CITY OF BANDON
COOS COUNTY, OREGON

WATER MASTER PLAN

JUNE 2022

The Dyer Partnership Engineers & Planners, Inc.

Project No. 101.100

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City of Bandon

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EXPIRES: 12/31/2022

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EXECUTIVE SUMMARY

SECTION 1: **EXECUTIVE SUMMARY**

This Water Master Plan (WMP) was compiled to provide guidance to address the future water needs of the City of Bandon. This Plan summarizes the components of the existing water distribution system, analyzes local water demand patterns, evaluates the performance of the water system with respect to critical service standards, identifies the improvements necessary to remedy system deficiencies and accommodate future growth. This Plan recommends specific projects for inclusion in the water distribution system Capital Improvement Program (CIP). A financing plan that will facilitate successful implementation of the recommended CIP was also developed.

1.1 Source of Supply and Water Supply Rights

Raw water is currently diverted from Ferry and Geiger Creek and treated. Bandon has total water rights as follows: spring branch of Ferry Creek 2 cubic feet per second (cfs) with a 1910 priority; Geiger Creek 5 cfs with a 1916 priority; Lower Geiger Creek 3 cfs with a 1961 priority; and Ferry Creek 3 cfs with a 1961 priority. The hatchery has rights for 1.5 cfs on Ferry Creek and 1.5 cfs on Geiger Creek, totaling 3 cfs. The hatchery water passes through the hatchery facility and can be pumped afterward for use by the City during low flow conditions.

Low flow conditions are becoming more of a concern. The City has been working on an off-channel storage project to supplement raw water supplies since 2016. Water right permits are required from the Oregon Water Resources Department (OWRD) for a change in location of storage, change of use, and use of the stored water. The storage water right has been approved and Final Orders for the other two should be submit to the City within the next three months.

Due to the high costs anticipated with the off-channel storage project the City is also exploring the possibility of developing a groundwater well field. Initial subsurface reviews have been completed and the next steps are to work with OWRD on required groundwater permits and to drill a test well to determine actual production rates. If feasible a total of three to six wells would be drilled. A copy of the preliminary feasibility report is included within the Appendix.

1.2 Existing System

Since the early 1900s, potable water has been supplied to the residents of the City of Bandon. Improvements have been made to satisfy demand and to maintain excellent water quality. The City's current water system consists of facilities for diversion, treatment, transmission, storage and distribution of water.

Water is drawn from Ferry Creek and Geiger Creek. The raw water is conveyed to and treated at the Water Treatment Plant (WTP) then held in the storage tanks.

Distribution and Storage System

Finish water pumps convey water from the WTP to the City's potable water pumps which feeds the distribution system. The distribution system consists of approximately 34 miles of piping ranging from 2-inch to 12-inch diameter pipe. The City has one pressure zone, and two potable water storage tanks with a total volume of three million gallons.

Distribution System Modeling

The City's water distribution system was evaluated using a hydraulic computer model, with emphasis on selected vital or high fire flow areas within the City. Based on the results of this model, the following vital areas were shown to have less fire flow than those recommended by the Oregon Fire Code: Harbor Lights Middle School, Bandon High School, Ocean Crest Elementary School, Fire Department, Sunset Oceanfront Lodging, Best Western at Face Rock, Windermere on the Beach, and Shooting Star Motel.

Water storage capacity within the City was evaluated and the total amount of existing storage was found to be sufficient. The City has sufficient treated water storage with the existing tanks through the planning period, Year 2041.

1.3 Water Demand

The population currently being served by the City's water system is 3,344; with residents both inside and outside of City Limits. Modest residential growth is expected. Population growth during the 20-year planning period is estimated to occur at an average rate of 0.7 percent per year. The population growth rate was determined using Portland State University College of Urban and Public Affairs: Population Research Center. The total population was attained by United States Census Bureau Fact Finder data

System water demand was compiled for both the amount of water pumped to the City, the amount produced at the WTP, and the amount diverted from raw water sources. The 7-year maximum for each demand value was used due to the impact the Coronavirus had on the demand in 2020 and 2021. The 7-year maximum average day demand is calculated to be 0.569 Million Gallons per Day (MGD), with a maximum month and daily demand of 0.729 MGD and 0.993 MGD, respectively. No additional WTP capacity is needed for future water demand. The average of the last five years non-account (water sold less water produced) water in the City's system is approximately sixteen percent.

Future water demand was based on the 7-year maximum water production/consumption parameters, projected growth within the City, and anticipated non-account water (13 percent). Population growth was projected using a 0.7 percent annual growth for the City over a 20-year period. The anticipated potable water use population for the Year 2041 is 3,845. The projected water demand production in the Year 2041 in terms of annual average day, maximum month and daily demand are 0.654, 0.838 and 1.14 MGD, respectively.

Based on the projected Maximum Daily Demand (MDD), the City's existing water rights on Ferry Creek and Geiger Creek, assuming the water is available, is sufficient to meet the City's demand through the planning Year 2041.

Reduced flows on Ferry Creek show there have been periods when creek flows have been lower than listed demand. This is one of the drivers for developing the Off-Channel Reservoir system or groundwater well field. Either system would provide raw water for extended periods of time.

1.4 Capital Improvement Plan

A total of thirty (30) improvement projects are recommended in the Capital Improvement Plan. Total project costs of these improvements is estimated between $27,513,045 to $32,248,800, depending upon which raw water supply option is chosen. These improvements were prioritized into three groups.

Recommended Priority I Improvements include WTP improvements, treated water storage tank improvements, the Middle Pond and Lower Pump Station improvements and further investigation into the feasibility of developing a groundwater well field. Total estimated cost for the Priority I Improvements is $9,041,400. The City has previously secured funding for a portion of the improvements at $3,109,250.

The Priority II Improvement is the Off-Channel Reservoir or the groundwater well field. Further work on the feasibility of the well field, included in Priority I costs, needs to be completed prior to making a final determination. The estimated total project cost for the Off-Channel Reservoir and groundwater well field is $8,342,000 and $3,606,245, respectively.

Recommended Priority III Improvements include distribution system improvements, system-wide meter replacement and a new 0.25 million gallon reservoir. The total cost for Priority III Improvements is $14,865,400.

1.5 Financing and Implementation Plan

Various funding programs were evaluated for financing the Priority I Improvements through the use of either low-interest loans or a combination of low-interest loans and grants. The projected monthly debt service ($/Equivalent Dwelling Unit (EDU)) from viable funding programs ranged from $5.40 to $8.60. The lowest projected average monthly user rates, including existing and new debt service and system Operation and Maintenance (O&M) costs, is $53.13 per EDU.

Recommendations for implementing the elements of this Water Master Plan include the following:

- Submit Plan to the Oregon Health Authority (OHA) and Oregon Water Resources Department (OWRD) for review and approval.
- Schedule and attend “One-Stop” meeting to discuss financing options for the proposed Priority I Improvements.
- Submit necessary applications to the funding agencies requesting a loans and grants to finance the Priority I Improvements.
- Following favorable review by the selected financing agencies, secure the authority to issue revenue or General Obligation Bonds in the amount needed to finance the Priority I Improvements.
- Authorize the development of an Environmental Review Report, detailed design of recommended improvements and preparation of plans and specifications for the Priority I Improvements. Secure the necessary special use permits.
- Receive construction bids and award contracts for Priority I Improvements.
- Initiate study of user rates for water system and implement proposed changes.
- Revise System Development Charges (SDCs) and rates for the water system based on the CIP given in this WMP.

A tentative schedule for implementation of the Water Master Plan over the next three years is shown in Table 1.5.1.

TABLE 1.5.1
PROJECT IMPLEMENTATION SUMMARY

Item No.	Key Activity	Implementation Date
1	City Council Adopts the Water Master Plan	August 2022
2	Submit Plan to OHA and OWRD for Review and Approval	August 2022
3	Approval of Plan by Oregon Health Authority & Oregon Department of Water Resources	December 2022
4	Attend “One-Stop” Meeting	January 2023
5	Submit Application for Financing for Phase I and Associated Environmental Evaluation/Notice for Project	February 2023
6	Obtain Financing for Priority I Improvements	July 2023
7	Start Environmental Review Process, Preparation of Plans, Specifications for Phase I	August 2023
8	Complete Environmental Review, Design & Preparation of Plans, Specifications, & Contract	March 2024
9	Health Authority Approval of Plans & Specifications	May 2024
10	Advertise for Priority I Construction Bids	June 2024
11	Receive Construction Bids for Priority I Improvements	July 2024
12	Start Construction of Priority I Improvements	August 2024
13	Complete Construction of Priority I Improvements	June 2025

SECTION 2:

INTRODUCTION

SECTION 2: **INTRODUCTION**

2.1 Background

Listed below is a summary of the plans, reports, and improvements the City of Bandon has completed over the past twenty seven years.

The majority of Priority I Improvements, as generally described and recommended in the 1992 Water System Master Plan, have been implemented. These projects included:

- Ferry Creek impoundment dredging to remove accumulated silt and restore reservoir capacity.
- Lower Pump Station improvements.
- Replacement of the line from the Lower Pump Station to the Middle Pond.
- Middle Pond Pump Station improvements.
- Water Treatment Plant expansion.
- New two million gallon storage reservoir. The older one million gallon storage reservoir located at the water plant site was also fully repaired and restored.
- Line improvements including a new raw water line from the Middle Pond Pump Station to the upgraded Water Treatment Plant. The transmission line construction generally fulfilled the recommendations for Priority I Improvements by providing transmission to the southeast portion of the Urban Growth Boundary (UGB) and connection to the existing water system on Harlem Ave. SE. and Ohio Ave. SE. The recommended Priority I 9th St. SW water line extension to Franklin has also been completed.

The 1992 Master Plan also discussed the merits of constructing a new raw water intake downstream of the fish hatchery. This would eliminate any concerns with availability of water during low flow years since the hatchery has a senior water right to the City's rights. This facility was construction in 2001.

The Dyer Partnership, Engineers & Planners, Inc. completed a Water Master Plan Addendum in October, 2003. This document updated the information contained in the 1992 Master Plan and reevaluated the City's water system and needs.

A number of improvements, as generally described and recommended in the 2003 Addendum, have been implemented. These projects included:

- UV disinfection equipment at the Water Treatment Plant.
- New clarifier at the Water Treatment Plant.
- Cathodic protection at the existing steel reservoir tanks.
- New 12-inch line from Seabird Drive to Kehl Lane, Ocean Spray Facility, along US Highway 101.

- New 12-inch line along Michigan Avenue from 2nd Street to 10th Street.
- New 8-inch line along Madison Avenue from 6th Street to 8th Street.

A high priority listed in both the 1992 Master Plan and 2003 Addendum was for the development of a long term water supply. The City has been working to develop an off channel water storage facility but to date, final approval has not been given.

As water demand increases in conjunction with the growth of the area's population, concerns over source water availability are becoming a greater issue for the City of Bandon. In response, the City will want to ensure that appropriate source water will be available to meet future water demands.

2.2 Plan Objective

The purpose of the Plan is to provide the City with a comprehensive planning document that provides engineering assessment and planning guidance for the successful management of its water system over the next 20-years and beyond. This document satisfies the Oregon Health Authority (OHA) requirement for communities with 300 or more service connections to have a current master plan (Oregon Administrative Rules (OAR) 333-061-0060). The principal objectives include:

- Evaluation of the existing water system components.
- Prediction of future water demands.
- Evaluation of the capability of the existing system to meet future needs.
- Recommendations for improvements needed to meet future needs and/or address deficiencies.

The Plan outlines water system improvements necessary to comply with State and Federal standards and to provide for anticipated growth. The capital improvements are presented as projects with estimated costs to allow the City to plan and budget as needed. Supporting technical documentation is included to aid in grant and loan funding applications and meets the requirements of Business Oregon Infrastructure Finance Authority (IFA), Oregon Water Resource Department (OWRD), Rural Development (RD), as well as OHA.

2.3 Scope of Plan

The overall scope of this Plan consists of: 1) an examination of the City's existing water supply sources and system; 2) a determination of the adequacy of existing water sources and need to develop new water sources for future potable water service; 3) development of a Capital Improvement Plan (CIP) for updating the existing system; 4) and an assessment of various funding alternatives for completion of CIP projects.

Planning Period

The planning period for this Plan is 20-years, ending in the Year 2041. The period is short enough for current users to benefit from system improvements, yet long enough to provide reserve capacity for future growth and increased demand.

Planning Area

The planning area includes the City Limits, Urban Growth Boundary (UGB), and areas anticipated to be incorporated or added during the planning period.

Work Tasks

In compliance with Oregon Health Authority (OHA) and Oregon Water Resources Water Department (OWRD) plan elements and standards, this Plan provides descriptions, analysis, projections, and recommendations for the City's water system over the next 20-years. The following elements are included:

- **Executive Summary.** Provides a summary of the conclusions and recommendations from this Plan.

- **Study Area Characteristics.** Identifies applicable Study Area characteristics, land use, population trends, and projections.

- **Regulatory Environment.** Identifies current and future regulatory requirements and regulations that affect the planning, operation and maintenance of community water systems.

- **Existing Water System.** Description and evaluation of the existing water system including supply, treatment, storage, and distribution.

- **Water Use and Projected Demand.** Determines the City's future water demand based on current use, projected population, and economic growth.

- **Design Criteria and Cost Basis.** Outline design requirements, basis of cost estimating.

- **Seismic Risk Assessment and Mitigation Plan.** Identifies critical facilities capable of supplying key community needs: including fire suppression, health and emergency response, and community drinking water supply points. Identification and evaluation of the likelihood and consequences of seismic failures for each critical facility is also completed. Additionally, it includes recommendations to minimize water loss from each critical facility, capital improvements, or recommendations for further study or analysis.

- **Alternatives Analysis and Capital Improvement Plan.** Identifies and evaluates various alternatives for the City's water system. Select the most cost-effective program that will meet the City's water needs within the planning periods. Identify and describe a CIP for the water system with a recommended implementation schedule.

- **Financing.** Identifies various local financing mechanisms and the most applicable funding programs. Develop a financing program for proposed improvements. Financing program will include: propose monthly rate structure, implementation schedule, and System Development Charges (SDC).

2.4 Authorization

The City of Bandon contracted with The Dyer Partnership, Engineers & Planners, Inc. on October 18, 2018 to prepare this Water Master Plan (WMP); included in the Contract was a Scope of Engineering Services on which this Plan is based.

2.5 Past Studies and Reports

Documents that discuss the City's water system and facilities have been used in the preparation of and analyses in this Plan. A list of these studies and reports follows.

- Water Meter and Billing Records from 2015 to 2021.
- Water Plant Records from 2015 to 2021.
- Water System Survey Report, December 2017, Oregon Health Authority.
- Off-Channel Reservoir Feasibility Study, 2016, The Dyer Partnership, Engineers & Planners, Inc.
- Water Master Plan Addendum, October 2003, The Dyer Partnership, Engineers & Planners, Inc.
- City of Bandon 1991 Comprehensive Plan, (with Amendments regarding Public Facilities).
- Comprehensive Water System Master Plan, December 1992, HGE Engineers and Planners, Inc.
- Coos County Water Management Plan, 1990, CH_2M Hill.
- Ferry Creek Project Evaluation Under PL84-984, April 1990, Tucson Myers & Associates.
- South Bandon Refinement Plan, Infrastructure Element, June 1997, The Dyer Partnership, Engineers & Planners, Inc.
- Bandon Water System Improvements Construction Drawings, November 1998, Lee Engineering, Inc.
- DEQ Water Sampling Project, Project Number: OR-98-09.5-319 DEQ Contract No. :096-011/2/03, City of Bandon Water Resource Committee.
- Source Water Protection Plan, September 17, 2003, City of Bandon Water Resource Committee.
- Water Management and Conservation Plan, October 2003, The Dyer Partnership, Engineers & Planners, Inc.

2.6 Acknowledgements

This Plan is the result of contributions made by a number of individuals and agencies. Dyer wishes to acknowledge the efforts of Mary Schamehorn, Mayor, Jim Youravish, Plant Operator, Lanny Boston, Fire

Chief, and the Bandon Utilities Commission. The assistance of the City's Staff was invaluable in compiling information on the City's services to the community.

SECTION 3:

STUDY AREA CHARACTERISTICS

SECTION 3: **STUDY AREA CHARACTERISTICS**

3.1 Study Area

The City of Bandon is located in southern Coos County along the southern Oregon Coast as shown in Figure 3.1.1.

The area encompassed within the City Limits is approximately four square miles. The southern portion of the Urban Growth Boundary (UGB) is outside of the City Limits. The Study Area for this Water Master Plan (WMP) includes the City Limits and UGB as shown on Figure 3.1.2.

3.2 Physical Environment

The following provides information about the physical environment in and around the City of Bandon.

Soils

There are many general classifications of surficial geologic formations found in the local Bandon area. The formations are described as follows.

- **Bandon Series.** The Bandon Series consists of well drained soils moderately deep to an ortstein pan that formed in marine and eolian sands on incised marine terraces. Slope is zero to 50 percent.

- **Blackrock Series.** The Blacklock Series consists of poorly drained soils that are shallow to an ortstein pan, and formed in sandy marine sediments. These soils are in depressions on marine terraces. They are underlain by a cemented pan at a depth of 12 to 20 inches. Slopes range from zero to seven percent.

- **Bullards Series.** The Bullards Series consists of very deep, well drained soils that formed in mixed eolian marine deposits. Bullards soils are on terraces and have slopes of zero to 60 percent.

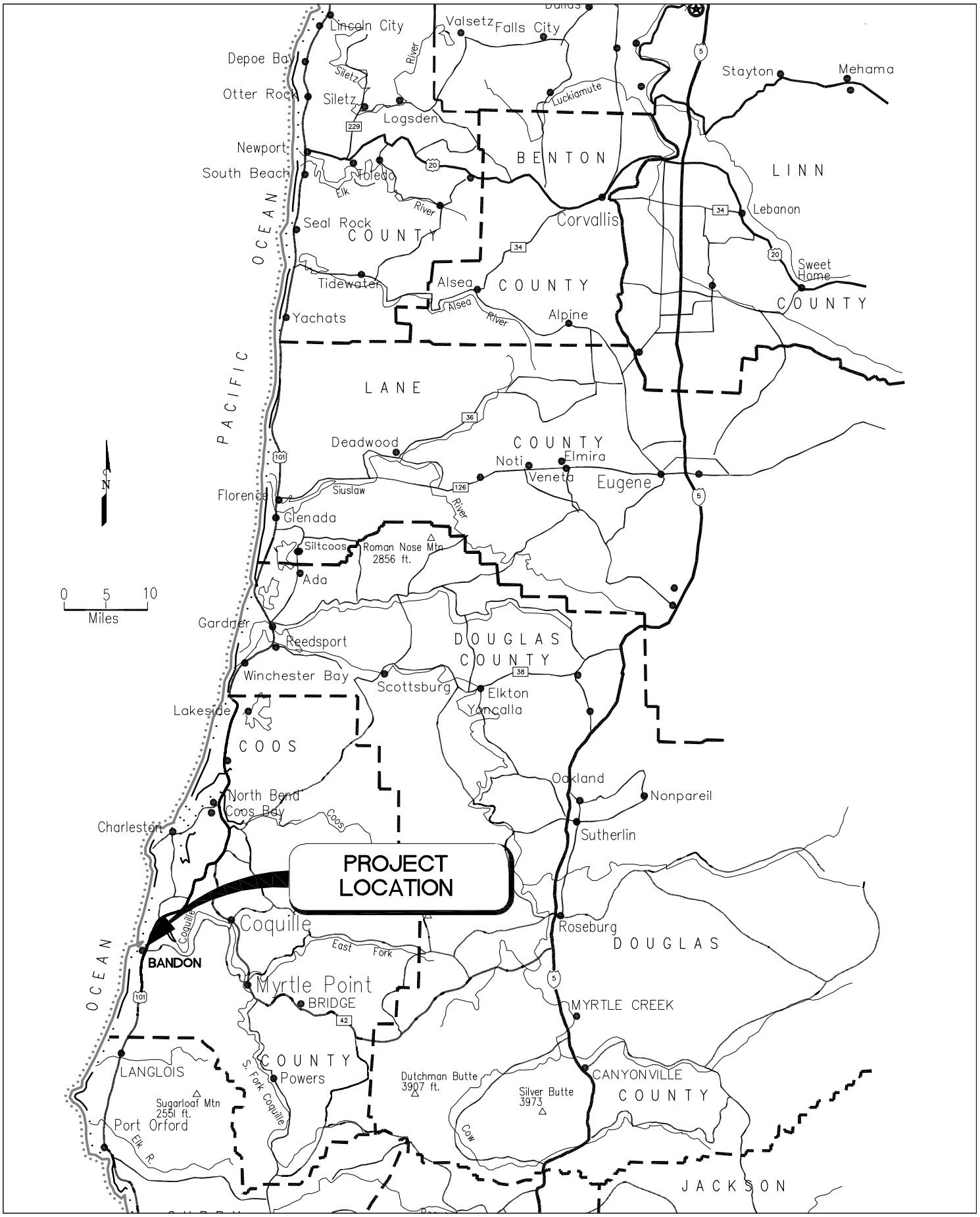
- **Chetco Series.** The Chetco Series consists of very deep, very poorly drained soils that formed in silty alluvium over marine clay. The soils are on flood plains and lowlands and have slopes of zero to three percent.

- **Clastop Series.** The Clatsop Series consists of deep, very poorly drained soils formed in mixed alluvium along tide influenced flood plains. Slopes are zero to three percent.

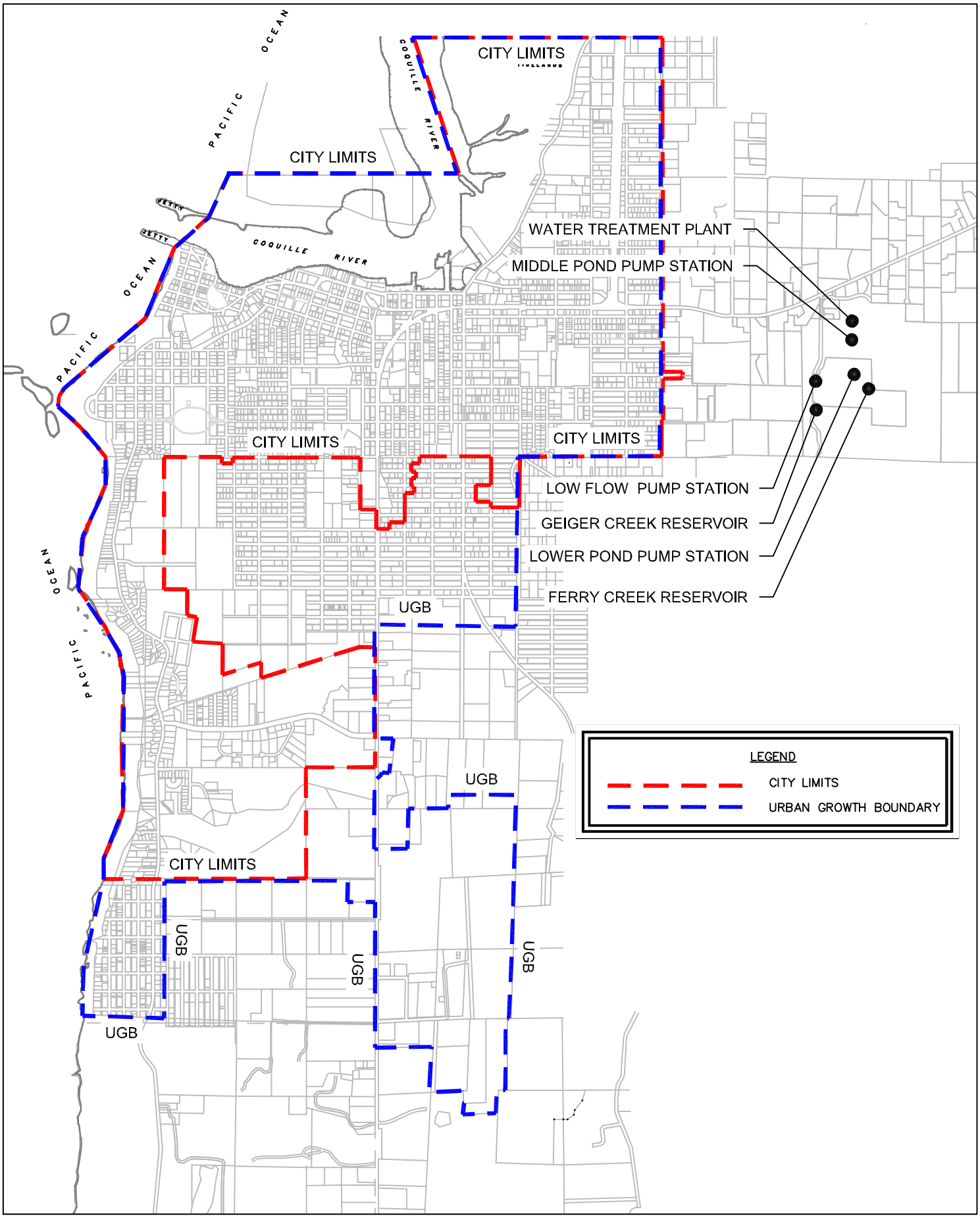
- **Heceta Series.** The Heceta Series consists of very deep, poorly drained soils on deflation plains, interdunal depressions, swales and sandy lowlands. They formed in recently stabilized dune sand. Slopes range from zero to three percent.

- **Udorthents Series.** The Udorthents Series consists of poorly drained soils on level plains. Slopes range from zero to one percent.

- **Waldport Series.** The Waldport Series consists of very deep, excessively drained soils formed in mixed eolian sand. They are on stabilized dunes and have slopes of zero to 70 percent.



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN***	FIGURE NO.
DATE: JULY 2020 PROJECT NO.: 101.100	***LOCATION MAP***	***3.1.1***



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN***	FIGURE NO. ***3.1.2***
DATE: JULY 2020 PROJECT NO.: 101.100	***STUDY AREA MAP***	

- **Willanch Series.** The Willanch Series consists of very deep, poorly drained soils that formed in mixed alluvium. These soils are in depressions on flood plains and have slopes of zero to three percent.

Geologic Hazards

There are several areas within the City that are susceptible to geologic hazards. These hazards include river flooding, earthquakes, high groundwater and erosion. A discussion of each hazard and expected locations are discussed below. Specific hazard maps are included in Appendix A.

- **Flooding**. The Federal Emergency Management Agency (FEMA) has developed flood plain information for the area within the City. All areas within its boundaries have been designated Zone AE or VE. Zone AE is an area with one percent annual chance of a flood event. Zone AE is an area with one percent annual chance of a flood event with additional hazards due to storm-induced velocity.

  The land area adjacent to a river, stream, lake, estuary, or other water body that is subject to flooding is referred to as a floodplain. The floodplain consists of two main sections: floodway and flood fringe. Floodways are defined as the channel of a river or stream, and the over bank areas adjacent to the channel. The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. The floodway area is reserved to conduct water of a 100-year flood out of the area. Within the floodway, no fill or structure is allowed that would cause any rise in the base flood elevation. The flood fringe refers to the outer portion of the floodplain, which begins at the edge of the floodway and continues outward. The flood fringe is characterized by shallow flooding usually consisting of standing or slow moving water. Residential buildings within the flood fringe need to be constructed above the base flood elevation. Other buildings may be flood-proofed.

  Portions of the City adjacent to the Pacific Ocean, Coquille River, and Ferry Creek are within the 100-year floodplain. The extent of the floodplain within the Study Area is presented in Appendix A. New development within the flood boundaries shown must be in accordance with the minimum standards of the Flood Insurance Act.

  Ocean flooding due to winter storm surges and tsunamis is a threat to beaches and built up sand areas. Ocean flooding and seasonal rain causes ponding on areas of accreted sand. Construction of the jetty system has caused accretions of sand north and south of the Coquille River, with cyclical building and depletion caused by ocean currents and wave action.

- **Earthquakes**. Earthquakes are the products of deep-seated geologic faulting and the subsequent release of large amounts of energy. The relative earthquake hazard includes factors such as earthquake induced landslides, liquefaction, and shaking amplification.

  The City is vulnerable to earthquake hazards because of: its proximity to the Cascadia Subduction Zone (CSZ), its regional seismicity topography, bedrock geology, and local soil profiles. The CSZ is off the Oregon Coast and presents the potential for an earthquake of magnitude 9.0 or higher. An event of such magnitude would result in buildings and infrastructure suffering varying amounts of damage. Large portions of US Highway 101 and roads across the Coast Range would be impassable. Many of the buildings were constructed on soil that would be subject to liquefaction while experiencing a severe ground shaking event. Additionally, principal roads that provide ingress and egress to the City are susceptible to earthquake induced landslides.

- **High Groundwater.** High groundwater or ponding can lead to: flooding of below-grade structures, flotation or damage to buoyant structures such as pipelines and tanks, differential settling of structures, and complications in the installation of underground facilities. In addition, high groundwater may result in shrink-swell related damage as the soil responds to changing levels of the water table and threats to water quality in areas of waste disposal. Within the Study Area, several soil types (Blackrock, Chetco, Clatsop, Heceta, Waldport, and Willanch) are considered to have moderate to high potential for ponding and perched water tables. High groundwater conditions are likely to exist near water bodies (e.g. rivers, creeks) within the Study Area.

- **Wave Movement.** Wave movement in the form of tsunamis is considered the greatest hazard within the Study Area. Tsunamis are large ocean waves generated at sea by large earthquakes in the ocean floor. Tsunamis are difficult to detect at sea, having wavelengths of a hundred miles or more and amplitudes seldom exceeding around a foot. As tsunamis approach land, the shallower depth causes the water to pile upon itself, thus increasing the height of the wave. The resulting wave(s) can be tens of feet high, can arrive several hours apart, and can cause extensive damage. The Oregon Department of Geology and Mineral Industries completed maps showing potentially areas impacted by tsunamis. In their simulation the tsunami was caused by a 9.2 earthquake within the Cascadia Subduction Zone. A majority of the City is in the area of inundation.

- **Erosion and Deposition.** Natural erosion occurs mainly along the ocean beaches and along the banks of Ferry Creek. Areas of sand have built up north and south of the mouth of the Coquille River since the construction of the jetty. Most areas of the coastline in the vicinity of the City are subject to sand accretion; however, beach erosion has been noted in some areas in the UGB. Undercutting and caving of stream banks is confined to the floodplain of the waterway, primarily at the outside curve of river bends, and may cause damage to adjacent structures. Sediments carried downstream by river currents contribute to sand accumulations on beaches.

- **Landslides.** Landslides pose a significant risk within the Study Area. They can cause property and road damage, personal injury and death, and water source contamination. The steep terrain around Ferry Creek and the Pacific Ocean increase the landslide risk associated with their respective areas. A Landslide Hazard Map can be found in Appendix A, Figure A.1.

Water Resources

Water resources within the Study Area include only surface water.

Surface Waters

The City draws all of its domestic drinking water from Ferry and Geiger Creeks. The intakes are located in the Ferry Creek Watershed within the Coquille River Sub-Basin. The geographic area providing water to the City of Bandon's intake (the drinking water protection area) extends upstream approximately two miles in a southeasterly direction and encompasses a total area of four square miles. The elevation change from the upper edge of the watershed to the intake is approximately 400 feet. These basins drain into the estuary portion of the Coquille River.

Ferry Creek Basin has an area of 1,130 acres (1.75 square miles) above its diversion point. Geiger Creek Basin has an area of 1,290 acres (2.0 square miles) above its diversion point. Both Ferry and Geiger Creeks have perennial features. However, flows vary significantly based upon rainfall and the season. Both streams typically run high during the winter and low during the drier summer months. In most years, flow levels are at a minimum in the months of August and September, coinciding with the time when

water demand in the City of Bandon is at its peak and other area streams are nearly dried up. High winter flows bring with them turbidity, which results in more difficult water treatment conditions. The low summer flows require careful monitoring of water availability from the creeks and conservative use by the community. These sources are generally adequate and reliable at the present time.

The City uses the low flow intake below the fish hatchery during extreme low flows during the summer months. The fish hatchery has senior water rights and has access to the water prior to the City.

Ground Waters

There are currently no permitted existing or proposed municipal ground water sources within the City.

Environmentally Sensitive Areas

The combination of dunes, rangeland, pasture and other wetlands provide a unique environment for the City and should be considered and protected in facilities planning. A discussion of environmentally sensitive areas and environmental topics pertinent to public facilities planning is presented below.

Wetlands

There are a number of significant wetland areas within the City. These areas are shown in Appendix A. The majority of the wetland areas can be found in the lowland areas throughout the City, along creeks and rivers.

Riparian Zones

The transition zone between creeks and uplands are also sensitive. The habitat should be protected with erosion control, provide cover for animals, and shading for reducing water temperatures. In addition to exceeding the physical tolerance levels of fish, high temperatures lower the oxygen concentrations, increase disease potential for aquatic life, and produce conditions favorable to invasive species.

Coos County has implemented setback requirement for all structures located near the bank of identified perennial and intermittent water sources. The County requires all residential structural development to have a 50-foot setback and forest/farmland to have a 100-foot setback from the streambank unless Oregon Department of Fish and Wildlife (ODFW) staff agree that this setback is unnecessary or a reduction in the setback would not jeopardize streambank, stability, water quality, or other conditions.

Air Quality and Noise

The Federal Clean Air Act has established several classifications for allowable air quality according to land uses, designations, and conditions. Air pollutants in the Study Area consist primarily of emissions from automobile and motorboat exhaust, residential fireplaces, wood stoves, and backyard burning. The most concentrated source of vehicle exhaust is highway traffic along US Highway 101, but traffic is not concentrated enough to cause a localized air pollution problem. Air quality in the area is expected to be in compliance with Federal and State standards for all criteria pollutants.

Energy Production and Consumption

Major energy resources identified in the Study Area are wood, wood byproducts, and wind. Wood and wood byproducts are both in good supply and are used locally for heating with wood burning stoves.

Other sources of energy are transported into the Study Area. Natural gas distribution is not available within the Study Area.

Solar energy is a potential source of energy for area residents depending upon access to southern exposure. Wind power may also be a viable future energy source for the Study Area due to high prevailing winds near the Study Area.

Residential, recreation, and transportation use comprises the majority of the energy consumption within the Study Area. Energy consumption is expected to increase within the Study Area due to population growth during the planning period. The City of Bandon, Pacific Power and Coos Curry Electrical serves the Study Area with electrical power.

Rare, Threatened and Endangered Species

A number of rare, threatened, and endangered species are known to reside near or within the Study Area. A list of these species within the Study Area is provided in Table 3.2.1. This list is based on information obtained from the Oregon Natural Heritage Information Center (March 2016) and the ODFW.

TABLE 3.2.1
LIST OF THREATENED AND ENDANGERED SPECIES IN THE STUDY AREA

Common Name	Scientific Name	Status (Federal/State)[1]
Oregon Coast Coho Salmon	Oncorhynchus kisutch	LT
Marbled Murrelet	Brachyramphus marmoratus	LT
Northern Spotted Owl	Strix occidentalis caurina	LT
Western Snowy Plover	Charadrius nivosus nivosus	LT
California Brown Pelican	Pelecanus occidentalis californicus	LE

[1] Federal: LT-Listed Threatened: LE-Listed Endangered

Wild and Scenic River System

There are no Wild and Scenic Rivers within the Study Area.

Historic Sites

Within the City of Bandon there are nine items listed in the National Register of Historic Places: the Coquille River Life Boat Station, Coquille River Light, Breuer Building, Bullard's Beach Site, Running Foxe Midden, First National Bank of Bandon, Philpott Site and Archeological Sites 35CS8 and 35CS9.

3.3 Socioeconomic Environment

The future need for water service and facilities within the City depends upon the socioeconomic conditions within the City and surrounding area. The local economic conditions, trends, population, land use, and public facilities will be discussed hereafter.

Economic Conditions and Trends

Regional economic conditions and trends will likely affect population growth and future water consumption in the City. The main industries are tourism, agriculture, commercial fishing, and sport fishing. The largest employers are comprised of City, County, State, and Federal governments. The

leading industries in the Study Area are tourism, retail trade, accommodation, fishing, food services, and forestry. Coos County employment growth rate for 2017 to 2018 was 1.2 percent and -0.8 percent for 2019-2020 which was impacted due to the coronavirus. This 2017-2018 growth rate is lower than the average for Oregon counties, but is near the average for the Country. Tourism or residential development can create a large, immediate demand for water and sewer services. Immigration to the area slowed in 2008, but has been slowing increasing since 2010. The popularity of the Bandon Dunes Golf Resort has also provided an economic boost for the City.

Based on US Census Bureau data, the Median Household Income (MHI) level in the City of Bandon for 2020 was $37,262. The MHI for Coos County was $49,445. The MHI for 2021 is not currently available.

Population

There are several alternatives that can be used to project the population growth over the planning period. For this Plan, as well as for the City's Wastewater Facilities Plan, the Population Research Center, Portland State University information was used in the development of the population projects. The City's population from the 2020 census was 3,321. The average growth rate for Coos County for the years 2018 to 2032 is estimated at zero percent, with a projected population growth rate of 0.7 percent for the City for the same time period. The average growth rate within the City from 2010 through 2018 averaged 0.3 percent. Portland State also showed a 2018 population of 3,422 which is higher than the 2020 census population. Therefore, the population projections will be based off of the 2020 population and a 0.70 percent growth rate. Given this population growth rate, the population projection for the next 20-years is shown in Table 3.3.1.

TABLE 3.3.1
CURRENT AND PROJECTED CITY POPULATION ESTIMATES

Year	2021	2026	2031	2036	2041
Residential Population	3,344	3,463	3,586	3,713	3,845
Population Growth Rate	0.70%	0.70%	0.70%	0.70%	0.70%

The City's population is not the service population since they do provide water service to both residential and commercial developments outside of the City Limits. The additional services add to the population projects listed above. There are 1,696 residential connections, as of December 2021, inside City Limits which equate to 1.97 people per connection. With 136 connections outside City Limits, as of December 2021, that would add an additional 252 people. It is predicted the population located within the vicinity of the City Limits will grow at the same rate as the City. Table 3.3.2 lists the current and projected service population.

TABLE 3.3.2
CURRENT AND PROJECTED SERVICE POPULATION ESTIMATES

Year	2021	2026	2031	2036	2041
Service Population	3,596	3,724	3,856	3,993	4,135
Population Growth Rate	0.70%	0.70%	0.70%	0.70%	0.70%

The City also has a transient population associated with tourism. The commercial connections within and outside the City Limits will be used to determine the additional demands generated by this group.

Land Use

Land use within the City is categorized into six general categories: residential, commercial, industrial, public facilities, controlled development and natural resources. The City of Bandon Zoning Map is shown in Figure 3.3.1. The land use categories are briefly discussed below.

Residential Lands

The City residential lands are throughout the community and on each side of US Highway 101. Residential land use ranges from single-family dwellings to multi-family dwellings, to bed and breakfasts. Detailed descriptions of each residential land use zone are described below.

1. **Residential 1 (R1).** The R1 zoning houses residential dwellings, residential care homes and foster care facilities as well as public utilities. The R1 zone is intended to provide sufficient and desirable location for residential use.

2. **Residential 2 (R2).** The R2 zoning houses residential dwellings, residential care homes and foster care facilities as well as public utilities. The R2 zone reserves and designated suitable areas to accommodate residential development.

Commercial Lands

The commercial properties are clustered around US Highway 101 and the Coquille River. Commercial activities generally include retail and tourist related services. Small shops and restaurants catering to the tourist market make up the majority of the commercial properties in the City.

1. **Old Town Commercial (C1).** The purposes of the Old Town Commercial is to provide space and protection for businesses and promote a mix of businesses that will serve residents and visitors to the area; while excluding uses which would detract from its appeal as an aesthetically pleasing commercial zone for residents and visitors. Uses for this zone include specialty stores, gourmet food shops, museums, eating and drinking establishments and more.

2. **General Commercial (C2).** The purpose of the General Commercial zone is to provide sufficient and appropriate space for general shopping, business and commercial needs of the City and the surrounding areas; while encouraging development of such space in a pleasant and desirable manner. These areas are intended to encourage the continuing quality of business retail services and to protect these uses which would break up continuity. Services for this zone include grocery stores, automobile repair and service, medical clinic, office, public utilities and more.

3. **Marine Commercial (C3).** The Marine Commercial zone provides and retains areas suitable for users and uses which depend upon or benefit from a waterfront location. Utilization for this zone include piers, docks, seafood processing, boat storage, channel maintenance and more.

Industrial Lands

There are a few properties zoned industrial within the City. The properties lay on the northern and southern border of the City Limits, and between Elmira Avenue and Fillmore Avenue from US Highway 101 and 6th Street.

1. **Light Industrial (LI).** The purpose of the Light Industrial zone is to provide a space for industrial uses with little or slight nuisance effect to adjacent land uses. Uses for this zone are warehousing, dairy or cranberry processing, self-storage and more.

2. **Heavy Industrial (HI).** The purpose of the Heavy Industrial zone is to provide a space for industry to ensure the future well-being of the City. Services for this zone include public utilities, including service structures.

Public Facilities Lands

Public facility lands consist of those required for parks, and recreation areas. The Water Treatment Plant and City Shops are included within the public facilities lands.

1. **Public Facility (PF).** The Public Facility zone seeks to identify and reserve publicly owned and areas for the development of needed public facilities and services. Conditional uses for this zone include recreational facilities, public parking and schools.

2. **Water (W).** The Water zone seeks to identify estuarine areas and management units as well as natural, conservation and development areas. Purposes for this zone include protection of wildlife habitat, restoration measures, research observations and bridge crossings.

Controlled Development

Controlled development zones consist of areas where local features and qualities are maintained through developments that are of a controlled nature and scale.

1. **Controlled Development Zone 1 (CD-1).** The CD-1 zone seeks to maintain the scenic and unique qualities of the City's ocean front and surrounding areas. It is intended for a mix of residential, tourism and recreational uses.

2. **Controlled Development Zone 2 (CD-2).** The CD-2 zone seeks to enhance and protect the natural resources and habitat characteristics of the Bandon Jetty and its bluff area; and to develop the coastal village atmosphere and exclude uses which would be inconsistent with the area character.

