Otter Rock Water District Water System Feasibility Study and Planning Support

January 2018

Civil West Engineering Services, Inc.

Newport Office
609 SW Hurbert Street
Newport, OR 97365
541-264-7040

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SECTION 4 – RECOMMENDATION AND CONCLUSION

Section 1

Introduction

The Otter Rock Water District (ORWD) provides potable water to Otter Rock, a small community approximately 8 miles north of Newport in Lincoln County, Oregon. ORWD obtains its water from three natural spring sources classified as groundwater that flow from the Cape Foulweather watershed.

The original system infrastructure dates back to the 1930's, with subsequent upgrades. In 1974, a 300,000-gallon cement tank was installed to augment the District's water supply and storage capacity. In 1995, Spring #3 was installed to increase the source capacity on a seasonal basis. The ORWD also has a 30,000-gallon cement water storage tank, constructed in the 1930's, which has been left in service to provide emergency storage in the case of temporary loss of service and to allow for maintenance of the larger tank. The distribution mains within the District consist primarily of 2 to 6-inch asbestos concrete (AC) pipe, with minor amounts of PVC pipe that has been installed to replace some of the failed pipes. The water services to individual houses have been upgraded to ¾" PVC piping.

The ORWD is on a monthly coliform testing schedule, as required by Oregon Health Authority (OHA). For records between 1993 and 2001, a total of 10 routine water samples tested positive for total coliform (TC+). No routine samples tested positive for <u>fecal</u> coliform and all repeat samples were negative. Because of these positive coliform results, operational changes were made at the spring box in 2001 to provide for a more constant overflow. As a result, no positive coliform tests occurred for the next 14 years, until 2015. Since then, a total of 6 water samples again tested positive for <u>total</u> coliform, with the latest positive test occurring in April of 2017. The sampling points that tested positive for coliform were located at points around the distribution system. When these tests proved positive, additional tests were taken at the spring sources, which tested negative for total coliform. As such, it appears that the water quality issues with the system can be attributed to the aging infrastructure, such as the water tanks, valves, distribution piping, etc. rather than the spring sources.

In addition to water quality challenges, the Water District is experiencing significant water loss due to leaks in the distribution system and/or water tanks. Some areas of the water system experience very low pressures and do not meet current Fire Code. Most of the piping and appurtenances were installed in the 1930's and are well beyond their standard life expectancy. Many of the valves that are essential for the operation of the system are no longer functioning and need to be replaced and reconfigured into the system.

The ORWD distribution system has developed and evolved over time. With the expansion, subdivision, and development of the surrounding area, the water system has successfully provided quality service to the residents of Otter Rock for many years. However, the system has more recently exhibited problems meeting current water quality standards and there are issues with leaking, low pressure zones, and essential valves that are non-functional.

With assistance from the OHA Circuit Rider program, ORWD was awarded a funding package from the Safe Drinking Water Revolving Loan Fund (SDWRLF), administered by Business Oregon, to prepare this ORWD water system feasibility study. Figure 1.1 shows an aerial view of the Water District area.

Figure 1.1: Otter Rock Water District Aerial View

This feasibility study includes evaluation of:

1. Rehabilitation or replacement of the water storage tanks;
2. Upgrade to the existing tank valving and distribution piping;
3. Installation of a booster pump station;
4. Rehabilitation of the spring sources and appurtenances;
5. Upgrade of existing distribution piping and appurtenances; and
6. Installation of individual water service meters.

Civil West Engineering has been contracted by ORWD to complete this feasibility study and explore various alternatives to improve drinking water quality, improve the efficiency and resiliency of the system, and to provide a long-term solution that meets the financial goals and objectives of the community that ORWD serves. The culmination of this feasibility analysis includes a clear and detailed review of the system improvement alternatives, which not only addresses immediate requirements, but also includes a long-term plan to address the needs of the residents. The study also includes preliminary cost estimates and projected financial impacts to the rate payers.

1.1 Options and Solutions

To ensure that the best solution for the community was identified, multiple alternatives were examined. Water quality and health and safety of the community was the major consideration. Ease of operation, maintenance of the system, overall system efficiency, and fiscal impact also contributed to the proposed alternatives.

The various improvements recommended in the Feasibility Study are summarized and listed below in Table 1.1. The total cost for all improvements in the Capital Improvement Plan (CIP) is $3.51 million. A phased approach is discussed in Section 4.

Table 1.1: Summary of CIP Projects

Summary of ORWD Water System Upgrades		
Item	**Description**	**Item Cost**
WST1	Structural Analysis of Both Water Storage Tanks	$ -
WST3	Replacement of the 30,000 Water Storage Tank	$ 54,375.00
WST4	Replacement of the 300,000 Water Storage Tank	$ 317,188.00
T6	Upgrade to Tank Valving and Piping	$ 235,422.00
T6	Installation of Booster Pump Station	$ 89,219.00
SP1	Rehabilitation of Spring #1 and Appurtenances	$ 27,434.00
SP2	Rehabilitation of Spring #2 and Appurtenances	$ 2,929.00
SP3	Rehabilitation of Spring #3 and Appurtenances	$ 6,786.00
D1	Replace Existing Distribution Piping and Valving	$ 2,226,481.00
D2	Installation of Distribution System Water Meters	$ 397,692.00
Financing	Project Interim Financing	$ 150,000.00
Opinion of Probable Cost Total (rounded)		**$ 3,510,000.00**

Section 2

Existing Conditions

2.1 Geographic Location

The unincorporated community of Otter Rock is 8 miles north of Newport, 5.5 miles south of Depoe Bay, and is bordered by Cape Foulweather to the northeast and the Pacific Ocean to the west. The community is about 100 acres in area and generally slopes downward toward the coast with a high elevation of approximately 160 feet at 3rd Street and Otter Crest Loop and a low elevation of approximately 50 feet at the southern terminus of Ellie Avenue. Devil's Punchbowl lies at the western terminus of 1st Street. The elevation of the viewing area looking over Devil's Punchbowl is approximately 95 feet. Most of the community lies between 90 and 140 feet elevation. An aerial view of the community along with tax lots and topography are shown in Figure 2.1. Red colors represent higher elevations and blue colors represent lower elevations.

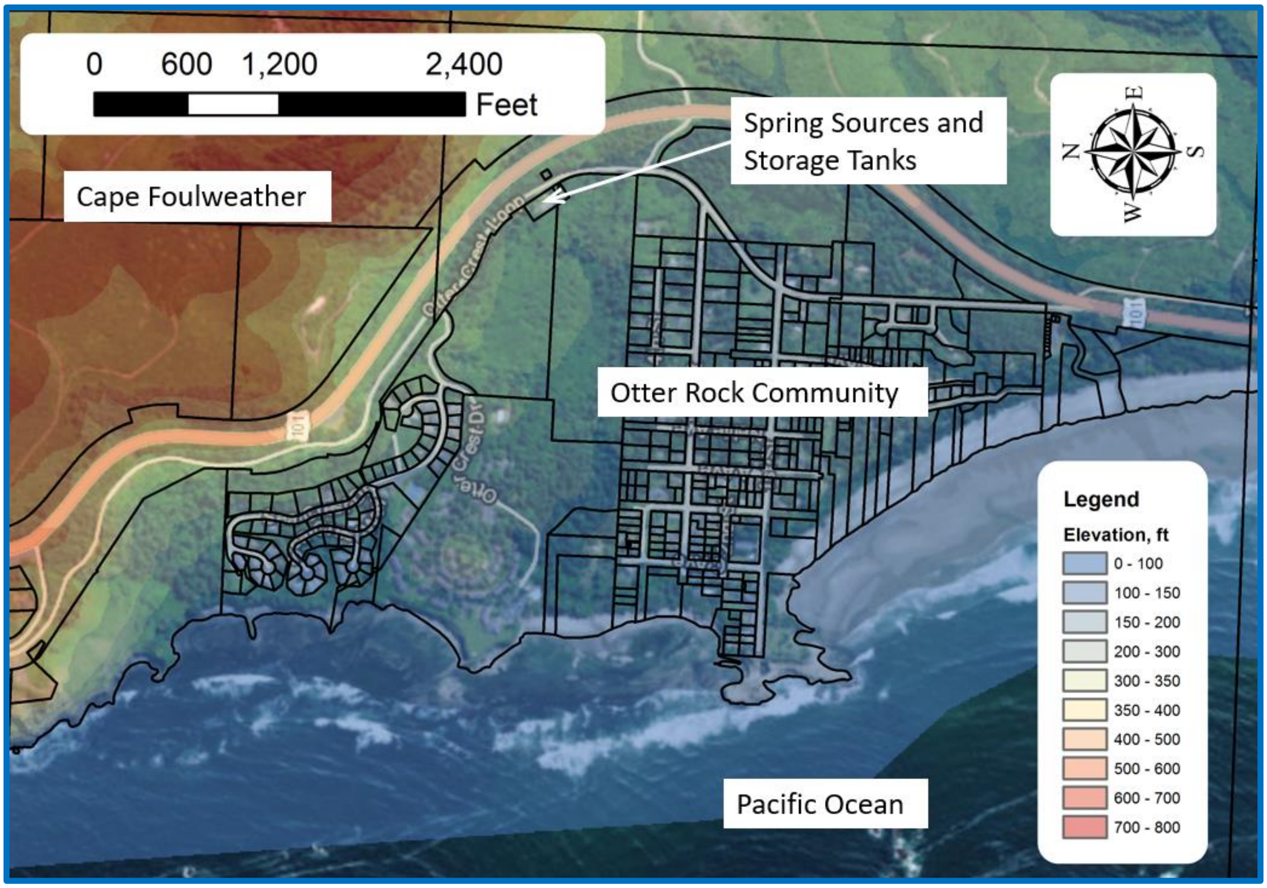


Figure 2.1: Otter Rock Area Map

2.2 Population

The current population in the ORWD service area is approximately 190 residents, half of which are half-time and half of which are full-time (source: system maintenance personnel). Future development is limited due to topography of the area. The present population growth rate for Lincoln County, based on estimates from Portland State University's Population Research Center for 2014-2015, is approximately 0.7%, which will be used for Otter Rock in this study. Projected future water demand, therefore, is based on current water demand for the present population and projected population growth. For the purposes of planning, a 20-year horizon is used for population growth. The population is projected to grow to approximately 218 by 2037 given a growth rate of 0.7% and a current population of 190.

2.3 Water Distribution System

2.3.1 Source

ORWD obtains all its potable water from three (3) springs to the northeast of the community along Otter Crest Loop. The springs are fed by percolating groundwater through Cape Foulweather geologic formations and into the springs. Springs #1 and #2 lie to the east of Otter Crest Loop and Spring #3 lies to the west of Otter Crest Loop. Concrete springboxes serve to collect the groundwater for all three sources. Spring #3 relies on a pump to deliver water to the storage tanks and the other two springs rely on gravity to feed the water storage tanks. Spring #3 is only used during emergencies. Spring #1 is the main water supply during storms and Spring #2 is the main supply during dry periods. Figures 2.2 and 2.3 show some components of the springs. Figure 2.2 shows the overflow pipes for Spring #2 and Figure 2.3 shows two 4-inch diameter stainless steel pipes leading to a brass manifold that conveys the spring water from Spring #1 to both overflow and to the 30,000-gallon storage tank.

