	**8.0%**
Additional Revenue	$103	$170	$261	$405	$641	$863	$1,088	$1,284	$1,487	$1,687
Total Bal. / (Def.) of Funds	$1	$1	$1	$1	$1	$1	$0	$0	$2	$2

14.6 Review of the Existing Water Rates

Currently, OWSI's water rates include a base rate, based on the service meter size, that is based on fixed costs the utility incurs regardless of the amount of water used. In addition, the rates include a 3-block increasing rate structure where the size of the block varies by service meter size. This portion of the water rates accounts for variable costs the utility incurs that are a function of the amount of water used. For purposes of this overview, the rates in effect as of June 2023 are presented in Table 14-4.

Table 14-4
Monthly Water Rates

Meter Size	Base Rate	1st Block (cu. ft.)	Rate	2nd Block (cu. ft.)	Rate	3rd Block (cu. ft.)	Rate
3/4"	$22.50	0 – 600	$0.0350	601 – 1,800	$0.0475	1,801+	$0.0600
1"	60.96	0 – 1,000	0.0350	1,001 – 3,000	0.0475	3,001+	0.0600
1-1/2"	121.54	0 – 2,000	0.0350	2,001 – 6,000	0.0475	6,001+	0.0600
2"	194.54	0 – 3,200	0.0350	3,201 – 9,600	0.0475	9,601+	0.0600
3"	365.00	0 – 6,000	0.0350	6,001 – 18,000	0.0475	18,001+	0.0600

14.7 Summary

Based upon the results of the analysis in the financial plan, OWSI's water utility will need to adjust the rate revenues in order to have adequate revenues to pay for the O&M expenses as well as capital projects found in the CIP. The biggest issue the water utility is facing is the timing and funding sources of the capital improvement projects identified in the CIP. During the next rate filing with the WUTC. It is recommended that OWSI conduct a water rate study to verify that the rates charged to its customers are cost-based and fully fund the utility. It is important to note that a rate study will perform a much more detailed analysis of OWSI's water utility than can be practically done in the financial plan as part of the WSP.