3. **Controlled Development Zone 3 (CD-3).** The CD-3 zone seeks to provide appropriate development in the entry into the South Jetty area while protecting and enhancing its natural resources. This area serves as a transitional area between the commercial uses of the Old Town and Waterfront area and the residential South Jetty neighborhood.

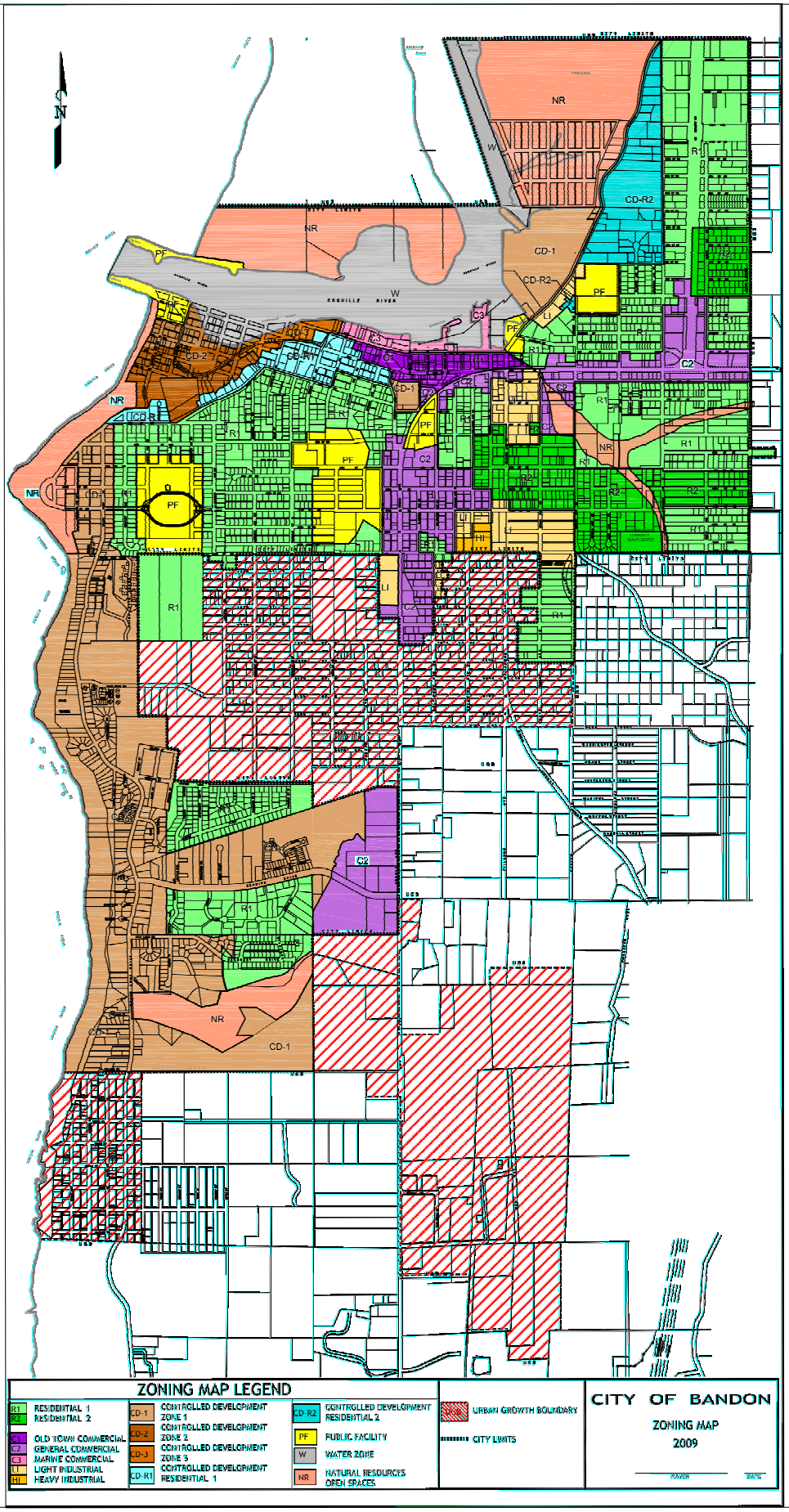
4. **Controlled Development Residential 1 (CD-R1).** The CD-R1 zone recognizes the unique qualities of the area and nearby properties overlooking the Jetty area, the Coquille River and Old Town. Qualities will be maintained by controlling the scale and nature of the developments in this zone. The vistas and residential character of this area shall be protected.

5. **Controlled Development Residential 2 (CD-R2).** The CD-R2 zone recognizes the unique qualities of the view areas overlooking the ocean, the Coquille River and their adjacent properties by controlling the nature and scale of development in this zone. The vistas and residential character of this area shall be protected.

Natural Resources

The Natural Resource zone consists of areas of natural value.

1. **Natural Resources and Open Spaces (NR).** The Natural Resources zone protects natural resources, such as open space areas, significant fish and wildlife habitats, outstanding scenic views and sites, ecological and scientific natural areas, wetlands and watersheds, historical areas and structures, and areas necessary to maintain or protect the quality of air, land and water resources from inappropriate or incompatible development. Natural Resources zone uses shall be limited to those uses that are consistent with protection of natural values, these uses include marine and wildlife sanctuaries, harvesting wild crops, low intensity recreational uses which do not use structures.



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN***	FIGURE NO. ***3.3.1***
DATE: JULY 2020 PROJECT NO.: 101.100	***ZONING MAP***	

SECTION 4:

REGULATORY ENVIRONMENT

SECTION 4: **REGULATORY ENVIRONMENT**

4.1 Municipal Water Management Plans

The Oregon Water Resources Department (OWRD) has developed rules that govern water management planning (Water Management and Conservation Plans; Oregon Administrative Rules (OAR) Chapter 690, Division 86). Included in the rules are groundwater management, hydroelectric power development, instream flow protection, interstate cooperation, water resources protection on public riparian lands, conservation and efficient water use, water allocation, and water storage. The Water Resources Commission has adopted a statewide policy on Conservation and Efficient Water Use (Statewide Water Resource Management; OAR 690-410). The policy requires major water users and suppliers to prepare water management plans. Municipal water suppliers are encouraged to prepare water management plans, and are required to do so if a plan is specified by a condition of a water use permit. The following elements are to be included in the plan: description of the water system, a water conservation element, a water curtailment element, and a long-range water supply element.

The City's most recent Water Management and Conservation Plan was completed in October of 2003.

4.2 Public Water System Regulations

Drinking water regulations were established in 1974 with the signing of the Safe Drinking Water Act (SDWA). The SDWA and subsequent regulations were the first to apply to all public water systems in the United States. The Environmental Protection Agency (EPA) was authorized to set standards and implement the Act. With the enactment of the Oregon Drinking Water Quality Act in 1981, the State of Oregon accepted primary enforcement responsibility for all drinking water regulations within the State. Requirements are detailed in OAR Chapter 333, Division 61. Since its inception, the SDWA and associated regulations have been amended a number of times, with the most recent amendments in January 2019.

One of the main elements of these drinking water regulations is the establishment of Maximum Contaminant Levels (MCLs) for inorganic, organic, microbiological, radionuclide contaminants, and turbidity. A MCL is the maximum allowable level of a contaminant in water delivered to the users of a public water system. Concentrations above the MCL for a contaminant are considered violations and require the water supplier to perform immediate corrective action and notify the public of such violations.

Surface Water Treatment Rule (SWTR)

The Surface Water Treatment Rule (SWTR) is one amendment to the Safe Drinking Water Act (SDWA). This rule affects all public water systems using surface water sources and established, among other requirements, that water must be treated through filtration and disinfection. This rule is required for all water providers using a surface water source unless certain water quality criteria and site-specific requirements are met. Treatment requirements, performance standards and MCLs are generally summarized as follows (excluding MCLs for inorganic materials, radioactive substances, and secondary contaminants) for a water system:

- For conventional filtration treatment, the turbidity level of representative samples of filtered water must at no time exceed one Nephelometric Turbidity Units (NTU), measured as specified in OAR 333-061-0030(3)(b). That is to say, zero percent of the turbidity measurements can exceed one NTU. Turbidity is monitored continuously with results reported every four hours.

- For conventional filtration treatment, the turbidity level of representative samples of filtered water must be less than or equal to 0.3 NTU in at least 95 percent of the measurement taken each month, measured as specified in OAR 333-061-0030(3)(b). The turbidity levels can rise above 0.3 NTU no more than five percent of the time.

- Total coliform-positive (coliform present) samples shall not exceed more than one sample collected during a month. Two monthly samples are required. A set of at least three repeat samples are required for each positive sample. Repeat sampling continues until the MCL is exceeded or a set of repeat samples with negative results (coliform absent) is obtained. Confirmed presence of fecal coliform or *E. coli* requires immediate notification of the public.

- At least 99.9 percent (3-log) inactivation and/or removal of *Giardia lamblia* cysts at a point downstream at or before the first customer.

- At least 99.99 percent (4-log) inactivation and/or removal of viruses at a point downstream at or before the first customer.

- A free chlorine residual of 0.2 milligrams/liter (mg/l) after 30 minutes of contact time shall be achieved under all flow conditions before the first customer. OAR 333-061-0050(5)(c)(B)

- The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in OAR 333-061-0032(3)(d) cannot be undetectable in more than five percent of the samples each month, for any two consecutive months.

The adoption of the 1989 SWTR has improved the quality of drinking water and greatly reduced the number of infections caused by water borne pathogens. The SWTR set standards to reduce water concentration of *Giardia* and viruses, with a goal to reduce the risk of infection to less than one in 10,000 people per year. However, some water sources have a high concentration of pathogens that, even when treated to the levels required by the rule, do not meet the health goal. Specifically, the rule does not specifically control the protozoan *Cryptosporidium*, which has been linked to at least 50 deaths of *Cryptosporidium*-caused illness outbreaks in Wisconsin, Nevada, Oregon, and Georgia. Although the public health benefits of disinfection are significant and well recognized, it has been found that the Disinfection Byproducts (DBP) also pose health risks at certain levels. The SDWA Amendments, signed by President Clinton in August 1996, mandated the establishment of a series of new drinking water regulations in response to these and other concerns. Since the enactment of the Amendments, the Environmental Protection Agency (EPA) has been busy developing, proposing, and finalizing regulatory actions. Some of the recent regulatory actions are summarized below.

Long Term 1 Enhanced Surface Water Treatment Rule

One of the first rules developed by the EPA under the SDWA Amendments was the Interim Enhanced Surface Water Treatment Rule (IESWTR). The IESWTR was promulgated to address health risks from microbial contaminants without significantly increasing the potential risks from chemical contaminants. This rule applies to public water systems that use surface water or Ground Water Under the Direct Influence of Surface Water (GWUDI) and serves at least 10,000 people. For water systems with a population of less than 10,000, the Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) was adopted. This rule was adopted in January 2002 and includes the following provisions:

- Maximum Contaminant Level Goal (MCLG) is set at zero.

- Filtered systems must comply with strengthened Combined Filter Effluent (CFE) turbidity performance requirements to assure 2-log removal of *Cryptosporidium*.

- Conventional and direct filtration systems must continuously monitor the turbidity of individual filters and comply with follow up activities based on this monitoring.

- Specific CFE turbidity requirements depend on the type of filtration. For conventional and direct filtration, the CFE shall be less than 0.3 NTU 95 percent of the time, and at no time higher than one NTU.

- Perform CFE turbidity monitoring at least every four hours; record continuous Individual Turbidity Effluent measurements (at least every 15 minutes).

- Disinfection profiling and benchmarking provisions to ensure continued microbial protection.

- Requirements for covers on new finished water reservoirs.

The City currently complies with all LT1ESWTR requirements.

Long Term 2 Enhanced Surface Water Treatment Rule

The Long Term 2 Enhances Surface Water Treatment Rule (LT2ESWTR) was proposed and reviewed by a Federal Advisory Committee at the same time as the Stage 2 Disinfection Byproduct Rule (DBPR). The requirements of this rule would pertain to all public water systems that use surface waters or GWUDI. The rule would incorporate system specific treatment requirements for one of four categories or "bins" depending upon the results of source water *Cryptosporidium* monitoring. Treatment requirements for each system would depend on system's existing treatment equipment and removal capabilities. To comply with additional treatment requirements, water providers would choose technologies from a "toolbox" of options. Proposed treatment requirements for average *Cryptosporidium* are presented in Table 4.2.1.

TABLE 4.2.1
PROPOSED TREATMENT REQUIREMENTS FOR AVERAGE *CRYPTOSPORIDIUM* CONCENTRATIONS

Bin No.	Avg. *Cryptosporidium* Concentration	Additional Treatment Requirements[1]
1	< 0.075/ liter	No action
2	0.075/ liter < x < 1.0/ liter	1-log treatment (any technology or technologies)
3	1.0/ liter < x < 3.0/ liter	2.0 log treatment (must achieve at least 1-log of treatment using specific technology [2]
4	> 3.0/ liter	2.5 log treatment (must achieve at least 1-log treatment using specific technology [2]

(1) For systems with conventional treatment that are in full compliance with IESWTR.
(2) Acceptable technologies include ozone, chlorine dioxide, ultraviolet, membranes, bag/cartridge filters, or in-bank filtration.

For small systems monitoring requirements, it is anticipated that source water *E. coli* concentrations would be utilized for *Cryptosporidium* monitoring. Observed *E. coli* concentrations above certain levels would trigger *Cryptosporidium* monitoring. The recommended *E. coli* monitoring for small systems would begin two and a half years after rule promulgation and would include 24 samples over one year. After six years of the system characterization, a second round of monitoring is proposed.

This rule only applies to public water systems serving populations greater than 10,000; therefore the City is not currently required to monitor *Cryptosporidium.* In the future, this rule may expand its reach and begin to impact the City's existing treatment and monitoring processes.

In summary, the rules are getting tougher with increased treatment standards, lower MCLs, and more regulated substances. Water suppliers must stay informed of upcoming standards and requirements to ensure that their system will stay in compliance. Proper preparation is critical. When upcoming MCLs are established, a supplier should begin to test for these materials to determine if compliance will be a problem. Advanced planning will allow a utility more time to make necessary modifications to treatment techniques. Additional information on recent and pending regulations can be found at www.epa.gov/safewater/standards.html.

Stage 1 Disinfectants/Disinfection Byproducts Rule

Stage 1 Disinfectants/Disinfection Byproducts Rule (Stage 1 DBPR) was published along with the IESWTR to control disinfectants and formation of their harmful byproducts. This rule establishes Maximum Residual Disinfectant Level Goals (MRDLGs) and Maximum Residual Disinfectant Levels (MRDLs) for three disinfectants: chlorine (4.0 mg/l), chloramines (4.0 mg/l), and chlorine dioxide (0.8 mg/l). The rule also establishes MCLGs and MCLs for specific disinfection byproducts as given in Table 4.2.2.

TABLE 4.2.2
MCLGS AND MCLS FOR STAGE 1 DISINFECTANTS

Disinfection By-Product	MCLG (mg/l)	MCL (mg/l)	Time Period
Total trihalomethanes (TTHM)	N/A	0.08	Annual Average
Bromodichloromethane	0	0.08	Annual Average
Dibromochloromethane	0.06	0.08	Annual Average
Bromoform	0	0.08	Annual Average
Haloacectic acids (HAA5)	N/A	0.06	Annual Average
Dichloroacetic acid	0	0.06	Annual Average
Trichloroacetic acid	0.02	0.06	Annual Average
Chlorite	0.8	1	Monthly Average
Bromate	0	0.01	Annual Average

Water system providers must monitor and control the use of disinfectants and meet the requirements for Total Trihalomethanes (TTHM) and the sum of five Haloacetic Acids (HAA5). In addition, water systems that use surface water or GWUDI and use conventional filtration treatment are required to also remove a specified percentage of organic materials, measured as Total Organic Carbon (TOC) that may react with disinfectants to form disinfection byproducts.

Furthermore, Oregon's decision to join the EPA Region 10 and the States of Utah and Washington in participation in the Area Wide Optimization Program (AWOP) is anticipated to create more stringent

treatment standards which the existing Water Treatment Plant can now meet only under ideal conditions. The AWOP performance goals are listed below in Table 4.2.3.

TABLE 4.2.3
AWOP PERFORMANCE GOALS

Sedimentation	Turbidity	Criteria
Settled water	Less than 2 NTU, 95% of the time	Avg. annual raw water turbidity > 10 NTU
Settled water	Less than 1 NTU, 95% of the time	Avg. annual raw water turbidity ≤ 10 NTU
Filtration	**Turbidity**	**Criteria**
Filtered water	< 0.1 NTU, 95% of the time	Based on 4-hour incremental max valves
		(15 min. period following backwash excluded)
Filtered water	Max. 0.3 NTU following backwash	Return to < 0.1 NTU < 15 minute of backwash

The objective of AWOP is to achieve "performance goals" without major capital expenditures. While these goals are not currently tied to regulatory compliance requirements, it is anticipated that they will be in time. Statements by the State such as, "to achieve optimized treatment and provide maximum protection of public health, you must achieve the described AWOP performance goals," suggests that these goals would better protect the public, and therefore should not be ignored.

Stage 2 Disinfection Byproduct Rule, Effective March 6, 2006

The Stage 2 Disinfection Byproduct Rule (Stage 2 DBPR) is being promulgated simultaneously with the Long Term 2 Enhanced Surface Water Treatment Rule to address concerns about risk tradeoffs between pathogens and DBPs. Stage 2 DBPR builds upon the Stage 1 DBPR to address higher risk public water systems for protection measures beyond those required for existing regulations. These rules strengthen protection against microbial contaminants, especially *Cryptosporidium*, and at the same time, reduce potential health risks of DBPs. The final Stage 2 DBPR contains maximum contaminant level goals for chloroform, monochloroacetic acid and trichloroacetic acid. National Primary Drinking Water Regulations, which consist of MCLs, monitoring, reporting, and public notification requirements for total trihalomethanes and haloacetic acids. The regulations include revisions to the reduced monitoring requirements for bromate. This document also specifies the best available technologies for the final MCLs. The EPA is approving additional analytical methods for the determination of disinfectants and DBPs in drinking water. The Stage 2 DBPR rule is intended to reduce potential cancer, reproductive problems, and developmental health risks from DBPs in drinking water. The requirements of this rule apply to community water systems and non-transient non-community water systems that add and/or deliver water that is treated with a primary or residual disinfectant other than Ultraviolet (UV). For public water systems serving fewer than 10,000 people; Stage 2 compliance monitoring began October 1, 2013.

An Initial Distribution System Evaluation (IDSE), conducted by the water provider, is intended to select new compliance monitoring sites that reflect locations with system high TTHM and HAA5 concentrations. Water providers would recommend new or revised monitoring sites based on their IDSE study. The results from the IDSE study would not be used for compliance purposes. For surface water systems with less than 10,000 people, water providers must monitor either quarterly (population from 500 to 9,999) or semi-annually (population less than 500) for one year at two distribution system sites per plant. These sites must be in addition to the Stage 1 DBPR compliance monitoring sites. Water providers that certify to the State that all samples taken in the last two years were below 40 mg/l TTHM / 30 mg/l HAA5 are not required to conduct the IDSE.

For long-term compliance monitoring, the principles of reduced compliance monitoring strategy (for very low DBP levels) utilized in Stage 1 DBPR would continue in the Stage 2 DBPR. Water providers would collect paired samples (TTHM and HAA5) at the site representing the highest TTHM and the highest HAA5 locations in the distribution system, as identified under the IDSE. If the highest levels of TTHM and HAA5 are observed at the same location, then only one sample would be needed. Monitoring would be either quarterly (population from 500 to 9,999) or annually (population less than 500).

The City has never been in violation of either Stage 1 or Stage 2 DBPR. As long as the City maintains its current treatment process, no future violations are foreseen.

Filter Backwash Recycle Rule

The EPA is required to regulate the recycling of filter backwash water within the treatment process of a public water system. The filter backwash recycle rule provisions impact all conventional and direct filtration systems, which recycle filter backwash and use of surface water or GWUDI. Under the rule, the following provisions will be required.

- Recycle water from filter backwash, supernatant from sludge thickening, and liquids from sludge dewatering must pass through all filtration processes for treatment.

Specific information on the regulations concerning public water systems may be found in the Oregon Administrative Rules (OAR), Chapter 333, Division 61. The rules are located at:
http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Rules/Documents/pwsrules.pdf

The City has a backwash recycle system, and complies with the Filter Backwash Recycle Rule.

Arsenic and Clarifications to Compliance and New Source Monitoring Rule

In January 2001, the Arsenic and Clarifications to Compliance and New Source Monitoring Rule was enacted. The major features of this rule included the following:

- Include health effects statements in Consumer Confidence Reports for arsenic levels from 5 to 50 microgram per liter (ug/l) and when systems are in violation of the arsenic MCL of 0.010 mg/l.

- All new systems/sources must collect initial monitoring samples for all Inorganic Compounds (IOCs), Synthetic Organic Compounds (SOCs), and Volatile Organic Compounds (VOCs).

- The new arsenic MCL of 10 ug/l became effective on January 23, 2006.

- One sample must be taken and analyzed after effective date of MCL. Surface water systems must take annual samples.

- A system with a sampling point result above the MCL must collect quarterly samples at that sampling point, until the system is reliably and consistently below the MCL.

The City has had ‘non-detect’ levels of Arsenic in every sample since 1984. Oregon Health Records do not show sample results prior to this date.

4.3 Responsibilities as a Water Supplier

Per OAR 333-061-0025, water suppliers are responsible for taking all reasonable precautions to assure that the water delivered to water users does not exceed maximum contaminant levels, to make certain that water system facilities are free of public health hazards, and to verify that water system operation and maintenance are performed as required by these rules. This includes, but is not limited to, the following:

- Routinely collecting and submitting water samples for laboratory analyses at the frequencies prescribed by OAR 333-061-0036;
- Taking immediate corrective action when the results of analyses or measurements indicate that maximum contaminant levels have been exceeded and report the results of these analyses as prescribed by OAR 333-061-0040;
- Reporting as prescribed by OAR 333-061-0040, the results of analyses or measurements which indicate that maximum contaminant levels have not been exceeded;
- Notifying all customers of the water system and the general public in the service area, as prescribed by OAR 333-061-0042, when the maximum contaminant levels have been exceeded;
- Notifying all customers served by the water system, as prescribed by OAR 333- 061-0042, when reporting requirements are not being met, when public health hazards are found to exist in the system, or when the operation of the system is subject to a permit or a variance;
- Maintaining monitoring and operating records and making these records available for review when the system is inspected;
- Maintaining a pressure of at least 20 pounds per square inch (psi) at all service connections at all times;
- Following up on complaints relating to water quality from users and maintaining records and reports on actions undertaken;
- Conducting an active program for systematically identifying and controlling cross connections;
- Submitting, to the Oregon Health Authority, plans prepared by a Professional Engineer registered in Oregon for review and approval before undertaking the construction of new water systems or major modifications to existing water systems, unless exempted from this requirement;
- Assuring that the water system is in compliance with OAR 333-061-0032;
- Assuring that the water system is in compliance with OAR 333-061-0210 through OAR 333-061-0272 relating to certification of water system Operators; and
- Assuring that transient non-community water systems utilizing surface water sources or groundwater sources under the influence of surface water are in compliance with OAR 333-061-0065(2)(c) relating to required special training.

4.4 Summary of City's Compliance with Regulations

The City has had no violations and are compliant with the current regulatory regulations. The City's reportable turbidity over the past four years has been less than 0.5 NTU.

SECTION 5:

EXISTING WATER SYSTEM

SECTION 5: **EXISTING WATER SYSTEM**

The City's existing water system consists of raw water intake facilities, treatment plant facilities, treated water storage, and the treated water distribution system. These components are discussed in detail below. A water systems map is shown in Figure 5.5.1.

5.1 Water Rights and Raw Water Supply

The nature and status of existing raw water supplies and water rights is crucial to the formulation of a successful long-range plan for the City. The following is a discussion of the sources, availability, and reliability of the City's raw water sources.

Raw Water Sources

The City has two active sources of raw water: Ferry and Geiger Creeks; and one inactive source, Simpson Creek. An overall map of the Study Area showing the major components of the City's water system is displayed in Figure 3.1.2.

Ferry and Geiger Creeks

The City of Bandon has water rights within the Ferry Creek and Geiger Creek drainage systems and currently utilizes these as the City's water supply source. The intakes are located in the Ferry Creek Watershed within the Coquille River Sub-Basin. The geographic area providing water to the City of Bandon's intake (the drinking water protection area) extends upstream approximately two miles in a southeasterly direction and encompasses a total area of approximately four square miles. The elevation change from the upper edge of the watershed to the intake is approximately 400 feet. These basins drain into the estuary portion of the Coquille River.

Ferry Creek Basin has an area of 1,130 acres (1.75 square miles) above its diversion point. Geiger Creek Basin has an area of 1,290 acres (2.0 square miles) above its diversion point. Both Ferry and Geiger Creeks have perennial features. However, flows vary significantly based upon rainfall and seasons. Both streams typically run high during the winter and low during the drier summer months. In most years, flow levels are at a minimum in the months of August and September, coinciding with the time when water demand in the City of Bandon are at its peak and other area streams are nearly dried up. High winter flows bring with them turbidity, which results in more difficult water treatment conditions. The low summer flows require careful monitoring of water availability from the creeks and conservative use by the community. These sources have served the City well but there is growing concern with the physical condition of each source and availability of water during low flow years.

Information regarding predicted low flows for these sources includes the Tucson Myers report of April 1990. A data correlation of Ferry Creek flow with Pony Creek flow was performed. The correlation location was at the confluence of Geiger and Ferry Creeks. Data used was from 1950 to 1980. The value was computed for flow that exceeded 99 out of 100 years. The lowest flow month was calculated for September at 1.06 Million Gallons per Day (MGD) or 1.64 cubic feet per second (cfs). CH2M Hill prepared another report in July of 1993 for Coos County based on assumed run off values and predicted rain fall. This report predicted much lower flows than the Tucson Myers report. However, CH2M Hill acknowledged in the report that the mathematical basis of their estimate does not match observed flow. The explanation was that "springs" add to the volume. Basing the flows on observed Pony Creek flows, the Tucson Myers report can be expected to under report as well.

Ferry Creek has a gauging station that is located close to the proximity of the low water point of diversion. Oregon Water Resources Department (OWRD) has published data for the years 1977 to 1982, 1994 to 1996 and 2017 to present. The lowest flow of 0.4 cfs was recorded for the 1978 water year. The OWRD website for Ferry Creek also shows a low flow event of 0.15 and 0.26 cfs in 1981 and 1995, respectively. These numbers did not match any of the daily flows for those two months. Table 5.5.1 summarizes recorded low flows for the water years 1977 to present.

TABLE 5.1.1
RECORDED LOW FLOWS

Water Year	Low Flow Date	Flow (cfs)
1977	October 6, 1977	0.8
1978	October 4, 1978	0.4
1979	October 10, 1979	1.3
1980	October 5, 1980	1.7
1981	October 1, 1981	1.7
1982-1993	No Data	NA
1994	September 9, 1994	1.4
1995	September 19, 1995	2.7
1996-2016	No Data	NA
2017	September 13, 2017	2.6
2018	September 28, 2018	2.2
2019	August 20, 2019	2.4
2020	October 21, 2020	2.0
2021	August 17, 2021	2.4
2022	Incomplete Data Set	N/A

In the winter months the flow rate is highly variable and depends on the precipitation which is attributed to surface water runoff. This watershed is very responsive to precipitation and drought which cause large fluctuations in flowrate. During the drier months the flows in Ferry Creek are at the lowest which also correspond to the highest water demand period for agricultural diversion.

Off-Channel Reservoir

Although approval is still pending, 100 acre-feet of water rights have been "moved" to the Off-Channel Reservoir by manner of Water Right Permit Amendment. Eighty-five acre-feet from the Geiger Creek Reservoir and 15 acre-feet from the Ferry Creek Reservoir was "moved" for storage at the Off-Channel Reservoir. The environmental review is complete and land has been acquired for the construction of the Off-Channel Reservoir. This will provide a maximum 100 acre-feet of water storage. Water will be diverted from the confluence of Geiger Creek and Ferry Creek during the peak runoff season for raw water storage and will supplement the low flows of late summer.

Oregon Water Resources Department on September 28, 2017 approved the right to change the diversion of 1.6 cfs from Geiger Creek to the off-channel storage facility and change the use from domestic to municipal. The two requirements of the Final Order are: construction has to be completed by October 1, 2022 and a claim for beneficial use application submitted by October 1, 2023. The City is in the process of filing for a time extension since the other two applications listed below have not yet been approved.

There are still two applications pending approval. Application R88383 is for the ability to store the water and Application S88383 is the ability to use the water. The OWRD internal review was approved on

January 25, 2018. The Department indicated on May 13, 2022 the Proposed Final Order for each application will begin processing within the next two to three months.

Supplemental Groundwater Supply

The City is also exploring the possibilities of using groundwater to supplement their water supply during an emergency or seasonal basis. GSI Water Solutions, Inc. has been retained to evaluate the feasibility of this option. The scope of this analysis included the following:

- Evaluation of the hydrogeologic setting in the vicinity of the City. This evaluation included reviewing available geologic reports, geologic spatial data, and well logs to develop a conceptual model of the local hydrogeologic system.
- Determination of feasibility moving forward.
- Impact to existing water rights, the need to apply for a new groundwater water right or the need to transfer the surface water right to a groundwater right.
- Potential impacts to existing wells.
- Preliminary well siting.
- Preliminary well design.
- Planning level cost estimate.
- Report and recommendations.

The conclusions of this analysis are groundwater is available and a well system is feasible to supplement the City's raw water supply. However, there are two major factors that need to be completed prior to development of an operational well field. These items are summarized as follows:

- A surface water to groundwater water right application has to be filed with OWRD. The OWRD has to review the application and issue a preliminary decision (a proposed Final Order and/or a draft preliminary determination) confirming the agency can approve the application, including the proposed well locations. This review process could take up to twenty-four months after the application is received.
- After approval is given by OWRD, the drill of a test well and observation well to determine the actual output available will be completed. The observation well will be used to assess the potential impacts to the groundwater. If the yield meets expectations the well field would be developed.

A copy of the technical memorandum is included in Appendix E.

Water Rights

All water in Oregon is publicly owned. Based on this public ownership, a water right is generally required for anyone to use water regardless of whether the water originates from surface or underground sources.

Oregon's water laws are based on the principal of prior application. That is, if a person obtains a water right on a particular source before someone else, that person would then possess a "senior" water right that would permit them first use of the water during times of lower flows or droughts. A "junior" water right is one that is obtained after other water rights for a particular source have been assigned. A water right may be both "senior" to some and "junior" to others.

During periods of low water availability under previous State law, a water right holder could use as much water as their water right allows as long as the use is truly beneficial and all senior water rights are satisfied. This method of resource appropriation governed all water used until the water is exhausted. Under the current revised rules surrounding water permit extensions in Oregon Administrative Rules (OAR) 690-315, the withdrawal of water for a municipal user becomes more complicated. Updated rules contained in OAR 690-86 modify the formerly routine five year extension, which allowed cities to "grow into" their water right. Extensions will now generally be for longer periods of time (typically 20-years) and will require preparation of a Water Management and Conservation Plan (WMCP). The rule modifications introduce the concept of "green light water" which is a portion of the water right which the City may divert until an updated WMCP is submitted and approved by the Oregon Water Resources Department. Certificated water rights do not fall under this requirement.

The City holds permit water rights to obtain a total of 3.0 cfs of surface water from Ferry Creek and 2.0 cfs from the Spring Branch of Ferry Creek by way of the Ferry Creek Reservoir. Additionally, permits exist to remove water from Geiger Creek in the amount of 5.0 cfs from a point of diversion upstream of the Geiger Creek Reservoir and 3.0 cfs from the reservoir itself.

In March 2000, an order was issued by OWRD approving Transfer Application T-8195. This order allows the City of Bandon to divert water associated from three of the four water rights discussed previously from an alternative location downstream of the fish hatchery. This avoids a conflict of water rights with the fish hatchery during periods of low flow because the hatchery use is non-consumptive. The water is available to the City after flowing through the hatchery pens. The City used this option in the summer of 2002.

In September 2017 an order was issued by OWRD approving the change in character of use from domestic to municipal for the Geiger Creek source and allowing the diversion of 1.6 cfs from Geiger Creek to the off-channel storage facility. Construction of this source must be completed by October 1, 2022 and certificate of beneficial use submitted by October 1, 2023.

The City also has another application in for the permitting of the off channel storage facility and for the use of the stored water. This application was filed in April 2017. To date OWRD is proposing to approve the application but is waiting for comments from the Department of Environmental Quality and Coos County Water Master. There is not an anticipated approval date.

Bandon has total water rights as follows: Geiger Creek 5 cfs with a 1916 priority; Lower Geiger Creek 3 cfs with a 1961 priority; Ferry Creek 3 cfs with a 1961 priority and Spring Branch of Ferry Creek of 2 cfs with a 1910 priority. The hatchery has rights for 1.5 cfs on Ferry Creek and 1.5 cfs on Geiger Creek, totaling 3 cfs. The hatchery water passes through the hatchery facility and can be pumped afterward for use by the City.

The City's storage water rights include 90 acre-foot (ac-ft) at the Geiger Creek Reservoir and 20-5/8 ac-ft at the Spring Branch of the Ferry Creek Reservoir. Water right documentation is provided in Appendix B and summarized in Table 5.1.2.

TABLE 5.1.2
WATER RIGHTS DOCUMENTATION SUMMARY

App. No.	Permit No.	Cert. No.	Trans. No.	P-date	Stream/Reservoir	Magnitude	Comment
S-4982	S-3011	N/A	N/A	6/19/1916	Geiger Creek	5.0 cfs	
S-34672	S-27232	N/A	N/A	3/7/1961	Geiger Creek	3.0 cfs	
S-34673	S-27233	N/A	N/A	3/7/1961	Ferry Creek	3.0 cfs	
E-481	E-27	9754	N/A	1/24/1910	Spring Branch of Ferry Creek	2.0 cfs	
R-5017	R-368	N/A	N/A	7/5/1916	Geiger Creek Res.	90.0 ac-ft	
R-501	R-28	9755	N/A	1/24/1910	Spring Branch of Ferry Creek Res.	20-5/8 ac-ft	
S-4982	S-3011	N/A	T-12632	3/29/2000	Geiger Creek	5.0 cfs	Move Point of Diversion
S-34672	S-27232	N/A	T-8195	3/29/2000	Geiger Creek	3.0 cfs	Move Point of Diversion
S-34673	S-27233	N/A	T-8195	3/29/2000	Ferry Creek	3.0 cfs	Move Point of Diversion
S-4982	S-3011	N/A	T-12632	9/28/2017	Geiger Creek	1.6 cfs	To Supply Off Channel Storage
S-4982	S-3011	N/A	T-12632	9/28/2017	Geiger Creek	N/A	Change Domestic to Municipal Use
R-88382	Pending	N/A	N/A	Pending	Off Channel Storage	100 ac-ft	Allow Off Channel Storage Facility
R-88383	Pending	N/A	N/A	Pending	Use Stored Water	1.6 cfs	Allow Off Channel Storage Usage

Diverted Water

The City has a raw water meter at the Water Treatment Plant (WTP) a new meter was installed in April 2020. The estimated amount of water diverted from this source for the water years 2015 to 2021 is presented in Table 5.1.3.

TABLE 5.1.3
HISTORICAL WATER DIVERSION (2015 – 2021)

Parameter	2015	2016	2017	2018	2019	2020	2021
Total Gallons, gal	226,607,745	232,863,328	243,805,729	274,925,603	275,598,235	185,170,475	192,751,674
Avg. Daily, cfs	0.97	0.96	1.00	1.13	1.11	0.78	0.82
Max Monthly, cfs	1.37	1.32	1.42	1.52	1.57	1.05	1.05
Max Daily, cfs	1.66	1.73	1.70	3.2	2.7	1.26	1.31
Total Water Rights	**13**						

The City has noticed inconsistencies with the raw water meter since 2014. The raw water meter was replaced in April 2020. The old pressure differential meter's flow had a buildup of barnacles and slime within the tube. This condition would definitely affect the readings. The new magnetic flow meter has proven to read within five gallons per minute (gpm) of the flow meters located on the filters.

Raw water flow diversion for 2020 and 2021 was approximately thirty percent less than previous years. The decline in demand is contributed to COVID-19 and the reduction of tourist visiting the area.

5.2 Raw Water Facilities

The raw water facilities consist of two raw water intake diversion structures and a raw water transmission main. These facilities are discussed in detail below.

Raw Water Intake

There are raw water intakes located at both Ferry Creek and Geiger Creek that feed the Lower Pump Station. The water gravity flows from each source to the Lower Pump Station where it is either pumped by two small pumps each with a capacity of 350 gpm and a large pump with a capacity of 700 gpm to the Middle Pond; or to the Water Treatment Plant at a maximum of 700 gpm. At the Middle Pond Pump Station two pumps and volutes each with a capacity of 350 gpm and a larger pump with a capacity of 700 gpm pump the water to the WTP at a maximum rate of 1,400 gpm.

Another intake location is along Ferry Creek just downstream of the hatchery. The Low Flow Pump Station uses two 700 gpm pumps for a total of 1,400 gpm to move the raw water to the Middle Pond. The Low Flow Pump Station concrete wet well and submersible pumps are in good condition, refer to Figure 5.2.1, but there is a fish screen that is setup for an air scour cleaning cycle but no air compressor was ever supplied. Therefore, the City has to periodically clean the screen. The Lower Pump Station building is in good condition and is a Concrete Masonry Unit (CMU) block building with a metal roof. Refer to Figure 5.2.1.

The Middle Pond Pump Station building, refer to Figure 5.2.3, is in good condition and is a CMU block building with a metal roof. Currently all the pump stations have the capacity of the WTP (1,400 gpm) but lack any redundancy. Both the Lower Pump Station and the Middle Pond Pump Stations would benefit from upgrades to the flow capacity to prevent the pumps from running constantly (twenty-four hours a day - seven days a week) during high demand periods. Backup power and better ventilation would improve the quality of the pump stations. The Middle Pond Pump Station would benefit from a new dock at the pond and a new flow meter for outgoing flow.

FIGURE 5.2.1
LOW FLOW PUMP STATION

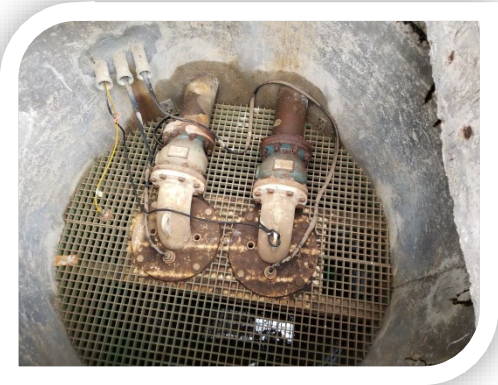


FIGURE 5.2.2
LOWER PUMP STATION

FIGURE 5.2.3
MIDDLE POND PUMP STATION

5.3 Water Treatment Plant

The City of Bandon completed construction of its water treatment and filtration plant in 2000 and has a current total treatment capacity of 2.0 MGD (1,400 gpm). The Water Treatment Plant is a custom plant, includes a multi-media filtration system, and makes use of the following processes:

- Pre-chlorination
- Alum Chemical Coagulation
- Filter Aid Polymer Addition
- Up-Flow Sludge Cone Clarification with Tube Settlers
- Multi-Media Filtration
- pH Adjustment
- Disinfection (Post Chlorination and Ultraviolet Disinfection)

- Reservoir Chlorine Contact

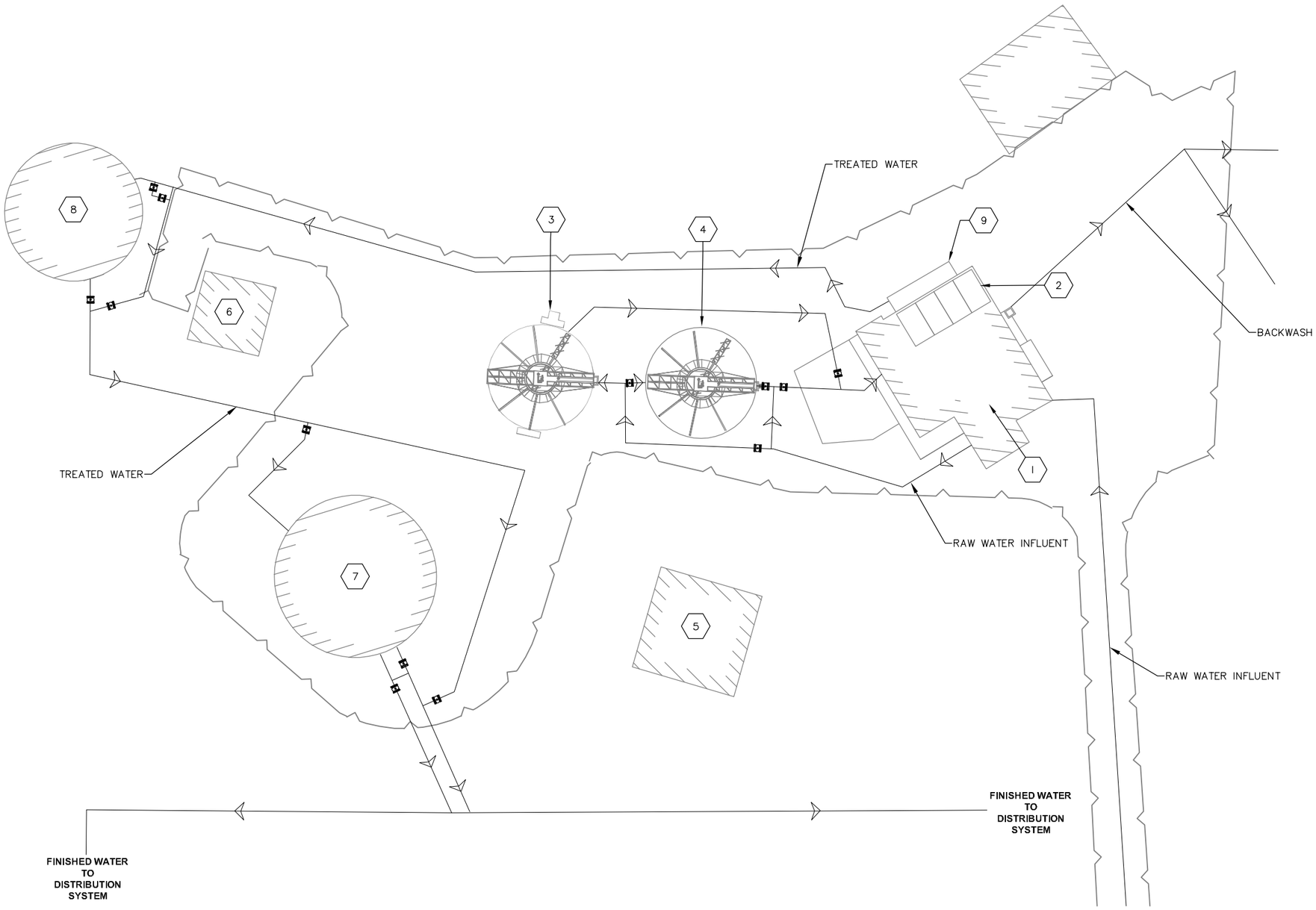
The use of rapid sand filtration, such as the plant employs, is considered desirable for treating highly turbid water, as may occur in the source streams during the rainy season. The up-flow sludge cone clarifier unit is reported to also provide good settlement and attenuates turbidity spikes resulting from muddied Geiger and Ferry Creek sources. During summer months when the sun shines on the side of the clarifier it warms the water which creates and inversion within the tank and increases turbidities. Some type of screening is needed to provide for more uniform raw water quality going to the filters. Furthermore, the Middle Pond provides for some settlement subsequent to removal from the source streams and prior to pumping through the clarifier. Plant personnel have also modified the piping to the filters so that Filtration Units 1 and 2 receive water and Tanks 3 and 4 are reserved for future expansion. These concrete tanks provide for additional gravity sedimentation prior to introduction of the water through the active filter units, if conditions so warrant. This reduces chemical costs and frequency of backwash, especially during winter season when turbidity from Ferry and Geiger Creeks is higher. Accumulated solids in the filters are removed by pumping to the backwash pond.