Figure 2.2: Spring #2 Overflow Pipes

Figure 2.3: Spring #1 Manifold Valving

2.3.2 Treatment

The spring sources are classified as groundwater sources by the Oregon Drinking Water Program (DWP) in accordance with Oregon Health Authority (OHA) regulations. Filtration of the source water is not required. For records since 1997, a total of 12 routine water samples tested positive for total coliform

(TC+). Five of the positive results have occurred since November of 2015. There were no positive test results between May of 2001 and November of 2015. In response to a change in the Ground Water Rule in 2009 that prescribes requirements for groundwater systems with significant deficiencies or source water fecal contamination, the Water District, with the assistance of Civil West Engineering, evaluated the feasibility and potential cost of installing an ultraviolet light disinfection system in 2009. Compliance with the Ground Water Rule provisions that would require 4-log virus treatment if fecal contamination is a problem cannot be reasonably achieved using UV equipment, however it is highly unlikely that the ORWD would be required to provide such treatment in the foreseeable future. Virus treatment is unlikely since a positive fecal coliform test has never occurred.

The spring sources are a valuable resource to the community – they represent a self-sustaining, locally derived source of water that has historically not required any treatment prior to consumption. The distribution of the water is entirely driven by gravity feed, so in the case of an emergency loss of power, the community will still be able to have potable water.

The source of the recent Total Coliform (TC+) hits is unknown; failing infrastructure, however, may be the potential cause. The roof of the large rectangular tank, for example, was recently replaced in September of 2016. Prior to replacement, potential sources of contaminants from surface water and animals living on or around the tank may have contributed to the TC+ hits. Likewise, positive hits from the other sample sites could have come from the hardware, not from the sources themselves. If the cause for the TC+ hits are not in the source groundwater, upgrades and rehabilitation efforts may resolve the water quality problems currently experienced in the system.

2.3.3 Storage

The water storage capacity of ORWD consists of a 30,000-gallon concrete cylindrical tank and a 300,000-gallon concrete rectangular tank. The large tank was installed in the 1970s. The small tank was installed some time before the large tank, possibly as far back as the 1930s when the original system was installed. The water is currently not filtered or treated; it is piped directly from the spring sources to the cylindrical tank, and then to the rectangular tank for eventual distribution to the community.

2.3.4 Distribution

The existing water distribution system extends throughout the community and provides potable water to the system rate payers. The distribution system is fed by a 6-inch AC pipe that runs from the water storage tanks along Otter Crest Loop to the Alpine Chalets at the southern end of Otter Rock. 6-inch AC lines tie into the main pipe at 1st and 3rd Streets. A 4-inch PVC loop comes off the Otter Crest Loop main line at Boland Way. The rest of the system is fed by the two 6-inch AC pipes on 1st and 3rd Streets, with a 6-inch AC pipe that connects 1st and 3rd Streets on C Avenue. Figure 2.4 shows the existing water system layout.

The existing system distribution piping consists of a mix of 6-inch, 4-inch, 2-inch, and 1½-inch AC and PVC piping. Most of the system is about 40 years old – well beyond the design life of the system. Due to numerous leaks in the system, the entire distribution system will need to be replaced with new pipe. Table 2.1 shows the existing pipe inventory.

Table 2.1: Existing Pipe Inventory

Size, in.	Material	Length, ft.
6	AC	8,258
4	PVC	8,792
2	PVC	1,248

Table 2.2 shows the existing distribution system valving and appurtenance inventory. The conditions of the existing system valves and appurtenances are unknown, but it is assumed that they will all need to be replaced.

Table 2.2: Distribution System Valve and Fire Hydrant Inventory

Size, in.	Type	Quanitity
6	Gate	10
4	Gate	24
2	Gate	1
6	Blow-off	1
4	Blow-off	8
2	Blow-off	4
6	Fire Hydrant	11

The fire hydrants are all very old and need to be replaced. Fire flow testing from April 2016 by Depoe Bay Fire Department showed that during fire flow conditions, pressures at the some of the fire hydrants dropped to unacceptable levels, which will require upgrades to the distribution system. Table 2.3 shows pressure and flow data furnished by the Assistant Fire Chief.

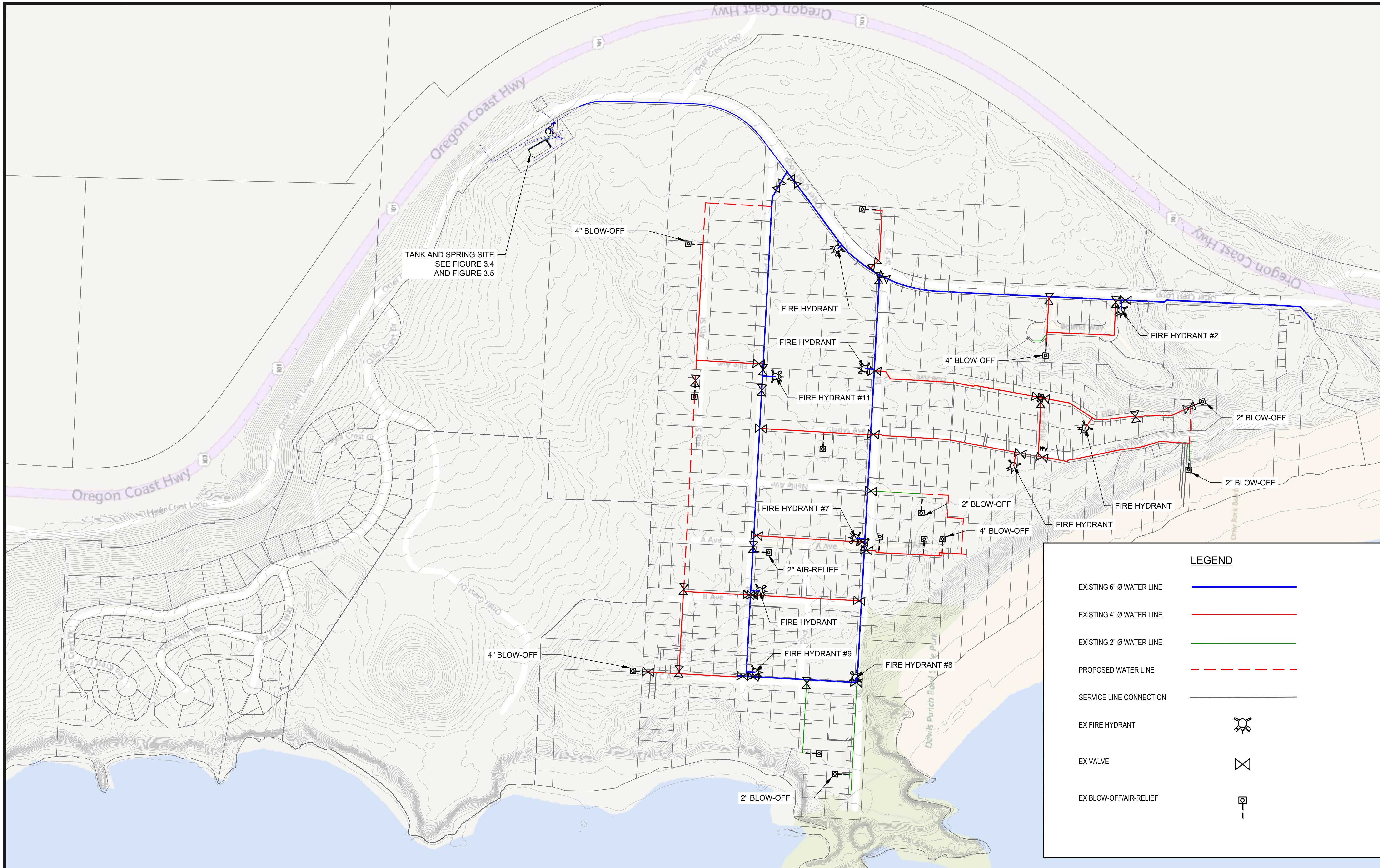
Table 2.3 – Existing Fire Hydrant Data

Existing Fire Hydrant Data				
Hydrant #	Location	Static Pressure (psi)	Residual Pressure (psi)	Flow (gpm)
2	Ottercrest Loop at Hwy 101	30.0	0.0	530.0
7	1st St. & A St.	30.0	25.0	494.0
8	1st St. & C Ave.	30.0	0.0	650.0
9	3rd St. & C Ave.	30.0	0.0	671.0
11	3rd St. & Ellie St.	30.0	10.0	530.0

As shown in Table 2.4, the average daily unit production for Otter Rock has risen to 283 gallons per person per day in the past two years, based on the master meter readings furnished by the Water District. The populations in the table were hindcast from the 2017 population with a 0.7% growth rate. ADD was determined from measured water meter readings from 2012 to 2017. Water use in America is documented by the U.S. Department of the Interior in the 2000 U.S. Geological Survey - Circular 1268. According to the study, the average annual per capita water consumption for Oregon is 187 gallons per capita per day (gpcd) including domestic, commercial, public use and loss. The difference between consumption and production is indicative of excessive leaks in the system. Leaks in the distribution piping and appurtenances have the potential to not only adversely affect water quality through the introduction of pathogens from surface water, but also contribute considerably to pressure losses throughout the system.

Table 2.4 – ORWD Water Production

Year	Population	ADD	
		Total (gpd)	Unit (gpcd)
2012	117	16,755	143
2013	118	23,958	204
2014	118	26,569	224
2015	119	33,808	283
2016	120	33,994	283



PLAN SCALE

200 0 100 200 400

1"=400'

Civil West Engineering Services, Inc.

ORWD
LINCOLN COUNTY, OR

EXISTING WATER SYSTEM

ORWD WATER SYSTEM FS

DRAWN BY: WJT
DATE: JUNE 20, 2017

FIGURE
2.4

DATE:8/17/17 FILE:O:\CW_Projects\2401 Otter Rock\2401-003 Water System Feasibility Study and Planning Support\Drawings\Dwg\ORWD AWS.dwg

Section 3

System Improvement Alternatives

3.1 Water Storage Tanks

A solution for ensuring that the community has adequate and safe water storage is to focus on utilizing and rehabilitating the resources already available to the community. The smaller circular 30,000-gallon cement tank, shown in Figure 3.1, appears to be structurally stable. Since its construction in the 1930's, little known work has been conducted on the tank aside from periodic chlorine flushing through the tank for disinfection. It is not known if the tank interior has been cleaned or rehabilitated in any significant manner since its construction. A thorough structural inspection of the tank is recommended to determine if the tank meets current structural and seismic code requirements for the State of Oregon.

Figure 3.1: 30,000-gallon Tank

The larger 300,000-gallon cement tank has been showing obvious signs of degradation. The west corners of the tank show signs of concrete spalling and grouting of the west corners has been required to slow down what appear to be substantial leaks in the tank, visible in Figure 3.2. The roof was replaced in September of last year with a white EPDM rubber roofing membrane. The interior of the tank was cleaned in 2016, and the tank is periodically flushed with chlorine for disinfection. As indicated on photos taken during the interior cleaning, there is substantial pitting in the tank walls and floor, especially around the steel fixtures that affix the various transmission pipes to the tank.

Figure 3.2: Northwest Corner of 300,000-gallon Tank

As far as assessing the existing capacity of the storage tanks, total storage capacity must include reserve storage for fire suppression, equalization storage, and emergency storage. In small communities, it is recommended that total storage be the sum of all three: fire plus equalization plus emergency storage. This is considered prudent since it is possible for fire danger to increase during water emergencies, such as power failures when alternative sources of heating and cooking might be used.

Equalization storage is typically set at 20-25% of the Maximum Daily Demand (MDD) to balance out the difference between peak demand and supply capacity. Equalization storage typically rises and falls daily or hourly as storage tank levels fluctuate normally.

Annual records of water demand from 2012 – 2016 were obtained from District staff and is summarized in Figure 3.3 below. Since 2012, the water demand for Otter Rock has fluctuated slightly and been on the climb in recent years. Over the most recent five years, the Average Day Demand (ADD) has been approximately 27,017 gallons per day (gpd).

Because meters are not recorded daily, the MDD must be estimated. Typical peaking factors can be used to estimate the peak daily flow, which are between 2.0 and 2.5 as a standard. For this evaluation, a peaking factor of 2.25 will be used. Given the ADD flow of 27,017 gpd, the MDD is calculate at 60,788 gpd. As described above, the equalization storage should be set at 20-25% of the MDD, which is 20% of 60,788 gallons for a total of 12,158 gallons.

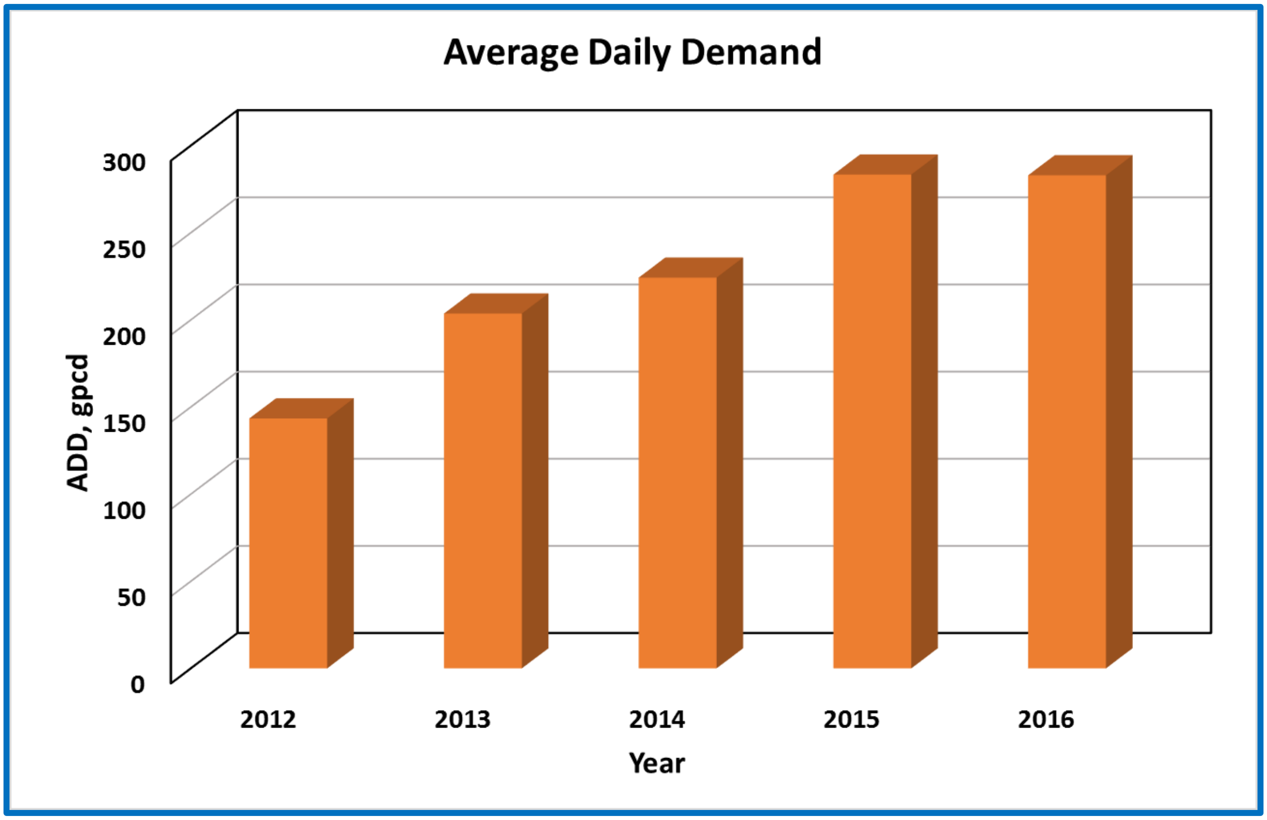


Figure 3.3: Otter Rock Annual Water Demand Totals (2012-2016)

Emergency storage is required to protect against a total loss of water supply such as would occur with a broken transmission line between the sources and the tanks, equipment breakdown, or source contamination. Emergency storage should be an adequate volume to supply the system's average daily demand for the duration of a possible emergency. For most systems, emergency storage should be equal to one maximum day of demand or 2.5 to 3.0 times the average day demand. As calculated above, the ADD is 27,017 gallons. This requires a total emergency storage of 81,015 gallons.

Fire reserve storage is needed to supply fire flow throughout the water system to fight a major fire. Per the 2014 Oregon Fire Code (Appendix B, type V-B, 3,601 to 4,800 SF), the minimum fire-flow and duration requirements are based on the size and occupancy type of the buildings. For Otter Rock, since most of the buildings are residential (but there are a number of commercial businesses in the area) a fire flow of 1,750 gpm for 2 hours will be assumed. Table 3.1 outlines both the current and the future water storage needs.

Table 3.1 - Current and future storage capacity needs summary

Storage Type	Description	2015 Capacity Needs (gal)	2036 Capacity Needs (gal)
Equilization Storage	20% of MDD	12,158	14,099
Emergency Storage	3 times ADD	81,015	93,993
Fire Reserve Storage	1,750 gpm for 2 hours	210,000	210,000
Total Storage		303,173	318,092

ORWD currently has approximately 330,000 gallons of storage with all reservoirs full. As shown in Table 3.1 above, the District has sufficient storage to provide anticipated fire flows and emergency storage through the planning period for this study.

3.1.1 Necessary Improvements

Both water storage tanks were constructed more than 47 years ago and are due for upgrades. The tanks were likely not designed to current state-wide seismic design criteria known as the State of Oregon Structural Specialty Code and Fire and Life Safety Code (OSSC). The tanks, therefore, may not meet current code requirements for seismic load capacity. An in-depth structural analysis by a licensed structural engineer will need to be conducted to determine compliance of the existing tanks with seismic code. The tanks may also not meet current code requirements for Oregon Structural Specialty Code, and may have to be modified accordingly. To compare the costs of rehabilitating the tank versus demolishing and replacing the tank completely, a thorough structural examination of the tank will need to be completed by a certified professional structural engineer to assess the need for seismic and structural retrofits. Table 3.2 shows the overall project cost estimate for structural analysis of both the 30,000 and the 300,000-gallon tanks.

Table 3.2: Cost Estimate for Structural Analysis of Both Tanks

Structural Analysis of Both Tanks					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (5%)	LS	1	$ 1,250.00	$ 1,250.00
2	Structural Analysis - 30,000 gallon Tank	LS	1	$ 5,000.00	$ 5,000.00
3	Structural Analysis - 300,000 gallon Tank	LS	1	$ 20,000.00	$20,000.00
Estimated Construction Costs				$ 26,250.00	
	Administrative/Legal (5%)			$ 1,313.00	
	Contingency (10%)			$ 2,625.00	
Estimated Project Total				**$ 30,188.00**	

Depending on the conclusion of the structural analyses, the tanks may be candidates for structural wrapping with a pre-stressing steel and shotcrete exterior. This option would involve fixing the roof to the tank wall to ensure that seismic forces due to roof displacement were transferred to the wall instead of interior support columns, which may be unable to resist these forces.

The interior of the tanks may need to be sand-blasted and recoated. With continuous contact between the cement in the tanks and the source water, deterioration of the cement often occurs due to chemical reactions between the water and cement. Sand-blasting the interior of the tanks will remove any accumulated layers of chemically corroded cement. Recoating the interior of the tanks will ensure a continued future separation of the stored water from the tank cement, which will minimize corrosion of the tanks.

For concrete tank interiors, two- or three-coat tank interior epoxy coating systems have been an industry standard for the past 25 years. Epoxy or zinc-epoxy interior coatings are expected to last 15–25 years. In addition, the service life of the interior coating can be extended by installing and properly maintaining and operating a cathodic protection system to help protect the interior submerged steel surfaces that have experienced coating failure.

Recent additions to available coating options include zinc-primed epoxy and polyurethane interior coating systems. Epoxy and zinc-epoxy coating systems are relatively easy to apply and have a relatively short material pot life. The higher performance interior coatings, such as polyurethanes and polyureas, are one-application, multi-pass systems. These materials have a very short recoat window, and, once applied and set, require significant additional surface preparation for topcoating and touch-up. Cathodic protection is not commonly used with zinc/aluminum spray-applied coatings.

Metalizing and a zinc primer under an epoxy or polyurethane topcoat are the only tank interior coating systems that offer corrosion resistance. Epoxy and polyurethane coatings offer a barrier, and polyurethanes have especially good resistance to coating “undercut,” should a coating break occur. (Undercut occurs where corrosion works its way under a coating and enables a coating failure spot to develop.) A metalized system has excellent resistance to corrosion.

High voltage holiday testing is required for polyurethane tank interior coating systems that are applied at more than 20 mils of dry film thickness. This test is more involved and more difficult to use than the standard low-voltage test.

A discussion and cost projections for rehabilitating or replacing the tanks follows.

3.1.2 Cost Estimates for 30,000-gallon Tank

Rehabilitation

This option will require the 30,000-gallon tank to be completely emptied and taken offline while examination and rehabilitation occurs. Currently, source water is routed from Springs #1, #2 and #3 to the 30,000-gallon tank and then conveyed to the 300,000-gallon tank. Source water from all three springs will need to be directly routed to the 300,000-gallon during the rehabilitation operation.

This cost estimate assumes there will be the need for structural upgrades. The interior of the tank will be sand-blasted to remove any corroded cement. Any piping fixtures in the tank will need to be replaced with stainless steel fixtures. Following sand blasting, the interior of the tank will need to be recoated with either a multi-layer epoxy coating or a polyurethane coating as discussed in Section 3.1.1.

The primary cost for rehabilitation of the 30,000-gallon tank will likely be structural upgrades to meet current structural codes and requirements. Table 3.3 shows the overall project cost estimate for rehabilitation of the 30,000-gallon tank.

Table 3.3: 30,000-Gallon Tank Rehabilitation Cost Estimate

Rehabilitation of 30,000-gallon Tank					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (5%)	LS	1	$ 1,720.00	$ 1,720.00
2	Construction Facilities and Temporary Controls (5%)	LS	1	$ 1,720.00	$ 1,720.00
3	Demo and Site Prep (3%)	LS	1	$ 1,030.00	$ 1,030.00
4	Interior Blasting/Recoating	SF	1500	$ 10.00	$15,000.00
5	Exterior Wash, Hand Tool/Recoating	SF	1100	$ 3.00	$ 3,300.00
6	Structural Retrofits	LS	1	$ 8,000.00	$ 8,000.00
7	Valves and Pipes	LS	1	$ 8,000.00	$ 8,000.00
Estimated Construction Costs				$ 38,770.00	
	Administrative/Legal (5%)			$ 1,939.00	
	Contingency (20%)			$ 7,754.00	
	Engineering (20%)			$ 7,754.00	
Estimated Project Total				**$ 56,217.00**	

Replacement

Depending on the conclusion of the structural analyses, it may be more cost effective to demolish and replace the tank entirely. Table 3.4 shows the overall project cost estimate to construct a new 30,000-gallon tank.