More frequent backwashing of filters may be required when turbidity levels are elevated. Based on decreased water demand during the winter rainy season and the abundance of source water, more frequent backwashing of filters does not have a noticeably negative impact on the raw water supplies or the environment in general. However, the layout of the plant provides for recovery of all backwash water in the Middle Pond. Backwash water goes to two settling ponds prior to discharging to the Middle Pond.

The Water Treatment Plant incorporates modern flow control and monitoring systems. Chemical feed rates are controlled by the raw water flow meter. As mentioned in the previous section, the inability of raw water flow meter to provide accurate readings created problems with plant operations and flow recording. The installation of the new meter corrected both items. Flow records are automatically graphed and reduced to daily consumption; monthly reports are forwarded to the Oregon Health Authority in compliance with OAR Chapter 333. In addition, daily rainfall at the plant is also recorded.

The treatment plant is arranged such that it can be upgraded to a 4.0 MGD plant by upsizing the raw and treated water pumps. Piping within the Lower and Middle Pump Stations was designed for this expanded plant condition. The clarifier is sized to operate at a maximum capacity of 2.5 MGD. The original clarifier can be replaced to provide the additional capacity required. Two of the four filter bays are empty. The two empty filter bays can be filled with media as space and piping headers are already provided to allow for the addition of two new units. Space is also provided within the treatment plant building for the addition of chemical tanks, feed units and pumps.

The Water Treatment Plant Site Plan is shown in Figure 5.3.1.



KEY NOTES:

1. EXISTING WATER TREATMENT PLANT BUILDING
2. EXISTING FILTERS
3. EXISTING CLARIFIER (WORKING)
4. EXISTING CLARIFIER (OUT OF SERVICE)
5. CELL TOWER AND BUILDING NO.1
6. CELL TOWER AND BUILDING NO. 2
7. 2 MILLION GALLON STORAGE TANK
8. 1 MILLION GALLON STORAGE TANK
9. UV FILTER BUILDING

GN

PLAN SCALE

N.T.S.

FIGURE NO. 5.3.1

CITY OF BANDON WATER MASTER PLAN

WATER TREATMENT PLANT EXISTING SITE PLAN

THE DYER PARTNERSHIP ENGINEERS & PLANNERS

DATE: JULY 2020

PROJECT NO.: 101.100

Plant and Facility Security

The plant site and grounds, including the treated water storage tank, have a six feet high chain link perimeter fence. The fence is topped with three strands of barbed wire. The plant building and perimeter gates are locked when plant personnel are not present. The facility has motion detection equipment installed at the gates and in certain areas for outside equipment access areas. The motion detection devices are monitored by a security company.

Located within the Water Treatment Plant grounds is a cell phone transmission tower and equipment building. Some security concerns have been expressed over the presence of cell phone maintenance personal onsite who may be unknown to the Water Treatment Plant Operator. It is recommended that a security evaluation of the plant site be conducted by City Staff and appropriate actions undertaken. It is anticipated that funding is available for any capital improvements required. The appropriate security actions recommended are as follows:

- Vulnerability Analysis
- Security Report
- Security Training
- Capital Improvement

A Security Vulnerability Assessment Engine for use by the City is provided at www.nrwa.org.

Physical security issues take the form of: locks, fences, motion and perimeter alarm equipment, identification and confirmation of site visitors and delivery personnel, cooperation with local police for increased surveillance, and a "neighborhood watch" type approach for pump stations, water tanks, fire hydrants, and reservoirs. Background checks for new hires and contract service personnel are also recommended.

Water Treatment Plant and Office

The WTP office and building is a CMU building with a metal roof. The building includes the chemical feed area, soda ash feed, piping gallery, office and laboratory. The building is in good condition but is in need of minor improvements. The improvements to the building would include new flooring in the front office area and new cabinetry at the sample island.

Raw Water Metering, Sampling and Chemical Addition

A new raw water meter was installed in April 2020. Raw water pumped from the Middle Pond is sampled for pH and turbidity as well as flow rate. A Streaming Current Monitor (SCM) was added to the chemical monitoring system in April 2021. Based upon information provided by the SCM, two polymers (Superfloc N-300 and Superfloc C-573), soda ash for pH adjustment, alum for clarification and filtration or chlorine may be added and mixed. Refer to Figure

FIGURE 5.3.2
POLYMERS ADDITION

5.3.2. The chemical feed rates is based upon Operator determination and information received from the SCM, flow meter, pH meter and turbidity meter. Feed rates are automatically adjusted within a predetermined range. The alum feed system consists of an alum storage tank with two pumps. The soda ash system consists of a mixer tank with two pumps and dilution water equipment. It is possible, due to the presence of two pumps and the piping configuration, to both pre-feed and post feed with respect to the filters. The filter aid polymer consists of a mixing tank and an aging tank, a pump and dilution water equipment. In addition to cold water for mixing and dilution, a hot water dilution water source is provided. Filter aid polymers may be introduced both before and after the clarifier. The polymer system pumps from a 55-gallon drum, has both cold and hot water dilution feed and may be introduced into the treatment process prior to the clarifier.

Clarifier Equipment

Raw water pumped from Middle Pond after chemical addition and mixing then enters the clarifier unit. Currently there are two clarifiers onsite, the original that is used only when necessary and a new clarifier that was installed in 2007. The original clarifier is in poor condition. The new clarifier is a 59 foot diameter glass fused to steel tank with 24-inch deep settlers and is in good condition. In 2019 the City installed steel cladding to the east and south sides of the tank to prevent the dark blue color of the tank walls from creating thermal loading and the subsequent increases in turbidity during summer months, which makes the water more difficult to treat. The new clarifier has a treatment capacity of 2.5 MGD. If the original clarifier is replaced the color of the tank should be white. Refer to Figure 5.3.3.

FIGURE 5.3.3
CLARIFIER EQUIPMENT

Filtration Equipment

Clarified water flows by gravity to the two filter units. Refer to Figure 5.3.4. Filter aid polymer may be added prior to the filter units. Each filter is rated 700 gpm, are dual media types and each have a surface area of 138.3 square feet. In 2018, the basins were cleaned, repaired and covered in an epoxy coating to protect the surface from deterioration. The filter media was also replaced. Filter backwash design is at a rate of 2,800 gpm with a typical ten minute cycle time. The backwash pumps use the filter effluent line connected to the two million gallon reservoir as the supply source. The backwash flow rate is metered. Backwash is assisted with air scour provided by a blower at a rate of 560 standard cubic feet per minute (scfm). Refer to Figure 5.3.5. Following backwash, the filters were designed to run in “filter to waste” mode at a rate of 700 gpm for five minutes. Head loss sensors in the filters control the effluent pump rates. The variable frequency speed control effluent pumps remove water directly from the plenum of the filters, rather than from a clear well as is typically the case for this type of plant. Flow rate and turbidity are monitored for the water pumped from each individual filter. Following backwash, soda ash may be added for pH control. Following the chemical addition location, a sample stream is taken for chlorine residual and pH measurement. Finally, chlorine is added to the finished water as it proceeds to the new two million gallon reservoir.

FIGURE 5.3.4
DUAL MEDIA FILTERS

FIGURE 5.3.5
AIR SCOUR BLOWER

Disinfection Equipment

The City of Bandon Water Treatment Plant uses onsite hypochlorite generation and Ultraviolet (UV) light for disinfection. Refer to Figure 5.3.6 for the chlorine dosing pumps and Figure 5.3.7 for the UV system. The hypochlorite system is much safer and provides more disinfection than the gas chlorine system previously used. This system combined with the large chlorine contact time available through both the two million gallon and the one million gallon reservoirs will provide adequate disinfection for the foreseeable future. The UV clarifier was installed in 2007 and has a design flow of two MGD.

FIGURE 5.3.6
CHLORINE DOSING PUMPS

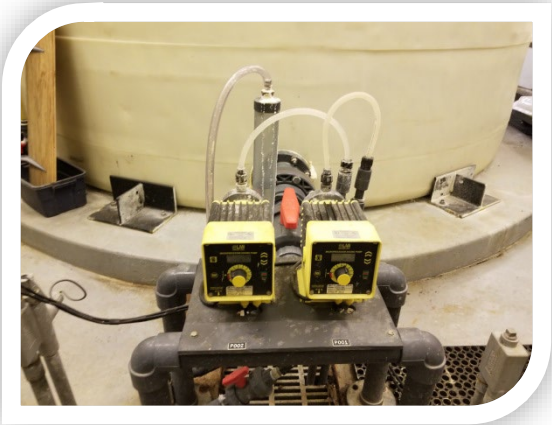


FIGURE 5.3.7
UV SYSTEM

FIGURE 5.3.8
TREATED WATER PUMP

Treated Water Pump Equipment

Two filter effluent pumps, refer to Figure 5.3.8, move treated water directly from the filter units at the treatment plant through the UV system, then to the one million gallon reservoir.

Treated water then flows into the two million gallon reservoir. This provides for extensive chorine contact time prior to distribution. In addition to providing treated water to the reservoirs, water is removed from a treated water header to provide backwash water for the filters. Each reservoir may be isolated to perform required maintenance.

Metering is provided for measuring the volume of water being sent to the distribution system. This meter is installed on the effluent line from the finished water storage reservoirs. The addition of this meter has allowed the City to better account for water used in the treatment process.

Backwash Lagoon

Backwash and process water flows into two backwash lagoons located south of the Water Treatment Plant. The backwash lagoons are square earth lined ponds. Drainage from the backwash lagoons flows to the Middle Pond whereby water is recycled for treatment. The solids that accumulate in the lagoons are removed periodically and placed in an onsite storage location. The ponds are currently in good shape and require no upgrades. Historical water production and backwash water volumes are listed in Table 5.3.1.

TABLE 5.3.1
HISTORICAL WATER PRODUCTION & BACKWASH WATER VOLUMES FOR THE WTP

Parameter	Year							Average
	2015	2016	2017	2018	2019	2020	2021	
Total Treated Water (MG)	159,464,560	175,229,045	182,756,184	195,668,209	207,880,981	191,862,017	185,130,487	185,427,355
WTP Backwash (MG)	9,966,213	10,189,463	11,450,794	12,595,108	11,428,297	9,552,536	9,821,935	10,714,907
WTP Backwash (%)	6.25%	5.81%	6.27%	6.44%	5.50%	4.98%	5.31%	5.79%

5.4 Treated Water Storage

Two tanks provide treated water storage totaling 3,000,000 gallons and provide chlorine contact time. One tank holds one million gallons with a bottom elevation of 178.9 feet. The other tank holds two million gallons and has a bottom elevation of 162.0 feet. Both tanks are located adjacent to the Water Treatment Plant and have overflow elevations of 218.5 feet. A brief description of each tank follows.

One Million Gallon Tank

FIGURE 5.4.1
ONE MILLION GALLON RESERVOIR

The one million gallon steel reservoir is located on a northeasterly portion of the water plant site. Refer to Figure 5.4.1. The tank is a welded steel tank on a concrete foundation. The tank was originally constructed in 1955. In conjunction with the water plant improvements performed in 2000, extensive repairs were made and the tank was repainted. The tank was painted again in 2013. In 2014 the tank underwent cathodic protection upgrades. There is corrosion showing on the inside of the tank which is a sign of failed coatings. The tank is considered to be in fair condition.

Two Million Gallon Tank

FIGURE 5.4.2
TWO MILLION GALLON RESERVOIR

The two million gallon steel reservoir is located approximately 142 feet southwest of the one million gallon tank. The "new tank" is a welded steel tank. A new vault and master meter were constructed in 2000 to measure the flow leaving the treatment and storage facility and entering the City of Bandon distribution system. In 2014 the tank underwent cathodic protection upgrades. Both the interior and exterior of the tank needs recoating. The City did go out to bid for seismic upgrades on the outlet line in September 2015. The bids came in higher than available funding and the project was not completed. The project was rebid in November 2021 and the low bid came within budget. The project was never awarded due to delivery issues with the equipment. The project could not be completed before Memorial Day weekend which was a requirement of the Bandon Fire Department. The City has ordered the seismic valve equipment and will be ordering the pipe fittings later this year to ensure the project can be constructed in the Spring 2023.

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Water Level Controls

A water level sensor is located in the effluent line between the two million gallon tank and the master meter. This sensor provides signal to automatically control the filter effluent pumps in order to maintain the desired water levels in the storage tanks. The elevation of the reservoirs provides adequate service pressure to the majority of the system and pressures exceeding 80 pounds per square inch (psi) to many of the properties in the lower elevation areas of the City. With the existing level controls, pumping arrangements, and treatment systems, the City of Bandon water system functions essentially as an automatic system.

Storage Volume

Current water storage capacity is adequate. However, in order to provide equalization and adequate fire volume to southern Bandon, additional treated water storage placement should be considered. Table 5.4.1 summarizes the storage reservoir information.

TABLE 5.4.1
STORAGE FACILITIES SUMMARY

Reservoir	Material	Year Constructed	Nominal Volume, gal	Base/Overflow Elevation, ft
One Million Gallon	Welded Steel	1955	1,000,000	178.90/218.5
Two Million Gallon	Welded Steel	2000	2,000,000	162.00/218.5

5.5 Water Distribution System

An overview of the City's water distribution system is presented in Figure 5.5.1. The City of Bandon's water distribution system is a combination of pipe materials and sizes. The distribution system consists of 12-inch main lines from the City's Water Treatment Plant and 2 to 12-inch diameter lateral pipe with service lines consisting of ¾ and 1-inch diameter pipe. The most prevalent pipe within the distribution system (34 percent) consists of 6-inch diameter pipe.

In addition to varying by diameter, the water distribution system is also composed of a variety of pipeline materials. The material that was used to construct water lines over the years depended primarily on the accepted and available materials of the time. In the 1940s and 1950s, cast iron, steel, and galvanized piping was commonly used. Later, Asbestos Cement (AC) piping was utilized for water main construction in the 1970s. Today ductile iron, PVC and Polyethylene (PE) pipe materials are used almost exclusively in the construction of new water and service lines. The City's piping consists primarily of AC and PVC pipe for distribution pipes; and galvanized steel and polyethylene pipe for service lines. A summary of the distribution system pipe size and material inventory (not including service lines) is given in Table 5.5.1. Current materials of choice for replacement are PVC pipe for lateral mains and PE pipe for service lines.

TABLE 5.5.1
DISTRIBUTION SYSTEM SIZE AND MATERIAL INVENTORY

Pipe Diameter, Inch	Materials of Construction					
	Asbestos Cement	Cast Iron	Ductile Iron	PVC	Total	% of Total
2	266			6,214	6,480	3.7%
4	33,697		282	9,574	43,553	24.5%
6	31,090		5,984	22,799	59,873	33.7%
8	2,565			15,611	18,176	10.2%
10	17,756	2,892	586	4,261	25,495	14.3%
12	1,441		10,414	12,295	24,150	13.6%
Total	86,815	2,892	17,266	70,754	177,727	100.0%
% of Total	48.9%	1.6%	9.7%	39.8%	100.0%	--

The existing condition of the distribution system depends greatly on the materials that were used to construct the system as well as the level of workmanship at the time of construction. Although a historical log of distribution system repairs has not been maintained, City Staff believe there are no major leaks within the system.

WATER TREATMENT PLANT

1 MILLION GAL. RESERVOIR

2 MILLION GAL. RESERVOIR

LOWER PUMP STATION

MIDDLE POND PUMP STATION

HWY 42-S

SEE FIGURE 3.1.2 FOR LOCATIONS OF PUMP STATIONS, WTP AND RESERVOIRS

Tank Name	Material	Nominal Volume, gal	Base/Overflow Elevation, ft
One Million Gallon Tank	Welded Steel	1,000,000	178.8/218.5
Two Million Gallon Tank	Welded Steel	2,000,000	162/218.5

Intake Pump Station	No. of Pumps	Hp	Flow (gpm)
Middle Pond Pump Station	3	2-15/1-25	1,400
Lower Ponf Pump Stations	3	2-20/1-50	1,400

HWY 101

MICHIGAN AVE.

TIDELANDS

COQUILLE RIVER

HWY 101

HWY 101

HWY 101

KAPING DR.

SEABIRD DR.

8TH ST SW

8TH ST SW

COQUILLE RIVER

PACIFIC OCEAN

JETTY

JETTY

PACIFIC OCEAN

BEACH LOOP DRIVE

PACIFIC OCEAN

SEABIRD DR.

BEACH LOOP DRIVE

LEGEND

- CITY OF BANDON BOUNDARY
- 2" WATER LINE
- 4" WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE

PLAN SCALE

N.T.S.

FIGURE NO. 5.5.1

CITY OF BANDON WATER MASTER PLAN

EXISTING WATER SYSTEM

THE DYER PARTNERSHIP ENGINEERS & PLANNERS

DATE: JULY 2020

PROJECT NO.: 101.100

\\dyer2\dyer-port\AAprojects\101 Bandon\101.100 Water Master Plan\DWG\Existing SystemMap.dwg, 7/6/2020 1:13:22 PM PLOT DATE July 16, 2020

Computer modeling was conducted to analyze the performance of the existing City of Bandon water system. Hydraulic analysis software called WaterCAD® CONNECT Edition (Version 10.2) by Haestad Methods was used to perform the complex calculations necessary to analyze the water distribution system. Pipe diameter and materials data was input into the computer model. A discussion on the computer modeling results of the distribution system is presented in Section 8.

5.6 Water Quality

Since operation of the updated plant began, in 2000, treated water quality has been excellent and there have been no recent violations. Lead and copper levels are well below action levels. The City of Bandon has met all requirements of the surface water treatment rules for at least the past five years. There have been no nitrates detected nor have there been any coliform violations for at least the past five years. No organic chemicals of any kind have been detected.

5.7 Financial Management

The financial management of the City's water system was reviewed by examining the current system charges, revenue, and Operations and Maintenance (O&M) budget.

System Charges and Revenue

The City collects water system charges to retire debt and finance the operation and maintenance of the water system. A summary of the current system charges is given below in Table 5.7.1.

TABLE 5.7.1
MONTHLY WATER SYSTEM CHARGES

Service	Base Rate	Rate $/1,000 gals After first 2,000 gals	Average Monthly Rate[(1)]
Inside City			
Residential	$31.50	$1.30	$33.45
Commercial/Industrial	$41.50	$1.30	--
Outside City			
Residential	$43.13	$2.17	$46.39
Commercial/Industrial	$53.13	$2.17	--
City Use			
Inside and Outside City	$9.62	$1.15	

(1) Average monthly rate was determined using the average monthly use per EDU in 2021 (3,500 gallons)

In addition to the base rate and additional usage charge the City adds a ten percent utility tax fee for inside City accounts only. That would put the average residential rate at $33.45.

The City collects revenue for the water system operation from service fees, new connections, System Development Charges (SDCs), and other miscellaneous sources. There are five funds that the revenues can be included in however the revenues from the five funds increase the total revenue for all water funds. A summary of the revenue budget for the fiscal year 2022 to 2023 is presented in Table 5.7.2.

TABLE 5.7.2
WATER OPERATIONS REVENUE

Revenues						
Fund	**Water Fund (940)**	**Water Plant Improvement Fund**	**Water Plant Reserve Fund (942)**	**Water SDC Reimbursable Fund (720)**	**Water System SDC Imp (721)**	**Total**
Other Taxes	$1,047,000		$2,500			$1,049,500
Reimbursements	$6,500					$6,500
Miscellaneous	$66,935	$3,980		$41,900	$159,930	$268,765
Transfer from Other Funds		$283,000				$283,000
Beginning Fund Balance	$252,227	$731,513	$806,099	$312,663	$1,475,798	$2,772,201
Total Revenues	$1,372,662	$1,018,493	$808,599	$354,563	$1,635,728	$5,190,045

Operation and Maintenance Budget

Each fiscal year, the City proposes, approves and adopts an annual budget for the water system. The General Fund is an internal service fund, which acts as a cost center for personnel, equipment, and materials to the other internal funds. A portion of the O&M budget is directed to the Construction Fund, and Equipment Replacement Reserve Fund; which was created for the distribution of funds required by the City's Capital Improvement Plan (CIP). Additional funds are distributed to the Debt Service Fund for the purpose of timely payments of long-term financing of water system improvements. There are five funds that the requirements can be included in; however, the five funds make up the total requirements for all water funds. A summary of the water operations expenditures is presented in Table 5.7.3.

TABLE 5.7.3
WATER OPERATIONS EXPENDITURES

Expenditures						
Fund	**Water Fund (940)**	**Water Plant Improvement Fund**	**Water Plant Reserve Fund (942)**	**Water SDC Reimbursable Fund (720)**	**Water System SDC Imp (721)**	**Total**
Personnel Services	$441,615					$441,615
Materials & Services	$466,590			$10,000	$10,000	$486,590
Capital Outlay	$116,000	$502,815	$808,599	$10,000	$510,000	$1,947,414
Debt Services	$39,759					$39,759
Contingency & Reserves	$308,698					$308,698
Fund Balance		$515,678		$334,563	$1,115,728	$1,965,969
Total Requirements	$1,372,663	$1,018,493	$808,599	$354,563	$1,907,106	$5,461,424

SECTION 6:

WATER USE AND PROJECTED DEMANDS

SECTION 6: **WATER USE AND PROJECTED DEMANDS**

6.1 Description and Definitions

Water demand can be defined as the quantity of water delivered to the system over a period of time to meet the needs of consumers, provide filter backwashing water, and to supply the needs of firefighting and system flushing. In addition, virtually all systems have an amount of leakage or loss that cannot be feasibly or economically reduced or eliminated. Total demand, therefore, includes all consumption and lost water. Demand varies seasonally with the lowest usage in winter months and the highest usage during summer months. Variations in demand also occur with respect to time of day (diurnal) with higher usage occurring during the morning and early evening periods and lowest usage during nighttime hours.

The objective of this section is to determine the current water demand characteristics and to project future demand requirements that will establish system component adequacy and sizing needs. Water demand is described in the following terms:

Average Annual Demand (AAD)
The total volume of water delivered to the system in a full year is expressed in gallons. When demand fluctuates up and down over several years, an average is used. This number uses the combined metered flow coming out of the treatment units.

Average Daily Demand (ADD)
The total volume of water delivered to the system over a year divided by 365 days or 366 days during leap years (2016 and 2020). The average use in a single day expressed in gallons per day (gpd). This number uses the combined metered flow coming out of the treatment units.

Dry Season Daily Demand (DDD)
The gallons per day average during the months of June through October. This number uses the combined metered flow coming out of the treatment units.

Maximum Monthly Demand (MMD)
The gallons per day average during the month with the highest water demand. The highest monthly usage typically occurs during a summer month. This number uses the combined metered flow coming out of the treatment units.

Peak Weekly Demand (PWD)
The greatest seven day average demand that occurs in a year is expressed in gallons per day. This number uses the combined metered flow coming out of the treatment units.

Maximum Day Demand (MDD)
The largest volume of water delivered to the system in a single day expressed in gallons per day. The MDD is commonly used to size facilities to provide capacity for periods of high demand. The MDD usually occurs during the warmest part of the year when agriculture, irrigation, and recreational uses of potable water are at their greatest. Higher use is also commonly associated with holidays, such as the Fourth of July, or during events, such as County Fairs. This number uses the combined metered flow coming out of the treatment units.

Peak Hourly Demand (PHD)
The maximum volume of water delivered to the system in a single hour expressed in gallons per day. Distribution systems should be designed to adequately handle the peak hourly demand. During this peak usage, storage reservoirs supply the demand in excess of the maximum day demand. Peak hour demand is

commonly experienced during the early morning hours when many water users are bathing, cooking, and engaging in other activities that require widespread water use.

Demands expressed in gpd, can be divided by the population served to come up with a demand per person or a per capita demand which is expressed in gallons per capita per day (gpcd). Per capita demands can be multiplied by future population projections to determine future water demands.

Loss/Lost Water
Metered source water less revenue producing water and authorized unmetered water uses.

Non-account Water
Metered source water less metered water sources. This value takes into account the combined metered flow coming out of the treated water storage tanks and the volume of water sold.

Unaccounted for Water
The amount of non-account water less known or estimated losses and leaks.

For most communities, the known or estimated losses and leaks within a water system are not known. Rather the amount of system loss or leakage is estimated based on an audit of water usage within the system. To the extent possible, the above water conservation terms will be used in this Plan.

6.2 Current Water Demand

For the purposes of this Plan, current water demand was evaluated using three different methods:

1. Water Diverted
2. Raw Water Treated
3. Water Consumption

These different water demands are discussed in detail below.

Water Diverted

As part of the auditing process, the City must account for all water diverted from each source. This is typically accomplished through a metering device at or near the point of diversion. Oregon Administrative Rules (OAR) 690-085-0015 requires that, "Where practical, water use shall be measured at each point of diversion." However, the rule also states that:

"…measurements may be taken at a reasonable distance from the point of diversion if the following conditions are met:

- The measured flow shall be corrected to reflect the flow at the point of diversion. The correction will be based on periodic flow measurements at the point of diversion taken in conjunction with flow measurements at the usual measuring point;
- If the measured flow includes flow contributions from more than one point of diversion, the measured flow shall be proportioned to reflect the flow at each point of diversion using the method prescribed subsection (a) of this section; and

- A description of the correction method shall be submitted with the annual report the first time it is used and any time it is changed, or once every five years, whichever is shorter."

If the point of diversion is relatively close to the Water Treatment Plant (WTP), it is common for many communities to use a single influent meter at the water plant to measure the amount of water that is diverted. This is the case for the City of Bandon.

As stated in Section 5.1, there was concern about the accuracy of the raw water flow meter for years 2016 until April 2020 when a new raw meter was installed. The disparity between the raw water, and the treated water data can be seen in Table 6.2.1. The new raw water flow meter and future installation of flow meters at the individual intake sites would increase data accuracy, and provide a means of measuring any losses between the intakes and the Water Treatment Plant. In addition, water treated values does not take into account filter to waste flows. This waste stream is not metered and could amount for up to an additional five percent of water treated.

TABLE 6.2.1
RAW WATER VS. WATER TREATED

Time Period	Raw Water (gallons)	Water Treated (gallons)	Percent Difference
2015	226,607,745	159,464,560	30%
2016	232,863,328	175,229,045	25%
2017	243,805,730	183,201,480	25%
2018	274,925,603	195,668,209	29%
2019	275,598,235	207,880,981	25%
2020*	185,170,475	191,862,017	-4%
2021	192,751,675	185,130,487	4%

*New raw water meter installed in April

Raw Water Treated

For planning purposes, demand projections and unit design factors for water consumption should be based on the City's yearly water production data rather than historical customer water consumption records (meter readings). This methodology incorporates all system losses and unmetered usage in the projected water requirements developed later in this Water Master Plan (WMP). The amounts of treated water produced, pumped to the City for consumption, and utilized for backwash are discussed below.

Water Treatment Plant Production

The amount of water produced at the Water Treatment Plant and sent to the treated water storage tanks for eventual City consumption is based on daily records maintained by City Staff. The amount of treated water produced at a WTP is equal to the sum of the amount of water sent to the treated water storage tanks plus the amount of water used for backwash, and miscellaneous water usage at the WTP (pump seals, sanitary usage, etc.). The City does not currently record miscellaneous water usage at the WTP or backwash to waste flows, therefore this additional usage at the WTP is not known. Water Treatment Plant production will be based on the master meter for treated water sent to town, which is calibrated every year, and the amount of water used for backwash.

Water production data was used to calculate the Average Annual Demand (AAD), Average Daily Demand (ADD), Dry Season Daily Demand (DDD), Maximum Monthly Demand (MMD), Peak Weekly Demand (PWD), and Maximum Daily Demand (MDD). A definition of each of these water demand

parameters was previously given in Section 6.1. A summary of the water demand parameters for the years 2015 to 2019 is presented in Table 6.2.2. The maximum water production for the time periods reviewed was observed in the Year 2019.

TABLE 6.2.2
ANNUAL, MONTHLY, WEEKLY AND DAILY TREATED WATER PRODUCTION

Treated						
Year	AAD, gpy*	ADD, gpd*	DDD, gpd	MMD, gpd	PWD, gpd	MDD, gpd
2015	159,464,560	436,889	557,150	652,358	705,185	993,152
2016	175,229,045	478,768	554,905	623,465	685,925	840,581
2017	183,201,480	501,922	564,379	644,691	705,490	757,602
2018	195,668,209	536,077	629,953	686,177	727,557	743,112
2019	207,880,981	569,537	603,010	709,912	755,003	813,473
2020	191,862,017	524,213	635,304	722,216	767,518	846,796
2021	185,130,487	507,207	656,980	729,079	761,087	878,195
Max	207,880,981	569,537	656,980	729,079	767,518	993,152
Average	186,048,172	488,414	576,597	651,673	706,040	833,612

* gpy- gallons per year; & gpd- gallons per day

AAD/ADD
Over the past five years, the overall Average Annual Demand (AAD) and the Average Daily Demand (ADD) water production has ranged from 159 to 207 Million Gallons (MG) per year or approximately 0.437 to 0.569 Million Gallons per Day (MGD). The average water production over this period was approximately 186 MG per year or 0.488 MG per day.

DDD
The Dry Season Daily Demand (DDD) value represents the daily water production during the dry season months (June through October), which includes the highest water demand months (usually July or August). Although this value is not typically calculated for water systems, it is presented in this Plan to allow a comparison of dry season production with available water to be diverted from the City's raw water sources. The DDD over the time period reviewed ranged from approximately 0.555 MGD to 0.657 MGD.

MMD
The Maximum Monthly Demand (MMD) represents the highest flow produced over a month. For the City, the MMD typically occurs in the months of July or August. From the years 2015 to 2021, the MDD ranged from approximately 0.623 to 0.729 MGD. The average MMD flow for this period was 0.652 MGD.

PWD
The Peak Weekly Demand (PWD) is the peak water production over a week. This flow usually occurs during the month of the highest water production (e.g. July or August). The PWD over the last five years has ranged from 0.686 to 0.768 MGD. The average PWD flow for this period was 0.706 MGD.

MDD
The Maximum Monthly Demand (MDD) values given in Table 6.2.2 are the highest daily water production rates for the given time periods. The MDD typically occurs in the month with the peak week of maximum water production. Over the last five years, the MDD has ranged from approximately 0.743 to .993 MGD. The average MDD over this time period was approximately .834 MGD.

Peaking Factor
Peaking factors are commonly used to develop relationships between the ADD and the other planning criteria. These factors are used primarily for calculating future water demand. Peaking factors tend to be similar from one water system to another. Typically, MMD is approximately 1.5 times the ADD while the PWD is generally between 1.5 and 2.0 times the ADD. Peaking factors between 2 and 2.5 are commonly used for MDD. As the DDD is a unique value for this Plan, there are no typical peaking values for comparison.

The peak hourly demand is often used in the computer modeling process to ensure that the storage and distribution system will continue to function during short, peak demand situations. This value may be calculated by plotting the probability of occurrence of demand versus the various water demand values. From this logarithmic plot, the PHD value can be extrapolated.

The PHD was estimated by means of an extrapolation based on probability. Such a projection is based on the principle that an average monthly flow is likely to occur 6/12 of the time or 50 percent, and a peak monthly flow occurs 1/12 of the time or 8.3 percent. Likewise, peak weekly flow will take place 1/52 of the time or 1.9 percent; peak daily flow occurs once in 365 days or 0.27 percent, a peak hour flow happens once in 8,760 hours or 0.011 percent. Using this method and the flow data for the max year of 2019 (MDD equals 0.993 MGD; PWD equals 0.768 MGD; MMD equals 0.729 MGD; ADD equals 0.57 MGD), the PHD for the City was estimated to be 1.07 MGD. The calculated peaking factor (PHD/ADD) is 2.52, which is below the range of peak factors of three to five which is commonly used for PHD. A summary of the calculated flow peaking factors is presented in Table 6.2.3.

TABLE 6.2.3
SUMMARY OF TREATED WATER PRODUCTION PEAKING FACTORS

Treated Water Peaking Factors					
Year	DDD/ADD	MMD/ADD	MDD/ADD	PWD/ADD	PHD/ADD
2015	1.28	1.49	1.61	2.27	2.45
2016	1.16	1.30	1.43	1.76	2.24
2017	1.12	1.28	1.41	1.51	2.14
2018	1.18	1.28	1.36	1.39	2.00
2019	1.07	1.25	1.33	1.43	1.88
2020	1.21	1.38	1.46	1.62	2.05
2021	1.30	1.44	1.50	1.73	2.11
Max	1.15	1.28	1.35	1.74	1.88
Average	1.19	1.35	1.44	1.67	2.21

Water Pumped to the City for Consumption

The water pumped to the City for consumption is equivalent to the water produced at the WTP minus the backwash and miscellaneous usage at the WTP. As miscellaneous usage is not metered at the WTP, this was not accounted for in the data.

In addition to having flow meters on both treatment filters, and a backwash meter, the City also has a flow meter directly downstream of the WTP storage tanks. This meter is intended to measure the flow conveyed to the City and is the only meter that is calibrated on a yearly basis. Ideally the flows tabulated on this meter should be equal to the metered flows from both the treatment units minus the flow used for the backwash processes. However, there is also filter to waste flows that is recorded on the individual filter meters but flows are not going into the system. For these reasons the flow meters on the filters were

not used when developing the various flow tables. A summary of water pumped to the City for the years 2015 through 2019 is shown in Table 6.2.4. The AAD, ADD, MMD, PWD, and MDD were derived from the flow data from the meter next to the storage tank; not including the water used for backwash.

TABLE 6.2.4
ANNUAL, MONTHLY, WEEKLY AND DAILY WATER PUMPED TO THE CITY

Pumped to City						
Year	AAD, gpy	ADD, gpd	DDD, gpd	MMD, gpd	PWD, gpd	MDD, gpd
2015	149,498,347	419,418	526,852	618,316	673,076	918,987
2016	165,039,582	411,944	525,650	591,820	651,540	811,664
2017	171,750,685	402,658	527,720	605,822	672,180	757,602
2018	183,073,101	459,669	591,386	647,409	695,345	743,112
2019	201,825,466	469,325	575,489	673,704	712,348	813,473
2020	182,338,908	477,596	606,219	698,118	746,081	839,977
2021	174,689,056	509,317	629,859	700,062	722,647	853,090
Max	201,825,466	509,317	629,859	700,062	746,081	918,987
Average	167,340,429	423,422	542,902	615,842	673,035	807,841

The average calculated peaking factor (PHD/ADD) is 2., which is slightly lower than the common range of peak factors of three to five used for PHD. A summary of the calculated flow peaking factors is presented in Table 6.2.5.

TABLE 6.2.5
SUMMARY OF TREATED WATER PUMPED TO THE CITY FLOW PEAKING FACTORS

Pumped Water Peaking Factors					
Year	DDD/ADD	MMD/ADD	MDD/ADD	PWD/ADD	PHD/ADD
2015	1.26	1.47	1.60	2.19	2.56
2016	1.28	1.44	1.58	1.97	2.60
2017	1.31	1.50	1.67	1.88	2.66
2018	1.29	1.41	1.51	1.62	2.33
2019	1.23	1.44	1.52	1.73	2.29
2020	1.27	1.46	1.56	1.76	2.25
2021	1.24	1.37	1.42	1.67	2.11
Max	1.24	1.37	1.46	1.80	2.11
Average	1.27	1.44	1.55	1.83	2.40

Water Consumption

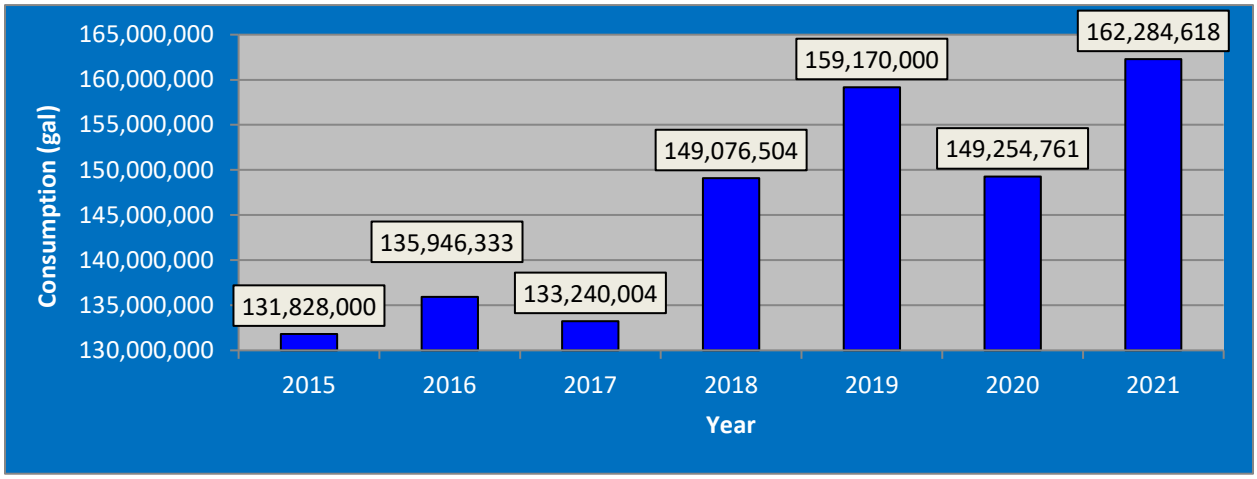
Water consumption or sales records allow for: determination of actual water consumption by the City's water users, calculation of an Equivalent Dwelling Unit (EDU), and provide measurement of non-account water when compared with plant production records.

Water Sales

Water consumption was based on the City's water consumption records for the years 2015 through 2021. A graph of the total annual amount of water sold to customers is presented in Figure 6.2.1.

The largest historical amount of water consumed by the City was in the Year 2021.

FIGURE 6.2.1
TOTAL METERED CONSUMPTION 2015 – 2021



Equivalent Dwelling Units

The number of EDUs, or residential housing units within a system, is determined to calculate the average cost for water services to a typical residence. The average cost per residential connection is not only used to educate the system users but is also used by regulatory and funding agencies for comparing costs with other communities. Since a water system typically consists of commercial, institutional, and industrial users, the most common method of calculating the average residential user cost is to evaluate each source on the basis of water consumption relative to the typical residential account or EDU.

Total metered consumption data for users on the City's system is compiled over a period of time (typically a year). The average water usage per EDU is calculated by dividing the residential water usage by the total number of residential connections on the system. The average EDU value is then used to assess an EDU by dividing the total water usage by the equivalent for the commercial accounts.

For the EDU calculation, the different sources (or sectors) on the City's system were divided into the following categories.

- Residential Inside City (single family dwellings, mobile home parks, multi-family, and assisted living).
- Residential Outside City (single family dwellings, mobile home parks, multi-family, and assisted living).
- Commercial/Industrial Inside City (supermarkets, motels, etc.)
- Commercial/Industrial Outside City (supermarkets, motels, etc.)
- City Use – Inside/Outside City (city shop, parks, buildings, etc.)

The estimated number of EDUs is summarized in Table 6.2.6. The estimated annual residential water consumption, inside the City, per EDU, based upon calendar Year 2021, is 42,000 gallons or 3,500 gallons per month. Residential accounts outside of the City equated to a higher number of EDUs than connections due to being assessed at a higher rate. For commercial accounts, inside and outside of the City, usage per connection and monthly charges were calculated. The monthly charge was compared to the inside City residential monthly charge and adjusted accordingly. Due to the structure of the rate system usage and costs both have to be used to determine the equivalent EDU totals.

TABLE 6.2.6
ESTIMATED NUMBER OF EDUS (YEAR 2021)

Number of Connections	Usage	EDU [1] (gpy)	EDU [2] (gpy) (FUNDING USAGE)
	Annual		
Residential-In City			
1,696	71,247,422	1,696	1,696
Residential-Out of City			
136	5,889,488	188	188
Commercial/Industrial-In City			
382	51,387,030	640	567
Commercial/Industrial-Out of City			
37	6,006,000	90	18
City Use-No Charge			
3	477,678	0	0
City Use-Charge			
54	27,277,000	90	25
Total			
2,242	**162,284,618**	**2,704**	**2,494**

[1] Usage used to determine number of EDUs based on average usage per residence is 42,009 gallons per year.
[2] Usage used to determine number of EDUs based on funding standards is 90,000 gallons per year for commercial accounts only.