Table 3.4: 30,000-Gallon Tank Replacement Cost Estimate

Replacement of 30,000-gallon Tank					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (5%)	LS	1	$ 1,500.00	$ 1,500.00
2	Construction Facilities and Temporary Controls (5%)	LS	1	$ 1,500.00	$ 1,500.00
3	Demo and Site Prep (15%)	LS	1	$ 4,500.00	$ 4,500.00
4	Glass-Fused, Bolted Steel Tank	LS	1	$ 20,000.00	$20,000.00
5	Earthwork, Grading, Gravel Resurfacing	LS	1	$ 5,000.00	$ 5,000.00
6	Valves, Pipes and Appurtenances	LS	1	$ 5,000.00	$ 5,000.00
Estimated Construction Costs				$ 37,500.00	
	Administrative/Legal (5%)			$ 1,875.00	
	Contingency (20%)			$ 7,500.00	
	Engineering (20%)			$ 7,500.00	
Estimated Project Total				**$ 54,375.00**	

3.1.3 Cost Estimates for 300,000-gallon Tank

Rehabilitation

This option will require the 300,000-gallon tank to be completely emptied and taken offline while rehabilitation occurs. Currently, source water is routed from all three springs to the 300,000-gallon tank via the 30,000-gallon tank. Water from the 30,000-gallon tank will need to be directly fed into the distribution system while rehabilitation of the 300,000-gallon tank takes place.

This cost estimate assumes there will be the need for structural upgrades. Operation staff indicates one roof support span within the tank appears broken. The interior of the tank will be sand-blasted to remove any corroded cement. Any piping fixtures in the tank will need to be replaced with stainless steel fixtures. Following sand blasting, the interior of the tank will need to be recoated with either a multi-layer epoxy coating or a polyurethane coating as outlined in Section 3.1.1.

The primary cost for rehabilitation of the 300,000-gallon tank will likely be structural upgrades to meet current structural codes and requirements. Table 3.5 shows the overall project cost estimate for the 300,000-gallon tank.

Table 3.5: 300,000-Gallon Tank Rehabilitation Cost Estimate

Rehabilitation of 300,000-gallon Tank					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (5%)	LS	1	$ 9,750.00	$ 9,750.00
2	Construction Facilities and Temporary Controls (5%)	LS	1	$ 9,750.00	$ 9,750.00
3	Demo and Site Prep (3%)	LS	1	$ 5,850.00	$ 5,850.00
4	Interior Blasting/Recoating	SF	10000	$ 10.00	$100,000.00
5	Exterior Wash, Hand Tool/Recoating	SF	6000	$ 3.00	$ 18,000.00
6	Structural Retrofits	LS	1	$ 60,000.00	$ 60,000.00
7	Valves and Pipes	LS	1	$ 17,000.00	$ 17,000.00
Estimated Construction Costs				$	220,350.00
	Administrative/Legal (5%)			$	11,018.00
	Contingency (20%)			$	44,070.00
	Engineering (20%)			$	44,070.00
Estimated Project Total				**$**	**319,508.00**

Replacement

Depending on the conclusion of the structural analyses, it may be more cost effective to demolish and replace the tank entirely. Table 3.6 shows the overall project cost estimate to construct a new 300,000-gallon tank.

Table 3.6: 300,000-Gallon Tank Replacement Cost Estimate

Replacement of 300,000-gallon Tank					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (5%)	LS	1	$ 8,750.00	$ 8,750.00
2	Construction Facilities and Temporary Controls (5%)	LS	1	$ 8,750.00	$ 8,750.00
3	Demo and Site Prep (15%)	LS	1	$ 26,250.00	$ 26,250.00
4	Glass-Fused, Bolted Steel Tank	LS	1	$ 140,000.00	$140,000.00
5	Earthwork, Grading, Gravel Resurfacing	LS	1	$ 20,000.00	$ 20,000.00
6	Valves, Pipes and Appurtenances	LS	1	$ 15,000.00	$ 15,000.00
Estimated Construction Costs				$	218,750.00
	Administrative/Legal (5%)			$	10,938.00
	Contingency (20%)			$	43,750.00
	Engineering (20%)			$	43,750.00
Estimated Project Total				**$**	**317,188.00**

Based on the above, and taking into account the cost associated with a structural analysis, it is recommended new tanks be constructed.

3.2 Upgrade to Existing Tank Valving and Piping

The existing valving and distribution piping surrounding the tanks and sources needs to be upgraded. Many of the valves either do not currently work (i.e., they are stuck open, closed, or something in between) or they are very difficult to operate. The existing distribution piping and valving between the springs and the tanks require a multitude of upgrades and additions over the decades.

Figures 3.4 and 3.5 show the existing valving and distribution piping system for the spring sources and the tanks. The piping material consists of a variety of materials including PVC, AC, stainless-steel, and galvanized iron. The galvanized iron pipe is an abandoned pipe that runs from Spring #2 to the small tank.

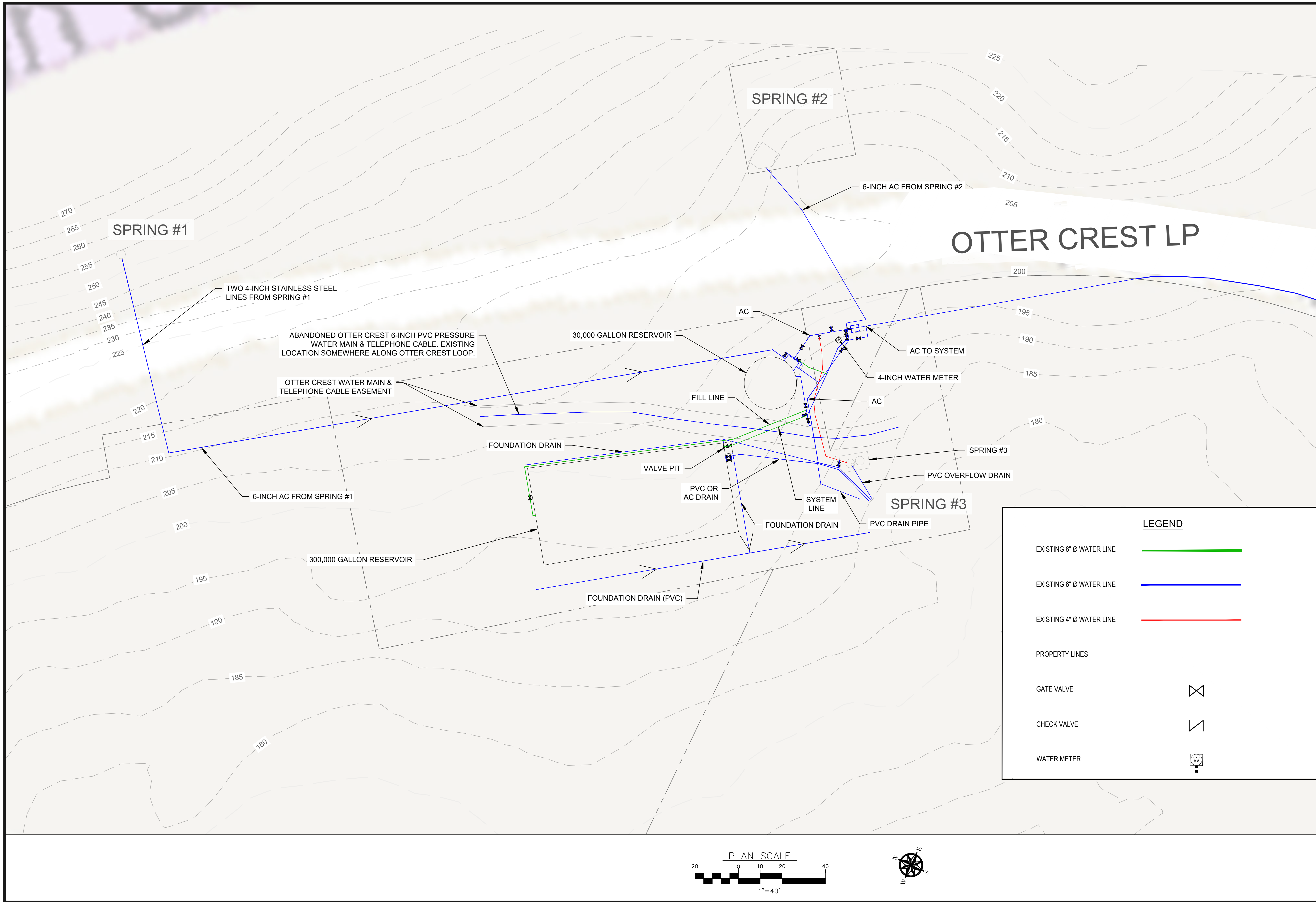
Spring #2 is gravity fed into a 6-inch AC pipe that runs under Otter Crest Loop and to the small tank. Spring #1 is gravity fed into two 4-inch stainless steel lines, one of which is a supply line and one of which is an overflow line, that run under Otter Crest Loop, into what appears to be a custom-built brass manifold, and into a 6-inch AC line that runs to the small tank. Source water from Spring #3 is pumped up from the spring in a 4-inch PVC pipe to the same 6-inch AC line that runs from Spring #2 to the small tank. Backflow into Spring #3 is prevented with a check valve.

As shown on Figures 3.4 and 3.5, the overflow for the small tank serves as the feed line for the large tank via a 6-inch AC line. Overflow for the small tank may also be routed to a riprap pad beneath Spring #3. An 8-inch line of unknown material runs off the 6-inch AC small tank overflow line to the intake for the large tank. The large tank has an 8-inch line that runs to a 6-inch AC line that provides the community with water. The large tank also has a 6-inch drain overflow line that runs to the riprap pad beneath Spring #3. The large tank has two foundation drains, one on the east side and one on the west side of the tank. The foundation drains also run to the riprap pad beneath Spring #3.

The neighboring communities, the Inn at Otter Crest and Sea Crest Subdivision, have a 6-inch PVC line that runs used to run directly beneath the existing water storage tank site for Otter Rock but has been rerouted to run along Otter Crest Loop.

3.2.1 Necessary Upgrades

The entire valving and distribution system around the tanks and springs needs to be upgraded. A simpler, more functional, and more robust system would serve the community for decades to come. Figure 3.6 shows a simplified schematic of a proposed valving and distribution system that would serve the needs of the District and the community.



Civil West Engineering Services, Inc.