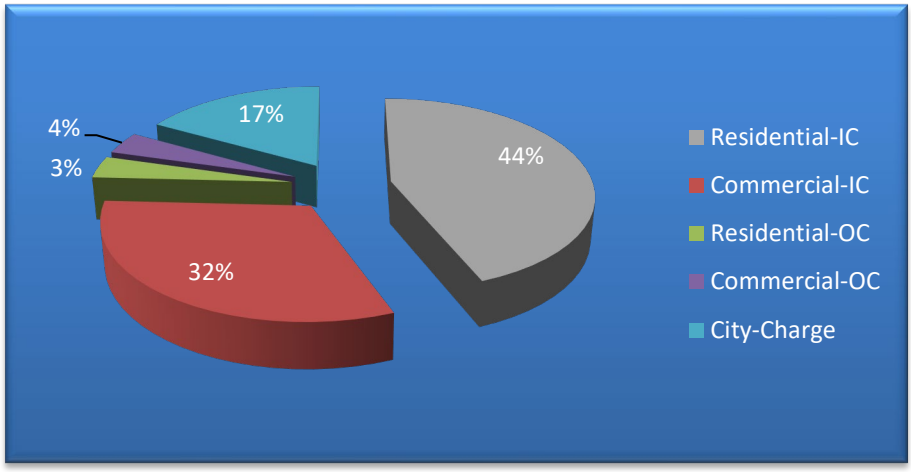
Business Oregon does not recognize the usage per EDU as unique to the specific planning area, but rather employ the use of a more generalized usage rate per EDU. The usage rate they use is 7,500 gallons per month (90,000 gallons per year) per dwelling unit. This is applied to commercial and other accounts only. The net effect is that the number of EDUs goes down due to the larger base usage amount. The other component to the EDU calculations above relates to the current user fee schedule. Fees charged to the different classifications will also affect the number of EDUs.

It should be reiterated that Table 6.2.6 shows the consumption levels per category within the system. All losses, non-account water, and other water uses are not accounted for within the consumption data. Water system planning requires that all water diverted from the source be analyzed and considered as total water system consumption.

Residential sources account for approximately 47 percent of all water consumed within the system. The remaining system users (e.g. commercial, public, and non-profit) utilize 54 percent of the metered water. About eight percent of the service connections are outside the City boundaries. These connections account for seven percent of the City's total water usage. The distribution of EDUs based on water

consumed and cost per average residential unit inside the City is summarized in Table 6.2.6 and shown in Figure 6.2.2.

FIGURE 6.2.2
PERCENT USAGE PER SOURCE



Non-account Water

Water sold is typically less than the amount of that leaving the treated water storage tank due to system leaks, unmetered use at the WTP (backwash water, turbidimeter water, wash down, etc.), unmetered use within the distribution system, inaccuracies in customer meters, and other unmetered use such as fire flows and system flushing. A comparison of the amount of water treated (sum of water pumped to the City) and the amount of water consumed is given in Table 6.2.7.

TABLE 6.2.7
COMPARISON OF WATER PRODUCED, BACKWASH, PUMPED AND CONSUMED

Time Period	Treated Water	Backwash	Water Pumped	Water Consumed	% Non-account [(1)]
2015	159,464,560	9,966,213	153,087,416	131,828,000	12%
2016	175,229,045	10,189,463	150,359,493	135,946,333	18%
2017	183,201,480	11,450,794	146,970,264	133,240,004	22%
2018	195,668,209	12,595,108	167,779,047	149,076,504	19%
2019	207,880,981	11,132,556	196,748,425	159,170,000	19%
2020	191,862,017	9,522,503	182,339,514	149,254,761	18%
2021	185,130,487	9,821,924	175,308,563	162,284,618	7%
Average	178,181,612	10,668,366	154,549,055	145,828,603	16%

[(1)] Percent unaccounted is based on the quotient of the water consumed and water pumped to the City.

Over the last five years, the average amount of non-account water pumped to the City is approximately 13 percent. The variation between the annual non-account percentages could be contributed to the inaccuracy of the flow meters within the distribution system.

Potential sources of lost treated water include the following:

- Leakage within the City's water distribution system.

- Inaccurate water meters.
- Unauthorized use or connections without meters.
- Unmetered water for firefighting and operations such as street cleaning, water main flushing and testing.

The OAR Section 690-86, states that all water systems should work to reduce system leakage levels to 15 percent or less. If the reduction of system leakage to 15 percent is found to be feasible, the water provider should work to reduce system leakage to ten percent. With the amount of non-account water within its system, the City has met regulatory standards and requirements. The City will need to work at reducing the amount of non-accounted water to be consistently within the ten percent mark. Reductions in lost water can result in increased revenues, reduced expenses, and improved water system performance.

Summary

The current water demand parameters for water treated and water pumped to the City were compiled and provided in Table 6.2.8 and 6.2.9. These parameters were based on the maximum value from the years 2015 to 2021 for the water demand data. This water demand criteria will serve as the basis for the planning criteria of this Water Master Plan.

TABLE 6.2.8
SUMMARY OF CURRENT TREATED WATER PRODUCTION

Demand	Total (gpd)	Peaking Factor	Per Capita Demand (gpd)
ADD	569,537	1	170
DDD	656,980	1.15	196
MMD	729,079	1.28	218
PWD	767,518	1.35	230
MDD	993,152	1.74	297

TABLE 6.2.9
SUMMARY OF CURRENT DEMAND OF WATER PUMPED TO THE CITY

Demand	Total (gpd)	Peaking Factor	Per Capita Demand
ADD	509,317	1	152
DDD	629,859	1.29	188
MMD	700,062	1.41	209
PWD	746,081	1.51	223
MDD	918,987	1.62	275

6.3 Projected Water Demand

Water demands are projected to Year 2041 using the past records of water produced and water sold along with projected population estimates and anticipated additional water demand (e.g. industry). The goal of projecting future water demand is not to build larger facilities to accommodate excessive water consumption; but rather to evaluate the capability of existing components and to size new facilities for reasonable demand rates. Large amounts of leakage and excessive water consumption should not be

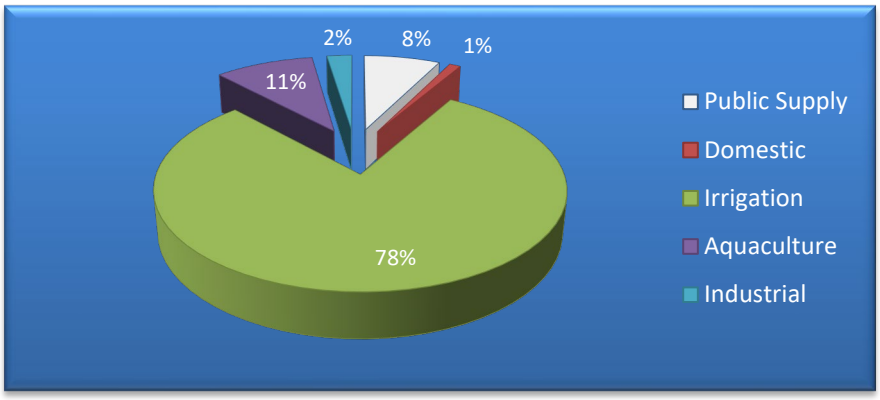
projected into the future estimates. Rather, efforts should be made to reduce leakage and lost water to a reasonable level and utilize lower, more acceptable demand rates for planning efforts. Water demand projections should be based on acceptable water loss quantities, reasonable conservation measures, and the community's expected water use characteristics.

There is a degree of uncertainty associated with future water demand projections for any community. Uncertainties in projections exist because of the estimates used to define the community's current water use and the built-in assumptions made with respect to anticipated growth in a community. The impact of water conservation measures on a community's future water consumption is also difficult to predict.

Future per Capita Water Usage and Growth

The US Department of the Interior 2010 US Geological Survey - Circular 1405 documented the per capita water use in Oregon is 113 gpcd. A total of 6,730 MGD of water was used by Oregon in Year 2010. Total water withdrawals are separated by water use categories. The categories with their representative water use amounts are shown in Figure 6.3.1.

FIGURE 6.3.1
STATE OF OREGON USAGE



Based on treated water records, the average per capita use in the City of Bandon is 170 gpcd. This includes all domestic, commercial, tourist, and City use divided by population. For this Plan, future water demand for water pumped to the City will be based on the current water pumped parameters (per capita usage), projected growth within the City (see Section 3.3), and anticipated unaccounted for water. This methodology assumes that water demand characteristics within the City will basically remain the same as the existing per capita basis with consideration for changes in anticipated non-account water. The future anticipated non-account water is discussed below.

Anticipated Lost Water

Responsible water planning should not include the propagation of high lost water levels into water demand projections. According to OAR 690-86-140, a water system should endeavor to reduce system leakage to 10 percent or less of the total water diverted from their raw water sources. The City's non-account average of 13 percent over the last seven years is slightly higher than optimal, and needs to be addressed. Completion of several project within the Capital Improvement Plan (CIP) developed in Section 10 will help to mitigate water loss.

Future water demand will be based on maximum water production form the Year 2015 through 2021 since flows are measured by the master meter on the line going to town and measured backwash flows.

The master meter is the most accurate of all existing meters since it is the only meter that is calibrated every year.

Summary of Future Water Demand

The ADD projections were calculated by multiplying the projected population (shown in Table 3.3.2) by the per capita usage (170 gpcd). The DDD, MMD, MWD, and PWD were then determined by multiplying the ADD by their respective peaking factors. A summary of the water production demand projections is presented in Table 6.3.1.

TABLE 6.3.1
FUTURE WATER PRODUCTION DEMAND

Parameter/Year	2021	2026	2031	2036	2041
Total Population	3,344	3,463	3,586	3,713	3,845
Water Demand					
ADD	569,537	589,752	610,684	632,359	654,804
DDD	656,980	680,298	704,444	729,447	755,338
MMD	729,079	754,957	781,753	809,500	838,232
PWD	767,518	794,760	822,968	852,178	882,425
MDD	993,152	1,028,402	1,064,904	1,102,701	1,141,840

*Growth rate of 0.7% applied from years 2021 through 2041 reflecting the City of Bandon reducing and users outside.

SECTION 7:

DESIGN CRITERIA AND COST BASIS

SECTION 7: **DESIGN CRITERIA AND COST BASIS**

7.1 Design Life of Improvements

The design life of a water system component is sometimes referred to as its useful life or service life. Design life is based on such factors as the type and intensity of use, type and quality of materials used in construction, and the quality of workmanship during installation. The estimated and actual design life for any particular component may vary depending on the above factors. The establishment of a design life provides a realistic projection of service upon which to base an economic analysis of new capital improvements.

The base planning period for this Water Master Plan is 20-years, ending in the Year 2039. The planning period is the time frame during which the recommended water system is expected to provide sufficient capacity to meet the needs of all anticipated users. The required system capacity is based on population, water demand projections, and land use considerations. The planning period for a water system and the design life for its components may not be identical. For example, a properly maintained steel storage tank may have a design life of 60-years, but the projected fire flow and consumptive water demand for a planning period of 20-years determines its size. At the end of the initial 20-year planning period, water demand may be such that an additional storage tank is required; however, the existing tank with a design life of 60-years would still be useful and remain in service for another 40-years. The typical design life for system components are discussed below.

Raw Water Intakes and Transmission

Intake structures including concrete impoundments should have design lives of 50 to 100-years when properly constructed and maintained. Water transmission piping should easily have a design life of 40 to 60-years if quality materials and workmanship are incorporated into the construction. Modern PVC and cement mortar-lined ductile iron piping can last up to 100-years when properly designed and installed.

Water Treatment Facility

Major structures and buildings should have a design life of approximately 50-years. Pumps and equipment usually have a useful life of about 15 to 20-years. The useful life of treatment equipment can be extended when properly maintained; if additional treatment capacity is not required. Filter media normally has a design life of ten to 15-years. Flow meters typically have a design life of ten to 15-years. Valves usually need to be replaced after 15 to 20-years of use.

Treated Water Transmission and Distribution Piping

Water transmission and distribution piping should easily have a design life of 40 to 60-years if quality materials and workmanship are incorporated into the construction. Modern PVC and cement mortar lined ductile iron piping can last up to 100-years when properly designed and installed. The City does have a lot of asbestos cement pipe that is reaching the end of its design life. Over time this material becomes soft and is subject to failure.

Treated Water Storage

Distribution storage tanks should have a design life of 50 to 60-years (steel construction) to 70 to 80-years (concrete and welded steel construction). Steel tanks with a glass-fused coating can have a design life similar to concrete construction. Actual design life will depend on the quality of materials, the

workmanship during installation, and the timely administration of maintenance activities. Several practices, such as the use of cathodic protection, regular cleaning, and frequent painting can extend or assure the service life of steel reservoirs.

7.2 Sizing and Capacity Criteria

Demand projections presented in Section 6 are based on population projections offered in Section 3. The projections assume an average 0.6 percent annual growth rate until the Year 2039.

Accurately predicting growth is difficult, especially beyond 20-years into the future. As time progresses, all of the projections should be updated to reflect actual population and demand. The analysis and presentation of recommended improvement alternatives can be found in Section 8.

Raw Water Source

The raw water sources and reservoirs must be capable of meeting Maximum Daily Demand (MDD) of the system over a period of 50-years. The selection of a source is a long-term commitment that cannot be easily changed. Water rights are becoming more critical as the State's population and water demand increases; and the number of viable water sources remains constant. In the City's case, the water sources need to be sufficient to handle the water demand during the dry season months (June through October). The appropriate design parameter for this dry season evaluation would be the MDD.

Intake and Raw Water Pumping Facilities

Intake piping and pump facilities are not easily expanded and should be sized to meet, at a minimal, the anticipated MDD well into the future. A design life of 50 years is common for these facilities.

Pumps and other mechanical equipment can be expected to last approximately 15 to 20-years under normal conditions before extensive maintenance or replacement is necessary. Commonly, two pumps are installed in a pumping station, each having capacity equal to the capacity of a Water Treatment Plant or the MDD predicted within a planning period. Duplex pumping systems can be designed to alternate after each cycle to extend the life of the equipment. If future demands increase beyond the ability of a single pump, the second pump can serve as a lag pump in parallel to sustain higher flow rates during peak demand times.

Transmission Piping

The existing transmission lines must have the ability to handle at least the 20-year MDD. The capacity of the raw water and treated water transmission piping will be evaluated against the 20-year MDD.

Water Treatment Facility

Water treatment plants are typically designed to handle the 20-year MDD flow since these facilities can be expanded and typically have an overall design life of around 20-years. The existing treatment plant components will be evaluated against the 20-year MDD flow.

Treated Water Storage

The total treated water storage capacity must include reserve storage for equalization storage, emergency storage, and fire reserve. An alternative method to analyzing the treated water storage requirements

suggests itemizing the potential requirements for treated water within the system. A discussion of these various needs follows.

Equalization Storage

Equalization storage is used to meet fluctuations of the supply capacity of the treatment plant and peak demand of the distribution system. Equalizing storage is typically 25 percent of the MDD of the water system.

Emergency Storage

To protect against a total loss of water supply such as would occur with a broken transmission main, a prolonged electrical outage, treatment plant breakdown, or source contamination emergency storage is required. The emergency storage reserve is set at one MDD or three times the Average Daily Demand (ADD). For the emergency storage calculations it was assumed that supply disruption will occur on a day of maximum demand and be corrected within 24 hours.

Fire Reserve Storage

To provide sufficient water for fire suppression in the water system fire reserve storage is utilized. The amount of fire reserve is based on the maximum flow and duration of flow needed to confine a major fire. Guidelines for determining the required fire flow and duration are generally determined using the "Fire Suppression Rating Schedule" by the Insurance Services Office (ISO) and/or the International Fire Code adopted by the State of Oregon. The needed fire flow and associated fire reserve storage dictated by these two methods can vary considerably.

The ISO needed fire flow is calculated using factors related to type of construction, type of occupancy, exposure to connected buildings, and building affective area. Using their formula a single wood framed dwelling totaling 2,400 square feet would require approximately, 1,000 gallons per minute (gpm) for two hours.

The 2014 Oregon Fire Code recommends fire flows of 1,000 gpm for a minimum of one hour; for one or two family dwellings not exceeding two stories in height or 3,600 square feet. Generally, for rural residential dwellings, 500 gpm is utilized as a basis for fire flow suppression. Most residences within City of Bandon are less than 3,600 square feet. Therefore, for this Plan, the fire reserve storage required for residential areas will be calculated using fire flows of 1,000 gpm and duration of one hour.

Commercial and institutional buildings typically require higher fire flows with longer durations. Determination of these flows are unique to each building under consideration and will depend upon such factors as the square footage of the floor area, and the type of construction based on the International Building Codes (IBC) classifications. For this Plan, commercial areas will be calculated using fire flows of 4,500 gpm and duration of two hours.

Another important design parameter for reservoirs is elevation. Ideally, reservoirs should be located at similar elevations to allow hydraulic balance within the distribution system. Within a given service area, the need for altitude valves, check valves, Pressure Reducing Valves (PRVs), booster pumps, pumper trucks for extracting fire flows, and other control devices is reduced when a consistent water surface is maintained in all reservoirs.

Distribution reservoirs should also be located at an elevation that maintains adequate water pressure throughout the system; sufficient water pressures at high elevations and reasonable pressures at lower

elevations. The pressure range in the system should stay within the range of 25 to 100 pounds per square inch (psi) and never drop below 20 psi at any usage rate.

All of the above criteria will be used to evaluate the adequacy of existing storage and the need, if any, for future additional storage in Section 8.

Distribution System

Distribution mains are typically sized for fire flows and 20-year population demand, or fire flow and saturation development demand. The mains should be at least 6-inch diameter to provide minimum fire flow capacity. All pipelines should be large enough to sustain a minimum line pressure of approximately 20 psi. The State of Oregon requires a water distribution system is designed and installed to maintain a pressure of at least 20 psi at all service connections at all times. The distribution system must be sized to handle the peak hourly flows and to provide fire flows while maintaining minimum pressures.

In addition to the above design criteria, the following general guidelines are recommended for the design of water distribution systems.

- 6-inch diameter lines - minimum size lateral water main for gridiron (looped) system and dead-end mains.

- 6-inch diameter lines - minimum size for permanently dead-ended mains supplying fire hydrants and for minor trunk mains.

- 8-inch and larger diameter - as required for trunk (feeder) mains.

The distribution system lateral mains should be looped whenever possible. A lateral main is defined as a main not exceeding a 6-inch diameter, which is installed to provide water service and fire protection for a local area including the immediately adjacent property. The normal size of lateral mains for single-family residential areas is 6-inch diameter. However, 8-inch diameter or greater lateral mains may be required to meet both the domestic and fire protection needs of an area.

The installation of permanent dead-end mains and dependence of relatively large areas on a single main should be avoided. For the placement of a fire hydrant on a permanently dead-ended main, the minimum size of such laterals should be 6-inch diameter. However, 6-inch diameter mains may be used for a stub out without exceeding 500 feet in length supplying a single fire hydrant not on a public street and for internal fire protection. On new construction, the minimum size lateral main for supplying fire hydrants within public ways should be 6-inch diameter provided 6-inch diameter mains are looped.

A computer model of the distribution system was developed as part of this Water Master Plan. The model utilized actual pipe sizes, system configuration, and materials as well as system pipe junction elevations and storage tank elevations. A computer model of the City's distribution system was checked to determine the maximum flow rate available at various locations within the system. The model was developed using a software program called WaterCAD® CONNECT Edition (Version 10.2) by Haestad Methods.

The requirements for firefighting within the City were developed by consulting with the local Fire Chief. For a detailed discussion of the distribution system performance and fire flow analysis, see Section 8.

7.3 Basis for Cost Estimates

The cost estimates presented in this Plan will typically include four components: construction cost, engineering cost, contingency, and legal and administrative costs. Each of the cost components are discussed in this section. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this WMP. As projects proceed and as site-specific information becomes available, the estimates may require updating. System improvements that are recommended in the City are detailed in this section along with associated costs.

Construction Costs

The estimated construction costs in this Plan are based on actual construction bidding results from similar work, published cost guides, other construction cost experience, and material prices. Reference was made to the as-built drawings, and system maps of the existing facilities to determine construction quantities, elevations of the reservoirs and major components, and locations of distribution lines. Where required, estimates will be based on preliminary layouts of the proposed improvements.

Future changes in the cost of labor, equipment, and materials may justify comparable changes in the cost estimates presented herein. For this reason, common engineering practices usually tie the cost estimates to a particular index that varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) Construction Cost Index is most commonly used. This Index is based on the value of 100 for the Year 1913. Average yearly values for the past ten years are summarized in Table 7.3.1.

TABLE 7.3.1
ENR CONSTRUCTION COST INDEX – 2011 TO 2021 [(1)]

Year	Index	% Change
2011	9,070	3.08%
2012	9,308	2.62%
2013	9,547	2.57%
2014	9,806	2.71%
2015	10,054	2.53%
2016	10,338	2.82%
2017	10,737	3.86%
2018	11,062	3.02%
2019	11,281	1.98%
2020	11,466	1.64%
2021	12,133	5.82%
	Average Annual	2.97%

(1) Index based on July of each year at 20-City average labor rates and material prices.

Cost estimates presented in this Plan for construction performed should be projected with a minimum increase of three percent per year. Between 2020 and 2021 the precent change was 5.82 percent Based on projects bid in 2021 and 2022 prices have increased by over ten percent. With the continued problems with the supply chain we anticipate project costs to increase by 15 to 20 percent. Future yearly ENR Indices can be used to calculate the cost of projects for their construction year based on the annual growth in the ENR Index but also look at costs of projects bid for similar work within the last eighteen months.

It is also recommended that in the event other public works projects are being performed in the same location, (sewer, street, storm, etc.), planning priority be given to combining these water projects with the projects at hand. By proceeding in this manner, the City will save money by eliminating repetitive mobilization, demolition, and road patching for the same locations.

Contingencies

A planning level contingency equal to approximately 15 percent of the estimated construction cost has been added. In recognition that the cost estimates presented are based on conceptual planning, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties which cannot be foreseen at this time but may tend to increase final costs.

Engineering

The cost of engineering services for major projects typically includes special investigations, a predesign report, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, startup services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 15 to 25 percent of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated projects.

Additional engineering services may be required for specialized projects. This could include geotechnical evaluations, Environmental Reports, structural evaluations, and other specialized consulting activities.

Legal and Administrative

An allowance of four percent of construction costs has been added for legal and administrative services. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim loan financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

Land Acquisition

Some projects may require the acquisition of additional right-of-way or property for construction of a specific improvement. The need and cost for such expenditures is difficult to predict and must be reviewed as a project is developed. Efforts were made to include costs for land acquisition, where expected, within the cost estimates included in this Plan.

Environmental Review

In order for a project to be eligible for Federal and/or State grants and loans, a review of anticipated environmental impacts of the proposed improvements is required. The primary goal of the environmental review is to help public officials make decisions that are based on the understanding and consideration of the environmental consequences of their actions; and to take actions that protect, restore, and enhance the environment. To accomplish these tasks, the National Environmental Policy Act (NEPA) was promulgated.

The NEPA requires Federal agencies or monies originating from Federal programs to either prepare or have prepared written assessments or statements that describe the:

- Effected environment and environmental consequences of a proposed project.
- Reasonable or practicable alternatives to the proposed project.
- Any mitigation measures necessary to avoid or minimize adverse environmental effects.

The environmental review includes one of the following four levels in the order of increasing complexity.

- Determination of categorical exclusion without an environmental impact or assessment report.
- Determination of categorical exclusion with an environmental impact or assessment report.
- Preparation of an environmental impact or assessment report.
- Preparation of an environmental impact statement.

Within this Plan, the cost for performing the anticipated environmental review was estimated for the projects to be financed with publicly financed grants and loans. The cost for the environmental review will be based on previous experience in preparing the required documents. If funding is obtained from a public funding agency, then the City will likely be required to submit some form of Environmental Report that examines the potential impact of the proposed improvements on local habitat and species. Review and approval by the affected agencies could take up to twelve months or more.

Permitting

Permitting is important because many activities associated with constructing and maintaining the water system requires permits to comply with State and Federal requirements for work within wetland areas or waterways. Typically, Oregon Division of State Lands and US Corps of Engineers are required in these instances. Compliance with storm water, erosion control, flood plain, and other various environmental requirements are often involved with the construction of transmission lines, raw water intakes, discharge facilities, raw and finished water reservoirs, and other items. For the cost estimates prepared in this WMP, it was assumed that the General Contractor would bear the cost of all permitting. Therefore, no permitting costs are included in these estimations.

SECTION 8:

ANALYSIS AND IMPROVEMENT ALTERNATIVES

SECTION 8: ANALYSIS AND IMPROVEMENT ALTERNATIVES

This section of the Water Master Plan (WMP) presents detailed analyses of each major component within the system and where appropriate, provides an evaluation of proposed alternatives and recommended option(s). Cost estimates for the recommended improvements are given in the Capital Improvement Plan, Section 9. Improvement phasing and potential impacts to ratepayers are discussed in Section 10.

8.1 Water Rights

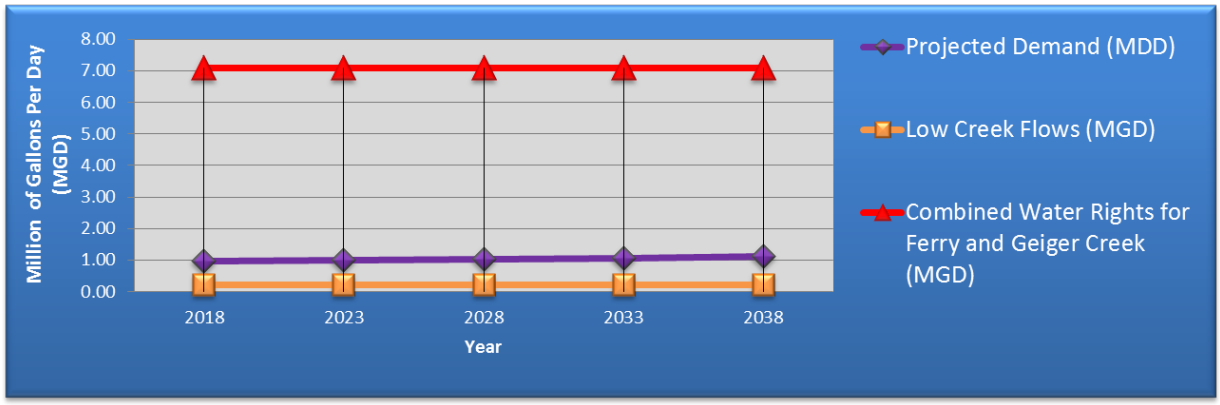
The City of Bandon is permitted to withdraw water with the following Permits 3011, 27232 and 27233; and below the point of confluence of Ferry Creek and Geiger Creek through Permit Amendment 8195 issued March 29, 2000. This point of diversion is typically used during low flow periods occurring during late summer early fall months. The purposed for developing this point of diversion was to avoid conflicts with the fish hatchery that has a senior water right of 3.0 cubic feet per second (cfs) prior to City use. The fish hatchery's water right is for water flowing through the hatchery and not for consumption which allows the City to draw water below the 3.0 cfs during low flow periods.

The two lowest recorded flows in Ferry Creek were 0.8 cfs in October 1977 and 0.4 cfs in October 1978. There were a total of seven days in October 1977 where the average flow was 0.80 cfs.

The total water supply available to the City in Ferry and Geiger Creeks has been as low as 0.80 cfs for up to a week during a dry month. This supply will consist of water that has passed through the hatchery fish pens from both Ferry and Geiger Creeks and was diverted downstream of the confluence of the two creeks by means of the Low Flow Pump Station.

The current water use projections as developed in Section 6 indicated a Maximum Daily Demand (MDD) of 0.980 Million Gallons per Day (MGD) or 1.52 cfs (MDD) for Year 2019 increasing to 1.11 MGD or 1.70 cfs by Year 2039. The single day demand exceeding the supply stream could be met by tank storage or impoundment reservoir storage for a few days. On a maximum month basis in Year 2039, the City is projected to require 1.33 cfs per day for a thirty day period. In summary, Ferry and Geiger Creeks have recorded flows significantly less than this for a seven day period. Refer to Figure 8.1.1 water right comparison versus projected MDD versus recorded low raw water flows.

FIGURE 8.1.1
WATER RIGHT COMPARISON



The numbers stated for MDD and Maximum Monthly Demand (MMD) is based on water production records. The raw water diverted is another parameter that needs to be considered. Raw water diversion averaged 0.755 MGD or 1.17 cfs for 2019. Historic records show that there are periods when that amount

of water is not available. The raw water flow meter was just replaced and a data base needs to be developed over time before diverted raw water values can be used in the decision process.

Therefore, the existing raw water supply source from Ferry and Geiger Creeks has provided adequate water during the maximum demand month for the last thirty plus years. However, historic records show that if the City experiences low flows as recorded in 1977 and 1978 there would be a serious water shortage. Based on the projected MDD, the City's existing water rights on Ferry and Geiger Creeks are sufficient to meet the City's demand through the planning period and well beyond. This does not mean the water will be available.

8.2 Raw Water Sources

Raw Water Pump Stations

The Middle Pond Pump Station requires upgrades to provide capacity and system reliability. To improve capacity the pumps at the Middle Pond Pump Station should be replaced to allow for 1,400 gallons per minute (gpm) flow and redundancy. A flow meter should also be placed at the Pump Station to provide a reading of water entering and being pumped to the Water Treatment Plant (WTP). Next, the current ventilation system does not provide adequate air flow and an exhaust fan should be installed to increase air movement inside the Pump Station. The Pump Station also does not have any electrical backup if local power becomes unavailable. Backup power is needed to provide the ability to pump water when there is a power outage. The WTP also lacks backup power. It is recommended that the backup generator is added at the WTP site also provide emergency power to the Middle Pond Pump Station. Finally, the dock at the Middle Pond needs replacement, a small wooden dock would be sufficient.

The Lower Pump Station requires upgrades to provide capacity. To improve capacity the pumps at the Lower Pump Station should be replaced to allow for 1,400 gpm flow and redundancy. A backup generator should be installed to provide the ability to pump water when there is a power outage. Next, the current ventilation system does not provide adequate air flow and an exhaust fan should be installed to increase air movement inside the Pump Station.

The Pump Station on Ferry Creek, low flow diversion point, currently has no emergency power source and should be connected to a backup generator for power in emergency situations. The backup generator for the Lower Pump Station could also be used for this Pump Station since the Pump Stations should not be running at the same time.

Raw Water Storage

Ferry Creek and Geiger Creek convey surface and base flow to two small existing dams that impound raw water within the watershed. A capacity survey in 2014 indicated that together they store approximately 3.38 acre-feet of raw water. These two dams are considered balancing reservoirs and are capable of supplying the raw water demand for approximately 2.5 days during normal conditions. Balancing reservoirs are intended to supply immediate fluctuations in water demand and do not impound water as a long term supply source. Both balancing reservoirs supply raw water to a small settling pond called Middle Pond. Raw water is pumped from Middle Pond to the City of Bandon's Water Treatment Plant for municipal use.

In 2016 the City began evaluating alternatives to address the insufficient emergency water supply. It was found that Ferry Creek and Geiger Creek dams were owned by the Oregon Department of Fish & Wildlife (ODFW) during this investigation. The ODFW also determined that the dams were unsafe. Since that time repairs have been made to remove this classification.

Off-Channel Reservoir

In October of 2016 the 'Off-Channel Reservoir Feasibility Study' was completed. This study discussed the feasibility of developing a reservoir that could provide the City with water during extreme drought conditions. The Off-Channel Reservoir would be considered an impounding or storage reservoir. Storage reservoirs are intended to divert and store raw water during high flow conditions and then use the stored raw water during low flow conditions.

The study evaluated the need for and developed the schedule for creek flow augmentation, and compared raw water availability with future demand projections. The analysis showed that in extreme drought conditions, the water available for diversion could not meet the projected demands. Additionally, after accounting for fish passage flow requirements, it was concluded that streamflow augmentation was needed. Once the need for an Off-Channel Reservoir was determined, a diversion/augmentation schedule was developed in which 108 days were designated for available water diversion, and 143 days were designated for streamflow augmentation.

The recommended reservoir would be approximately 11.5 acres in size, six to eight feet higher than the average base elevation, and approximately 16 feet deep. The reservoir was sized to hold a maximum of 100 acre-feet of water. While augmenting during summer months, the reservoir storage reaches its minimum volume of 45 acre-feet before recharging.

The Off-Channel Reservoir supply water would be diverted from Ferry Creek utilizing the City's existing Low Flow Pump Station. Diverted water would be pumped to the reservoir in a new 12-inch diameter pipe located within a utility easement and parallel to the City's existing treated water main. Water from the Off-Channel Reservoir would gravity flow to the creek while augmenting creek flows, and would gravity flow to the Low Flow Pump Station, and subsequently be pumped to the Middle Pond for City use when operating as an emergency water supply.

Assuming the following: the reservoir is at its minimum volume (45 acre-feet); there is no available flow for diversion from the creeks; the system demand is equal to the 2041 Dry Season Daily Demand (DDD); and the Off-Channel Reservoir combined with the existing reservoirs would be able to provide approximately 24 days of raw water supply. This varies from the study's 30 day supply estimate as the demand projections have been updated. In the event of an extreme drought, it is likely that the City would require some form of water curtailment. If it was assumed that the water usage dropped to the 2036 Average Daily Demand (ADD) as a result of the curtailment. Usage would typically have a more significant drop when under curtailment. The reservoir would provide approximately 28 days of storage.

Wells

Ground water was also evaluated to determine if this could be a viable water source during low flow conditions. In May 2022 the Supplemental Groundwater Supply Feasibility Evaluation was completed. This study discussed the feasibility of developing a well field that could provide the City with water during extreme drought conditions.

The study evaluated the local and regional hydrogeologic setting with one geologic unit, marine terrace deposits, appearing favorable for the development of a supplemental groundwater supply with a 30 day capacity of 300 to 500 gpm. The study anticipates that a single new properly designed waster supply well could potentially achieve a yield of 75 to 100 gpm, presuming that at least 50 feet of saturated and screenable aquifer material is present at specific well sites. Based on the assumptions a total of three to six wells would be necessary to meet the target capacity.

The preferred well field site is located in the vicinity of the existing water treatment facility. A total of six wells are shown. Two other well field sites were located on the north and south sides of the Ferry Creek Reservoir. If the wells were developed a new groundwater permit would have to be applied for.

Oregon Water Resources Department (OWRD) is likely to find the following with respect to the department's review criteria for new groundwater permits:

1. **Whether Water is Available.** Although groundwater is available for the proposed use, the use would have the Potential to Cause Substantial Interference (PSI) with surface water, and additional surface water use is not available any month of the year. The OWRD is expected to find that water is not available for the proposed use.

2. **Basin Program Rules.** The use of groundwater for municipal use is consistent with the basin program rules.

3. **Injury to Existing Water Rights.** There is uncertainty as to whether the proposed use would cause injury to existing water users. These uncertainties can only be resolved after an application has been submitted and OWRD's groundwater section has completed its review. Based on GSI's estimations of pumping interference from a new full-scale wellfield, two existing water users would be impacted, which are discussed below:

   – **ODFW Fish Hatchery.** The Oregon Department of Fish and Wildlife's (ODFW's) hatchery has a water right certificate for non-consumptive use of water from Ferry Creek. The ODFW's Water Right Certificate No. 7904 has a priority date of July 20, 1925, which is junior to some of the City's existing water rights (including Certificate No. 9754, see Section 3.3). GSI indicated it is unlikely that OWRD would determine that a full-scale wellfield would cause injury to ODFW's fish hatchery because a groundwater system by nature will result in less direct stream depletion than the City's existing surface water intakes on Ferry Creek.

   – **Exempt (Domestic) Wells.** There are existing exempt (domestic) wells located a few hundred feet north of the City's Water Treatment Plant (along Houston Lane, Melton Road). These wells are exempt from needing a water right to use groundwater. Some of these wells are shallow (less than 50 feet). Therefore, pumping interference from a full-scale wellfield could preclude the exempt wells from obtaining groundwater. GSI suggests it is possible that OWRD would determine that there may be injury to existing exempt (domestic) wells from a full-scale wellfield depending on where the wells are located. New wells located near the City's Water Treatment Plant would likely cause injury to the exempt wells while new wells located south of Ferry Creek would not likely result in injury to the exempt wells.

4. **Consistency with OWRD Administrative Rules.** As part of their evaluation under the Division 33 rules, ODFW and the Department of Environmental Quality (DEQ) would be expected to recommend either denial of the application or require that the City provide mitigation to address impacts to listed fish species in the affected surface water source.

Based on the expected finding that water is not available for the proposed use, and expected recommendations from ODFW and DEQ, OWRD would likely deny an application for a new municipal groundwater permit from wells in the area of the City. One option to potentially change this outcome could be to provide mitigation to offset the impacts to surface water, as described below.

To obtain a new groundwater permit, the City would likely need to resolve the concerns described above regarding PSI, surface water not being available, and impacts to listed fish species. Historically, the method to resolve these issues has typically been to provide mitigation. Mitigation has been provided in the form of transferring a surface water right instream in the affected surface water source, or possibly cancelling a water right certificate that authorizes use from the affected surface water source. However, OWRD has very recently announced that it will generally not accept mitigation when water is not available. Further discussions with OWRD are recommended to determine if the agency would accept mitigation in this situation.

8.3 Water Treatment Facilities

Water Treatment Plant Operations and Building Improvements

The Water Treatment Plant deficiencies are typically related to insufficient capacity, or poor condition of existing facilities. The WTP capacity relative to projected demands, and the general condition and functionality of the existing WTP were assessed and are discussed below.

The maximum day demand is projected to be 1,106,428 gallons per day by Year 2039. The Water Treatment Plant is rated and capable of treating up to 2,000,000 gallons per day in its present condition. Therefore, assuming timely maintenance and upkeep, no major improvements or expansions are anticipated as being required during the next 20-year period.

One of the two clarifiers at the WTP is aged, is not functioning correctly, and cannot be relied on for normal operation. Replacing the clarifier will provide redundancy to the system and would facilitate continued water treatment while completing maintenance tasks on the unit in service. This improvement would also allow the City of Bandon to treat larger volumes of water and prepare for possible future expansion. The bond issue the City passed in 2019 included monies for a new second clarifier. In 2020 the Oregon Structural Specialty Code replaced ASCE 7-10 with ASCE 7-16 as the basis for structural design. The net result of this change is a glass fused to steel tank is no longer an option for the new clarifier. The glass fused to steel tank manufactures can not meet the new code for the connection of the tank to concrete footing without adding a steel bottom. The steel bottom is not an option since the base needs to be cone shaped to collect solids. The only option for the new clarifier is to replace the existing concrete clarifier with a new concrete clarifier that meets the new structural codes. The change in materials is estimated to add an additional $1,200,000 to the overall total project cost.

The existing raw water clarifier currently in service is a glass fused to steel bolted steel tank blue in color. The tanks surfaces exposed to sunlight rise in temperature causing an inversion within the tank during the warm summer months. This inversion creates a thermal movement of settled particles from the bottom of the tank to the surface. The net result is turbidity to the plant which increases or creates problems with treatment. The City installed an exterior barrier on the south side of the tank in 2019 thus greatly reducing the temperature inversion.

Although overall conditions at the WTP are good, there are some improvements that would increase the functionality of the facility. The plant was designed to have a streaming current meter located just prior to the clarifier. The streaming current monitor was added in 2021 to improve the efficiency of the chemical feed systems. The raw water flow meter was replaced in 2020. These two instrumentation upgrades eliminated the chemical feed issues. The City should provide a roof over the top of the outdoor filter

basins to block the sunlight and prevent algal growth. It was originally recommended to provide three backup generators to provide standby power at the WTP, Middle Pond Pump Station and Lower Pump Station to provide the ability to treat water when there is a power outage. The City is now in the process of designing a system with only one generator that would provide power for the three facilities listed but also the Low Water Pump Station, Fish Hatchery and several residential dwellings. Finally, the proposed upgrades to the plant will require Programmable Logic Controller (PLC) modifications to the Supervisory Control and Data Acquisition (SCADA) system.

The WTP building overall is in good condition but the flooring in the front office is deteriorating and needs replacement to provide a safe working environment. Additionally, a new sample island in the laboratory will allow for additional storage and increased organization of laboratory equipment.

8.4 Treated Water Storage

Two tanks provide treated water storage totaling 3,000,000 gallons. One tank stores one million gallons and the other stores two million gallons. Both tanks require general rehabilitation. The one million gallon tank needs interior recoating. The two million gallon tank needs both the interior and exterior recoated. In addition to the rehabilitation of both tanks, the two million gallon tank needs seismic improvements to maintain a viable water source in the event of an earthquake.

The interior coating and seismic improvements to the two million gallon tank was bid in December 2021. The bid came within budget but the projects were not awarded due to the anticipated delivery date for the seismic monitoring equipment. Materials were not due on-site until June 2022 which would not allow for the reservoir to be taken off line due to the heavy summer months demand. The City has purchased the seismic monitoring equipment and the project will be rebid in December 2022.

Design Storage Capacity

There are three parameters used to determine the treated water storage requirements of a given water system. These parameters are defined as follows:

1. Equalization was set at 25 percent of MDD.

2. Emergency storage was set at one MDD (Treated water delivered to City).

3. Fire flow was set at 4,500 gpm for a two hour duration.

The MDD for the individual reservoir assessments was based on the MDD per capita, and the population served in each service area. An analysis of this required storage is shown in Table 8.4.1.

TABLE 8.4.1
ENTIRE SYSTEM FIRE FLOW ASSESSMENTS

Parameter/year	2021	2026	2031	2036	2041
Water Demand (GPD)					
MMD	993,152	1,028,402	1,064,904	1,102,701	1,141,840
Necessary Storage (gal)					
Emergency Storage (1 x MDD)	993,152	1,028,402	1,064,904	1,102,701	1,141,840
Equalization (.25 x MDD)	248,288	257,101	266,226	275,675	285,460
Fire Reserve (4500 GPM @ 2 Hours)	540,000	540,000	540,000	540,000	540,000
Total Required Storage	1,781,440	1,825,503	1,871,130	1,918,376	1,967,300
Storage Assessment (gal)					
Existing Storage	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Surplus Storage	1,218,560	1,174,497	1,128,870	1,081,624	1,032,700

Recommended Storage Improvements

Although an additional reservoir is not required based on storage capacity, it is recommended that the City of Bandon construct an additional 250,000 gallons of storage approximately one third of a mile NW of Seabird and Beach Loop for equalization in the southern portion of the City. This reservoir would provide emergency water to the surrounding area if it was cut off from the primary reservoirs at the WTP due to broken water lines during a seismic event.

Corrosion was noted on the interior of both the one and two million gallon tanks and on the exterior of the two million gallon tank during the last reservoir inspections. Both tanks are not outfitted with seismic features. The two million gallon tank deficiencies are being addressed. After the larger tank is upgrade focus should be on upgrading the one million gallon reservoir.

8.5 Distribution System

A hydraulic model was utilized to assist in evaluating the capability of the City's existing water system in providing proper water flows (primarily fire flow) to selected areas. The basis for and results from the hydraulic model along with proposed water distribution system improvements are discussed below.

Hydraulic Modeling

With the advent of computer hydraulic models, an entire municipal water system can be mathematically analyzed with respect to existing hydraulic characteristics and "what if" scenarios. The mapping, calibration, and analysis of the City's water distribution system using a computer hydraulic model are discussed below.

The existing distribution piping network was evaluated with a computer model; specifically, WaterCAD software by Haestad Methods. WaterCAD is a state-of-the art software tool primarily used in the analysis and modeling of water distribution systems. This program employs mathematical algorithms based on hydraulic principles to predict system pressures and flow rates within a water system. Fire flows are of particular interest since the magnitude of these flows dictates the necessary hydraulic capacity of the water system.

Calibration of Computer Model

Information on the current operating parameters of the distribution system were entered into the computer model. Input parameters included daily system flows, pump flow rates, flow curves, and operating pressures at pump stations and water treatment plants. User demand was more or less allocated evenly to each node of the existing system. A more refined allocation of the demand is not necessary based upon the projected user demand even at peak flows; it is substantially less than fire flow requirements.

A model is a representation of an existing system used to predict the behavior of the system based upon real changes. A model is only useful if it can be calibrated and validated. The accuracy of the model output with existing conditions was checked or calibrated using water pressures and flows observed and collected in the field by the City's Fire Department. The hydraulic model solves for pressures and flows available in the main lines and not from hydrants. Pressures were calibrated for the system first by adjusting friction factors until the pressures in the model closely approximated measured pressures in the real system. In general, calibration is within approximately plus or minus ten percent; which is considered a reasonable level of accuracy given the uncertainties in the model data.

Hydraulic Analysis of the Existing System

The existing distribution system was modeled using a hydraulic computer modeling software. This model included current piping, Pump Stations, reservoirs, and the Water Treatment Plant. The model contained 380 pipe elements and 306 nodes or junctions. Due to adequate system pressures and a relatively well-looped distribution network, hydraulic performance of the system is adequate in most areas. Residual pressures of 20 pounds per square inch (psi) were used as a constraint on the system. This is a requirement of the Oregon Health Authority. Greater fire flows may be attained due to the lack of this constraint in the physical system.

Performance of the distribution system with respect to maximum available fire flow capabilities was specifically examined at selected vital areas within the City that were identified with the assistance of the City's Fire Department staff. The locations examined were chosen for a number of reasons including potential fire suppression, representation of a portion of the City, and identification of potentially undersized lines. The actual fire flow requirements for each of these vital areas were determined using the 2018 International Fire Code, and compared to the available fire flow.

The fire flow model was run with the requirement of maintaining minimum residual pressures of 20 psi throughout the system during a fire flow event. A map displaying existing fire hydrant locations can be found in Figure 8.5.1. Existing fire flows throughout the City are shown in Figure 8.5.2.

Table 8.5.1 lists critical facilities in the City of Bandon, their required fire flow based on Oregon State Fire Code and current available fire flow. It was assumed that each building was a Type IIA or IIIA building construction. The only facilities that had fire suppression systems in place was the Southern Coos Hospital and Health Center. Fire flow available is based on the WaterCAD model and the fire flow metered came from the 2006 meter readings provided by the City.

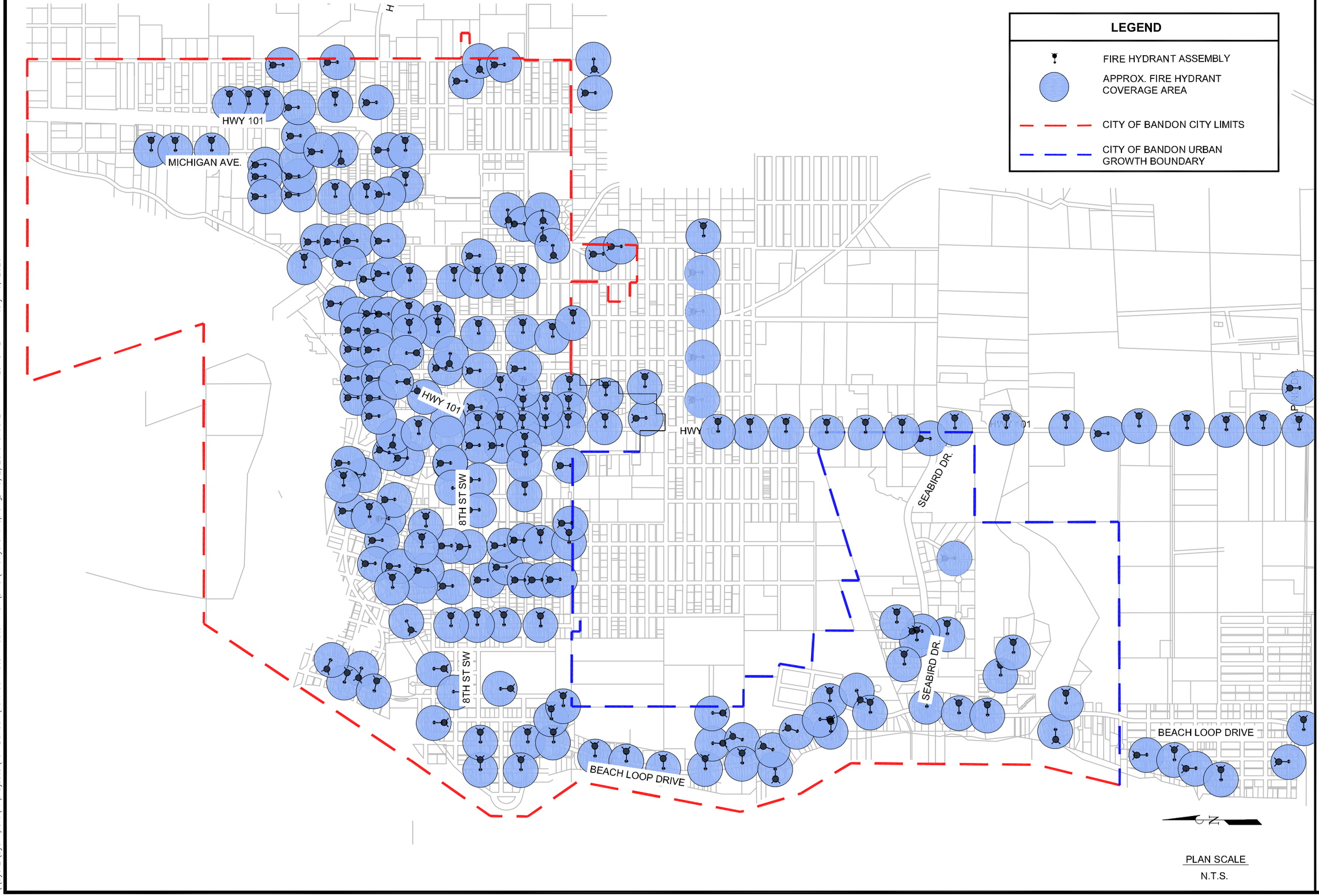


FIGURE NO. 8.5.1

CITY OF BANDON WATER MASTER PLAN

FIRE HYDRANT MAP

THE DYER PARTNERSHIP ENGINEERS & PLANNERS

DATE: JULY 2020

PROJECT NO.: 101.100

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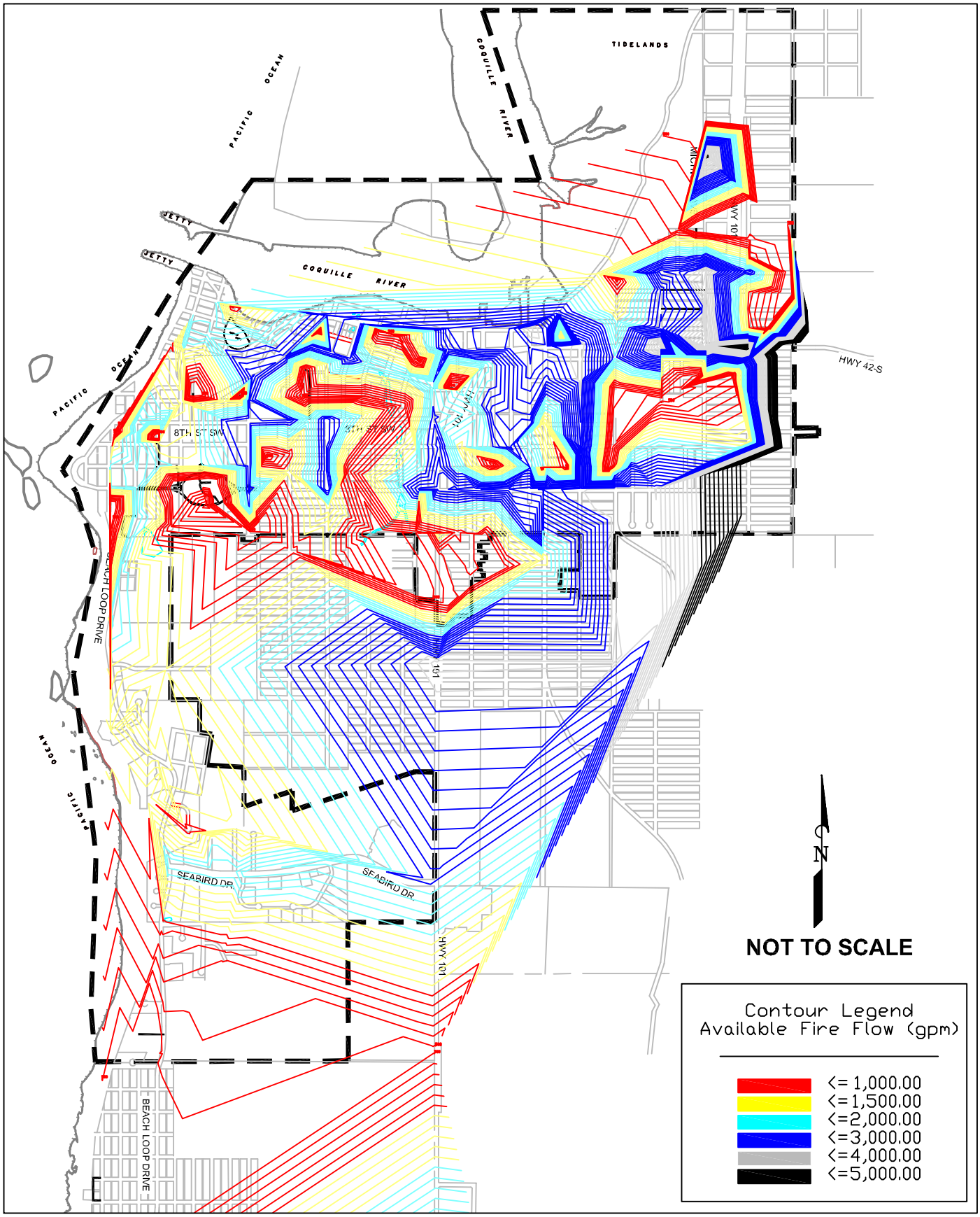


THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN***	FIGURE NO. ***8.5.2***
DATE: JULY 2020 PROJECT NO.: 101.100	***EXISTING WATER SYSTEM FIRE FLOWS***	

TABLE 8.5.1
FIRE FLOW PARAMETERS FOR VITAL AREAS

Location	Required Flow (gpm)	Fire Flow Available (gpm)	Fire Flow-Meter Reading (gpm)	Amount Deficient
Harbor Lights Middle School	3,000	2,145	N/A	957
Bandon High School	3,000	1,997	N/A	1,116
Ocean Crest Elementary School	2,750	2,801	N/A	538
Fire Department	2,000	315	358	1,357
Shopping Center	3,500	3,623	N/A	N/A
Southern Coos Hospital and Health Center	2,250	3,136	N/A	N/A
Coast Community Health Center	1,500	3,915	N/A	N/A
Bandon Inn	1,750	2,463	N/A	N/A
LaKris Inn	1,500	2,366	955	N/A
Sunset Oceanfront Lodging	2,250	1,817	582	895
Lighthouse Cove Inn	1,500	2,777	955	N/A
Best Western at Face Rock	3,250	917	N/A	2,843
Windermere on the Beach	1,750	917	N/A	1,343
Table Rock Motel	1,500	1,799	N/A	N/A
Shooting Star Motel	1,500	683	358	797

Fire Flow Water Line Improvements

Based on the results from the computer hydraulic model, and discussions with City Staff, several proposed improvements were identified for the City's distribution system. Fire flow improvements either improve looping within the distribution system, or increases pipe sizes. Both methods increase fire flows within the distribution system. These proposed improvements are discussed below.

Looping Improvements

Chicago - 9th to 10th: This project will increase fire flows along 9th and 10th Streets and to the surrounding area, and includes construction of a 6-inch line extension on Chicago between 9th and 10th Streets.

***9th Street Extension to Jackson Avenue*:** This project will increase fire flows to the area between 8th and 11th and Jackson and Franklin and consists of a 6-inch line extension of the existing 4-inch line on 9th Street, west to Jackson Avenue.

2nd W Street Extension - Douglas to Edison: This project will increase the fire flows along 2nd Street between Douglas and Edison and to the surrounding area, and consists of a 6-inch line extension westward of the existing 4-inch line on 2nd W line between Douglas and Edison.

***Baltimore Avenue Extension South*:** This project will increase the fire flows along Baltimore Avenue and to the surrounding area, and includes the construction of an 8-inch line south on Baltimore from 17th Street to connection with the southern loop 12-inch line on 20th Street.

***Douglas and Bandon Extension to 8th Street*:** This project will increase the fire flows along Douglas Street and Bandon Street and to the surrounding area, and includes the construction of 6-inch line extensions on Douglas and Bandon Streets to 8th Street.

***Franklin - 24th to Seabird*:** This project will increase the fire flows along Franklin Avenue and to the surrounding area, and includes the extension of an 8-inch line on Franklin Avenue continues south for connection with the east-west existing 8-inch line on Seabird.

***Face Rock Extension to South Loop Line by 24th Street*:** This project completes a loop with construction of an east-west 12-inch line extension from the existing 8-inch Face Rock line. This new water line is near the recommended new reservoir. This looping will facilitate better distribution of this stored water.

Jackson - 24th to New South Tank Line: This will increase the fire flows along Jackson Street, and the surrounding area. This new water line is near the recommended new reservoir. This project includes the construction of an 8-inch line along Jackson Street extending south from 24th Street to the connection with the new tank feed line. This will complete connection with the east-west existing 8-inch line on Seabird and complete a sub-loop within the southern service area.

Polaris to Beach Loop: This project improves fire flow delivery to the cul-de-sac. This project extends the 8-inch line on Polaris Street back to the 6-inch Beach Loop line to complete a loop through the south subdivision area.

Pipe Upsizing Improvements

***8th Street - Oregon Avenue to Franklin Avenue*:** This project increases the fire flow to Harbor Lights Middle School and Bandon High School. The project is on 8th Street, and includes an 8-inch line replacing the existing 6-inch line between Oregon Avenue and continuing west to Franklin for ultimate connection with the north-south line extension on Franklin Avenue.

Beach Loop Road - Seabird Lane to Best Western: This project will provide necessary fire flow to two hotels south of Seabird along Beach Loop. The project is on Beach Loop Road, a 10-inch line replacing the existing 6-inch line from just south of Seabird Lane to the water line connection for the Best Western Inn at Face Rock Hotel.

***13th Street - Franklin Avenue to Allegheny Avenue*:** This project will provide necessary fire flows to the Rural Fire Department and a motel. This project is on 13th Street, and includes an 8-inch line replacement of the existing 4-inch line between Franklin Avenue and Allegheny, then turning south to run to the dead-end of Allegheny Avenue.

***Ohio Avenue - Highway 42S to 10th Street NE*:** In order to provide adequate fire protection in the northern portion of the Urban Growth Boundary, expansion of the City of Bandon's distribution system will generally involve completion of a 12-inch main line north along Ohio, west on 10th Street NE and southwest on River Drive, completing a loop in the northeast portion of the Urban Growth Boundary. This portion of the loop will significantly increase fire flows on streets east of US Highway 101 and north of Highway 42S.

10th Street NE - Michigan Avenue to Ohio Avenue: A key segment of the northern loop discussed above is construction of a 12-inch main line between Michigan Avenue and Ohio Avenue.

Jackson - 12th to Face Rock: This project increases fire flows along and around Jackson Avenue and includes an 8-inch line extension south from the existing 8-inch line on 12th Street for ultimate connection

with the east-west Face Rock extension is proposed. This project eliminates a developing "bottleneck" between 12th and 13th Streets.

***Michigan Avenue to Caroline Street*:** This project will increase fire flow in the neighborhood around Michigan Avenue and Caroline Street, and will include construction of a new line that will replace the existing 4-inch and 6-inch line from the intersection of 4th and Michigan Avenue and winding through the neighborhood and terminating at the intersection of Caroline Street and Harlem Avenue.

***13th Street – US HWY 101 to Delaware*:** This project will increases the fire flows along 13th Street and includes completion of a 6-inch water line and replacement of a 4-inch line on 13th Street between US Highway 101 and Baltimore; and a 6-inch water line from Baltimore to Chicago to Delaware.

North Avenue - 3rd SE to 4th SE & June, Klamath, and Lexington: This project involves completion of a local loop in the eastern service area just south of Highway 42S. This will increase the fire flows along and around North Avenue between 3rd and 4th Street.

9th Street - Jackson to Beach Loop: This project significantly improves fire flow delivery to the western part of developed areas within the City of Bandon. This project completes a 10-inch line through town connection with Beach Loop by way of 11th, Jackson and 9th.

***US HWY 101 - 13th to 14th & 15th to 17th*:** This project will increase the fire flows along US Highway 101 and includes construction of 6-inch line sections on US Highway 101 between: 13th and 14th; 15th to 17th; and then east on 17th to connection with the existing 6-inch line.

***Franklin - 11th to 13th*:** This project eliminates a developing "bottleneck" between 11th and 13th Streets. The project is on Franklin Avenue and includes an 8-inch line extension south from the existing 10-inch line on 11th Street to 13th Street.

Polaris to Beach Loop: This project improves fire flow delivery to the cul-de-sac. This project extends the 8-inch line on Polaris Street back to the 6-inch Beach Loop line to complete a loop through the south subdivision area.

Fire Flow Improvement Impacts

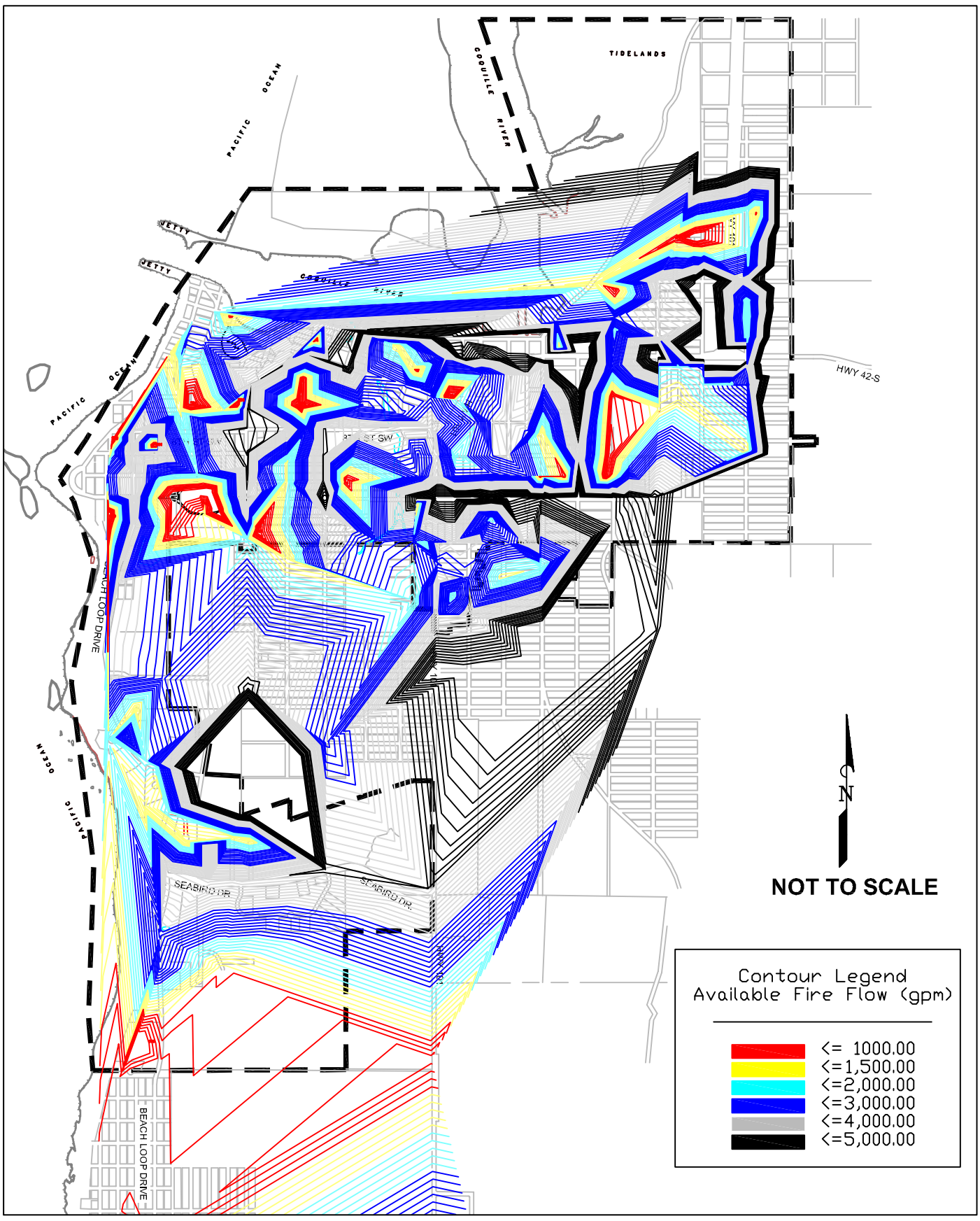
A WaterCAD model was developed with the recommended fire flow improvements. Fire flows at the critical areas within the system were reevaluated. Figure 8.5.3 displays the City's fire flows following the completion of the recommended projects. The recommended improvements eliminate the fire flow deficiencies listed in Table 8.5.1.

Leak Detection and Repair Program

Over the last five years the City has experienced an average of 18 percent water loss when comparing water sent to the City versus water consumed. In 2019 the water loss was at 21 percent. On two separate occasions the City has brought in an independent contractor to see if they could locate any large leaks. None were found.

With the Water Treatment Plant's treated water master meter being calibrated on a yearly basis the potential losses are most likely within the distribution and record keeping systems. Aged water meters and unaccounted water usage are two good places to start.

The City should develop a program to detect and repair leaks to reduce the volume of water losses. Testing older water meters for accuracy should be a priority. Loss records should be maintained on a monthly basis.



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN***	FIGURE NO. ***8.5.3***
DATE: JULY 2020 PROJECT NO.: 101.100	***PROPOSED WATER SYSTEM FIRE FLOWS***	

SECTION 9:

SEISMIC RISK ASSESSMENT & MITIGATION PLAN

SECTION 9: SEISMIC RISK ASSESSMENT AND MITIGATION PLAN

The City of Bandon will be required to develop a seismic risk assessment and mitigation plan. According to Oregon Administrative Rules (OAR) 333-061-0060-5-A-J: a seismic risk assessment and mitigation plan for water systems fully or partially located in areas identified as VII to X using the Map of Earthquake and Tsunami Damage Potential for a Simulated Magnitude 9 Cascadia Earthquake. The City lies in a level IX area and therefore is required to develop this documentation.

The primary seismic threat in this region is the Cascadia Subduction Zone. This is a 680-mile long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American Continent at a rate of four centimeters per year. Over the last 5,400 years numerous large earthquakes have occurred within this zone with an average interval of 500 years. The last recorded event was 1700 AD. If the next large scale earthquake occurs within the average interval, another large scale event is expected by 2200 AD.

The Seismic risk assessment must:

- Identify critical facilities capable of supplying key community needs: including fire suppression, health and emergency response, and community drinking water supply points.

- Identify and evaluate the likelihood and consequences of seismic failures for each critical facility.

The mitigation plan may:

- Encompass a 50-year planning horizon.

- Include recommendations to minimize water loss from each critical facility, capital improvements, or recommendations for further study or analysis.

With regards to building code requirements, structural design requirements were based on the zone the structure was located within. The zones ranged from zero to four with four having the most requirements. Coastal communities are typically in Zone 4. This system has been replaced but at the time of construction of the Pump Station buildings, Water Treatment Plant (WTP) building and raw water clarifier it was in place. Reference will be made to the various zones throughout this section.

9.1 Critical Facilities

The City primarily serves residential areas; therefore the critical facilities to which it supplies water are minimal. Currently the critical facilities are limited to the City's treatment and distribution facilities. The Bandon Rural Fire Protection District's Firehouse and Southern Coos Hospital and Health Center facilities are served by the City but are separate entities from the City and thus not considered further in this Section.

City Raw Water Intakes

The City's raw water supply is pumped to the Water Treatment Plant from either the Lower Pump Station which is fed by Ferry Creek and Geiger Creek impoundments or the Low Flow Pump Station fed by Ferry Creek. Each intake feeds the Middle Pond and raw water is pumped from this pond to the plant via the Middle Pump Station. The intake buildings at the Lower and Middle Pump Stations are constructed of

Concrete Masonry Unit (CMU) block and sits on a concrete slab. The pumps are connected to ductile iron raw water piping. There are currently no signs of structural failure or decay. These buildings were designed to withstand seismic loads for Zone 3.

The Low Flow Pump Station is a below grade concrete wet well sitting on a concrete slab. This structure would fare better in a seismic event but was not designed to withstand seismic loads.

City Water Treatment Plant

The potable water drinking supply comes from the City's WTP. The raw water clarifier that was constructed in 2007 was design to withstand a seismic event for Zone 4. The building that houses the treatment plant is a CMU building with a metal roof. The rooms within the facility are the office, bathroom, mechanical room, and chemical room. The exterior filter units are also constructed of poured in place concrete. This building and filter units were designed to withstand a seismic event for Zone 3. See Section 5 for more details on the WTP.

City Reservoirs

The City currently has two reservoirs. Both are welded steel with a concrete foundation. These reservoirs are described in detail in Section 5. Neither of the City's reservoirs are currently equipped with seismic anchoring or valving. Design details could not be found for either tank. Neither of the tanks are showing visible signs of structural failure. The City did bid a project in September 2015 and December 2021 to install seismic valving on the outlet of the two million gallon reservoir. The bids came in higher than the available funding the first bid and materials were not available in a timely fashion the second time. The project is planned to go out to bid a third time in December 2022.

9.2 Likelihood of Seismic Failures

All critical facility locations lie in a Level 8 or 9 damage area as specified by the Department of Geology and Mineral Industries (DOGAMI) Map of Earthquake and Tsunami Damage Potential. In addition, these facilities, were all designated as having a very high risk for seismic hazards by O-HELP. The O-HELP is a program developed by Oregon State University to display seismic hazards and ground deformation hazard ratings for given addresses. It is an interactive map found at http://ohelp.oregonstate.edu/.

There is a high probability that seismic failure will occur at most of the critical facilities in the event of a large-scale seismic event. The contributing factors are lacking seismic design, and in some cases aged structures that may be more prone to structural failure. These conclusions are not obtained from structural analysis, and should be further investigated to provide the City with a better idea of where their seismic mitigation efforts should be placed. The Capital Improvement Plan will include structural investigation to all critical facilities.

9.3 Consequences of Seismic Failures

The potential consequences resulting from seismic failure at each of the critical facilities are discussed below.

City Raw Water Intakes

There is concern that both Ferry Creek and Geiger Creek impoundments would liquefy during a seismic event. Assuming debris flow would not reach the Low Flow Pump Station, this Pump Station becomes more critical. If the off-channel storage facility was built that facility would stand the best of chance of

surviving a seismic event. The Low Flow Pump Station would still be utilized to pump raw water to the Middle Pond but would not have to worry about drawing water from Ferry Creek.

The Middle and Lower Pump Station buildings would be compromised since they were not designed to the more restrictive requirements of Zone 4 and it is questionable if they would remain operational. The City has a portable pump that could be used to pump water from the Middle Pond to the WTP.

City Water Treatment Plant

Seismic damage at the WTP could happen since the facility was not designed to Zone 4 standards. Production capabilities of the plant could be compromised. Given that there is redundancy in many of the WTP components it is possible that the damage may not shut down the WTP completely, but rather limit its capacity. If the structural failure did cause complete shutdown or minimizes the capacity so much that the demand greatly exceeds the supply, the City will eventually be left without water to fight fires, or to keep its users hydrated. This would pose a health risk to the community.

City Reservoirs

In the event that any of the reservoirs or associated piping experienced seismic failure it is likely the reservoirs could no longer provide water to the service area. Depending on the degree of seismic failure in a tank, or its associated piping, water loss may occur, and/or the flows from the tank may be limited or cut off entirely. If the outlet or inlet pipe is broken near the perimeter of the reservoir, before the isolation valve, the entire reservoir could be drained. This would leave the users with no emergency water source to fight fires or hydrate users. This would pose a severe health risk to the community.

9.4 Seismic Mitigation Plan

The City recognizes the threat of being located so close to the Cascadia Subduction Zone. Currently, the City has limited information on the ability of their system to withstand a large seismic event. Current system assessments have been the result of visual inspections by City Staff, non-structural engineers and information from construction plans. It is safe to say the critical facilities have not been designed for the worst case event. Before the City can develop a refined plan to mitigate all the known threats within their system, more evaluations need to be completed that will determine: all structural failure points, the potential for these failures to occur, and the structural improvements that would minimize any impacts due to a large-scale seismic event. It is recommended that the City develop a schedule for the evaluations of their critical facilities. Funds for the evaluations should be added to the City budget, and the evaluations should be completed within the next five years.

Additional seismic improvements are recommended as part of the Capital Improvement Plan in Section 10.

SECTION 10:

CAPITAL IMPROVEMENT PLAN & PHASING PLAN

SECTION 10: CAPITAL IMPROVEMENT PLAN AND PHASING PLAN

10.1 Background

A Capital Improvement Plan (CIP) is a long term plan for replacement of existing or installation of new infrastructure required to improve a system's function or maintenance. The CIP for water systems provides the City Staff and residents with a systematic approach to dealing with its short term and long term infrastructure needs and demands.

Under Oregon Revised Statutes ORS 223.309(1), a capital plan, public facilities plan, master plan or comparable plan must be prepared before the adoption of System Development Charges (SDCs). This plan must list the capital improvements that may be funded with improvement fee revenues and include the estimated cost and timing of each improvement. Oregon Revised Statutes discuss which improvements may be funded by SDC revenues (ORS 223.307) and what types of projects qualify for credit purposes. The Capital Improvement Plan may be modified at any time pursuant to ORS 223.309 (2).

Water system improvements recommended to the City are provided in this Plan along with associated costs. The recommended improvements for the City's CIP were derived from the analysis presented in Sections 8 and 9. A breakdown of the cost estimates for each project can be found in Appendix C.

10.2 Project Phasing

To assist the City in its planning efforts, the proposed capital improvements have been assigned into one of three priorities with Priority I and II being the most critical projects and Priority III being long-term projects.

The priority of each project was presented and discussed with City Staff. The estimates presented are preliminary and are based on the level and detail of planning presented in this Water Master Plan (WMP). As projects proceed and as site-specific information becomes available, the estimates may require updating.

Compilation of an Environmental Report is typically a requirement of government organizations funding infrastructure projects. The purpose of this Environmental Report is to consider any adverse effects that the project may have on the surrounding environment and propose mitigation measures to minimize these impacts. The estimated cost for compiling an Environmental Report for each priority was included in this WMP.

Priority I Improvements

Priority I Improvement projects include projects to the Water Treatment Plant, two Million Gallons (MG) treated water reservoir, one MG reservoir, Middle Pond Pump Station, and the Lower Pump Station and Low Flow Pump Station.

The City went out for a General Obligation Bond Measure in November of 2019 to ask voters to approve monies to construct a second functional raw water clarifier. The bond measure passed but during design it was realized due to code changes the second raw water clarifier would have to be constructed out of concrete not glass fused to steel material. The change in material type added approximately $1,240,000 to

the total project cost. Total project cost will be included within Priority I costs. The total for Priority I projects is $9,041,400. The following is a description of these projects.

Project Descriptions

1. Water Treatment Plant (Total Project Cost: $4,947,800)

A number of projects are recommended for the Water Treatment Plant. The projects are recommended to improve the operation and effectiveness of the treatment process. The most significant projects at the WTP are the clarifier replacement and installation of generators.

A. Water Treatment Plant Building (Total Project Cost: $598,000)

Flow Measurement Equipment
The raw water flow meter at the WTP has been replaced. Flow meters should be added to the filter to waste line going to the backwash ponds, the Middle Pump Station, Lower Pump Station and the Low Flow Pump Station. The filter to waste line is not metered and this process line has high volumes of unaccounted filtered water. Accurate readings at the intake will provide useful data for future projects and could be useful in identifying the overall water balance of the system. The flow meters at the pump stations can also be used to evaluate the performance of the pumps and be an indicator to the need for pump maintenance.

Filter Sun Shade Roof Structure
It was noted that algae growth occurs in both filter basins. This is due to natural ultraviolet light exposure. It would be relatively inexpensive to provide a roof over the top of the outdoor filter basins to reduce the sunlight and prevent the algae growth.

PLC Modifications
The proposed upgrades to the plant will require Programmable Logic Controller (PLC) modifications at the WTP. The existing system is outdated and replacements parts are no longer available. The new system also includes upgrading all current operational programs.

Flooring in Front Office
The flooring in the front office is deteriorating and needs replacement to provide a safe working environment.

Sample Island
The sample island in the laboratory is in poor condition. A new sample island will allow for additional storage and increased organization of laboratory and testing equipment.

B. Backup Generator System (Total Project Cost: $1,302,000)

A new backup generator located at the entrance to the Water Treatment Plant will service the WTP, Middle Pump Station, Lower Pump Station, Low Flow Pump Station, fish hatchery and several residential dwellings. The generator will allow for continued use of the raw water supply and treatment system if local power is unable to provide electrical service. A covered area and the appropriate integration with the plant and pump station electrical systems will be required to provide for a working system. Since the City has started design of this system the anticipated total project cost will be included within Priority 1 costs but not included in the financial evaluation.

C. Existing Clarifier Replacement (Total Project Cost: $3,047,800)

The City constructed a new 50' diameter glass-fused-to-steel raw water clarifier in 2007, and the existing concrete clarifier was taken out of service. A new clarifier is required to provide redundancy and increase treatment plant capacity. The existing concrete clarifier will be replaced with a new 50' diameter concrete clarifier. A glass-fused-to-steel clarifier is no longer an option due to a code change in 2020. Therefore, a concrete clarifier is required. Part of the budget passed in the 2019 Bond Issue included $1,810,000 for the existing clarifier replacement project. Due to change in materials the total project cost increased to $3,050,000 an increase of approximately $1,240,000. Only the difference in amounts will be included in the financial evaluation.

2. 2 MG Treated Water Storage Tank (Total Project Cost: $2,130,400)

The City's two million gallon storage tank requires rehabilitation in the form of coating the inside and outside of the tank and seismic upgrades. There is 36,874 square feet on the interior and 32,456 square feet on the exterior that has to be recoated. There is a larger interior surface than exterior due to the steel floor. All surfaces will be sand blasted prior to application of a primer coat and two finish coats. These projects will ensure the integrity of the storage tank and allow for continued safe drinking water storage. The seismic improvements and interior recoating of the reservoir was bid in December 2021. The project was not awarded due to equipment delivery dates conflicting with the construction timeframe. The City did prepurchase the seismic monitoring system, $51,370, and will be ordering the pipe and fittings prior to the rebid date later this year. The cost listed above does not include these two items.

3. 1 MG Treated Water Storage Tank (Total Project Cost: $985,300)

The City's one million gallon storage tank requires rehabilitation in the form of coating the inside of the tank and seismic upgrades. There is 19,500 square feet of surface area that has to be recoated. Additional costs have been added for the abatement of lead based paint. All surfaces will be sand blasted prior to application of a primer coat and two finish coats. These projects will ensure the integrity of the storage tank and allow for continued safe drinking water storage.

4. Middle Pond Pump Station (Total Project Cost: $322,100)

Projects at the Middle Pond Pump Station include replacing the smaller two of the three pumps with two new pumps to provide greater capacity and allow for redundancy at the pump station. Other projects include a new ventilation system, replacement of the dock and painting the interior of the building.

Pump Replacement
The existing pumps at the Middle Pond Pump Station are in fair condition but have a limited capacity. Replacing the two smaller existing pumps will increase the pump station capacity from 1,400 gallons per minute (gpm) when all three pumps are running to 1,400 gpm with just two of the three pumps running. This will provide pump redundancy at the pump station which will prevent total system failure and increase the functionally of the system.

Ventilation System
The current ventilation system at the Middle Pond Pump Station need to be upgraded to lower the humidity and regulate the temperature allowing for longevity of the components inside the pump station while providing safe working conditions.

Replace Dock
The small dock at the Middle Pond Pump Station is deteriorated. The dock provides a walkway into the pond for better inspection and ease of access. Replacement of the dock will ensure safe working conditions.

5. Lower Pump Station (Total Project Cost: $318,300)

Projects at the Lower Pump Station include new pumps and upgrades to the ventilation system.

Pump Replacement
The existing pumps at the Lower Pump Station are in fair condition but have a limited capacity. Replacing the two existing pumps at the Lower Pump Station will increase the pump station capacity from 1,400 gpm when all three pumps are currently running to 1,400 gpm with just two of the three pumps running. This will provide pump redundancy at the pump station which will prevent total system failure and increase the functionally of the system.

Ventilation System
The current ventilation system at the Middle Pond Pump Station needs to be upgraded to lower the humidity and regulate the temperature allowing for longevity of the components inside the pump station while providing safe working conditions.

6. Groundwater Supply (Total Project Cost: $337,500)

To determine if ground water is a feasible raw water source during low flow conditions additional coordination with Oregon Water Resources Department (OWRD) is required. A preliminary ground water right application needs to be filed. After the City gets the green light to develop a well field, an exploratory well and testing program should be instituted to determine if satisfactory outputs can be obtained. Costs for Priority I work, as listed in the GSI Report, is $25,000 for an OWRD permit application and coordination and up to $312,500 for exploratory drilling and testing program. If results are favorable a full-scale wellfield design and projects costs should be developed and a full-scale wellfield constructed. Costs for design and construction of the full-scale wellfield will be included within Priority II project costs.

TABLE 10.2.1
PRIORITY I PROJECT COSTS

Project No.	Project Name	Project Cost
1	Water Treatment Plant	
1A	Water Treatment Plant Building	$598,000
1B	Backup Generator System	$1,302,000
1C	Existing Clarifier Replacement	$3,047,800
2	2 MG Treated Water Storage Tank Improvements	$2,130,400
3	1 MG Treated Water Storage Tank Rehabilitation	$985,300
4	Middle Pond Pump Station	$322,100
5	Lower Pond Pump Station	$318,300
6	Groundwater Supply	$337,500
	Priority I Total Project Cost	**$9,041,400**

Priority II Improvements

Priority II Improvement projects for this WMP represent projects that require addressing once the Priority I Improvement projects have been completed and financing is available. Due to the cost of, and need for

additional raw water during low flow years two options were evaluated: off-channel reservoir and groundwater supply. The off-channel reservoir option has been advancing since 2014 and is currently going through the permitting process with OWRD. The groundwater supply option was started in 2021 and still going through the preliminary analysis to determine as to whether or not this is a viable option. Costs to complete the preliminary analysis are included within the Priority I projects. If groundwater is available the City will have to choice which of the two options they will pursue.

Project Descriptions

7. Raw Water Supply

A. Off-Channel Reservoir (Total Project Cost: $8,342,000)

The City purchased a ten-acre parcel in 2014 for the purpose of constructing an Off-Channel Reservoir. No property will have to be purchased for this project. This parcel is contiguous to another ten-acre parcel the City owns and the twenty acre site will provide an adequately sized site to construct the 100 acre-foot raw water storage reservoir, settling ponds, and overflow basin. This property is not within the City, but is in close proximity. It has access to electric service and there is a utility easement that runs from the property to the Low Flow Pump Station. The property is approximately the same elevation as the Middle Pond, so the same pumps at the Low Flow Pump Station can be used to pump water to the proposed Off-Channel Reservoir.

A series of sedimentation basins will allow lower Operation and Maintenance (O&M) costs by allowing sediment to settle out before entering the raw water storage reservoir. These basins can be cleaned much easier than the larger storage reservoir. Emergency overflow will be directed to a bioswale and energy-dissipater basin and then flow back to Geiger Creek. The site will be enclosed by a 50-foot wide buffer of natural vegetation (brush) and will be security-fenced and gated.