ORWD
LINCOLN COUNTY, OREGON

EXISTING TANKS AND SPRINGS
ORWD WATER SYSTEM FS

DRAWN BY: WJT
DATE: JUNE 20, 2017

FIGURE 3.4

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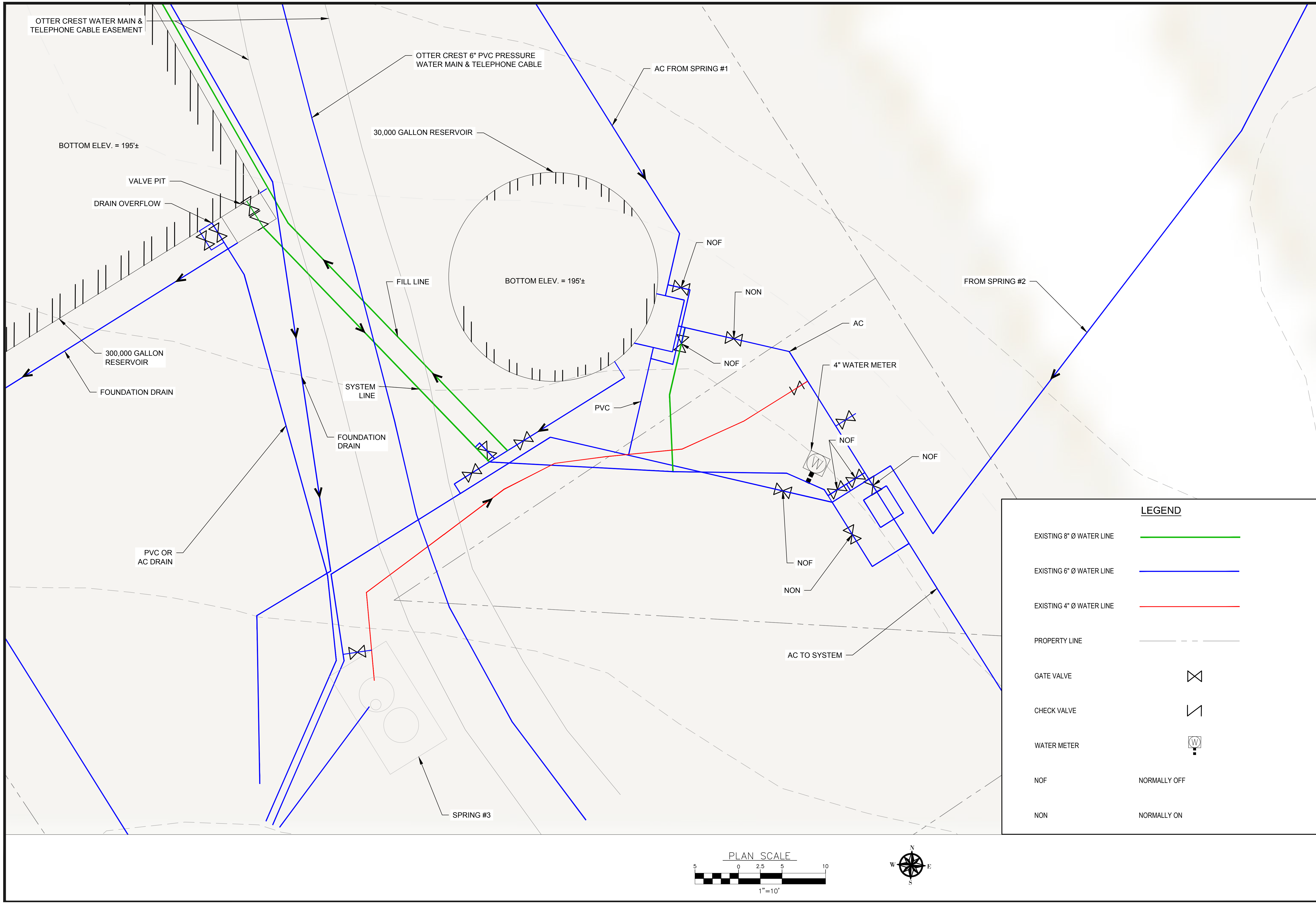

Civil West Engineering Services, Inc.

ORWD
LINCOLN COUNTY, OREGON

EXISTING TANKS & SPRINGS DETAIL
ORWD WATER SYSTEM FS

DRAWN BY: WJT
DATE: JUNE 20, 2017

FIGURE
3.5

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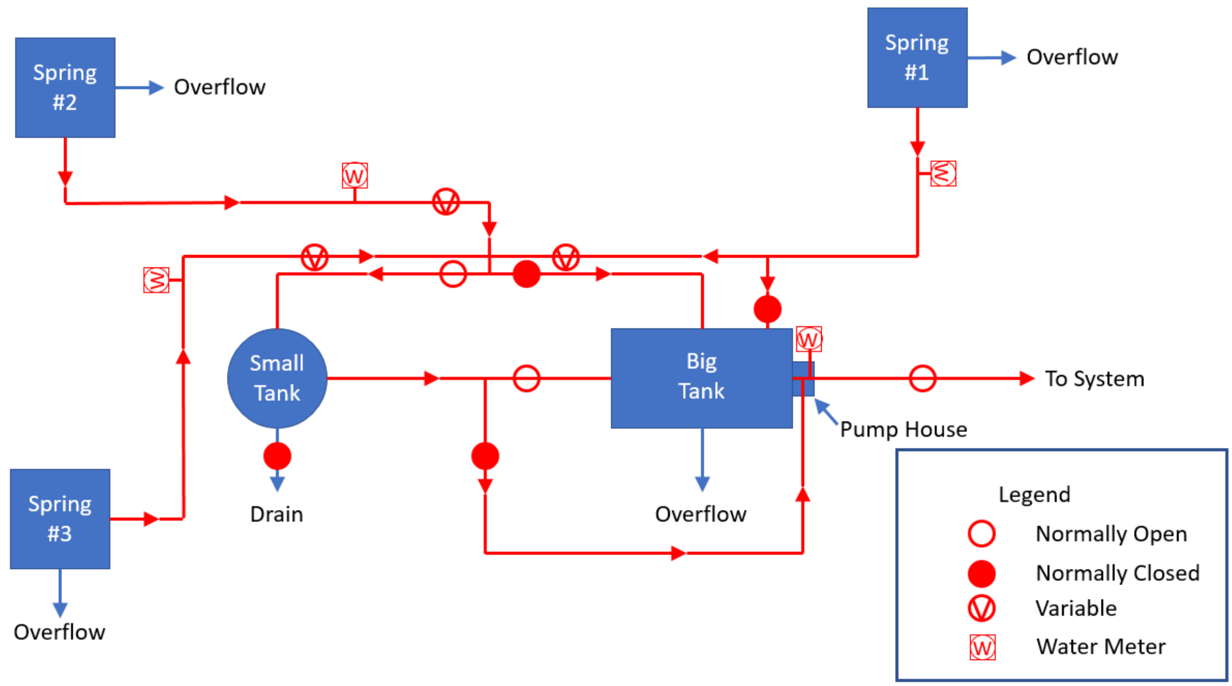

Figure 3.6: Simplified Schematic of Proposed Spring and Tank Valving and Distribution Piping

The proposed system has water meters at each of the springs and a meter on the line going to the system. All of the distribution lines, as well as the drain and overflow lines, consist of 6-inch HDPE pipe. The variable valves shown in the figure are open or closed depending on source production and water demand requirements. Based on comments from the District, there needs to be a direct connection between Spring #1 and the large tank, a connection that does not currently exist. The valves will all be flanged gate valves housed in readily accessible subsurface concrete valve vaults.

The above configuration in Figure 3.6 allows each of the tanks to be isolated for maintenance or emergencies, provides a direct connection between the large tank and Spring #1, meters each of the springs, and meters flow to the system. The overflows will be routed to the existing riprap pad beneath Spring #3. Although not shown in Figure 3.6, the foundation drains for the large tank will also be routed to the riprap pad beneath Spring #3.

3.2.2 Tank Valving and Piping Cost Estimate

The cost estimate includes approximately 1,500 new feet of 8-inch HDPE pipe, nine 8-inch flanged gate valves, and four meters. Table 3.7 shows the cost estimate for upgrades to existing tank valving and distribution piping. The costs include 35 feet of 8-inch HDPE Directional Bore Pipe for connection of Spring #2 to the storage system across Otter Crest Loop.

Table 3.7: Cost Estimate for Upgrade to Existing Tank Valving and Distribution Piping

Upgrade to Existing Tank Valving and Distribution Piping					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (15%)	LS	1	$19,490.00	$19,490.00
2	Construction Facilities and Temporary Controls (5%)	LS	1	$ 6,500.00	$ 6,500.00
3	Demo and Site Prep (5%)	LS	1	$ 6,500.00	$ 6,500.00
4	8" HDPE Pipe, Trenching and Backfill	LF	1500	$ 65.00	$97,500.00
5	8" HDPE Pipe, Directional Bore	LF	35	$ 300.00	$10,500.00
6	8" Flanged Gate Valve	EA	9	$ 1,430.00	$12,870.00
7	Install New Meter	EA	4	$ 2,250.00	$ 9,000.00
Estimated Construction Costs				$	162,360.00
	Administrative/Legal (5%)			$	8,118.00
	Contingency (20%)			$	32,472.00
	Engineering (20%)			$	32,472.00
Estimated Project Total				**$**	**235,422.00**

3.3 Installation of Booster Pump Station

Most of the properties in Otter Rock currently have inadequate pressure from the gravity-fed system. To provide the required minimum of 20 psi residual pressure at the service connections, a small booster pump station is required at the tank site to serve the community. This booster pump station will be located next to the 300,000-gallon tank in a new 8’ x 12’ concrete block building and will contain two small pumps and a small hydro-pneumatic tank functioning to maintain a constant downstream pressure of between 50 and 70 psi. This new building could also house chlorination equipment, should this become necessary in the future. The existing wooden building next to the 30,000-gallon tank will be demolished as part of this project.

3.3.1 Booster Pump Cost Estimate

Table 3.8 shows the cost estimate for installation of booster pumps with electrical controls and appurtenances housed in a concrete block structure.

Table 3.8: Cost Estimate for Booster Pump Station

Booster Pumps					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (10%)	LS	1	$ 5,350.00	$ 5,350.00
2	Construction Facilities and Temporary Controls (5%)	LS	1	$ 2,680.00	$ 2,680.00
3	Pumping Equipment, Control Panel	LS	1	$15,000.00	$15,000.00
4	Concrete Block Building	SF	96	$ 250.00	$24,000.00
5	Demolish Existing Building	LS	1	$ 5,000.00	$ 5,000.00
6	Electrical Service	LS	1	$ 3,000.00	$ 3,000.00
7	6" Flanged PRV	EA	1	$ 3,500.00	$ 3,500.00
8	Piping and Appurtenances	LS	1	$ 3,000.00	$ 3,000.00
Estimated Construction Costs				$	61,530.00
	Administrative/Legal (5%)			$	3,077.00
	Contingency (20%)			$	12,306.00
	Engineering (20%)			$	12,306.00
Estimated Project Total				**$**	**89,219.00**

3.4 Upgrade of Spring Sources

All three of the springs have unique problems that need to be addressed to maintain maximum operability and water quality. The following sections outline the repairs and upgrades that are recommended for each of the springs.

3.4.1 Spring #1 Upgrades

Spring #1 is the northern most spring. Its source is on the east side of Otter Crest Loop. Water collects in the springbox, flows into a 4-inch stainless steel pipe under Otter Crest Loop through a cross culvert, and to a manifold where it is distributed to the small tank via a 6-inch AC pipe. Overflow is accommodated by another 4-inch stainless steel pipe that also flows to the manifold on the west side of Otter Crest Loop Road through the cross culvert. Based on visual inspection of the system, the overflow then is directed into a 6-inch PVC pipe that outfalls farther down the slope to the west of the manifold.

Figure 3.7 shows (a) the springbox cover, (b) the inside of the springbox, (c) the adjacent access manhole, and, (d) the manifold on the west side of Otter Crest Loop. The springbox cover consists of a lid restraining bar with a pad lock, which is difficult to open. Replacement of the pad lock with a corrosion resistant lock would make accessing the springbox much more efficient. Aside from the lock, the springbox itself appears to be in good condition. The access manhole, however, has significant leaks coming from the bottom and through the wall penetrations that need to be repaired. Figure 3.7c shows moisture on the bottom of the manhole. Left unrepaired, the continual moisture will lead to structural degradation of the manhole.