The reservoir will be constructed of native materials, as determined by the geotechnical study, appropriate for reservoir construction. Materials excavated for the reservoir will be used to construct the berm. This will minimize trucking of materials in and out of the site.

The sedimentation basins and raw water storage reservoir will be lined to eliminate leakage and so nearby wells are not adversely impacted by water from the local water table migrating into the basins. The raw water storage reservoir will be covered to eliminate evaporation. The combination of the liner and cover will serve as significant water conservation measures.

The floating cover will keep water cool and minimize algae growth. Mixers and aerators will keep the water from stratifying. Stratification of stored water results in difficulty in treating this water, the possibility of algal blooms, and adverse impacts to fish if this water is released into the stream.

Water for the reservoir will be pumped from the existing Low Flow Pump Station, located downstream from the fish hatchery, through a new 12-inch diameter pipe, located in an existing utility easement. An existing 12-inch treated water main and electrical lines already utilize the easement. Water will be diverted from the reservoir by gravity to the Low Flow Pump Station, where it will be pumped to the Middle Pond.

Water may be released for stream augmentation at the Low Flow Pump Station, if determined necessary by regulatory agencies. During low creek flows up to twenty five percent of the flow going to the Middle Pond may have to be diverted. There is also the potential of placing a hydro-electric generator on the water line going to the creek. This would help reduce O&M costs.

A fish screen will be provided at the outlet of the raw water storage basin if required by regulatory agencies.

A Supervisory Control and Data Acquisition (SCADA) system will be installed to provide telemetry control of valves and pumps.

The project cost was developed using the cost estimate developed in the 'Off-Channel Reservoir Feasibility Study, 2016 and applying the Engineering News Record (ENR) as described in Section 7. The revised cost estimate is included within Appendix C. See Figure 10.2.1 for a preliminary project layout.

B. Groundwater Supply (Total Project Cost: $3,606,245)

The following narrative is taken directly from GSI's Supplemental Groundwater Supply Feasibility Evaluation, which is include within Appendix E. The cost for the Exploratory Drilling and Testing Program is included in Project 6.

"Based on stream depletion modeling (see Section 3.2), GSI believes it is likely that OWRD would grant approval for new wells located anywhere within the City's watershed because the input parameters for the stream depletion models are based on hydraulic properties that OWRD co-authored. However, as a contingency plan this well siting evaluation also identified backup well locations within the prescriptive delineations (within 500 feet by 1,000 feet of original point of diversion) in the event that OWRD does not agree with the stream depletion model results.

Further, OWRD will only approve of well locations that do not cause injury to existing water users. Based on GSI's estimations of pumping interference, two existing local water users would be impacted, which are discussed in Section 3.1 and summarized below:

- *ODFW Fish Hatchery: The Oregon Department of Fish and Wildlife's (ODFW's) hatchery has a water right certificate for non-consumptive use of water from Ferry Creek. GSI believes it is unlikely that OWRD would determine that the proposed well locations would cause injury to ODFW's fish hatchery because a groundwater system by nature will result in less direct stream depletion than the City's existing surface water intakes.*
- *Exempt (Domestic) Wells: There are existing exempt (domestic) wells a few hundred feet north of the City's water treatment plant (along Houston Lane, Melton Road). Pumping interference from a full-scale wellfield could preclude the exempt wells from obtaining groundwater. GSI believes it is possible that OWRD would determine injury to existing exempt (domestic) wells from a full-scale wellfield located near the City's water treatment plant.*

Due to the possibility that OWRD may determine injury to existing exempt (domestic) wells from a full-scale wellfield located near the City's water treatment plant, backup well locations that are far from existing exempt wells were identified as a contingency plan. These backup well locations are identified on Figure 6.

Well Siting Results

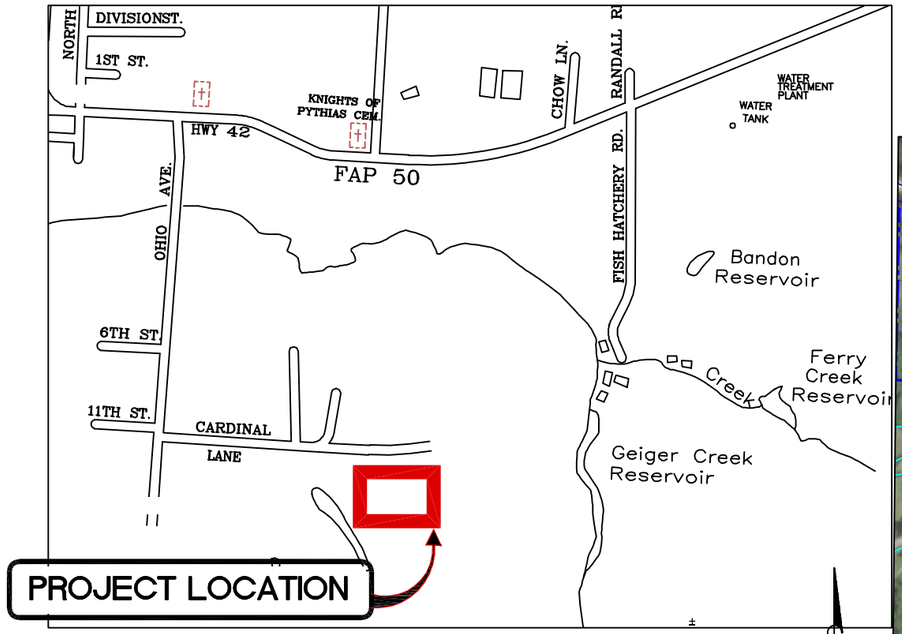
Results of the well siting evaluation are presented on Figure 6. A preferred group and two backup group well locations were identified, with six well locations per group (total of eighteen well locations). Key results for each group are summarized below:

- *Preferred Well Locations: The preferred well locations are able to meet all applicable regulatory setbacks outright and are close to existing water system infrastructure. The thickness of the marine terrace deposits at these locations is estimated to be between 80-100 feet, which exceeds the minimum thickness of 50 feet of screenable saturated aquifer material anticipated to be necessary to produce a sustainable well yield of 75-100 gpm. With respect to pumping interference, all six of the preferred well locations maintain a separation distance of at least 400 feet from one another. In terms of water right considerations, the preferred well locations would require evidence of similar stream depletion to facilitate a surface water to groundwater transfer. GSI believes it is likely that OWRD would be in agreement that the similar stream depletion conditions are satisfied by the preferred well locations, however OWRD may determine that the preferred well locations cause injury to existing exempt (domestic) wells north of the City's water treatment plant. Overall, development of a supplemental groundwater supply at the preferred well locations appears most favorable although there are some uncertainties that cannot be resolved until a water right transaction is submitted and reviewed by OWRD.*
- *Backup Well Locations: The backup well locations represent contingency locations in the event that OWRD does not agree with the stream depletion modeling results or determines that a full-scale wellfield near the City's water treatment plant will cause injury to existing exempt (domestic) wells. Two additional series of backup well locations were identified, which are discussed below:*
  - *B Series Backup Wells: This series of backup well locations were sited on the north side of Ferry Creek to prioritize proximity to the City's water treatment plant. Two of the backup well locations are unable to meet all applicable regulatory setbacks outright and would require a waiver from OWRD/OHA (locations 5b and 6b on Figure 6, within 500 feet of HAZWASTE site). The thickness of the marine terrace deposits at these locations is estimated to be 30-50 feet, which could be insufficient to produce a sustainable well yield of 75-100 gpm/well. With respect to pumping interference, a majority of the backup well locations are unable to maintain a separation distance of at least 400 feet. Overall, development of a supplemental groundwater supply at the B Series backup well locations is less favorable than the C Series and may not be feasible due to the limited aquifer thickness.*
  - *C Series Backup Wells: This series of backup well locations were sited on the south side of Ferry Creek to prioritize hydrogeologic feasibility (thickness of marine terrace deposits). All six of the backup well locations are able to meet all applicable regulatory setbacks outright. The thickness of the marine terrace deposits at these locations is estimated to be 60-90 feet, which could be sufficient to produce a sustainable well yield of 75-100 gpm/well. With respect to pumping interference, a majority of the backup well locations are able to maintain a separation distance of at least 400 feet and the potential for injury to existing groundwater users is low. Overall, development of a supplemental groundwater supply at the C Series backup well locations is more favorable than the B Series and appears feasible, but may be more expensive due to the additional conveyance that would be required."*

The costs listed in Table 10.2.2 for this project is listed as the high, worst case or well field C, option in Table 4 of GSI's Report.

TABLE 10.2.2
PRIORITY II PROJECT COSTS

Project No.	Project Name	Project Cost
7A	Off-Channel Reservoir	$8,342,000
	OR	
7B	Groundwater Supply	$3,605,245



VICINITY MAP

SCALE: 1" = 1000'

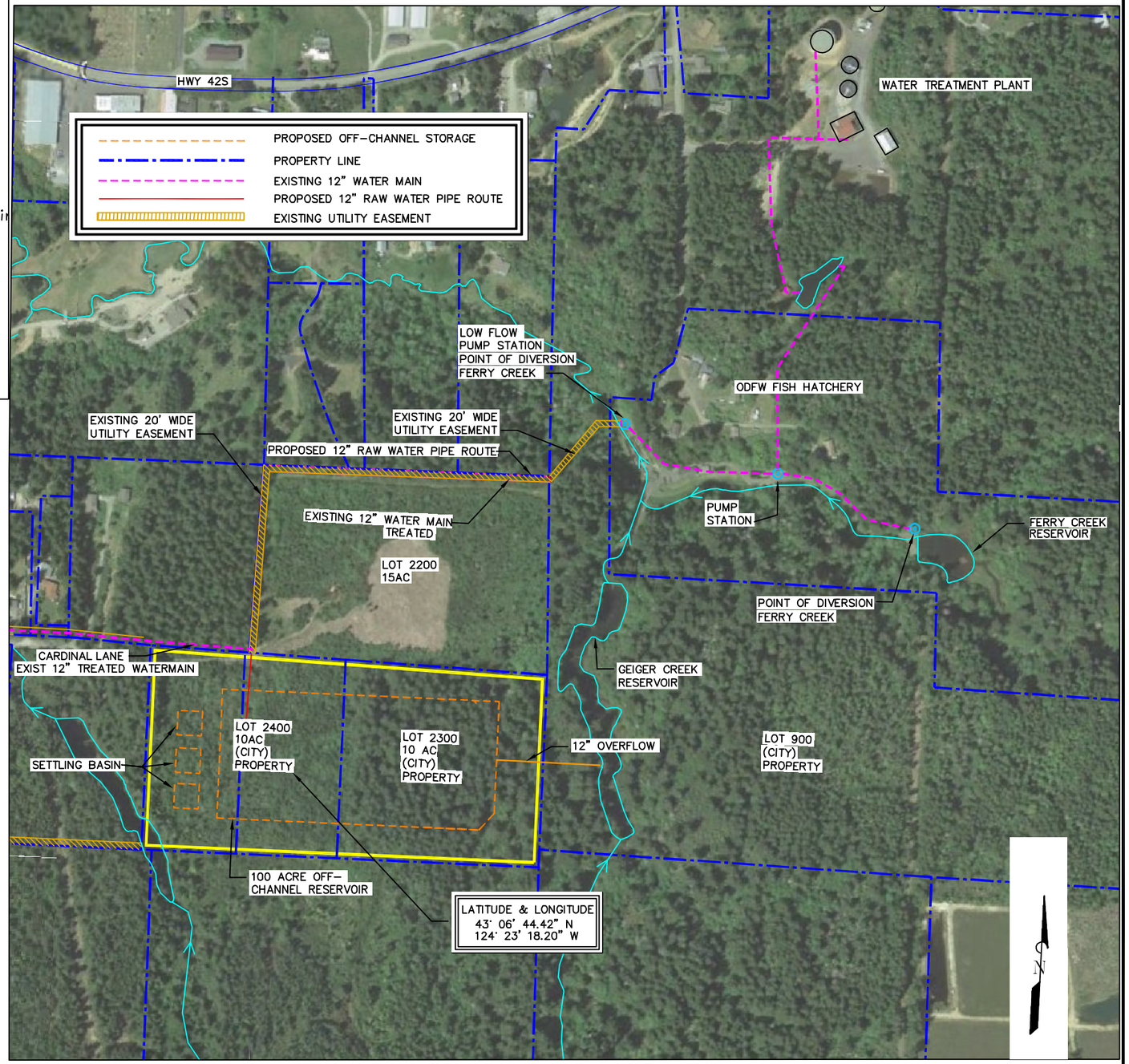


FIGURE NO. 10.2.1

CITY OF BANDON WATER MASTER PLAN

INTAKE AND OFF-CHANNEL RESERVOIR MAP

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: JULY 2020

PROJECT NO.: 101.100

\\dyer2\H\dyer-part\AAprojects\101 Bandon\101.100 Water Master Plan\DWG\FIG 10.2.1 Reservoir And Channel Map.dwg, 7/15/2020 2:06:33 PM PLOT DATE July 16, 2020

Priority III Improvements

Priority III Improvement projects for this WMP represent projects that require addressing once the Priority II Improvement project has been completed and financing is available. These projects are discussed in detail below. Recommended improvements include construction of new water lines, a reservoir, and installation of Automatic Meter Reading (AMR) system. The total cost estimate for Priority III Improvement projects is $14,865,400.

Project Descriptions

8. 8TH ST SW – Oregon AVE to Franklin AVE SW (Total Project Cost: $602,700)

On 8th Street, an 8-inch line replacing the existing 6-inch line between Oregon Avenue and continuing west to Franklin for ultimate connection with the north-south line extension on Franklin Avenue. This project includes provisions to construct approximately 1,650 feet of new 8-inch water line.

9. Beach Loop DR – Seabird DR to Best Western (Total Project Cost: $569,300)

On Beach Loop Road, a 10-inch line replacing the existing 6-inch line from just south of Seabird Lane to the water line connection for the Best Western Inn at Face Rock Hotel. This project will provide necessary fire flow to two hotels south of Seabird along Beach Loop. This project includes provisions to construct approximately 1,300 feet of new 8-inch water line.

10. 13TH ST SW – Franklin AVE SW to Allegheny AVE SW to Allegheny RD (Total Project Cost: $702,500)

On 13th Street, a 8-inch line replacement of the existing 4-inch line between Franklin Avenue and Allegheny, then turning south to run to the dead-end of Allegheny Avenue. This project includes provisions to construct approximately 2,150 feet of new 8-inch water line.

11. Ohio AVE NE – Highway 42S to 10TH ST NE (Total Project Cost: $1,566,000)

On Ohio Avenue, a 12-inch main line extension west on 10th Street NE and southwest on River Drive is proposed. This project includes provisions to construct approximately 3,910 feet of new 12-inch water line.

12. 10TH ST NE – Michigan Avenue - Ohio AVE (Total Project Cost: $534,100)

A key segment of the northern loop discussed above is construction of a 12-inch main line between Michigan Ave. and Ohio Ave. This project includes provisions to construct approximately 1,193 feet of new 12-inch water line and a highway bore under US Highway 101.

13. Jackson AVE SW – 12TH ST SW to Face Rock DR (Total Project Cost: $615,700)

On Jackson, an 8-inch line extension south from the existing 8-inch line on 12th Street for ultimate connection with the east-west Face Rock extension is proposed. This project includes provisions to construct approximately 2,200 feet of new 8-inch water line.

14. Michigan AVE – 10TH ST NE to 4TH ST NE to Lexington AVE NE to 2ND ST NE to June AVE NE to 1ST ST NE to Harlem ST to Caroline ST SE (Total Project Cost: $1,519,300)

The new line will replace the existing 4-inch and 6-inch line from the intersection of 4th and Michigan Avenue and winding through the neighborhood and terminating at the intersection of Caroline Street and Harlem Avenue.

15. 13TH ST NE – Highway 101 to Delaware AVE SE (Total Project Cost: $366,400)

This project includes completion of a 6-inch water line and replacement of a 4-inch line on 13th Street between US Highway 101 and Baltimore; and a 6-inch water line from Baltimore to Chicago to Delaware.

16. System Wide Water Meter Replacement (Total Project Cost: $1,203,700)

This project includes provisions for the continuing replacement of all existing meters with new, accurate, and consistent electronic water meters. Modern meters are capable of nearly 100 percent accuracy. The proposed meters offer Automated-Meter-Reading systems capable of significantly increasing the efficiency of the reading and billing process. The replacement of water meters with new meters should be considered a priority so that the City may gather accurate data cost effectively and have greater assurance that the meters do not under read.

17. Chicago AVE SE – 9TH ST SE to 10TH ST SW (Total Project Cost: $89,700)

This project includes construction of a 6-inch line extension on Chicago between 9th and 10th Streets.

18. North AVE SE – 3RD ST SE to 4TH ST SE & June AVE SE, Klamath AVE SE, Lexington AVE SE (Total Project Cost: $319,400)

This project involves completion of a local loop in the eastern service area just south of Highway 42S. A 6-inch line should be run from 3rd Street SE and North Avenue south and then west to the existing 4-inch on 4th SE. A 6-inch line should be installed on 4th SE west of Michigan to the end of the existing line 4-inch line.

19. 9TH ST SW to Jackson AVE SW (Total Project Cost: $73,500)

This project consists of a 6-inch line extension of the existing 4-inch line on 9th Street, west to Jackson Ave. This extension would have to be made between property lines at the end of a cul-de-sac.

20. 2ND W ST – Douglas AVE SW to Edison AVE SW (Total Project Cost: $101,500)

This project consists of a 6-inch line extension westward of the existing 4-inch line on 2nd W line between Douglas and Edison. The end of the existing line is at the Coast Guard Station. This extension is on relatively steep terrain.

21. 9TH ST – Jackson AVE SW to Beach Loop DR (Total Project Cost: $661,700)

This project completes a 10-inch line through town connection with Beach Loop by way of 11th, Jackson and 9th.

22. Highway 101 – 15TH ST SE to 17TH ST SE down 17TH (Total Project Cost: $299,400)

This project includes construction of 6-inch line sections on US Highway 101 between: 13th and 14th; 15th to 17th; and then east on 17th to connection with the existing 6-inch line.

23. Baltimore AVE SE – 17TH ST SE to 20TH ST SE (Total Project Cost: $230,200)

This project includes construction of an 8-inch line south on Baltimore from 17th Street to connection with the southern loop 12-inch line on 20th Street.

24. Franklin AVE SW – 11TH ST SW to 13TH ST SW (Total Project Cost: $303,600)

On Franklin an 8-inch line extension south from the existing 10-inch line on 11th Street to 13th Street. This will require that on Franklin between 11th and 13th an existing 6-inch line be paralleled in order to provide adequate capacity for demands to the south. This project includes provisions to construct approximately 700 feet of new 8-inch water line.

25. South Bandon 0.25 Million Gallon Reservoir & Pump Station (Total Project Cost: $2,731,000)

The City has adequate treated water storage capacity for existing demand levels. However, additional treated water storage reserves would provide greater equalization and security to the City and would help provide needed fire projects in portions of the service area. A ground storage tank with an associated hydro-pneumatic tank and pump station is feasible. Constructing the new reservoir along Seabird will distribute reserves and provide more uniform flow and pressure distribution in the southern half of the water system. A new access road and pump station will need to be constructed in order to provide access and distribution at the new reservoir.

26. Franklin AVE SW – 15TH ST SE to 24TH ST SE (Total Project Cost: $645,500)

On Franklin, an 8-inch line extension south from the existing 8-inch line between 14th and 15th should be continued south to 24th Street SE for ultimate connection with the east-west main extension on 24th Street. This project includes provisions to construct approximately 2,450 feet of new 8-inch water line.

27. Franklin AVE SW to 24TH ST SW to Seabird DR (Total Project Cost: $580,900)

On Franklin, an extension of an 8-inch line continues south for connection with the east-west existing 8-inch line on Seabird. This will complete a sub-loop within the southern service area and significantly improve fire flow capacity. This project constructs approximately 1,900 feet of new 8-inch water line.

28. Face Rock DR to Jackson AVE SW (Total Project Cost: $633,500)

This project completes a loop with an east-west 12-inch line extension from the existing 8-inch Face Rock line. This project includes provisions to construct approximately 1,280 feet of new 12-inch water line.

29. Jackson AVE SW – Face Rock DR to New South Tank Line (Total Project Cost: $383,000)

On Jackson, an 8-inch line extending south for connection with the tank feed line. This will complete connection with the east-west existing 8-inch line on Seabird and complete a sub-loop within the southern service area. This project includes provisions to construct approximately 1,500 feet of new 8-inch water line.

30. Polaris ST to Beach Loop DR (Total Project Cost: $132,800)

This project extends the 8-inch line on Polaris Street back to the 6-inch Beach Loop line to complete a loop through the south subdivision area.

TABLE 10.2.3
PRIORITY III PROJECT COSTS

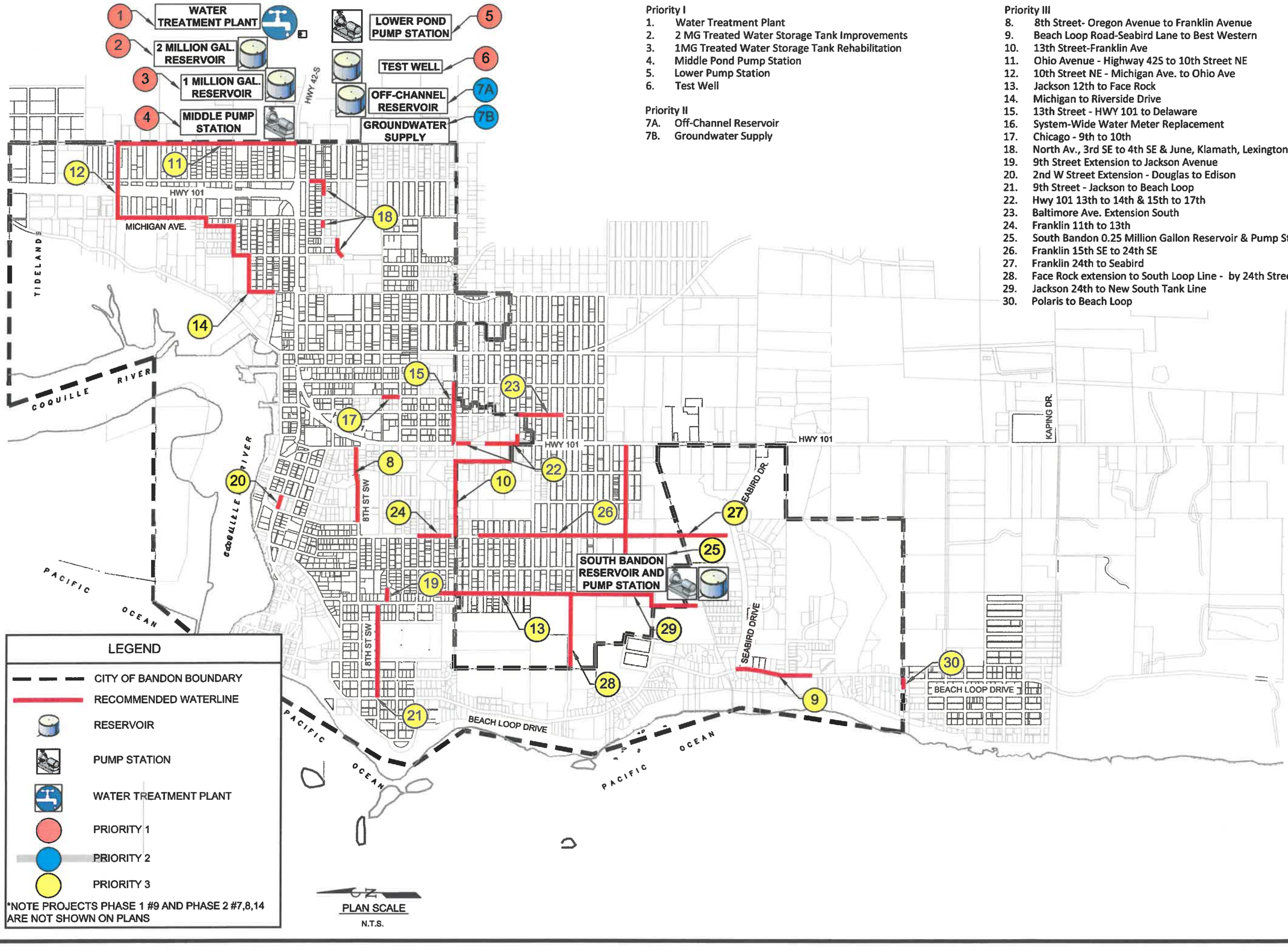
Project No.	Project Name	Project Cost
8	8TH ST SW - Oregon AVE to Franklin AVE SW	$602,700
9	Beach Loop DR - Seabird DR to Best Western	$569,300
10	13TH ST SW - Franklin AVE SW to Allegheny AVE SW to Allegheny RD	$702,500
11	Ohio AVE NE - Highway 42S to 10TH ST NE	$1,566,000
12	10TH ST NE - Michigan Avenue - Ohio AVE	$534,100
13	Jackson AVE SW – 12TH ST SW to Face Rock DR	$615,700
14	Michigan AVE - 10TH ST NE to 4TH ST NE to Lexington AVE NE to 2ND ST NE to June AVE NE to 1ST ST NE to Harlem ST to Caroline ST SE	$1,519,300
15	13TH ST NE – Highway 101 to Delaware AVE SE	$366,400
16	System Wide Water Meter Replacement	$1,203,700
17	Chicago AVE SE - 9TH ST SE to 10TH ST SW	$89,700
18	North AVE SE – 3RD ST SE to 4TH ST SE & June AVE SE, Klamath AVE SE, Lexington AVE SE	$319,400
19	9TH ST SW to Jackson AVE SW	$73,500
20	2ND W ST – Douglas AVE SW to Edison AVE SW	$101,500
21	9TH ST – Jackson AVE SW to Beach Loop DR	$661,700
22	Highway 101 – 15TH ST SE to 17TH ST SE down 17TH	$299,400
23	Baltimore AVE SE – 17TH ST SE to 20TH ST SE	$230,200
24	Franklin AVE SW – 11TH ST SW to 13TH ST SW	$303,600
25	South Bandon 0.25 Million Gallon Reservoir & Pump Station	$2,731,000
26	Franklin AVE SW – 15TH ST SE to 24TH ST SE	$645,500
27	Franklin AVE SW to 24TH ST SW to Seabird DR	$580,900
28	Face Rock DR to Jackson AVE SW	$633,500
29	Jackson AVE SW – Face Rock DR to New South Tank Line	$383,000
30	Polaris ST to Beach Loop DR	$132,800
	Priority III Total	$14,865,400

10.3 Summary of Projects

A summary of all the project priorities and costs of the recommended capital improvements (Priority I, II, and III) is provided in Table 10.3.1. A map showing the recommended improvements is shown in Figure 10.3.1. For simplicity sake some water line routing is shown as a straight line knowing that there will be routing changes due to existing structures or physical features. The additional length of water line required to avoid these features has been added to the estimates.

TABLE 10.3.1
PROJECT PRIORITY

Project Number	Project Name
Priority I	**$9,041,400**
Priority II	**$8,342,000 Or $3,606,245**
Priority III	**$14,865,400**



Priority I
1. Water Treatment Plant
2. 2 MG Treated Water Storage Tank Improvements
3. 1MG Treated Water Storage Tank Rehabilitation
4. Middle Pond Pump Station
5. Lower Pump Station
6. Test Well

Priority II
7A. Off-Channel Reservoir
7B. Groundwater Supply

Priority III
8. 8th Street- Oregon Avenue to Franklin Avenue
9. Beach Loop Road-Seabird Lane to Best Western
10. 13th Street-Franklin Ave
11. Ohio Avenue - Highway 42S to 10th Street NE
12. 10th Street NE - Michigan Ave. to Ohio Ave
13. Jackson 12th to Face Rock
14. Michigan to Riverside Drive
15. 13th Street - HWY 101 to Delaware
16. System-Wide Water Meter Replacement
17. Chicago - 9th to 10th
18. North Av., 3rd SE to 4th SE & June, Klamath, Lexington
19. 9th Street Extension to Jackson Avenue
20. 2nd W Street Extension - Douglas to Edison
21. 9th Street - Jackson to Beach Loop
22. Hwy 101 13th to 14th & 15th to 17th
23. Baltimore Ave. Extension South
24. Franklin 11th to 13th
25. South Bandon 0.25 Million Gallon Reservoir & Pump Station
26. Franklin 15th SE to 24th SE
27. Franklin 24th to Seabird
28. Face Rock extension to South Loop Line - by 24th Street
29. Jackson 24th to New South Tank Line
30. Polaris to Beach Loop

FIGURE NO. 10.3.1

CITY OF BANDON WATER MASTER PLAN

RECOMMENDED SYSTEM IMPROVEMENTS

THE DYER PARTNERSHIP ENGINEERS & PLANNERS

DATE: MAY 2022

PROJECT NO.: 101.100

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SECTION 11:

FINANCING

SECTION 11: **FINANCING**

11.1 Grant and Loan Programs

Outside funding assistance, in the form of grants or low interest loans, will be necessary to make some of the proposed improvements affordable to the residents of the City of Bandon. The amount and types of outside funding will dictate the amount of local funding the City will have to secure. In evaluating grant and local programs, the major objective is to select a program, or a combination of programs, which are most applicable and available for the intended project.

A brief description of the major and State funding programs, which are typically utilized to assist qualifying communities in the financing of major water system improvement programs, is given below. Each of the government assistance programs has particular prerequisites and requirements. With each program having its specific requirements, not all communities or projects may qualify for each of these programs.

Economic Development Administration Public Works Grant Program

The Economic Development Administration (EDA) Public Works Grant Program, administered by the US Department of Commerce, is aimed at projects which directly create permanent jobs or remove impediments to job creation in the project area. Thus, to be eligible for this grant, a community must be able to demonstrate the potential to create jobs from the project. Potential job creation is assessed with a survey of businesses to demonstrate the prospective number of jobs that might be created if the proposed project was completed.

Proposed projects must be located within an EDA designated Economic Development District. Priority consideration is given to projects that improve opportunities for the establishment or expansion of industry and projects that create or retain private sector jobs in both the near term and long term. Communities, which can demonstrate that the existing system is at capacity (e.g. moratorium on new connections), have a greater chance of being awarded this type of grant. The EDA grants are usually fifty percent or less of the project cost; therefore, some type of local funding is also required. Grants typically do not exceed one million dollars.

Rural Development Administration Loans and Grants

The Rural Development Administration (Rural Development) manages the loans and grants for water programs that were formerly overseen by the Farmers Home Administration. While these programs are administered by a new agency, the program requirements are essentially the same. The Rural Utilities Service (RUS) is one of three entities that comprise the US Department of Agriculture's (USDA) Rural Development mission area. The RUS supports various programs that provide financial and technical assistance for development and operation of safe and affordable water supply systems.

Rural Development has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities, including water systems. Grants are also available to applicants who meet the Median Household Income (MHI) requirements. While eligible applicants must have a population less than 10,000, priority is given to public entities in areas smaller than 5,500 people to restore deteriorating infrastructure systems. Preference is also given to projects that involve the merging of facilities and those serving low-income communities.

In addition, borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms.
- Legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services.
- Financially sound entity based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including Operation and Maintenance (O&M), and to retire the indebtedness and maintain a reserve.
- Water systems must be consistent with any development plans of State, multi-jurisdictional area, County, or municipality in which the proposed project is located. All facilities must comply with Federal, State, and local laws including those concerned with zoning regulations, health and sanitation standards, and the control of water pollution.

Loan and grant funds may be used for the following types of improvements:

- Construct, repair, improve, expand, or otherwise modify infrastructure systems.

In some cases, funding may also be available for related activities such as:

- Legal and engineering costs connected with the development of facilities.
- Land acquisition, water and land rights, permits, and equipment.
- Start-up operations and maintenance.
- Purchase of facilities to improve service or prevent loss of service.

Interim financing must be used during the length of the project and Rural Development funds are made available when the construction phase of the project is completed. If interim financing is not available or if the project cost is less than $50,000; multiple advances of Rural Development funds may be made as construction progresses.

The maximum term on all loans is 40 years. However, no repayment period will exceed any statutory limitation on the organization's borrowing authority, nor the useful life of the improvement of the facility to be financed. Interest rates are set quarterly and are based on current market yields for municipal obligations. Current interest rates may be obtained from any Rural Development office.

The following rates currently apply for the Rural Development program:

Market Rate. Those applicants pay the market rate whose MHI of the service area is more than the $61,400 (Oregon non-metropolitan MHI). The market rate is currently 2.50 percent.

Intermediate Rate. Those applicants whose MHI of the service area is between $49,120 (eighty percent of the State MHI) through $61,400 pay the intermediate rate. The intermediate rate is paid by those applicants whose MHI of the service area is less than eighty percent of the Oregon non-metropolitan MHI. The current intermediate line rate is 2.00 percent.

> ***Poverty Line Rate.*** Those applicants whose MHI of the service area is below $49,120 (eighty percent of the State MHI) pay the lowest rate. Improvements must also be required by a governing agency to correct a regulatory violation or health risk. The current poverty line rate is 1.50 percent.

The City of Bandon is eligible for the intermediate rate since there is no regulatory violations or health risks despite the City's being eligible for the poverty line rate because of MHI. The MHI for the City of Bandon is listed at $37,262. If the City had a health or sanitary issue, and the project is needed to merit regulatory standards, then the City would meet both qualifications for the poverty rate.

Other restrictions and requirements may be associated with these loans and grants. If the City becomes eligible for grant assistance, the grant will apply only to eligible project costs and is only available after a City has incurred long-term debt resulting in an annual debt service obligation equal to one-half of one percent of the MHI. To receive a Rural Utilities Service Loan, the City must secure bonding authority, usually in the form of General Obligation or Revenue Bonds.

Applications for financial assistance are made at area offices of Rural Development. For additional information on Rural Development loans and grant programs, call 866-923-5626 Ext. 1 or visit the RUS website at https://www.rd.usda.gov/programs-services/rural-economic-development-loan-grant-program. The Oregon Rural Development website is https://www.rd.usda.gov/or.

Technical Assistance Grants (TAG)

Available through the USDA RUS as part of the water programs, technical assistance grants are intended to provide technical assistance to associations on a wide range of issues relating to the delivery of water services. Technical Assistance Grant funds may be used for the following activities:

- Identify and evaluate solutions to water related problems.
- Assist entities with preparation of applications for water loans and grants.
- Provide training to association personnel in order to improve the management, operation and maintenance of water.
- Pay expenses related to providing the technical assistance and/or training.

Technical Assistant Grants may be made for up to 100 percent, not to exceed $30,000, of the eligible project costs. Applications are filed with any USDA Rural Development office. For additional information on Rural Development loans and grant programs, call 866-923-5626 Ext. 1 or visit the RUS website at https://www.rd.usda.gov/programs-services/water-waste-disposal-technical-assistance-training-grants.

Oregon Community Development Block Grant (CDBG) Program

The Community Development Block Grant Program (CDBG) section of the Business Oregon - Infrastructure Finance Authority (IFA) administers the CDBG Program. Grants and technical assistance are available to develop livable urban communities for persons of low and moderate incomes by expanding economic opportunities and providing housing and suitable living environments.

Non-metropolitan cities and counties in rural Oregon can apply for and receive grants. Oregon Tribes, urban cities (Ashland, Bend, Corvallis, Eugene, Gresham, Hillsboro, Medford, Portland, Salem and

Springfield) and counties (Clackamas, Multnomah, Washington, Marion) receive funds directly from Housing and Urban Development (HUD).

All projects must meet one of three national objectives:

- The proposed activities must benefit low and moderate income individuals.
- The activities must aid in the prevention or elimination of slums or blight.
- There must be an urgent need that poses a serious and immediate threat to the health or welfare of the community.

Funding amounts are based on:

- The applicant's need;
- The availability of funds; and
- Other restrictions defined in the program's guidelines.

The following are the maximum grants possible for any individual project, by category:

- Microenterprise: $100,000
- Public Works Water and Wastewater Improvements: $2,500,000
- Community/Public Facilities: $1,500,000
- Community Capacity/Technical Assistance: no specific per-award-limit but limited overall funds.
- Regional Housing Rehabilitation: $400,000 - $500,000
- Emergency Projects: $500,000

For additional information on the CDBG programs, call 503-346-8620 or visit the Infrastructure Finance Authority (IFA) website at https://www.oregon.gov/biz/programs/CDBG/Pages/default.aspx.

Oregon Special Public Works Fund

The Special Public Works Fund (SPWF) provides funds for publicly owned facilities that support economic and community development in Oregon**.** Special Public Works Funds provide funding for construction and/or improvement of infrastructure needed to support industrial, manufacturing and certain types of commercial development. Funds are available to public entities for:

- Emergency projects as a result of a disaster,
- Energy systems,
- Levee certification, and
- Telecommunication systems

Public agencies that are eligible to apply for funding are:

- Cities
- Counties
- County service districts (organized under ORS Chapter 451)
- Tribal councils;
- Ports
- Districts as defined in ORS 198.010
- Airport Districts (ORS 838)

Facilities and infrastructure projects that are eligible for funding are:

- Water and sewer utilities,
- Local roads, bridges, and other transportation system facilities,
- Emergency services buildings, including 911 system and ambulance facilities.
- Police and fire stations,
- Medical treatment centers,
- Emergency and auxiliary shelters,
- Storm water drainage,
- Port facilities,
- Infrastructure required for access to school,
- City halls,
- City and county courts, and
- Jails

Loans
Loans for development (construction) projects range from less than $100,000 to $10 million. The Infrastructure Finance Authority offers very attractive interest rates that reflect tax-exempt market rates for highly qualified borrowers. Initial loan terms can be up to 25 years or the useful life of the project, whichever is less.

Grants
Grants are available for construction projects that create or retain trade sector jobs. They are limited to $500,000 or 85 percent of the project cost, whichever is less. The grants are based on up to $5,000 per

eligible job created or retained. As this grant is dependent on job creation, it is not ideal for municipal water infrastructure projects.

Limited grants are available to plan industrial site development for publicly owned sites and for feasibility studies. For additional information on IFA programs, call 503-346-8620 or visit the IFA website at: https://www.orinfrastructure.org/Infrastructure-Programs/SPWF/#:~:text=The%20Special%20Public%20Works%20Fund,and%20community%20development%20in%20Oregon.

Water/Wastewater Financing Program

Water/wastewater financing is available for construction and/or improvement of water and wastewater systems to meet State and Federal standards. This loan program funds the design and construction of public infrastructure needed to ensure compliance with the Safe Drinking Water Act or the Clean Water Act.

The public entities that are eligible to apply for the program are:

- Cities
- Counties
- County service districts (organized under ORS Chapter 451)
- Tribal councils;
- Ports
- Special districts as defined in ORS 198.010

The proposed project must be owned and operated by a public entity as listed above. Allowable funded project activities may include:

- Reasonable costs for construction improvement or expansion of drinking water system, wastewater system, or stormwater system;
- Water source, treatment, storage, and distribution;
- Wastewater collection, treatment, and disposal facilities;
- Stormwater system;
- Purchase of rights of way and easements necessary for construction;
- Design and construction engineering; or
- Planning/technical assistance for small communities.

To be eligible for funding:

- A system must have received, or is likely to soon receive, a Notice of Non-Compliance by the appropriate regulatory agency or is for a facility plan or study required by a regulatory agency
- A registered Professional Engineer will be responsible for the design and construction of the project

Funding and Uses
Loan and grant amounts are determined by a financial analysis of the applicant's ability to afford a loan (debt capacity, repayment sources, and other factors).

Loans
Program guidelines, project administration, loan terms and interest rates are similar to the Special Public Works Fund program. The maximum loan term is 25 years or the useful life of the infrastructure financed, whichever is less. The maximum loan amount is $10 million per project through a combination of direct and/or bond-funded loans. Recently IFA, was offering lower, reduced interest rates for municipalities whose household income is less than the statewide median income. The current terms of this loan are for 30 years at 2.11 percent interest. Due to the current financial climate this rate is estimated to increase a maximum of 0.75 percent in June 2022; therefore, a rate of 2.86 percent interest was used during funding alternatives analysis.

Loans are generally repaid with utility revenues or voter-approved bond issues. A limited tax general obligation pledge also may be required. "Creditworthy" borrowers may be funded through the sale of State Revenue Bonds.

Grants
Grant awards up to $750,000 may be awarded based on a financial review.

An applicant is not eligible for grant funds if the applicant's annual MHI is equal to or greater than 100 percent of the State average MHI for the same year.

Funding for Technical Assistance
The Infrastructure Finance Authority offers technical assistance with financing for municipalities with populations of less than 15,000. The funds may be used to finance preliminary planning, engineering studies, and economic investigations.

Technical assistance projects must be in preparation for a construction project that is eligible and meets the established criteria.

- Grants up to $20,000 may be awarded per project.
- Loans up to $60,000 may be awarded per project.

Interested applicants should contact Business Oregon prior to submitting an application. Applications are accepted year-round.

Clean Water State Revolving Fund (CWSRF)

Each year the Oregon Health Authority (OHA) receives an allotment from the Federal government for the Clean Water State Revolving Fund. The funds along with a twenty percent State match are used to make

low interest loans to finance needed drinking water system improvements. Funds may be used for the following types of activities:

Planning
Master plans, pilot studies, and feasibility studies that are part of compliance related construction project.

Preliminary and Final Engineering and Design
Surveying, legal review, preparation of engineering drawings, and specifications for construction. Costs necessary for recipients to contract environmental review services are included.

Construction Costs
All aspects of a public water system from source of supply, filtration, treatment, storage, transmission, and metering.

Source Water Protection
As part of a source water management plan for a watershed or a delineated source water protection area for a well.

Property Acquisition
The acquisition of real property directly related to or necessary for the proposed project including rights-of-way, easements, and facility sites.

While many activities are eligible for CWSRF financing, the following activities are considered ineligible activities. These activities include dams or rehabilitation of dams, purchase of water rights unless owned on a system that is being purchased through a consolidation project, finished water reservoirs, administrative costs, operation and maintenance expenses, and projects primarily intended to supply or attract future growth.

The program's financing is available to all sizes of water systems. Municipal, nonprofit and privately owned community water systems are eligible, as well as nonprofit non-community systems. Terms of the loan are 30 years at eighty percent of the State / local bond rate. This rate is currently 1.0 percent. Financially disadvantaged applicants can get up to a 30 year loan at an interest rate of one percent, as well as the possibility of some principal forgiveness.

The Oregon Health Authority and Business Oregon Infrastructure Finance Authority (IFA) rate proposed projects. Highest ratings are given to projects that present the following:

- Addresses the most serious risk to human health.
- Necessary to ensure Safe Drinking Water Act compliance.
- Applicant has the greatest financial need, on a per household basis, according to affordability criteria.

Additional consideration will be given to disadvantaged communities. The definition of a disadvantaged community has changed to one in which the average annual water rate will exceed 1.25 percent of local MHI. The above ratio is subject to adjustment with the availability of 2010 Census figures and inflation indexing thereafter.

Applicants with 300 or more service connections are eligible for assistance with final design and construction projects; only if they maintain a current, approved master plan that evaluates the needs of the

water system for at least a 20-year period and includes the major elements outlined in Oregon Administrative Rules (OAR) 333-061-0060(5). Systems with less than 300 service connections may receive funding for an engineering feasibility analysis instead of a master plan.

11.2 Local Funding Sources

The amount and type of local funding obligations for water system improvements will depend, in part, on the amount of grant funding anticipated and the requirements of potential loan funding. Local revenue sources for capital expenditures include various types of bonds, water service charges, connection fees, and System Development Charges (SDC). Local revenue sources for operating costs include water service charges. The following sections identify those local funding sources and financing mechanisms that are most common and appropriate for the improvements identified in this Plan.

General Obligation Bonds

A General Obligation (G.O.) Bond is back by the full faith and credit of the issuer. For payment of the principal and interest on the bond, the issuer may levy ad valorem general property taxes. Such taxes are not needed if revenue from assessments, user charges or some other sources are sufficient to cover debt service.

Oregon Revised Statutes limit the maximum term to 40 years for cities. Except in the event that Rural Utilities Service will purchase the bonds, the realistic term for which General Obligation Bonds should be issued is 15 to 20 years. Under the present economic climate, the lower interest rates will be associated with the shorter terms.

Financing of water system improvements by General Obligation Bonds is usually accomplished by the following procedure:

- Determination of the capital costs required for the improvement.
- An election authorizing the sale of General Obligation Bonds.
- Following voter approval, the bonds are offered for sale.
- The revenue from the bond sale is used to pay the capital costs associated with the projects.

From a fund raising viewpoint, General Obligation Bonds are preferable to revenue bonds in matters of simplicity and cost of issuance. Since the bonds are secured by the power to tax, these bonds usually command a lower interest rate than other types of bonds. General Obligation Bonds lend themselves readily to competitive public sale at a reasonable interest rate because of their high degree of security, tax-exempt status, and general acceptance.

These bonds can be revenue-supported wherein a portion of the user fee is pledged toward payment of the debt service. Using this method, the need to collect additional property taxes to retire the obligated bonds is eliminated. Such revenue-supported General Obligation Bonds have most of the advantages of revenue bonds, but also maintain the lower interest rate and ready marketability of General Obligation Bonds.

Other advantages of General Obligation Bonds over other types of bonds are as follows:

- The laws authorizing General Obligation Bonds are less restrictive than those governing other types of bonds.
- By the levying of taxes, the debt is repaid by all property benefited and not just the system users.
- Taxes paid in the retirement of these bonds are IRS deductible.
- General Obligation Bonds offer flexibility to retire the bonds by tax levy and/or user charge revenue.

The disadvantage of General Obligation Bond debt is that it is often added to the debt ratios of the underlying municipality, thereby restricting the flexibility of the municipality to issue debt for other purposes. Furthermore, General Obligation Bonds are normally associated with the financing of facilities that benefit an entire community, must be approved by a majority vote and often necessitate extensive public information programs. A majority vote often requires waiting for a general election in order to obtain an adequate voter turnout. Waiting for a general election may take years, and too often a project needs to be undertaken in a much shorter amount of time.

The City passed a General Obligation Bond issue in 2019. Part of the monies were allocated for the replacement of the older raw water clarifier. Since the City must have voter approval for any utility rate increases, the City may have to pass another General Obligation Bond issue to fund a portion of the proposed improvements.

Revenue Bonds

Revenue Bonds are becoming a frequently used option for long-term debt. These bonds are an acceptable alternative and offer some advantages to General Obligation Bonds. Revenue Bonds are payable solely from charges made for the services provided. These bonds cannot be paid from tax levies or special assessments; their only security is the borrower's promise to operate the system in a way that will provide sufficient net revenue to meet the debt service and other obligations of the bond issued.

Many communities prefer Revenue Bonds because the debt obligation will be limited to system users since repayment is derived from user fees. Another advantage of Revenue Bonds is that they do not count against a municipality's direct debt, but instead are considered “overlapping debt.” This feature can be a crucial advantage for a municipality near its debt limit or for the rating agencies, which consider very closely the amount of direct debt when assigning credit ratings. Revenue Bonds also may be used in financing projects extending beyond normal municipal boundaries. These bonds may be supported by a pledge of revenues received in any legitimate and ongoing area of operation, within or without the geographical boundaries of the issuer.

Successful issuance of Revenue Bonds depends on the bond market evaluation of the revenue pledged. Revenue Bonds are most commonly retired with revenue from user fees. Recent legislation has eliminated the requirement that the revenues pledged to bond payment have a direct relationship to the services financed by Revenue Bonds. Revenue Bonds may be paid with all or any portion of revenues derived by a public body or any other legally available monies. In addition, if additional security to finance Revenue Bonds was needed, a public body may mortgage grant security and interests in facilities, projects, utilities or systems owned or operated by a public body.

Normally, there are no legal limitations on the amount of Revenue Bonds to be issued; but excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks. In rating Revenue Bonds, buyers consider the economic justification for the project, reputation of the borrower, methods and effectiveness for billing and collecting, rate structures, provision for rate increases as needed to meet debt service requirements, and track record in obtaining rate increases historically. In addition, other factors considered include adequacy of reserve funds provided in the bond documents, supporting covenants to protect projected revenues, and the degree to which forecasts of net revenues are considered sound and economical.

Municipalities may elect to issue Revenue Bonds for revenue producing facilities without a vote of the electorate (ORS 288.805-288.945). In this case, certain notice and posting requirements must be met and a 60-day waiting period is mandatory. A petition signed by five percent of the municipality's registered voters may cause the issue to be referred to an election.

Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. These bonds are an intermediate form of financing that is less than full-fledged general obligation or revenue bonds. However, these types of bonds are quite useful especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not accruing to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment is designed to apportion the cost of improvements, approximately in proportion to the afforded direct or indirect benefits, among the benefited property owners. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the City sells Bancroft improvement bonds to finance the construction, and the assessment is paid over twenty years in forty semi-annual installments with interest. Cities and special districts are limited to improvement bonds not exceeding three percent of true cash value.

With improvement bond financing, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. The Engineer usually determines an approximate assessment, either on a square foot or a front-foot basis. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the Contractor. Therefore, some method of interim financing must be arranged, or a pre-assessment program, based on the estimated total costs, must be adopted. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to fifty percent of the total assessments to be levied. As a result, owners of undeveloped property usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive when facilities for an entire community are contemplated. In comparison, General Obligation Bonds can be issued in lieu of improvement bonds, and are usually more favorable.

Capital Construction (Sinking) Fund

Sinking funds are often established by budget for a particular construction purpose. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. Such funds can also be developed with revenue derived from SDC.

A City may wish to develop sinking funds for each sector of the public services. This fund can be used to rehabilitate or maintain existing infrastructure, construct new infrastructure elements, or to obtain grant and loan funding for larger projects.

The disadvantage of a sinking fund is that it is usually too small to undertake any significant projects. Also, setting aside money generated from user fees without a designated and specified need is not generally accepted in municipal or public utility budgeting processes.

System Development Charges

A System Development Charge (SDC) is a fee collected as each piece of property is developed and is used to finance the necessary capital improvements and municipal services required by the development. Such a fee can only be used to recover the capital costs of infrastructure. Operating, maintenance, and replacement costs cannot be financed through the SDC.

Two types of charges are permitted under the Oregon Systems Development Charges Act: improvement fees, and reimbursement fees. The SDCs charged before construction are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDCs are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

Under the Oregon SDC Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A Capital Improvement Plan (CIP) must also be prepared which lists the capital improvements that may be funded with improvement fee revenues and the estimated cost and timing of each improvement. Thus, revenue from the collection of SDCs can only be used to finance specific items listed in a CIP. In addition, SDCs cannot be assessed on portions of the project paid for with grant funding. The current SDC and rate structure should be re-evaluated and adjusted to account for the improvements described herein.

User Fees

User fees are used as a source of revenue to retire Revenue Bonds and to finance operation and maintenance. User fees represent monthly charges of all residences, businesses, and other users that are connected to the water system. These fees are established by resolution and can be modified, as needed, to account for increased or decreased operating and maintenance costs. The monthly charges are usually based on the class of user (e.g. single family dwelling, multiple family dwelling, schools) and the quantity of water through a user's connection.

Assessments

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, a City may provide some improvements or services that directly benefit a

particular development. A City may choose to assess the industrial or commercial developer to provide up-front capital to pay for the administered improvements.

11.3 Financing Strategy

A financing strategy or plan must provide a mechanism to generate capital funds in sufficient amounts to pay for the proposed improvements over the relatively short duration in design and construction, generally two years. The financing strategy must also identify the manner in which annual revenue will be generated to cover the expense for long-term debt repayment and the on-going operation and maintenance of the system. The objectives of a financial strategy include the following:

- Identify the capital improvement cost for the project and the estimated expense for O&M.
- Evaluate the potential funding sources and select the most viable program.
- Determine the availability of outside funding sources and identify the local cost share.
- Determine the cost to system users to finance the local share and the annual cost for O&M.

With any of the proposed funding sources within the financial strategy, the City is advised to confirm specific funding amounts with the appropriate funding agencies prior to making financing arrangements.

Total estimated cost for the Priority I Improvements is $9,041,400. The City has previously secured funding for a portion of the improvements at $3,109,250. A financial strategy to address financing of the Phase I Improvements within the Capital Improvement Plan is discussed below.

Grants and Low Interest Loans

Three types or programs of project funding were identified as viable for funding the City's proposed Phase I Improvements: 1) Rural Development Water and Waste Disposal Grants and Loans; 2) Business Oregon Water/Wastewater Financing Program; and 3) Clean Water State Revolving Fund. Private financing was not considered due to the fact that interest rates are historically higher than State or Federal rates. Based on these funding programs, three alternative funding packages were compiled and evaluated. These alternatives are designated as A, B, and C. A summary of the funding alternatives for these improvements is given in Table 11.3.1.

The projected rate increases anticipated from the funding options range from $5.40 to $8.60 per Equivalent Dwelling Unit (EDU) per month. These rate increases are very similar in magnitude and should be investigated further at a "One-Stop" meeting with the funding agencies. For the purposes of this financing plan, further evaluation will be made with the rate increase associated with Alternative A.

TABLE 11.3.1
FUNDING ALTERNATIVES FOR PRIORITY I IMPROVEMENTS

Funding Source	Grant Amount, $ (1)	Loan Amount, $ (1)	Loan Term, yrs	Interest Rate, %	Rate Increase, $/EDU/mth (2)
Alternative A – Rural Development (RD)/Water/Wastewater Financing Program Grants & Loans					
RD 25/75 (Grant/Loan)	$1,483,038	$4,449,113	40	2	$5.40
Alternative B – Water/Wastewater Financing Program Grants & Loans					
Water/Wastewater 20/80 (Grant/Loan)	$750,000	$5,182,150	30	2.86	$8.60
Alternative C – Clean Water State Revolving Fund Loan					
DWSRF (Loan)	--	$5,932,150	30	1.0	$7.65

(1) Amount based on current dollars.
(2) Based on 2,494 EDUs. EDUs associated with non-profit or City use was not included in the total EDU tabulation.

Local Financing Requirements

The financing plan for the Priority I Improvements is based on the City securing authorization to issue bonds for $4,449,113. A breakdown of approximate monthly water user costs for the improvements, based on current water O&M budget and debt reserve is given in Table 11.3.2. The estimated total monthly average cost to each EDU is anticipated to be approximately $53.13.

TABLE 11.3.2
APPROXIMATE MONTHLY USER COSTS

Item	Annual Cost	Monthly User Cost/EDU (1)
Debt Service on $4,153,950	$161,677	$5.40
Debt Service at 10%	$16,168	$0.54
Existing Debt Service	$39,759	$1.32
2022 - 2023 Operational O & M	$1,372,663	$45.87
Total	**$1,590,266**	**$53.13**

(1) Based on 2,494 EDUs

Affordability

One major consideration in deciding on any proposed capital improvements is the user's ability to support the full cost, including debt repayment, of utility service. Several measures of household affordability or ability-to-pay have been proposed or are currently being utilized.

The majority of affordability indicators are largely a function of income and rates. One of the most common affordability indicators is the ratio of annual user charges to the MHI. The threshold of affordability for this ratio varies from 1.5 to 2.5 percent of MHI. Business Oregon utilizes 1.25 percent of the MHI as a threshold for qualifying for grant monies (August 2018 SDWRLF).

Affordability of rates and projected rate increases are also factors when bond rating agencies are determining credit quality. Fitch Ratings generally considers combined water and sewer service rates higher than two percent of MHI (or one percent for individual water utilities) to be financially taxing (Water and Sewer Revenue Bond Rating Guidelines, Fitch Ratings September 3, 2015). A summary of affordability measures and thresholds from selected studies is provided in Table 11.3.3. If the City was

given a funding package equivalent to funding Alternative A for the Priority I projects, the affordability percentage for the City of Bandon users would be 1.71 percent. This is on the low end of average affordability, and potential grant funding may be limited.

TABLE 11.3.3
SUMMARY OF AFFORDABILITY MEASURES AND THRESHOLDS

Source	Indicator(s)	Threshold
Future Investment in Drinking Water & Wastewater Infrastructure (2002)	Ratio of annual user charge & MHI	2.5% of MHI
Rural Utilities Service Water & Waste Disposal Loans & Grants	Debt service portion of annual user charge & MHI	>0.5% & MHI below poverty line or >1.0% & MHI between 80 & 100% of statewide non-metropolitan MHI
Department of Housing & Urban Development	Ratio of water & sewer bills, & household income	1.3 to 1.4%
National Consumer Law Center "The Poor and the Elderly – Drowning in the High Cost of Water", circa 1991	Ratio of sum of water & sewer bills & household income	>2.00 %
EPA Economic Guidance for Water Quality Standards Workbook (1995)	Ratio of annual user charge & MHI	<1.0% - no hardship expected 1.0 – 2.0% - mid-range >2.0% may be unreasonable burden
Affordability Criteria for Small Drinking Water Systems: An EPA Science Advisory Board Report (2002)	Discussion of affordability threshold, expenditure baselines, and differences in cost, income, and benefits	<1.0% must provide additional security >2.5% - system probably cannot issue debt
National Drinking Water Advisory Council Affordability Recommendations (2003)	EPA national affordability threshold given size category	grounds for consideration of measures other than median income
State of Oregon Assessment Tools for SRF Loans	Ratio of annual user charge & MHI	1.5% MHI

Abbreviations: AUC – Annual User Charge
MHI – Median Household Income

One limitation of using the ratio of annual user charges to the MHI is determination of a representative MHI for a community. Currently, most funding agencies utilize the 2020 Census data for making this determination. The 2020 Census Data has the City of Bandon's MHI at $37,262 per year. The affordability of existing and future water rates within the City is summarized in Table 11.3.4.

TABLE 11.3.4
AFFORDABILITY OF PROJECTED WATER USER COSTS FOR THE CITY OF BANDON

AFFORDABILITY TABULATIONS	
Median Household Monthly Income (MHI)	$37,262
Current Monthly Rates	
Estimated Monthly User Charge/EDU ($)	$33.45
Annual User Charge/ MHI (%)	1.08%
Projected Monthly Rates	
Estimated Monthly User Charge/EDU ($)	$53.13
Annual User Charge/ MHI (%)	**1.71%**

11.4 Recommendations

The following recommendations are made to the City to implement the elements of this Water Master Plan (WMP).

1. Submit Plan to the Oregon Health Authority (OHA) and Oregon Department of Water Resources (OWRD) for review and approval.

2. Schedule and attend "One-Stop" meeting to discuss financing options for the proposed Priority I Improvements.

3. Submit necessary applications to the funding agencies requesting a loans and grants to finance the Priority I Improvements.

4. Following favorable review by the selected financing agencies, secure the authority to issue revenue or General Obligation Bonds in the amount needed to finance the Priority I Improvements.

5. Authorize the development of an Environmental Review Report, detailed design of recommended improvements and preparation of plans and specifications for the Phase I Improvements. Secure the necessary special use permits.

6. Receive construction bids and award contracts for Priority I Improvements.

7. Initiate study of user rates for water system and implement proposed changes.

8. Revise SDCs and rates for the water system based on the CIP given in this WMP.

11.5 Project Implementation

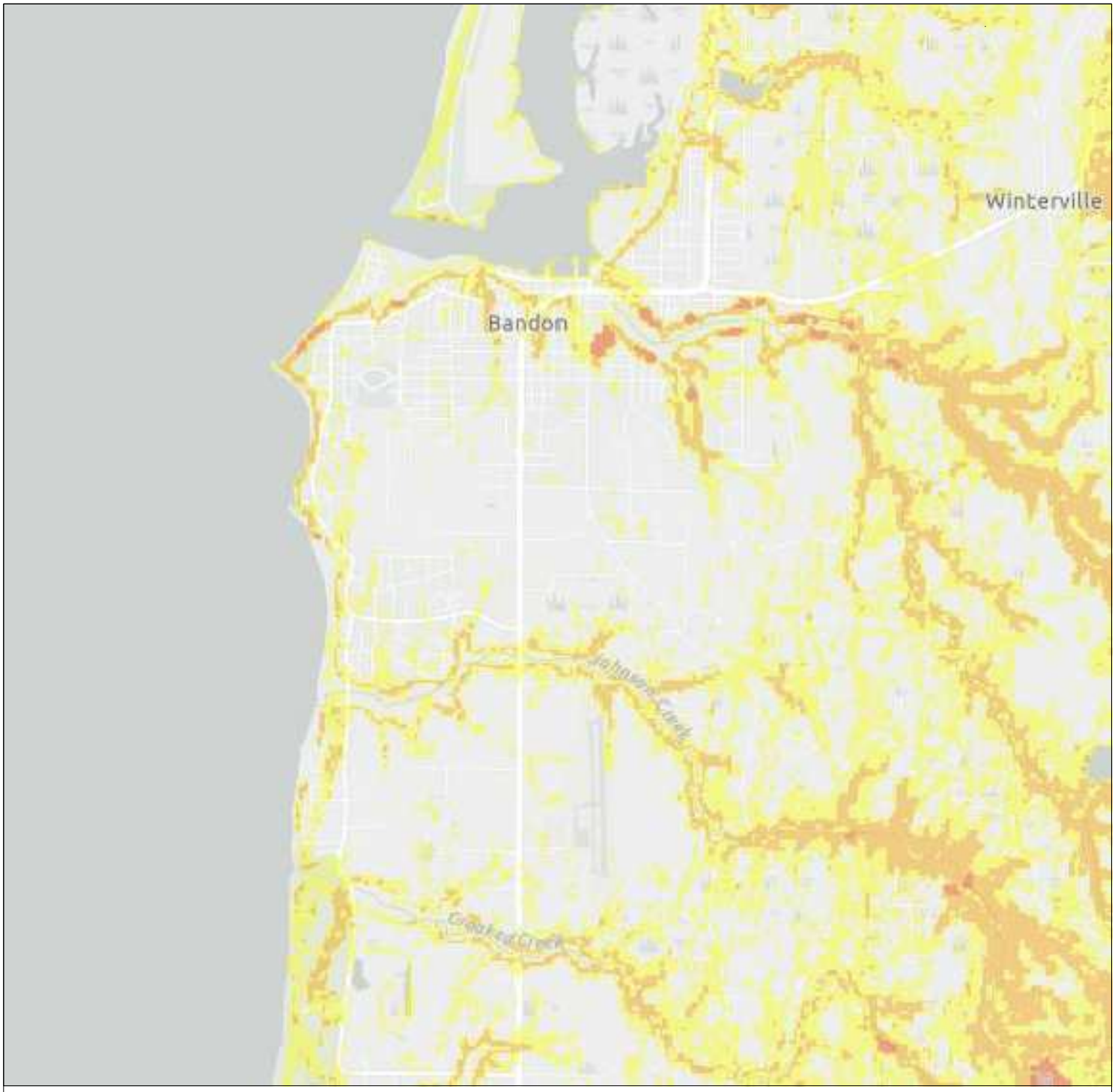
A tentative schedule, identifying the key activities and approximate implementation date for the Water Master Plan over the next three years, is presented in Table 11.5.1 on the following page.

TABLE 11.5.1
PROJECT IMPLEMENTATION SUMMARY

Item No.	Key Activity	Implementation Date
1	City Council Adopts the Water Master Plan	August 2022
2	Submit Plan to OHA and OWRD for Review and Approval	August 2022
3	Approval of Plan by Oregon Health Authority & Oregon Department of Water Resources	December 2022
4	Attend “One-Stop” Meeting	January 2023
5	Submit Application for Financing for Phase I and Associated Environmental Evaluation/Notice for Project	February 2023
6	Obtain Financing for Priority I Improvements	July 2023
7	Start Environmental Review Process, Preparation of Plans, Specifications for Phase I	August 2023
8	Complete Environmental Review, Design & Preparation of Plans, Specifications, & Contract	March 2024
9	Health Authority Approval of Plans & Specifications	May 2024
10	Advertise for Priority I Construction Bids	June 2024
11	Receive Construction Bids for Priority I Improvements	July 2024
12	Start Construction of Priority I Improvements	August 2024
13	Complete Construction of Priority I Improvements	June 2025

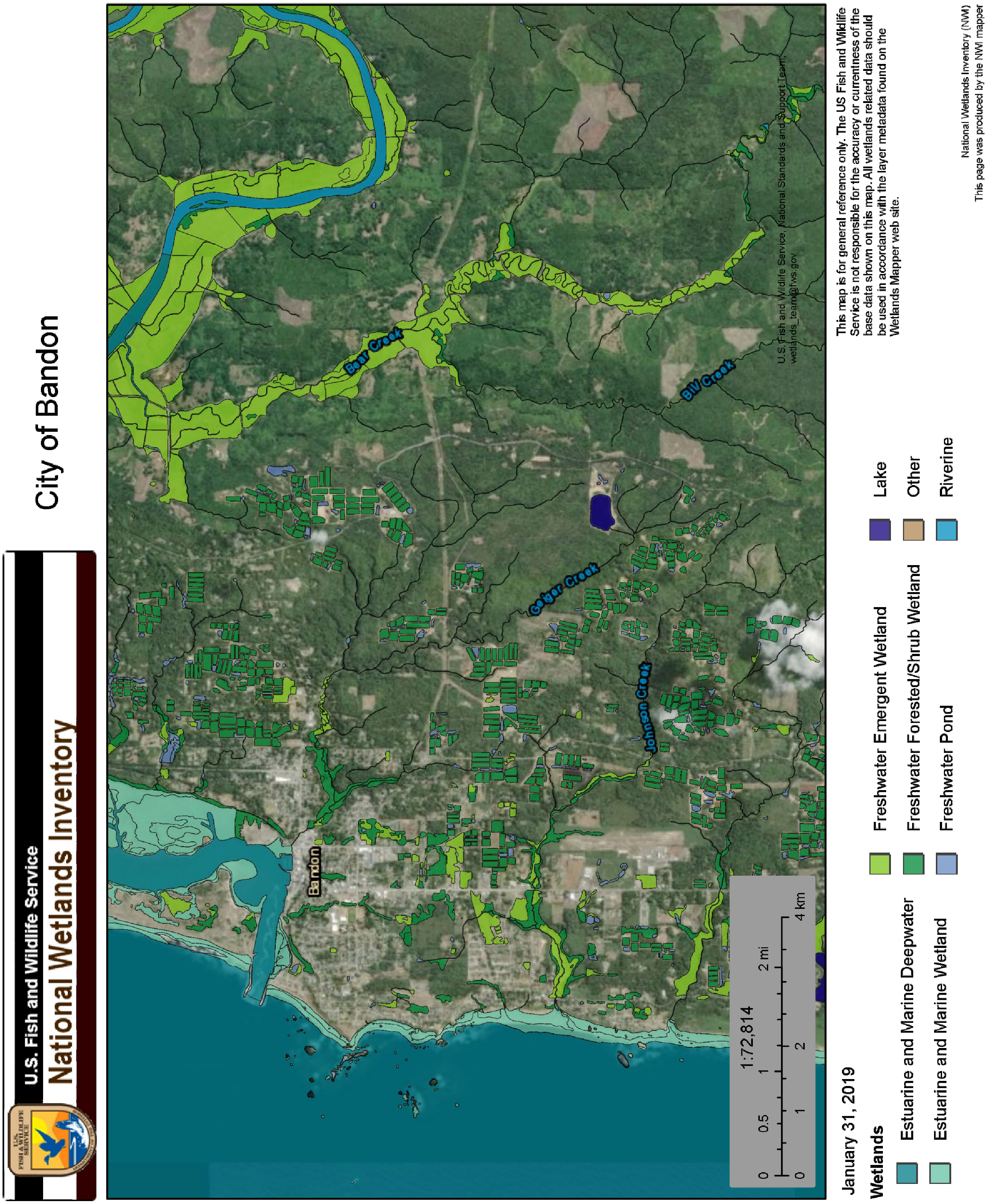
APPENDICES

APPENDIX A: STUDY AREA INFORMATION

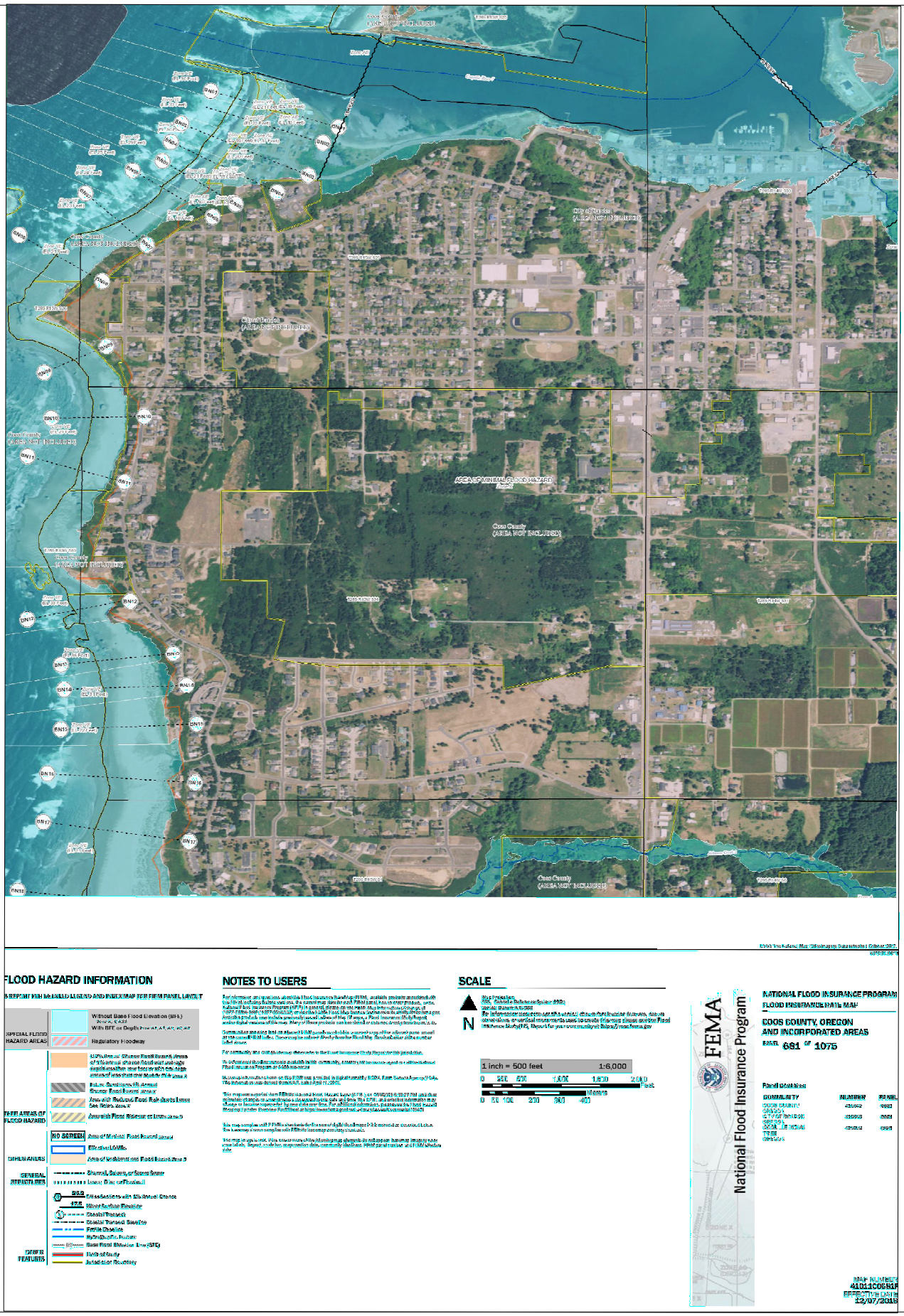


THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN***	FIGURE NO. ***A.1***
DATE: JULY 2020 PROJECT NO.: 101.100	***LANDSLIDE HAZARD MAP***	

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN***	FIGURE NO. ***A.2***
DATE: JULY 2020 PROJECT NO.: 101.100	***EARTHQUAKE HAZARD MAP***	



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN***	FIGURE NO.
DATE: JULY 2020 PROJECT NO.: 101.100	***WETLAND HAZARD MAP***	***A3***



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON WATER MASTER PLAN***	FIGURE NO. ***A4***
DATE: JULY 2020	***FEMA FIRM MAP***	
PROJECT NO.: 101.100		

APPENDIX B: WATER RIGHTS CERTIFICATES & PERMITS

RECEIVED
MAR 1 1941
STATE ENGINEER

Permit No. F 2
24

*APPLICATION FOR PERMIT

To Appropriate the Public Waters of the State of Oregon

I, City of Bandon
(Name of applicant)

of City Hall, Bandon, Oregon,
(Mailing address)

State of Oregon, do hereby make application for a permit to appropriate the following described public waters of the State of Oregon, SUBJECT TO EXISTING RIGHTS:

If the applicant is a corporation, give date and place of incorporation

Incorporated February 18, 1891, at Bandon, Oregon

1. The source of the proposed appropriation is Ferry Creek
(Name of stream)
, a tributary of Coquille River

2. The amount of water which the applicant intends to apply to beneficial use is 3 cubic feet per second. See Remarks (1)
(If water is to be used from more than one source, give quantity from each)

**3. The use to which the water is to be applied is Municipal
(Irrigation, power, mining, manufacturing, domestic supplies, etc.)

4. The point of diversion is located 1374.40 ft. S (N. or S.) and 1263.01 ft. E (E. or W.) from the ~~corner of~~ / center of Sec. 29, T. 28S., R14W. W. M.
(Section or subdivision)

(If preferable, give distance and bearing to section corner)

(If there is more than one point of diversion, each must be described. Use separate sheet if necessary)

being within the SW 1/4 SE 1/4 of Sec. 29, Tp. 28 S (N or S), R. 14 W (E. or W.), W. M., in the county of Coos.
(Give smallest legal subdivision)

5. The See Remarks (2) to be
(Main ditch, canal or pipe line) (Miles or feet)
in length, terminating in the of Sec., Tp. (N or S), R. (E. or W.), W. M., the proposed location being shown throughout on the accompanying map.
(Smallest legal subdivision)

DESCRIPTION OF WORKS

Diversion Works—

6. (a) Height of dam feet, length on top feet, length at bottom feet; material to be used and character of construction
(Loose rock, concrete, masonry)
See Remarks (2)
rock and brush, timber crib, etc., wasteway over or around dam)

(b) Description of headgate
(Timber, concrete, etc., number and size of openings)

(c) If water is to be pumped give general description
(Size and type of pump)
(Size and type of engine or motor to be used, total head water is to be lifted, etc.)

*A different form of application is provided where storage works are contemplated.

**Application for permits to appropriate water for the generation of electricity, with the exception of municipalities, must be made to the Hydroelectric Commission. Either of the above forms may be secured, without cost, together with instructions by addressing the State Engineer, Salem, Oregon.

22243

Canal System or Pipe Line—

7. *(a) Give dimensions at each point of canal where materially changed in size, stating miles from headgate. At headgate: width on top (at water line)* ..... *feet; width on bottom* ..... *feet; depth of water* ..... *feet; grade* ..... *feet fall per one thousand feet.*

(b) At ..... *miles from headgate: width on top (at water line)* ..... *feet; width on bottom* ..... *feet; depth of water* ..... *feet; grade* ..... *feet fall per one thousand feet.*

(c) Length of pipe See Remarks (2) *ft.; size at intake,* ..... *in.; size at* ..... *ft. from intake* ..... *in.; size at place of use* ..... *in.; difference in elevation between intake and place of use.* ..... *ft. Is grade uniform?* ..... *Estimated capacity,* ..... *sec. ft.*

8. *Location of area to be irrigated, or place of use* See accompanying map Sheet 1

Township North or South	Range E. or W. of Willamette Meridian	Section	Forty-acre Tract	Number Acres To Be Irrigated
28 S	R14W	19	A11	
		20	A11	
		29	A11	
		30	A11	
		31	A11	
		32	W 1/2	
28 S	R15W	24	A11	
		25	A11	
		36	A11	

(If more space required, attach separate sheet)

(a) Character of soil .....

(b) Kind of crops raised .....

Power or Mining Purposes—

9. *(a) Total amount of power to be developed* ..... *theoretical horsepower.*

(b) Quantity of water to be used for power ..... *sec. ft.*

(c) Total fall to be utilized ..... (Head) *feet.*

(d) The nature of the works by means of which the power is to be developed .....

(e) Such works to be located in ..... (Legal subdivision) *of Sec.* ..... *Tp.* ..... (No N or S) *R.* ..... (No E or W) *W. M.*

(f) Is water to be returned to any stream? ..... (Yes or No)

(g) If so, name stream and locate point of return ..... *Sec.* ..... *Tp.* ..... (No N or S) *R.* ..... (No E or W) *W. M.*

(h) The use to which power is to be applied is .....

(i) The nature of the mines to be served .....

Municipal or Domestic Supply—

10. (a) To supply the city of Bandon, Oregon

Coos (Name of) County, having a present population of 1635

and an estimated population of 3000 in 1980

(b) If for domestic use state number of families to be supplied

(Answer questions 11, 12, 13, and 14 in all cases)

11. Estimated cost of proposed works, $ See Remarks (2)

12. Construction work will begin on or before See Remarks (2)

13. Construction work will be completed on or before See Remarks (2)

14. The water will be completely applied to the proposed use on or before January 1980

CITY OF BANDON,

(Signature of applicant)

BY Claude E. Waldrop

Claude E. Waldrop, Mayor.

Remarks: (1) There being insufficient water available in this stream at low flow to satisfy the rights of the existing water right holders and the future requirements of the City of Bandon, it is requested that this water right application be granted to the exclusion of all subsequent applications on this stream in accordance with ORS 537.190 Section (2).

(2) Water under this permit will be diverted through existing facilities of the Oregon State Game Commission and the City of Bandon.

STATE OF OREGON, }
County of Marion, } ss.

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for

In order to retain its priority, this application must be returned to the State Engineer, with corrections on or before , 19 .

WITNESS my hand this day of , 19 .

STATE ENGINEER

By

ASSISTANT

PERMIT

STATE OF OREGON, }
County of Marion, } ss.

This is to certify that I have examined the foregoing application and do hereby grant the same, SUBJECT TO EXISTING RIGHTS and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 3.0 cubic feet per second measured at the point of diversion from the stream, or its equivalent in case of rotation with other water users, from Ferry Creek

The use to which this water is to be applied is municipal

This permit is issued to the exclusion of all subsequent appropriations under the provisions of the order by the State Engineer entered at Volume 11, pages 137-8, Special Order Record of the State Engineer.

If for irrigation, this appropriation shall be limited to - - of one cubic foot per second or its equivalent for each acre irrigated

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The priority date of this permit is March 7, 1961

Actual construction work shall begin on or before April 13, 1962 and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 1963.

Complete application of the water to the proposed use shall be made on or before October 1, 1963.

WITNESS my hand this 13th day of April, 1961.

Laura A. Stanley
STATE ENGINEER

Application No. 34673
Permit No. 27233

PERMIT
TO APPROPRIATE THE PUBLIC WATERS OF THE STATE OF OREGON

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 7th day of March, 1961, at 8 o'clock A. M.

Returned to applicant:

Approved:

Recorded in book No. of Permits on page

STATE ENGINEER

Drainage Basin No. 17 page 22I

Fees

State Printing 98137

STATE OF OREGON

COUNTY OF COOS

ORDER APPROVING AN ADDITIONAL POINT OF DIVERSION

Pursuant to ORS 537.211, after notice was given and no objections were filed, and finding that no injury to existing water rights would result, this order approves, as conditioned or limited herein, PERMIT AMENDMENT 8195 submitted by

CITY OF BANDON
P.O. 67
BANDON, OREGON 97411.

The first permit to be modified is Permit 3011 with a date of priority of JUNE 19, 1916. The permit allows the use of GEIGER CREEK AND GEIGER CREEK RESERVOIR CONSTRUCTED UNDER APPLICATION 5017, PERMIT R-368, a tributary of FERRY CREEK, for DOMESTIC SUPPLY. The amount of water to which this permit is entitled is limited to an amount actually beneficially used and shall not exceed 5.0 cubic feet per second, if available at the authorized point of diversion: NE¼ NE¼ SW¼, SECTION 4, T 29 S, R 14 W, W.M.; S 27°14'E 3431.4 FEET FROM THE CORNER COMMON TO SECTIONS 32, 33, 4, AND 5, T 28 AND 29 S, R 14 W, W.M., or its equivalent in case of rotation, measured at the point of diversion from the source.

This is an order in other than a contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60 day time period specified by ORS 183.484(2).

Pursuant to ORS 536.075 and OAR 137-004-080 and OAR 690-01-005 you may either petition for judicial review or petition the Director for reconsideration of this order.

The second permit to be modified is Permit 27232 with a date of priority of MARCH 7, 1961. The permit allows the use of GEIGER CREEK, a tributary of FERRY CREEK, for MUNICIPAL USE. The amount of water to which this permit is entitled is limited to an amount actually beneficially used and shall not exceed 3.0 cubic feet per second, if available at the authorized point of diversion: SW¼ SE¼, SECTION 28, T 28 S, R 14 W, W.M.; 1544.54 FEET SOUTH AND 218.9 FEET EAST FROM THE CENTER OF SECTION 29, T 28 S, R 14 W, W.M., or its equivalent in case of rotation, measured at the point of diversion from the source.

The third permit to be modified is Permit 27233 with a date of priority of MARCH 7, 1961. The permit allows the use of FERRY CREEK, a tributary of the COQUILLE RIVER, for MUNICIPAL USE. The amount of water to which this permit is entitled is limited to an amount actually beneficially used and shall not exceed 3.0 cubic feet per second, if available at the authorized point of diversion: SW¼ SE¼, SECTION 29, T 28 S, R 14 W, W.M.; 1374.4 FEET SOUTH AND 1263.01 FEET EAST FROM THE CENTER OF SECTION 29, or its equivalent in case of rotation, measured at the point of diversion from the source.

The use shall conform to any reasonable rotation system ordered by the proper state officer.

The authorized place of use is located as follows:

PERMITS 3011, 27232, 27233

ALL SECTIONS 19, 20, 29, 30 AND 31

W½ SECTION 32

TOWNSHIP 28 SOUTH, RANGE 14 WEST, W.M.

ALL SECTIONS 24, 25, AND 36

TOWNSHIP 28 SOUTH, RANGE 15 WEST, W.M.

The right to use the water for the above purpose is restricted to beneficial use on the lands or place of use described

The applicant proposes an additional point of diversion, below the confluence of Ferry Creek and Geiger Creek, located:

SW¼ SE¼, SECTION 29, T 28 S, R 14 W, W.M.; 1193.45 FEET NORTH AND 2709.05 FEET EAST FROM THE SW CORNER OF SECTION 29.

THIS CHANGE TO AN EXISTING WATER PERMITS MAY BE MADE PROVIDED THE FOLLOWING CONDITIONS ARE MET BY THE WATER USER:

1. The quantity of water diverted at the new point of diversion, together with that diverted at the old points of diversion, shall not exceed the quantity of water lawfully available at the original points of diversion.

2. The water user shall install and maintain a headgate, an in-line flow meter, weir, or other suitable device for measuring and recording the quantity of water diverted. The type and plans of the headgate and measuring device must be approved by the Department prior to beginning construction and shall be installed under the general supervision of the Department.

3. Water shall be acquired from the same surface water source as the original point of diversion.

4. All other terms and conditions of the permit remain the same.

5. The water user shall install and maintain a fish screen or fish by-pass device. The type and plans of the screen or by-pass device must be approved by the Oregon Department of Fish and Wildlife prior to beginning of construction and shall be installed under the supervision of the Department of Fish and Wildlife.

Permits 3011, 27232, and 27233, all in the name of CITY OF BANDON, are amended as described herein.

WITNESS the signature of the Water Resources Director, affixed MAR 29 2000.

for Martha O. Pagel, Director

*Reservoir Permit No. 368

APPLICATION FOR A PERMIT TO CONSTRUCT A RESERVOIR AND TO STORE FOR BENEFICIAL USE THE UNAPPROPRIATED WATERS OF THE STATE OF OREGON

We, City of Bandon
(Name of Applicant.)
of Bandon (Postoffice), County of Coos
State of Oregon, do hereby make application for a permit to construct the following described reservoir and to store the unappropriated waters of the State of Oregon, subject to existing rights.