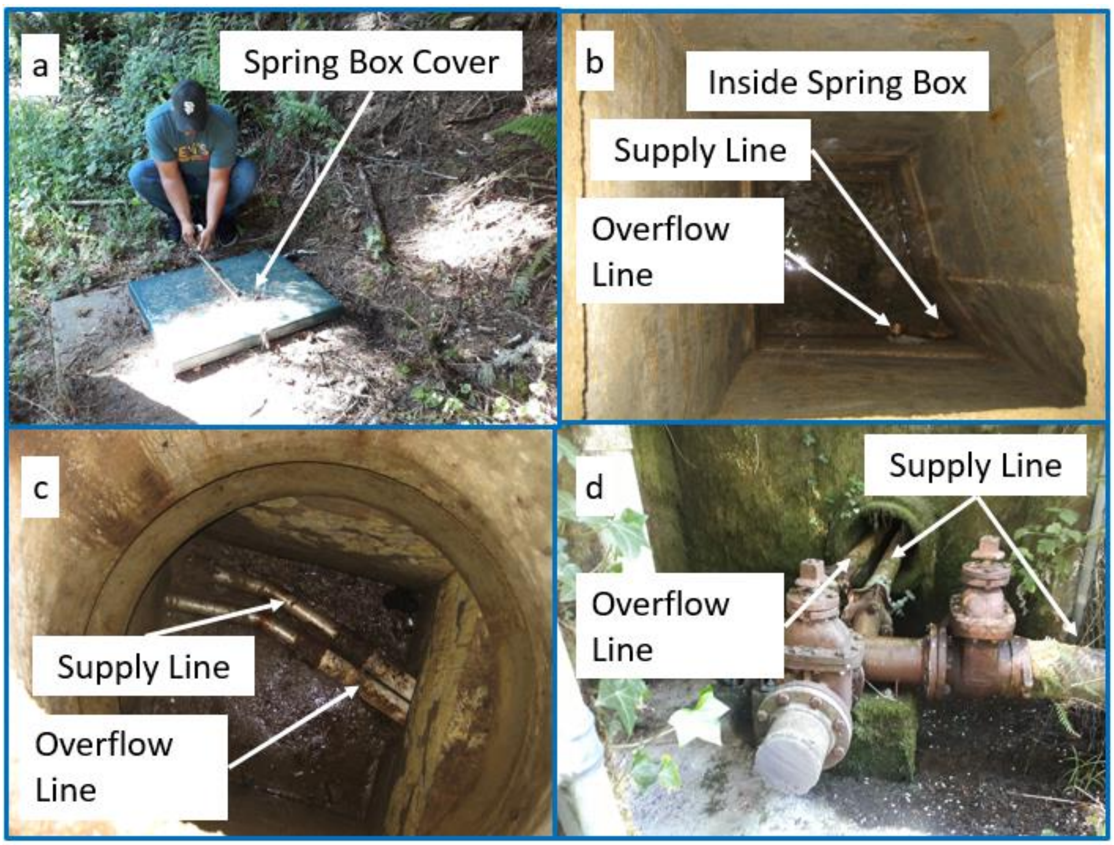

Figure 3.7: Spring #1 Source, Pipes, and Appurtenances

The piping and appurtenances associated with Spring #1 were installed about 40 years ago and are well past their service lives. Upgrades are recommended to maintain the structural integrity of the existing springbox and service access manhole, to ensure that overflow is routed away in a safe manner, and to allow for maximum control over the effective operation of the spring. The existing 4-inch stainless steel supply and overflow lines should be replaced from the service manhole to the manifold along with the installation of new 4-inch stainless steel to HDPE transition couplings. The condition of the culvert routing the supply and overflow lines is unknown – a thorough inspection of the culvert needs to be conducted prior to running the new pipe to ensure structural stability. The culvert may need to be replaced if there are signs of compromised structural integrity, however this is not included in the cost estimate. The manifold block wall will need to be replaced with a new retaining wall, as well as new fencing around the manifold to ensure security. All the valves and couplings near the manifold are recommended for replacement. Replacement of the 6-inch PVC from the manifold to the large tank is accounted for in Section 3.2.2.

3.4.2 Spring #1 Cost Estimate

Spring #1 cost estimate includes rehabilitation of the access manhole, installation of new transition couplings and 4-inch HDPE supply pipe and overflow pipe from the spring to the manifold, rehabilitation of the overflow outfall structure east of the manifold housing, replacement of the valving and couplings at the manifold and replacement of the manifold retaining wall. Table 3.9 shows the cost estimate for upgrades to Spring #1.

Table 3.9: Spring #1 Upgrade Cost Estimate

Rehabilitation of Spring #1					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (18%)	LS	1	$ 2,180.00	$2,180.00
2	Construction Facilities and Temporary Controls (7%)	LS	1	$ 850.00	$ 850.00
3	Demo and Site Prep (5%)	LS	1	$ 610.00	$ 610.00
4	Stainless Steel to HDPE Transition Couplings	EA	2	$ 200.00	$ 400.00
5	Manhole Rehabilitation	LS	1	$ 3,000.00	$3,000.00
6	Large Concrete Block Retaining Wall (2' X 2' X4') - w/ Geogrid	SF	75	$ 58.00	$4,350.00
7	Fencing w/ Gate	LF	20	$ 15.00	$ 300.00
8	4" PVC Drain Pipe	LF	35	$ 50.00	$1,750.00
9	4" HDPE Pipe	LF	35	$ 65.00	$2,280.00
10	Manifold Valving	LS	1	$ 3,200.00	$3,200.00
Estimated Construction Costs				$	18,920.00
	Administrative/Legal (5%)			$	946.00
	Contingency (20%)			$	3,784.00
	Engineering (20%)			$	3,784.00
Estimated Project Total				**$**	**27,434.00**

3.4.3 Spring #2 Upgrades

Spring #2 sits on the east side of Otter Crest Loop to the south of Spring #1. It consists of a springbox, a 6-inch supply line that runs through an 18-inch culvert under Otter Crest Loop Road, and two overflow lines that spill into the same cross culvert. The overflow water then exits the culvert on the west side of Otter Crest Loop and continues down the slope via a small stream. The supply line consists of a 6-inch PVC pipe that is directly routed from the springbox to the small tank.

The feed line from the spring to the small tank used to be a 6-inch galvanized steel pipe. The galvanized steel pipe, however, was abandoned at some point in the past, and was replaced with the 6-inch PVC pipe discussed above. The current feed line and the overflow water share the same conduit. During periods of high overflow, the culvert can backup and flow over Otter Crest Loop, causing minor flooding. The current supply pipe takes an immediate right angle following its exit from the culvert and goes to the small tank.

Figure 3.8 shows various components of Spring #2: (a) the outside of the springbox, (b) the overflow pipes, (c) the feedline and the culvert that goes beneath Otter Crest Loop, and (d) the feedline and overflow water coming out of the culvert. It is recommended that the existing 18-inch culvert remain in place to route overflow and surface flow across the Otter Crest Loop. The existing supply line through the culvert will be removed and an engineered riprap outfall pad will be installed on the west side of Otter Crest Loop. Directional bore drilling will be used to construct an 8-inch pipe from the springbox across Otter Crest Loop to the tanks.

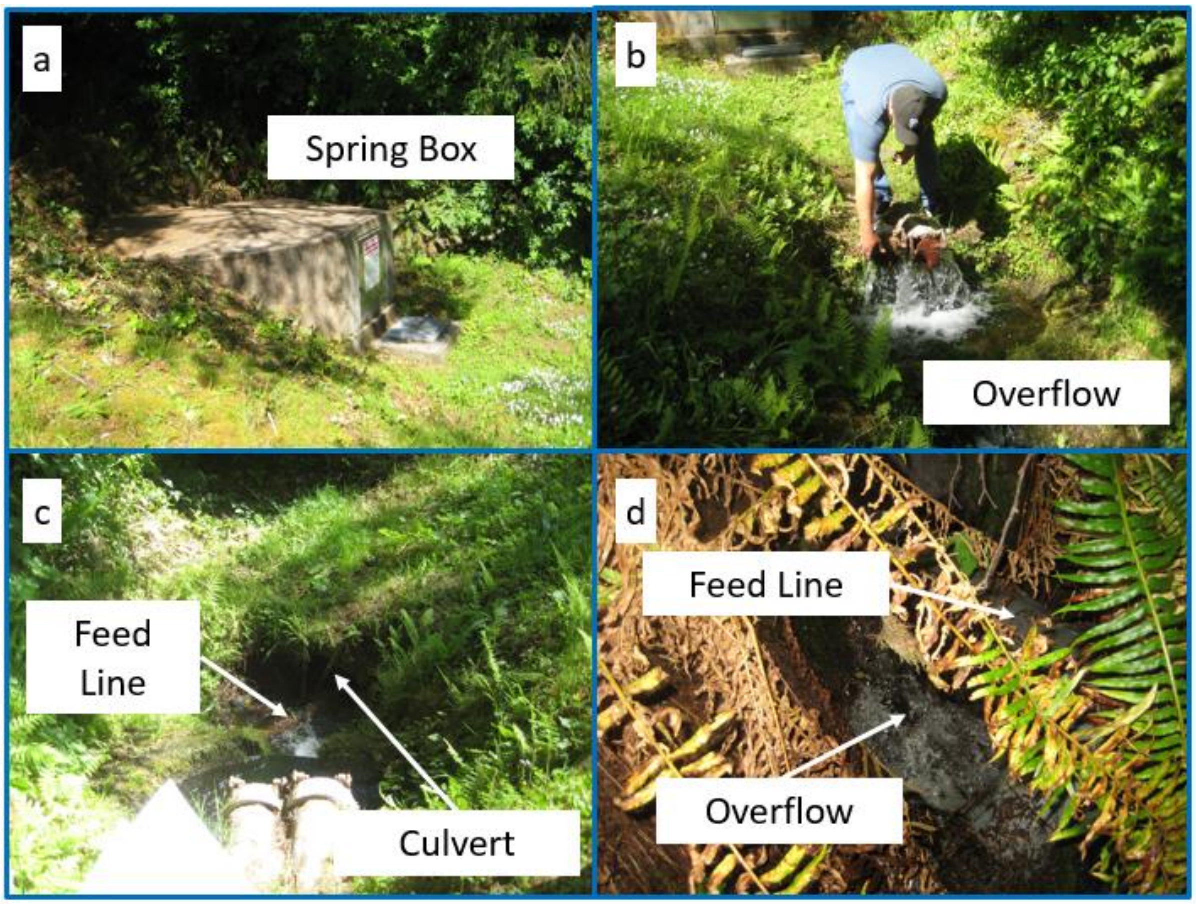

Figure 3.8: Spring #2 Source, Pipes, and Appurtenances

3.4.4 Spring #2 Cost Estimate

Spring #2 upgrades include rehabilitation of the existing outfall pool and weir system to ensure accurate assessments of outflow from the spring, a new 8-inch pipe under Otter Crest Loop, installation of a new rock outfall on the west side of the road, and removal of the existing 6-inch PVC supply line from the culvert. Installation of the 8-inch directional bore pipe is addressed in Section 3.2.2. Table 3.10 identifies the required upgrades for Spring #2.

Table 3.10: Spring #2 Upgrade Cost Estimate

Rehabilitation of Spring #2					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (18%)	LS	1	$ 280.00	$ 280.00
2	Construction Facilities and Temporary Controls (7%)	LS	1	$ 110.00	$ 110.00
3	Demo and Site Prep (5%)	LS	1	$ 80.00	$ 80.00
4	Rip Rap 6"-8"	CY	5	$ 58.00	$ 290.00
5	Pavement Restoration	SY	35	$ 36.00	$1,260.00
Estimated Construction Costs				$	2,020.00
	Administrative/Legal (5%)			$	101.00
	Contingency (20%)			$	404.00
	Engineering (20%)			$	404.00
Estimated Project Total				**$**	**2,929.00**

3.4.5 Spring #3 Upgrades

Of the three springs, Spring #3 produces the only direct TC+ hits. The infrequent use the spring may contribute to the positive hits – prolonged periods of inactivity allows for the bacterial growth in the pipes, valves, and appurtenances. Spring #3, unlike the other two springs, feeds into the small tank via a submersible pump encased in a 48-inch diameter manhole. As groundwater exfiltrates from the ground up into the manhole, the submersible pump pumps the water via a 4-inch PVC pipe to the 6-inch AC feed line from the Spring #2. The source water then goes into the small tank. Figure 3.9 shows (a) the manhole for Spring #3 and (b) the outfall which includes overflow for Spring #3, overflow for the large tank, drain for the large tank, and the foundation drain for the large tank.

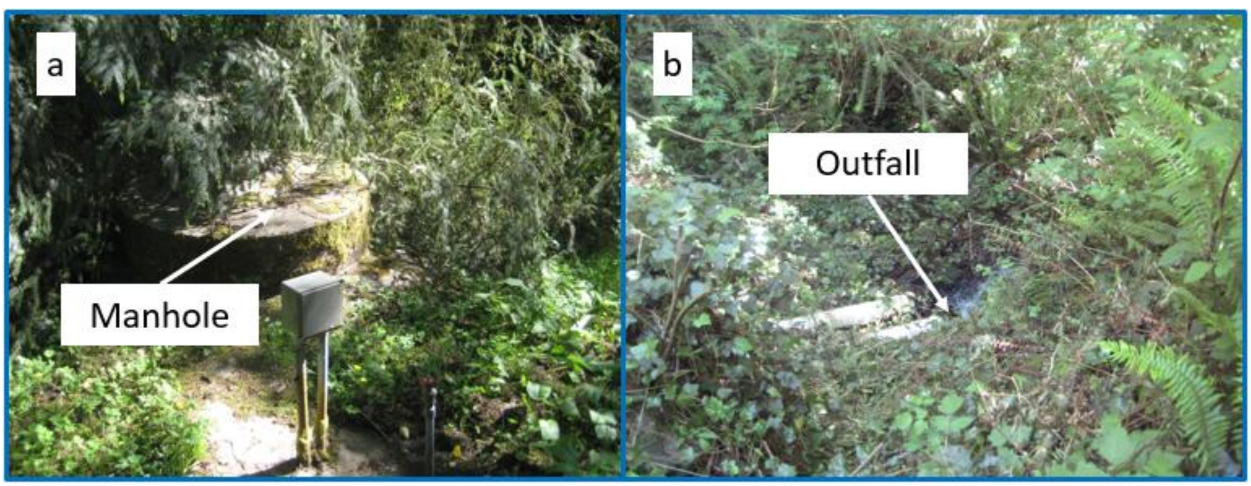

Figure 3.9: Spring #3 Manhole and Outfall

Like the other two springs, the pipes and appurtenances surrounding the Spring are recommended to be upgraded. However, unlike the other two springs, Spring #3 has a pump and float switch that need replacement. The existing 4-inch PVC line that runs to the small tank will need to be replaced with a new HDPE line. The outfall beneath Spring #3 appears to be cutting into the existing bank and will need to be replaced with an appropriately engineered riprap outfall energy dissipater.

3.4.6 Spring #3 Cost Estimate

Upgrades for Spring #3 include replacement of the submersible pump and float switch, replacement of pipes and appurtenances associated with the spring, and installation of a riprap energy dissipater. Table 3.11 shows the itemized cost estimate for upgrades required at Spring #3.

Table 3.11: Spring #3 Upgrade Cost Estimate

Rehabilitation of Spring #3					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (18%)	LS	1	$ 650.00	$ 650.00
2	Construction Facilities and Temporary Controls (7%)	LS	1	$ 260.00	$ 260.00
3	Demo and Site Prep (5%)	LS	1	$ 180.00	$ 180.00
4	Hydromatic SK75 Submerisible Pump and Float Switch	EA	1	$ 800.00	$ 800.00
5	Spring Redevelopment	EA	1	$ 2,500.00	$2,500.00
6	Rip Rap 6"-8"	CY	5	$ 58.00	$ 290.00
Estimated Construction Costs				$ 4,680.00	
	Administrative/Legal (5%)			$ 234.00	
	Contingency (20%)			$ 936.00	
	Engineering (20%)			$ 936.00	
Estimated Project Total				**$ 6,786.00**	

3.5 Upgrade of Existing System Distribution Piping and Appurtenances

3.5.1 Necessary Upgrades

Upgrades to the distribution system piping will include the replacement of all existing 2-inch, 4-inch and 6-inch pipes with new 6-inch HDPE pipe. The increase in size for the distribution piping will serve to accommodate both higher fire flows and projected future growth of the community. All system valves and fire hydrants will also need to be replaced. As it currently exists, fire hydrant spacing is inadequate to provide adequate coverage for the community. According to the Oregon Fire Code, fire hydrant spacing should not exceed 500 feet, which has been accounted for in the quantity estimate for the hydrants. In addition to the system fire hydrants, a hydrant needs to be installed at the tank site. The installation of a hydrant at the tank serves a couple of essential functions: fire protection at the tanks and springs and the capability, in the event of an emergency, to run hose directly from the tanks to the community. To facilitate accurate and comprehensive water quality testing capabilities, sampling stations will be installed throughout the system. OHA requires three sampling locations for water systems serving up to 1,000 persons. For the sake of redundancy, six sampling stations will need to be installed throughout the system in a manner that effectively samples the entire system for coliform.

3.5.2 Distribution Piping Cost Estimate

Table 3.12 shows the cost estimate for upgrades to the existing water distribution system.

Table 3.12: Cost Estimate for Upgrade to Existing Distribution Piping and Valving

Upgrade to Existing Distribution Piping and Valving					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (10%)	LS	1	$ 112,650.00	$ 112,650.00
2	Construction Facilities and Temporary Controls (5%)	LS	1	$ 56,330.00	$ 56,330.00
3	Demo and Site Prep (5%)	LS	1	$ 56,330.00	$ 56,330.00
4	6" HDPE, Trenching and Backfill	LF	17500	$ 55.00	$ 962,500.00
5	6" Flanged Gate Valve	EA	35	$ 1,099.00	$ 38,470.00
6	Blow-off Assembly	EA	5	$ 2,000.00	$ 10,000.00
7	Sampling Station	EA	6	$ 2,000.00	$ 12,000.00
8	Fire Hydrant Assembly	EA	23	$ 4,500.00	$ 103,500.00
9	Asphalt Repair, 3" / Street Repair	ton	1320	$ 100.00	$ 132,000.00
Estimated Construction Costs				$	1,483,780.00
	Administrative/Legal (5%)			$	74,189.00
	Contingency (20%)			$	296,756.00
	Engineering (20%)			$	296,756.00
	Environmental Review			$	75,000.00
Estimated Project Total				**$**	**2,226,481.00**

3.6 Installation of Individual Water Service Meters

Funding for much of the project will need to come from outside funding agencies such as Business Oregon or United States Department of Agriculture (USDA). Part of the requirement for these types of funding is to ensure that every connection is metered. In addition to satisfying funding requirements, the installation of meters both at the sources and at all the connections allows for a more thorough understanding of system uses and losses, which will ensure maximum operational efficiency of the system.

3.6.1 Water Meter Estimate

Table 3.13 shows the cost estimate for installation of new meters and meter boxes for the entire system, all existing 147 residential and 7 commercial connections. In 20 years, the number of residential connections is projected to grow to 169 connections (based on 0.7% growth rate). It is assumed that the number of commercial connections will remain the same. Although not included in this estimate, advanced metering infrastructure (AMI) or automated meter reading (AMR) may also be utilized in the system to streamline data collection, monitor use and leaks in the system, and provide a basis for accurate application of a rate structure. There may be funding from USDA to support the development of AMI/AMR systems and pay for the additional cost.

Table 3.13: Cost Estimate for Installation of Individual Water Service Meters

Installation of Individual Water Service Meters					
Item No.	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Mobilization - Bonds, Insurance (10%)	LS	1	$22,050.00	$ 22,050.00
2	Construction Facilities and Temporary Controls (7%)	LS	1	$15,435.00	$ 15,440.00
3	Demo and Site Prep (5%)	LS	1	$11,025.00	$ 11,030.00
4	Install New Meter, 1" with Meter Box and Cover	LS	7	$ 750.00	$ 5,250.00
5	Install New Meter, 3/4" with Meter Box and Cover	EA	147	$ 1,500.00	$220,500.00
Estimated Construction Costs				$	274,270.00
	Administrative/Legal (5%)			$	13,714.00
	Contingency (20%)			$	54,854.00
	Engineering (20%)			$	54,854.00
Estimated Project Total				**$**	**397,692.00**

Section 4

Recommendation and Conclusion

4.1 Capital Improvement Plan Purpose and Need

This Section summarizes the recommended water system capital improvements needed to properly serve the community's needs over the next 20 years as determined by the detailed analyses in this Water System Feasibility Study and Planning Support. The Capital Improvement Plan (CIP) consists of various projects to improve water quality, maintain and protect existing water system assets, correct deficiencies, and provide water system capacity that accounts for some growth.

The water system CIP is used to help establish funding needs, user rates, system development charges (SDCs), and to plan for and prioritize various project needs. The CIP can change over time as projects are completed and/or new, unforeseen needs arise, and an attempt should be made to annually update the CIP and keep the list of needs current.

4.2 Capital Improvement Plan Projects

4.2.1 CIP Summary

The various raw water supply, water storage, and water distribution system improvements recommended in this Feasibility Study for the 20-year planning period are summarized below in Table 4.1. Since the costs for rehabilitating or replacing the tanks are very similar, it is recommended that the old tanks be removed, and new tanks be constructed.

Anticipating the need and desire to pursue funding assistance (e.g. grants), included in the cost projections is interim financing, as typically required with funding agencies. The interim financing line item below accounts for interest paid during the project design and construction portions of the projects.

Table 4.1: Summary of Water CIP Projects

Summary of ORWD Water System Upgrades		
Item	**Description**	**Item Cost**
WST1	Structural Analysis of Both Water Storage Tanks	$ -
WST3	Replacement of the 30,000 Water Storage Tank	$ 54,375.00
WST4	Replacement of the 300,000 Water Storage Tank	$ 317,188.00
T6	Upgrade to Tank Valving and Piping	$ 235,422.00
T6	Installation of Booster Pump Station	$ 89,219.00
SP1	Rehabilitation of Spring #1 and Appurtenances	$ 27,434.00
SP2	Rehabilitation of Spring #2 and Appurtenances	$ 2,929.00
SP3	Rehabilitation of Spring #3 and Appurtenances	$ 6,786.00
D1	Replace Existing Distribution Piping and Valving	$ 2,226,481.00
D2	Installation of Distribution System Water Meters	$ 397,692.00
Financing	Project Interim Financing	$ 150,000.00
Opinion of Probable Cost Total (rounded)		**$ 3,510,000.00**

4.2.2 CIP Phases

It is recommended that all identified improvements be made to the existing water system. However, the cost for the water system improvements is considerable and there may be reason to prioritize the improvements or take projects on in phases. The following is a potential phased approach:

- Phase 1 consists of improvements to the water distribution and water supply system due to the existing pressure and flow deficiencies and the probability that these improvements will be the most effective in terms of meeting OHA water quality standards. Table 4.2 lists the critical improvements necessary and costs for the first phase.

Table 4.2: Phased CIP Projects – Phase 1

Water CIP - Phase 1		
Item	**Description**	**Item Cost**
D1	Replace Existing Distribution Piping and Valving	$ 2,226,481.00
D2	Installation of Distribution System Water Meters	$ 397,692.00
SP1	Rehabilitation of Spring #1 and Appurtenances	$ 27,434.00
SP2	Rehabilitation of Spring #2 and Appurtenances	$ 2,929.00
SP3	Rehabilitation of Spring #3 and Appurtenances	$ 6,786.00
Financing	Project Interim Financing	$ 110,000.00
Opinion of Probable Cost Total (rounded)		**$ 2,780,000.00**

- Phase 2 projects includes water storage and associated valving and piping, and pressure booster pump. Phase 2 does not account for inflation as this phase could be delayed for several years. Table 4.3 lists the other recommended improvements for the second phase.

Table 4.3: Phased CIP Projects – Phase 2

Water CIP - Phase 2		
Item	**Description**	**Item Cost**
WST3	Replacement of the 30,000 Water Storage Tank	$ 54,375.00
WST4	Replacement of the 300,000 Water Storage Tank	$ 317,188.00
T6	Upgrade to Tank Valving and Piping	$ 235,422.00
T6	Installation of Booster Pump Station	$ 89,219.00
Financing	Project Interim Financing	$ 40,000.00
Opinion of Probable Cost Total (rounded)		**$ 730,000.00**

4.2.3 Pros and Cons of Phasing

In a public meeting held December 12, 2017, the following Table 4.4 was presented and discussed (project costs have been updated since the meeting).

Table 4.4: Pros and Cons

	PROJECT OPTIONS		
	#1 **Do Nothing**	**#2** **Phased Approach** **(Minimum Project)**	**#3** **Complete Project** **(All Identified Improvements)**
Capital Project Cost	$0	$2,780,000*	$3,510,000*
Approx. Average User Cost (no grants / *w/ $500k grant*)	Rates remain the same at $30	Revenue-based debt service Actual water bill will vary based on usage **$103.00/month*** ***$90.00/month****	Revenue-based debt service Actual water bill will vary based on usage **$122.00/month*** ***$109.00/month****
Project Scope	Do Nothing	1. Replace existing distribution piping; install fire hydrants 2. Install individual water meters 3. Rehabilitate all three (3) springs	1. Replace existing distribution piping; install fire hydrants 2. Install individual water meters 3. Rehabilitate all three (3) springs 4. Replace both storage tanks and upgrade tank valving and piping for greater efficiencies 5. Booster pump station for increased system pressures and firefighting ability
Pros	1. Least expensive option (temporarily) 2. No construction disruption 3. Easy solution (for the moment)	1. Improved water quality 2. Least expensive project improvement option 3. Track water usage; bill according to use 4. Improved fire protection	1. Improved water quality; no chlorination 2. Optimum fire protection 3. Better overall system pressures 4. Track water usage; bill according to use 5. Property insurance rates remain
Cons	1. Potential resident health issues from poor water quality 2. Potential requirement to chlorinate water in the future 3. System is aging and failing; costs will only increase over time 4. Inadequate fire protection – possible property insurance impacts	1. Improvements not complete – increased future costs await in a future phase 2. Possibility of tank failure – no water and possible drinking water contamination 3. Possible property insurance impacts still exist	1. Most expensive option; highest debt repayment 2. Potential of home plumbing leaking due to increased system pressures

*Values presented here vary from the December 12, 2017 public meeting due to changes in known number of users and interim financing.

4.3 Current Charges

There is currently no economic development in the area which could result in major expansion of the system or increased demand by the users. While low usage demand helps keep solutions simple, the additional cost of maintenance and improvements must be borne by the few.

4.3.1 Current Rate Structure

There are currently 154 active services in the community, seven of which are commercial accounts. Out of the 147 residential services, approximately half of these are for vacation homes, according to the ORWD. The commercial accounts all have meters while only three residences are metered. All single family residential service accounts are billed at a flat rate of $30.00 per month for a base gallon usage of 6,500 gallons per month. Likewise, all single family residential service accounts with rented accessory dwelling units and multi-unit residential units are at a flat rate $30.00 per month per unit. The current rate structure for commercial and government services is shown in Table 4.5, below.

Table 4.5 – ORWD Commercial and Government Rate Structure

ORWD Rate Structure			
	Meter Size	Base Gal.	Minimum Charge
Commercial	3/4-inch	6,500	$ 37.50
	1-inch	10,500	$ 45.00
	1-1/2-inch	18,500	$ 75.00
	2-inch	26,500	$ 90.00
Government	3/4-inch	6,500	$ 30.00
	2-inch	26,500	$ 90.00

4.3.2 Connection Charges and System Development Charges

Like most communities, a connection fee is charged when a new water service is installed within the service boundary where no previous connection existed. The connection fee is meant to match the actual cost of labor, equipment, and material furnished by the District as required to provide and install the service line and meter. Typical connection charges for small residential service connections are currently $300 to $400. The additional proposed meter boxes would increase the connection charge to $1,500 to $1,700.

Otter Rock also has a water System Development Charge (SDC) in place established by ordinance and based upon a written methodology developed with past engineering analysis and costs estimates together with an economic and financial analysis of the system. The current connection fee plus System Development Charge (SDC) for new service connections is $5,650, plus the cost of installation. The SDC was most recently updated in July of 2016 and it is recommended that this rate be updated for the 2018/2019 fiscal year. A new SDC analysis needs to be conducted to determine an appropriate charge. Although the methodology is complex, a rough order estimate of an updated water SDC is $8,000 to $12,000, plus the cost of installation.

This report is not intended to include an exhaustive rate study. The impact of the various alternatives upon rates, however, will be included in the next section. Although there are numerous factors involved with a methodology analysis to eventually develop a rate study, an expected cost range for a methodology analysis would be $8,000 to $10,000. The methodology analysis would include the evaluation of the current SDC assessment calculation and incorporation of the new CIP and recommendations to prepare an updated SDC assessment method and limit.

4.4 Potential Grant and Loan Services

4.4.1 Capital Improvement Costs

The Capital Improvement Plan (CIP) listed in Section 4.2.1 has a total estimated cost of $3.51 million dollars.

4.4.2 Background Data for Funding

Funding for water system capital improvements occurs with loans, grants, principal forgiveness, bonds, or a combination thereof. Parameters such as the local and State median household income (MHI), existing debt service, water use rates, low/moderate income level percentages, financial stability, and project need are used by funding agencies to evaluate the types and levels of funding assistance that can be received by a community.

4.4.3 Business Oregon

Recent restructuring in the State has resulted in the creation of Business Oregon from what previously was the Oregon Business Development Department (OBDD).

Business Oregon administers resources aimed at community development activities primarily in the water and wastewater infrastructure areas. The Business Oregon Regional Coordinator for Lincoln County is Melissa Murphy (503-983-8857) and any application process should begin by contacting her. The funding programs through Business Oregon include:

- Community Development Block Grants (CDBG)
- Safe Drinking Water Revolving Loan Fund (SDWRLF)
- Special Public Works Funds
- Water/Wastewater Financing

Block Grant assistance for ORWD may be possible due to possibly meeting the national objectives for low and moderate-income persons.

The SDWRLF generally must be used to address a health or compliance issue and could potentially provide a loan up to $6 million per project. To receive a loan the project must be ranked high enough on the Project Priority List in the Intended Use Plan developed by the State. A Letter of Interest (LOI) must be submitted before a project can be listed in the Intended Use Plan. The LOIs are accepted annually. Coordinate with the regional coordinator for LOI deadlines. Loan terms are typically 3-4% interest for 20 years, however "Disadvantaged Communities" may potentially qualify for 1% loans for 30 years as well as some principal forgiveness. To be considered a Disadvantaged Community the average residential water rate must be at or above the threshold rate and the area MHI must be less that the State MHI. USDA provides water system development loans at 1.875% for 30 years, which is used in this report.

All recipients of SDWRLF awards need to complete an environmental review on every project in accordance with the State Environmental Review Process (SERP), pursuant to federal and state environmental laws. The Environmental Report typically required can cost $25,000 to $75,000 depending on the specific biological, cultural, waterway, and wetland issues that arise.

Loans and grants are also available through the Special Public Works Funds and Water/Wastewater Financing depending on need and financial reviews by Business Oregon.

The Drinking Water Source Protection Fund (DWSPF) is designed for the protection of drinking water sources. Funds are available through the DWSRF local assistance and other State programs set-aside. This set-aside allows states to provide loans (up to a maximum of $100,000) for certain source water assessment (SWA) implementation activities, including source water protection (SWP) land acquisition and other types of incentive-based source water quality protection measures.

States may also provide direct assistance in the form of a grant (up to $30,000 per eligible system) or technical support in the areas of SWP area delineation and assessment, wellhead protection programs, and capacity development strategy. Examples of activities eligible through this set-aside include the development of local SWP ordinances and implementation of public education programs to highlight the importance of wellhead protection.

4.5 Potential Water Rate Increases

Because of the assorted options in funding programs and requirements for contact and communication with the Regional Coordinators prior to applications, the recommended first step in exploring funding options is to attend a "One-Stop" financing meeting. The One-Stop meeting is held in Salem once a month with the goal of gathering the State and federal funding agencies together at one time and one place to discuss all potential funding possibilities and issues. No funding commitments are made at the meeting, but probable funding sources and details are provided to enable ORWD to choose the best alternatives possible at that time and to initiate funding application steps.

The following tables provide an indication of the potential individual average user rates the identified improvements will have. The tables show a range of possible funding scenarios depending on the amount of grant money awarded. Grants from Business Oregon typically have a $750,000 maximum limit, if eligible. The project expense is spread evenly over all existing 154 water service connections. In summary, the following criteria were assumed and used in the user rate calculations:

- Connections = 154 (147 residential plus 7 commercial)
- Loan Interest Rate = 1.875%
- Loan Period = 30-years
- The current $30/month flat rate will be retained and included to account for operation and maintenance expenses.

Table 4.6 represents the financial situation should all recommended improvements be made. From the table, a user rate of approximately $122/month would result for an overall comprehensive improvement project if no grant funding was included. A user rate of approximately $109/month would result if a $500,000 grant was obtained. Table 4.7 represents the financial situation if a phased approach were used. Phase 2 costs do not include likely project increases due to inflation.

Table 4.6: Total Project – Projected Average Water User Rate

All Phases	**No Grant, 1.875% Loan**	**$500,000 Grant**	**$750,000 Grant**
Capital Cost	$3,510,000	$3,510,000	$3,510,000
Loan Needed	$3,510,000	$3,010,000	$2,760,000
Interest Rate	1.875%	1.875%	1.875%
Loan Period (yrs)	30	30	30
Annual Annuity	$154,040.42	$132,097.34	$121,125.80
Monthly Income Required	$12,836.70	$11,008.11	$10,093.82
Monthly Income Reqd' w/ 10% reser	$14,120.37	$12,108.92	$11,103.20
Number of EDUs (Current)	154	154	154
Monthly Cost per EDU	**$91.69**	**$78.63**	**$72.10**
Current Flat Rate Water Bill	$30.00	$30.00	$30.00
New Average Residential Water Bill	**$121.69**	**$108.63**	**$102.10**

Table 4.7: Phased Project – Projected Average Water User Rate

Phase 1	**No Grant, 1.875% Loan**	**$500,000 Grant**	**$750,000 Grant**
Capital Cost	$2,780,000	$2,780,000	$2,780,000
Loan Needed	$2,780,000	$2,280,000	$2,030,000
Interest Rate	1.875%	1.875%	1.875%
Loan Period (yrs)	30	30	30
Annual Annuity	$122,003.52	$100,060.44	$89,088.90
Monthly Income Required	$10,166.96	$8,338.37	$7,424.08
Monthly Income Reqd' w/ 10% reser	$11,183.66	$9,172.21	$8,166.48
Number of EDUs (Current)	154	154	154
Monthly Cost per EDU	**$72.62**	**$59.56**	**$53.03**
Current Flat Rate Water Bill	$30.00	$30.00	$30.00
New Average Residential Water Bill	**$102.62**	**$89.56**	**$83.03**
Phase 2	**No Grant, 1.875% Loan**	**30% Grant**	**40% Grant**
Capital Cost	$730,000	$730,000	$730,000
Loan Needed	$730,000	$511,000	$292,000
Interest Rate	1.875%	1.875%	1.875%
Loan Period (yrs)	30	30	30
Annual Annuity	$32,036.90	$22,425.83	$12,814.76
Monthly Income Required	$2,669.74	$1,868.82	$1,067.90
Monthly Income Reqd' w/ 10% reser	$2,936.72	$2,055.70	$1,174.69
Number of EDUs (Current)	154	154	154
Monthly Cost per EDU (additional)	**$19.07**	**$13.35**	**$7.63**
New Average Residential Water Bill (Phase 1 + Phase 2)	**$121.69**	**$102.91**	**$90.66**