If the applicant is a corporation, give date and place of incorporation Bandon, Oregon, Feb. 18, 1891

1. *The name of the proposed reservoir is* Giger Creek Reservoir

2. *The name of the stream from which the reservoir is to be filled and the appropriation made is* Giger Creek Tributary of Ferry Creek (Coquille River)

3. *The amount of water to be stored is* 90 *acre feet.*

4. *The use to be made of the impounded water is* Domestic Supply to be appropriated under secondary Application No. 4982, Permit No. 3011
(Irrigation, power, domestic supply, etc.)

5. *The location of the proposed reservoir will be in Sec.* 4 Twp. 29 S R 14 W.W.M.
(Give sections or townships to be submerged)

(a) *State whether situated in channel of running stream and give character of material at outlet* Res. is situated in channel of running stream. Material at outlet is earth.

(b) *If not in channel of running stream, state how it is to be filled. If through a feed canal, give name and dimensions*

6. *The dam will be located in* NW¼ NE¼ SW¼ (Smallest legal subdivision), *Sec.* 4, Tp 29 S R 14 W

*A different form of application should be used for the appropriation of stored water to beneficial use. Such forms can be secured without charge, together with instructions, by addressing the State Engineer, Salem, Oregon.

~~Tp.~~ ....., ~~R.~~ ....., ~~W.M.~~ *It will be* 30 *feet in height, having a length*
(No. N. or S.) (No. E. or W.)
on top of 140 *feet; length on bottom* 10 *feet; width on top* 14 *feet;*
slope of front or water side 3 : 1 ;
(Feet horizontal to 1 vertical)
slope on back 2 : 1 ; *height of dam above water*
(Feet horizontal to 1 vertical)
line when full 5 *feet.*

7. *The construction of dam, the material of which it is to be built, and method of protection from waves are as follows:* Earth fill with concrete core wall. ~~small and reservoir is~~ (No paving to protect front face from wave action; water area is /entirely surrounded by hills on three sides.)

8. *The location of wasteway with dimensions are as follows:* Concrete waste way 5 ft. by 14 ft. around east end of dam.
(State whether over or around the dam)

9. *The location of outlet from the proposed reservoir, with character of construction and dimensions, are as follows:* 2 16" cast iron pipes through dam and core wall
(State whether through or around the proposed dam)

10. *The area submerged by the proposed reservoir, when full, will be* 7.28 *acres, with a maximum depth of water of* 20 *feet, and approximate mean depth of water* 12 *feet.*

11. *The estimated cost of the proposed work is $* 40,000(Including pipe lines and rights of way)

12. *Construction work will begin on or before* July 1, 1917

13. *Construction work will be completed on or before* July 1, 1918

Duplicate maps of the proposed reservoir and storage works, prepared in accordance with the rules of the /Board ~~of Control,~~ State Water *accompany this application.*

City of Bandon, Coos County, Oregon
(Name of applicant)

(CORPORATE SEAL)

By Geo. C Topping, Mayor,

E B Kansrud, Recorder.

Signed in the presence of us as witnesses:

(1) J S Sawyer (Name), Bandon, Oregon (Address of witness)

(2) T Manciet (Name), Bandon, Oregon (Address of witness)

Remarks: .....

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STATE OF OREGON,
County of Marion } *ss.*

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for correction or completion, as follows: .....

.....

.....

.....

In order to retain its priority, this application must be returned to the State Engineer, with corrections, on or before ....., *19*.....

WITNESS my hand this .....*day of* ....., *19*.....

.....
State Engineer.

STATE OF OREGON,
County of Marion } *ss.*

This is to certify that I have examined the foregoing application and do hereby grant the same, subject to the following limitations and conditions: The right under this permit shall be limited to the storage of water for domestic supply to be diverted under secondary Application No. 4982,

Permit No. 3011

The right hereunder shall be limited to the storage of 90 acre feet.

~~The priority date of this permit is July 5, 1916.~~

Actual construction work shall begin on or before July 24, 1917

and shall thereafter be prosecuted with reasonable diligence and be completed on or before
June 1, 1921 EXTENDED TO 6/1/28 6/1/31
Extended to Oct. 1, 1942
Extended to Oct. 1, 1947
Extended to Oct. 1, 1952
Extended to Oct. 1, 1957
Extended to Oct. 1, 1960
Extended to Oct. 1, 1983
Extended to October 1, 1988

WITNESS my hand this 24th *day of* July, *19* 16

John H Lewis
State Engineer.

B extended to 10-1-95
B + C to 10-1-2000

368(c)

17

Application No. 5017

Reservoir Permit No. 368

PERMIT

TO CONSTRUCT A RESERVOIR AND STORE FOR BENEFICIAL USE THE UNAPPROPRIATED WATERS OF THE STATE OF OREGON

Division No. 1 District No. _____

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 5 *day of* July, *1916., at* 8:30 *o'clock* A *M.*

Returned to applicant for correction

Corrected application received

Approved

Jul 24 1916

Recorded in Book No. 2 *of Reservoirs on Page* 368

John H Lewis

State Engineer.

1 map RS $8.00

State Water

Oregon Water Resources Department
Water Rights Division

Water Rights Application
Number R-5017

Final Order
Extension of Time for Permit Number R-368

Appeal Rights

This is a final order in other than contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60 day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080 you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the Director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.

Application History

The Department issued Permit R-368 on July 24, 1916. The permit called for completion of construction by October 1, 1918 and complete application of water to beneficial use by October 1, 1921. On December 7, 2006, City of Bandon submitted to the Department an Application for Extension of Time for Permit R-368. In accordance with OAR 690-315-0050(2), on July 17, 2007, the Department issued a Proposed Final Order proposing to extend the time to complete construction to October 1, 2026 and the time to fully apply water to beneficial use to October 1, 2026. The protest period closed August 31, 2007, in accordance with OAR 690-315-0060(1). No protest was filed.

At time of issuance of the Proposed Final Order the Department concluded that, based on the factors demonstrated by the applicant, the permit may be extended subject to the following conditions:

CONDITIONS

1. **Water Use Reporting Condition**

   The permit holder shall keep a complete record of the amount of water used each month and shall submit a report which includes the recorded water use measurement to the Department annually beginning in **2008**.

2. **Checkpoint Condition**

The permit holder must submit a completed Diligence Progress Report to the Department by **October 1, in the years 2007, 2012, 2019 and 2024.** ***A form for each year is enclosed for your use.***

(a) At each checkpoint, the permit holder shall submit and the Department shall review evidence of the permit holder's diligence towards completion of the project and compliance with terms and conditions of the permit and extension. If, after this review, the Department determines the permit holder has not been diligent in developing and perfecting the water use permit, or complied with all terms and conditions, the Department shall modify or further condition the permit or extension to ensure future compliance, or begin cancellation proceedings on the undeveloped portion of the permit pursuant to ORS 537.260 or 537.410, or require submission of a final proof survey pursuant to ORS 537.250;

(b) The Department shall provide notice of receipt of progress reports in its weekly notice and shall allow a 30 day comment period for each report. The Department shall provide notice of its determination to anyone who submitted comments.

The applicant has demonstrated good cause for the permit extension pursuant to ORS 537.230, 539.010(5) and OAR 690-315-0040(2).

Order

The extension of time for Application R-5017, Permit R-368, therefore, is approved subject to conditions contained herein. The deadline for completing construction is extended to October 1, 2026. The deadline for applying water to full beneficial use is extended to October 1, 2026.

DATED: September 13, 2007

Dwight French, Administrator of
Water Rights and Adjudications
for
Phillip C. Ward, Director

- If you have any questions about statements contained in this document, please contact Kim French at (503) 986-0813.
- If you have other questions about the Department or any of its programs, please contact our Water Resources Customer Service Group at (503) 986-0900

AMENDED by special order
V. 54 pg. 199

* Permit No. 3011

APPLICATION FOR A PERMIT

To Appropriate the Public Waters of the State of Oregon

I, City of Bandon, Coos County, Oregon
(Name of Applicant)

of Bandon (Postoffice), County of Coos

State of Oregon, do hereby make application for a permit to appropriate the following described public waters of the State of Oregon, subject to existing rights:

If the applicant is a corporation, give date and place of incorporation

Incorporated Feb. 18th, 1891, at Bandon, Oregon.

1. The source of the proposed appropriation is Giger Creek and the water stored in the Giger Creek Reservoir to be constructed under Application No. 5017, Permit No. R 368 (Name of stream), tributary of Coquille River

2. The amount of water which the applicant intends to apply to beneficial use is Five cubic feet per second.

3. The use to which the water is to be applied is Domestic supplies
(Irrigation, power, mining, manufacturing, domestic supplies, etc.)

4. The point of diversion is located S 27° 14' E 3431.4 feet from the cor. to Secs. 32 - 33 - 4 & 5 Twp. 28 & 29 S R 14 W.W.M.
(Give distance and bearing to section corner)

being within the NE¼ NE¼ SW¼ (Give smallest legal subdivision) of Sec. 4, Tp. 29 S (No. N. or S.)

R. 14 W (No. E. or W.), W. M., in the county of Coos

5. The pipe line (Main ditch, canal or pipe line) to be 2.4 miles in length, terminating ~~in the~~ at the ¼ cor. bet. ~~of~~ Secs. 30 & 31 (Smallest legal subdivision), Tp. 28 S (No. N. or S.), R. 14 (No. E. or W.) W. M., the proposed location being shown throughout on the accompanying map.

6. The name of the ditch, canal or other works is Giger Creek Intake Pipe Line

DESCRIPTION OF WORKS

DIVERSION WORKS—

7. (a) Height of dam 30 feet, length on top 140 feet, length at bottom 15 feet; material to be used and character of construction
(Loose rock, concrete, masonry, rock and brush, timber crib, etc., wasteway over or around dam)
Earth fill with concrete core wall. Concrete wasteway around East end of dam.

(b) Description of headgate 16 inch Gate Valve.
(Timber, concrete, etc., number and size of openings)

* A different form of application is provided where storage works are contemplated. These forms can be secured, without charge, together with instructions, by addressing the State Engineer, Salem, Oregon.

V54 P199
T-8195

CANAL SYSTEM—

8. (a) Give ~~dimensions~~ at each point of canal where materially changed in size, stating miles from headgate. At headgate: Width on top (at water line).....feet; width on bottom .....feet; depth of water.....feet; grade.....feet fall per one thousand feet.

(b) At.....miles from headgate. Width on top (at water line)..... .....feet; width on bottom.....feet; depth of water.....feet; grade.....feet fall per one thousand feet.

.....

.....

.....

FILL IN THE FOLLOWING INFORMATION WHERE THE WATER IS USED FOR:

IRRIGATION—

9. The land to be irrigated has a total area of.....acres, located in each smallest legal subdivision, as follows: .....
(Give area of land in each smallest legal subdivision which you intend to irrigate)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(If more space is required, attach separate sheet)

POWER, MINING, MANUFACTURING, OR TRANSPORTATION PURPOSES—

10. (a) Total amount of power to be developed.....theoretical horsepower.

(b) Total fall to be utilized.....feet.
(Head)

(c) The nature of the works by means of which the power is to be developed.....

.....

(d) Such works to be located in.....of Sec.....
(Legal subdivision)

Tp....., R....., W. M.
(No. N. or S.) (No. E. or W.)

(e) Is water to be returned to any stream?.....
(Yes or No)

(f) If so, name stream and locate point of return.....

....., Sec....., Tp....., R....., W. M.
(No. N. or S.) (No. E. or W.)

(g) The use to which power is to be applied is.....

.....

(h) The nature of the mines to be served.....

.....

MUNICIPAL SUPPLY—

11. *To supply the city of* Bandon

Coos (Name of) *County, having a present population of* 2500, *and an estimated population of* 10,000 *in* ~~1930~~ 1930

(Answer questions 12, 13, 14, and 15 in all cases)

12. *Estimated cost of proposed works, $* 40,000

13. *Construction work will begin on or before* July 1, 1917

14. *Construction work will be completed on or before* July 1, 1918

15. *The water will be completely applied to the proposed use on or before* July 1, 1920

Duplicate maps of the proposed ditch or other works, prepared in accordance with the rules of the State Water Board, accompany this application.

(Corporate Seal)

City of Bandon, Coos Co., Ore.
(Name of applicant)
by Geo. P Topping, Mayor

E B Kansrud,
Recorder of the City of Bandon.

Signed in the presence of us as witnesses:

(1) J S Sawyer, (Name) Bandon, Oregon (Address of witness)

(2) T Mancier (Name) Bandon, Oregon (Address of witness)

Remarks: $40,000 Bonds have been voted by the people for this work, but the issue has not been sold.

STATE OF OREGON,
County of Marion } *ss.*

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for correction or completion, as follows:

In order to retain its priority, this application must be returned to the State Engineer, with corrections, on or before....., *191*....

WITNESS my hand this.....*day of*....., *191*....

.....
State Engineer.

3011(c)

17

Application No. 4982

Permit No. 3011

PERMIT

TO APPROPRIATE THE PUBLIC WATERS OF THE STATE OF OREGON

Division No. 1 *District No.*

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 19 *day of* June, 191 6, *at* 8:30 *o'clock* a *m.*

Returned to applicant for correction

Corrected application received

Approved:
Jul 24 1916

Recorded in Book No. 11 *of Permits, on Page* 3011

John H Lewis
State Engineer.

1 map RS

$8.00

STATE OF OREGON,
County of Marion } *ss.*

This is to certify that I have examined the foregoing application and do hereby grant the same, subject to the following limitations and conditions: ~~*If for irrigation, this appropriation shall be limited to one eightieth of one cubic foot per second, or its equivalent, for each acre irrigated, and shall be subject to such reasonable rotation system as may be ordered by the proper State officer.*~~

The use of the water under this permit shall be limited to water for domestic supply ~~and to the waters of Giger Creek,~~ and to the water stored in the Giger Creek Reservoir to be constructed under Application No. 5017, Permit No. R 368.

The amount of water appropriated shall be limited to the amount which can be applied to beneficial use and not to exceed 5.0 *cubic feet per second, or its equivalent in case of rotation. The priority date of this permit is* June 19, 1916

Actual construction work shall begin on or before July 24, 1917

and shall thereafter be prosecuted with reasonable diligence and be completed on or before
Extended to Oct. 1, 1961 Extended to Oct. 1, 1960 Extended to Oct. 1, 1947 June 1, 1921
Extended to Oct. 1, 1963 Extended to Oct. 1, 1952 EXTENDED TO 6/1/28 6/1/26 6/1/31
Extended to Oct. 1, 1968 Extended to Oct. 1, 1957 Extended to Oct. 1 1973 Extended to Oct. 1978 10-1-42
BC Extended to Oct. 1, 1948

Complete application of the water to the proposed use shall be made on or before
Extended to Oct. 1, 1961 Extended to Oct. 1, 1960 Extended to Oct. 1, 1948 October 1, 1924 10/1/26 10/1/31
Extended to Oct. 1, 1963 Extended to Oct. 1, 1952
Extended to Oct. 1, 1968 Extended to Oct. 1 1978 BC Extended to Oct. 1, 1963 Extended to Oct. 1, 1957 Extended to Oct 1978 10-1-42

WITNESS my hand this 24th *day of* July, 1916

John H Lewis
State Engineer.

~~Permits for power development are subject to the limitation of franchise as provided in Sec. 6633, Lord's Oregon Laws, and the payment of annual fees as provided in Chapter 318, Laws of 1915.~~

This form approved by the State Water Board, March 11, 1909.

BC 1988, BC extended to 10-1-95, 10-1-2000

APPENDIX C: COST ESTIMATES

Priority I

Project 1A - Water Treatment Plant Building

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$33,894	$33,894
2	Demolition and Site Prep	LS	1	$22,596	$22,596
3	***Flow Measurement Equipment***				***$91,100***
3a	Meter Vault	EA	3	$8,800	$26,400
3b	Magnetic Flow Meter	EA	3	$8,800	$26,400
3c	Recording Units	EA	3	$8,800	$26,400
3d	Signal & Power	LS	1	$5,600	$5,600
3e	Misc. Fittings and Appurtenances	LS	1	$6,300	$6,300
4	Filter Sun Shade Roof Structure	SF	2280	$100	$228,000
5	Sample Island in Laboratory	EA	1	$12,500	$12,500
6	Tile Flooring in Front Office	SF	2000	$15	$30,000
7	PLC Modifications	EA	1	$15,000	$15,000

Project Subtotal	**$433,090**
Contingency	**$65,000**
Engineering	**$86,600**
Legal Admin.	**$13,000**
Project Total	**$598,000**

Project 1B – Backup Generator System

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$76,000	$76,000
2	Demolition and Site Prep	LS	1	$50,700	$50,700
3	Generator & Transfer Switch	LS	1	$675,000	$675,000
4	Roof Structure	SF	480	$125	$60,000
5	Mis Electrical Gear & Conduit	LS	1	$50,000	$50,000
6	Concrete Pad	CY	20	$500	$10,000
7	Installation	LS	1	$50,000	$50,000

Project Subtotal	**$971,700**
Contingency	**$145,800**
Engineering	**$145,800**
Legal Admin.	**$38,900**
Project Total	**$1,302,000**

Project 1C – Existing Clarifier Replacement

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$194,100	$194,100
2	Demolition and Site Prep	LS	1	$145,500	$145,500
3	Excavation	CY	140	$25	$3,500
4	Engineered Fill	CY	135	$50	$6,750
5	Concrete Tank	LS	1	$1,100,000	$1,100,000
6	Clarifier Mechanism	LS	1	$577,500	$577,500
7	Tube Settlers	LS	1	$66,000	$66,000
8	Painting	LS	1	$60,000	$60,000
9	Miscellaneous Metals	LS	1	$42,200	$42,200
10	Site Piping	LS	1	$42,200	$42,200
11	Appurtenances	LS	1	$34,000	$34,000
12	Landscaping	LS	1	$8,500	$8,500

Project Subtotal	**$2,280,300**
Contingency	**$342,000**
Engineering	**$410,500**
Legal Admin.	**$15,000**
Project Total	**$3,047,800**

Project 2 - 2 MG Treated Water Storage Tank Improvements

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$122,700	$122,700
2	Demolition and Site Prep	LS	1	$68,200	$68,200
3	Seismic Upgrades	LS	1	$250,000	$250,000
4	Interior Surface Preparation	LS	1	$166,800	$166,800
5	Interior Coatings	LS	1	$442,488	$442,488
6	Exterior Surface Preparation	LS	1	$81,140	$81,140
7	Exterior Surface Coatings	LS	1	$421,900	$421,900

Project Subtotal	**$1,553,228**
Contingency	**$232,972**
Engineering	**$279,600**
NACE Inspection	**$18,000**
Legal Admin.	**$46,600**
Project Total	**$2,130,400**

Project 3 - 1MG Treated Water Storage Tank Rehabilitation

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$55,700	$55,700
2	Demolition and Site Prep	LS	1	$31,000	$31,000
3	Seismic Upgrades	LS	1	$325,000	$325,000
4	Interior Surface Preparation	LS	1	$87,750	$87,750
5	Interior Coatings	LS	1	$205,750	$205,750

Project Subtotal	**$705,200**
Contingency	**$105,800**
Engineering	**$141,100**
NACE Inspection	**$12,000**
Legal Admin.	**$21,200**
Project Total	**$985,300**

Project 4 - Middle Pond Pump Station

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$20,200	$20,200
2	Demolition and Site Prep	LS	1	$10,100	$10,100
3	Pump and Volute (700 gpm)	EA	2	$97,500	$195,000
4	Exhaust Fan	EA	1	$3,800	$3,800
5	Floating Dock-Pre-Fabricated	EA	1	$2,500	$2,500

Project Subtotal	**$231,600**
Contingency	**$34,800**
Engineering	**$46,400**
Legal Admin.	**$9,300**
Project Total	**$322,100**

Project 5 - Lower Pump Station

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$19,900	$19,900
2	Demolition and Site Prep	LS	1	$10,000	$10,000
3	Pump (700 gpm)	EA	2	$97,500	$195,000
4	Exhaust Fan	EA	1	$3,800	$3,800

Project Subtotal	**$228,700**
Contingency	**$34,400**
Engineering	**$45,800**
Legal Admin.	**$9,200**
Project Total	**$318,100**

Project 6 – Groundwater Supply, See Supplemental Ground Water Feasibility Study in Appendix E

Priority II

Project 7A – Raw Water Supply

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Construction Facilities and Temp. Controls	1	LS	$637,700.00	$ 637,700
2	Site Preparation	1	LS	$7,500.00	$ 7,500
3	Access Road Construction	1	LS	$1,300.00	$ 1,300
4	Dike Road Surfacing	1	LS	$12,500.00	$ 12,500
5	Geotextile Fabric	3,500	SY	$2.00	$ 7,000
6	Aggregate Base	1,000	Ton	$26.00	$ 26,000
7	Perimeter Drainage Ditch	2,550	LF	$2.00	$ 5,100
8	Foundation Stabilization	375	CY	$40.00	$ 15,000
9	Stripping - Removal	74,200	CY	$3.75	$ 278,250
10	Stripping - Reinstallation	74,200	CY	$3.25	$ 241,150
11	Excavation - used for sediment & overflow basins	26,100	CY	$3.50	$ 91,350
12	Excavation/Embankment - used for berm	52,200	CY	$4.00	$ 208,800
13	Cement Amendment for slope stabilization	15,600	CY	$6.00	$ 93,600
14	Pond Surface Fine Grading	1	LS	$10,000.00	$ 10,000
15	Pond Anchor Trench	1,500	LF	$5.00	$ 7,500
16	Pond Underdrains	1	LS	$25,000.00	$ 25,000
17	Pond Liner Underlainment	700,000	SF	$0.60	$ 420,000
18	Pond Lining (includes leakage testing)	700,000	SF	$1.00	$ 700,000
19	Floating Algae Control Cover	275,000	SF	$3.00	$ 825,000
20	Mixer / Aerator Unit	3	EA	$57,000.00	$ 171,000
21	Johnson Fish Screen w/ Air Scour System	1	LS	$25,000.00	$ 25,000
22	12" Misc. Fittings	8	EA	$1,100.00	$ 8,800
23	12" Gate Valve	1	EA	$2,100.00	$ 2,100
24	12" Check Valve	2	EA	$6,000.00	$ 12,000
25	8" Check Valve	1	EA	$4,000.00	$ 4,000
26	12" Float Valve	1	EA	$20,000.00	$ 20,000
27	Emergency Spillway Structure	2	EA	$3,000.00	$ 6,000
28	Safety Equipment (for maintenance)	1	LS	$10,000.00	$ 10,000
29	Creek Crossing	1	LS	$20,000.00	$ 20,000
30	Pipe Inlet & Outfall Structures (Manifold System)	2	EA	$20,000.00	$ 40,000
31	Pump Station Connection	1	LS	$25,000.00	$ 25,000
32	Pump Station Improvements	1	LS	$75,000.00	$ 75,000
33	12" DIP Restrained Joint Waterline - Class C	150	LF	$110.00	$ 16,500
34	12" DIP Restrained Joint Waterline - Class B	400	LF	$85.00	$ 34,000
35	12" DIP Waterline - Class B	1,750	LF	$70.00	$ 122,500

Item	Description	Units	No. Units	Unit Cost		Subtotal
36	12" C900 PVC Waterline - Class C	1,600	LF	$65.00	$	104,000
37	8" C900 PVC Waterline - Class C	150	LF	$45.00	$	6,750
38	Concrete Anchor Wall	2	EA	$1,500.00	$	3,000
39	Combination Air Release Valve w/vault	1	EA	$2,100.00	$	2,100
40	Standard Blowoff Assembly	1	EA	$1,150.00	$	1,150
41	SCADA	1	LS	$25,000.00	$	25,000
42	Electrical to site by Bandon Electric	1	LS	$50,000.00	$	50,000
43	Electrical Site Service	1	LS	$6,000.00	$	6,000
44	HP Generator System	1	LS	$50,000.00	$	50,000
45	10HP duplex pump station	1	LS	$75,000.00	$	75,000
46	Pre-sedimentation Basin System Exc/Emb	2,800	CY	$4.00	$	11,200
47	Pre-sedimentation Basin Liner/Underlainment	9,600	SF	$1.30	$	12,480
48	Safety Equipment (for maintenance)	1	LS	$2,500.00	$	2,500
49	Energy Dissipator Basin	1	LS	$7,500.00	$	7,500
50	Overflow Bioswale Exc/Emb	4,500	CY	$3.50	$	15,750
51	Security Fence	3,600	LF	$75.00	$	270,000
52	Security Gate	1	EA	$10,000.00	$	10,000
53	Erosion & Sediment Control	1	LS	$7,000.00	$	7,000
54	Landscaping	1	LS	$25,000.00	$	25,000

Project Subtotal	**$4,889,000**
Contingency	**$1,222,000**
Engineering	**$831,000**
Permitting	**$90,000**
Geotechnical	**$55,000**
Water Rights	**$20,000**
Planning	**$147,000**
Administration	**$7,254,000**
Inflation Factor	**$1,088,000**
Project Total	**$8,342,000**

Project 7B – Groundwater Supply , See Supplemental Ground Water Feasibility Study in Appendix E

Priority III

Project 8 - 8TH ST SW - Oregon AVE to Franklin AVE SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$32,300	$32,300
2	Demolition	LS	1	$21,500	$21,500
3	New 8-inch Waterline	LF	1650	$130	$214,500
4	Fire Hydrant Assembly	EA	2	$6,300	$12,600
5	Connections to Exist 6-inch	EA	1	$2,500	$2,500
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Misc. Fittings and Appurtenances	LS	1	$26,600	$26,600
8	AC Patch	LF	1650	$60	$99,000
9	Service Lateral	EA	12	$1,800	$21,600

Project Subtotal	**$433,500**
Contingency	**$65,100**
Engineering	**$86,700**
Legal Admin.	**$17,400**
Project Total	**$602,700**

Project 9 - Beach Loop DR - Seabird DR to Best Western

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$29,100	$29,100
2	Demolition	LS	1	$19,400	$19,400
3	New 10-inch Waterline	LF	1300	$150	$195,000
4	Fire Hydrant Assembly	EA	3	$6,300	$18,900
5	Connections to Exist 6-inch	EA	1	$2,500	$2,500
6	Connections to Exist 12-inch	EA	1	$4,800	$4,800
7	Misc. Fittings and Appurtenances	LS	1	$24,000	$24,000
8	AC Patch	LF	1300	$60	$78,000
9	Service Lateral	EA	21	$1,800	$37,800

Project Subtotal	**$409,500**
Contingency	**$61,500**
Engineering	**$81,900**
Legal Admin.	**$16,400**
Project Total	**$569,300**

Project 10 - 13TH ST SW - Franklin AVE SW to Allegheny AVE SW to Allegheny RD

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$39,600	$39,600
2	Demolition	LS	1	$26,400	$26,400
3	New 8-inch Waterline	LF	2150	$130	$279,500
4	Fire Hydrant Assembly	EA	2	$6,300	$12,600
5	Connections to Exist 4-inch	EA	1	$1,900	$1,900
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Misc. Fittings and Appurtenances	LS	1	$32,600	$32,600
8	AC Patch	LF	1830	$60	$109,800

Project Subtotal	**$505,300**
Contingency	**$75,800**
Engineering	**$101,100**
Legal Admin.	**$20,300**
Project Total	**$702,500**

Project 11 - Ohio AVE NE - Highway 42S to 10TH ST NE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$88,200	$88,200
2	Demolition	LS	1	$58,800	$58,800
3	New 12-inch Waterline	LF	3910	$180	$703,800
4	Fire Hydrant Assembly	EA	2	$6,300	$12,600
5	Connections to Exist 4-inch	EA	6	$1,900	$11,400
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Connections to Exist 12-inch	EA	2	$4,800	$9,600
8	Misc. Fittings and Appurtenances	LS	1	$72,600	$72,600
9	AC Patch	LF	2770	$60	$166,200

Project Subtotal	**$1,126,100**
Contingency	**$169,000**
Engineering	**$225,300**
Legal Admin.	**$45,100**
Project Total	**$1,565,500**

Project 12 - 10TH ST NE - Michigan AVE - Ohio AVE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$30,100	$30,100
2	Demolition	LS	1	$20,100	$20,100
3	New 12-inch Waterline	LF	1193	$180	$214,740
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 12-inch	EA	2	$4,800	$9,600
6	Misc. Fittings and Appurtenances	LS	1	$24,100	$24,100
7	AC Patch	LF	730	$60	$43,800
8	Boring under Roadway	LF	85	$310	$26,350
9	Service Lateral	EA	5	$1,800	$9,000

Project Subtotal	**$384,100**
Contingency	**$57,700**
Engineering	**$76,900**
Legal Admin.	**$15,400**
Project Total	**$534,100**

Project 13 - Jackson AVE SW 12TH ST SW to Face Rock DR

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$34,000	$34,000
2	Demolition	LS	1	$22,700	$22,700
3	New 8-inch Waterline	LF	2200	$130	$286,000
4	AC Patch	LF	600	$60.00	$36,000
5	Fire Hydrant Assembly	EA	4	$6,300	$25,200
6	Connections to Exist 4-inch	EA	1	$1,900	$1,900
7	Misc. Fittings and Appurtenances	LS	1	$28,000	$28,000
8	Service Lateral	EA	5	$1,800	$9,000

Project Subtotal	**$442,800**
Contingency	**$66,500**
Engineering	**$88,600**
Legal Admin.	**$17,800**
Project Total	**$615,700**

Project 14 - Michigan AVE - 10TH ST NE to 4TH ST NE to Lexington AVE NE to 2ND ST NE to June AVE NE to 1ST ST NE to Harlem ST to Caroline ST SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$85,600	$85,600
2	Demolition	LS	1	$57,100	$57,100
3	New 8-inch Waterline	LF	4030	$130	$523,900
4	Fire Hydrant Assembly	EA	6	$6,300	$37,800
5	Connections to Exist 6-inch	EA	6	$2,500	$15,000
6	Connections to Exist 12-inch	EA	2	$4,800	$9,600
7	Misc. Fittings and Appurtenances	LS	1	$66,300	$66,300
8	AC Patch	LF	4030	$60	$241,800
9	Service Lateral	EA	31	$1,800	$55,800

Project Subtotal	**$1,092,900**
Contingency	**$164,000**
Engineering	**$218,600**
Legal Admin.	**$43,800**
Project Total	**$1,519,300**

Project 15 – 13TH ST SE – Highway 101 to Delaware AVE SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$19,700	$19,700
2	Demolition	LS	1	$13,100	$13,100
3	New 6-inch Waterline	LF	1090	$110	$119,900
4	Fire Hydrant Assembly	EA	6	$6,300	$37,800
5	Connections to Exist 6-inch	EA	2	$2,500	$5,000
6	Connections to Exist 4-inch	EA	2	$1,900	$3,800
7	Misc. Fittings and Appurtenances	LS	1	$16,200	$16,200
8	AC Patch	LF	590	$60	$35,400
9	Service Lateral	EA	7	$1,800	$12,600

Project Subtotal	**$263,500**
Contingency	**$39,600**
Engineering	**$52,700**
Legal Admin.	**$10,600**
Project Total	**$366,400**

Project 16 - System-Wide Water Meter Replacement

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	2245	$32	$72,500
2	Demolition and Site Prep	LS	2245	$26	$58,000
3	Install New Water Meters	EA	2245	$323	$724,700
4	New AMR Equipment	LS	1	$10,700	$10,700

Project Subtotal	**$865,900**
Contingency	**$129,900**
Engineering	**$173,200**
Legal Admin.	**$34,700**
Project Total	**$1,203,700**

Project 17 – Chicago AVE SE – 9TH ST SE to 10TH ST SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$4,500	$4,500
2	Demolition	LS	1	$3,000	$3,000
3	New 6-inch Waterline	LF	300	$110	$33,000
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 4-inch	EA	1	$1,900	$1,900
6	Connections to Exist 6-inch	EA	1	$2,500	$2,500
7	Misc. Fittings and Appurtenances	LS	1	$3,700	$3,700
8	AC Patch	LF	40	$60	$2,400
9	Service Lateral	EA	4	$1,800	$7,200

Project Subtotal	**$64,500**
Contingency	**$9,700**
Engineering	**$12,900**
Legal Admin.	**$2,600**
Project Total	**$89,700**

Project 18 - North AVE SE, 3RD ST SE to 4TH ST SE & June AVE SE, Klamath AVE SE, Lexington AVE SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$18,000	$18,000
2	Demolition	LS	1	$12,000	$12,000
3	New 6-inch Waterline	LF	973	$110	$107,030
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 4-inch	EA	3	$1,900	$5,700
6	Connections to Exist 6-inch	EA	3	$2,500	$7,500
7	Misc. Fittings and Appurtenances	LS	1	$14,800	$14,800
8	AC Patch	LF	973	$60	$58,380

Project Subtotal	**$229,700**
Contingency	**$34,500**
Engineering	**$46,000**
Legal Admin.	**$9,200**
Project Total	**$319,400**

Project 19 – 9TH ST SW to Jackson AVE SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$4,200	$4,200
2	Demolition	LS	1	$2,800	$2,800
3	New 6-inch Waterline	LF	260	$110	$28,600
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 4-inch	EA	1	$1,900	$1,900
6	Connections to Exist 10-inch	EA	1	$3,800	$3,800
7	Misc. Fittings and Appurtenances	LS	1	$3,300	$3,300
8	AC Patch	LF	30	$60	$1,800

Project Subtotal	**$52,700**
Contingency	**$8,000**
Engineering	**$10,600**
Legal Admin.	**$2,200**
Project Total	**$73,500**

Project 20 – 2ND W ST – Douglas AVE SW to Edison AVE SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$5,300	$5,300
2	Demolition	LS	1	$3,600	$3,600
3	New 6-inch Waterline	LF	320	$110	$35,200
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 4-inch	EA	1	$1,900	$1,900
6	Connections to Exist 10-inch	EA	1	$3,800	$3,800
7	Misc. Fittings and Appurtenances	LS	1	$9,000	$9,000
8	AC Patch	LF	40	$60	$2,400
9	Service Lateral	EA	3	$1,800	$5,400

Project Subtotal	**$72,900**
Contingency	**$11,000**
Engineering	**$14,600**
Legal Admin.	**$3,000**
Project Total	**$101,500**

Project 21 – 9TH ST – Jackson AVE SW to Beach Loop DR

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$37,300	$37,300
2	Demolition	LS	1	$24,900	$24,900
3	New 10-inch Waterline	LF	2000	$150	$300,000
4	Fire Hydrant Assembly	EA	4	$6,300	$25,200
5	Connections to Exist 10-inch	EA	2	$3,800	$7,600
6	Connections to Exist 6-inch	EA	1	$2,500	$2,500
7	Misc. Fittings and Appurtenances	LS	1	$30,500	$30,500
8	AC Patch	LF	800	$60	$48,000

Project Subtotal	**$476,000**
Contingency	**$71,400**
Engineering	**$95,200**
Legal Admin.	**$19,100**
Project Total	**$661,700**

Project 22 - Highway 101 - 15TH ST SE to 17TH ST SE down 17TH

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$16,900	$16,900
2	Demolition	LS	1	$11,300	$11,300
3	New 6-inch Waterline	LF	770	$110	$84,700
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 6-inch	EA	3	$2,500	$7,500
6	Misc. Fittings and Appurtenances	LS	1	$32	$31,600
7	AC Patch	LF	770	$60	$46,200
8	Service Lateral	EA	6	$1,800	$10,800

Project Subtotal	**$215,300**
Contingency	**$32,300**
Engineering	**$43,100**
Legal Admin.	**$8,700**
Project Total	**$299,400**

Project 23 - Baltimore AVE SE – 17TH ST SE to 20TH ST SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$13,000	$13,000
2	Demolition	LS	1	$8,700	$8,700
3	New 8-inch Waterline	LF	800	$130	$104,000
4	Fire Hydrant Assembly	EA	2	$6,300	$12,600
5	Connections to Exist 6-inch	EA	1	$2,500	$2,500
6	Misc. Fittings and Appurtenances	LS	1	$22,900	$22,900
7	AC Patch	LF	30	$60	$1,800

Project Subtotal	**$165,500**
Contingency	**$24,900**
Engineering	**$33,100**
Legal Admin.	**$6,700**
Project Total	**$230,200**

Project 24 - Franklin AVE SW - 11TH ST SW to 13TH ST SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$16,000	$16,000
2	Demolition	LS	1	$10,700	$10,700
3	New 8-inch Waterline	LF	780	$130	$101,400
4	Fire Hydrant Assembly	EA	2	$6,300	$12,600
5	Connections to Exist 4-inch	EA	2	$1,900	$3,800
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Misc. Fittings and Appurtenances	LS	1	$9,700	$9,700
8	AC Patch	LF	780	$60	$46,800
9	Service Lateral	EA	8	$1,800	$14,400

Project Subtotal	**$218,300**
Contingency	**$32,800**
Engineering	**$43,700**
Legal Admin.	**$8,800**
Project Total	**$303,600**

Project 25 - South Bandon 0.25 Million Gallon Reservoir & Pump Station

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$121,100	$121,100
2	Demolition and Site Prep	LS	1	$80,800	$80,800
3	.27-MG Bolted Steel Tank	EA	1	$552,600	$552,600
4	Site Work and Fencing	LS	1	$77,500	$77,500
5	Access Road	EA	1	$38,700	$38,700
6	Misc. Fittings and Appurtenances	LS	1	$129,100	$100,000
7	8" line connection to Existing	LF	800	$130	$104,000
8	New Pump Station	EA	1	$472,600	$472,600
9	Seismic Valving	EA	1	$232,400	$232,400
10	Electrical-On-Site and Service	EA	1	$45,200	$45,200
11	Telemetry	EA	1	$32,300	$32,300
12	Exterior Liquid Level Indicator	EA	1	$6,500	$6,500

Project Subtotal	**$1,863,700**
Contingency	**$279,600**
Engineering	**$372,800**
Legal Admin.	**$74,600**
Environmental Review	**$30,000**
Land Acquisition	**$110,300**
Project Total	**$2,731,000**

Project 26 - Franklin AVE SW 15TH ST SE to 24TH ST SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$35,700	$35,700
2	Demolition	LS	1	$23,800	$23,800
3	New 8-inch Waterline	LF	2450	$130	$318,500
4	AC Patch	LF	250	$ 60.00	$15,000
5	Fire Hydrant Assembly	EA	4	$6,300	$25,200
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Connections to Exist 12-inch	EA	1	$4,800	$4,800
8	Misc. Fittings and Appurtenances	LS	1	$29,400	$29,400
9	Service Lateral	EA	5	$1,800	$9,000

Project Subtotal	**$464,300**
Contingency	**$69,700**
Engineering	**$92,900**
Legal Admin.	**$18,600**
Project Total	**$645,500**

Project 27 – Franklin AVE SW to 24TH ST SW to Seabird DR

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$32,200	$32,200
2	Demolition	LS	1	$21,500	$21,500
3	New 8-inch Waterline	LF	1900	$130	$247,000
4	AC Patch	LF	600	$60.00	$36,000
5	Fire Hydrant Assembly	EA	6	$6,300	$37,800
6	Connections to Exist 12-inch	EA	2	$4,800	$9,600
7	Misc. Fittings and Appurtenances	LS	1	$26,500	$26,500
8	Service Lateral	EA	4	$1,800	$7,200

Project Subtotal	**$417,800**
Contingency	**$62,700**
Engineering	**$83,600**
Legal Admin.	**$16,800**
Project Total	**$580,900**

Project 28 - Face Rock DR to Jackson AVE SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$35,700	$35,700
2	Demolition	LS	1	$23,800	$23,800
3	New 12-inch Waterline	LF	1280	$180	$230,400
4	AC Patch	LF	810	$60.00	$48,600
5	Fire Hydrant Assembly	EA	13	$6,300	$81,900
6	Connections to Exist 8-inch	EA	2	$2,900	$5,800
7	Misc. Fittings and Appurtenances	LS	1	$29,400	$29,400

Project Subtotal	**$455,600**
Contingency	**$68,400**
Engineering	**$91,200**
Legal Admin.	**$18,300**
Project Total	**$633,500**

Project 29 - Jackson AVE SW - Face Rock DR to New South Tank Line

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$21,600	$21,600
2	Demolition	LS	1	$14,400	$14,400
3	New 8-inch Waterline	LF	1500	$130	$195,000
4	Fire Hydrant Assembly	EA	3	$6,300	$18,900
5	Connections to Exist 8-inch	EA	1	$2,900	$2,900
6	Connections to Exist 12-inch	EA	1	$4,800	$4,800
7	Misc. Fittings and Appurtenances	LS	1	$17,800	$17,800

Project Subtotal	**$275,400**
Contingency	**$41,400**
Engineering	**$55,100**
Legal Admin.	**$11,100**
Project Total	**$383,000**

Project 30 - Polaris ST to Beach Loop DR

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$7,100	$7,100
2	Demolition	LS	1	$5,000	$5,000
3	New 8-inch Waterline	LF	430	$130	$55,900
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 6-inch	EA	1	$2,500	$2,500
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Misc. Fittings and Appurtenances	LS	1	$5,800	$5,800
8	AC Patch	LF	75	$60	$4,500
9	Service Lateral	EA	3	$1,800	$5,400

Project Subtotal	**$95,400**
Contingency	**$14,400**
Engineering	**$19,100**
Legal Admin.	**$3,900**
Project Total	**$132,800**

APPENDIX D: WATER TREATMENT PLANT DATA

Pumped to City (gal)								
Month	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Average**
January	11,091,797	8,402,712	13,005,926	11,738,685	14,152,597	11,835,541	12,116,579	11,763,405
February	9,410,938	9,607,599	10,696,268	10,791,306	12,472,871	11,515,025	12,184,553	10,954,080
March	11,002,676	12,255,603	13,407,293	12,358,857	14,082,671	15,561,375	12,732,398	13,057,268
April	13,742,158	12,562,750	12,657,557	12,752,472	16,257,338	11,621,500	15,097,749	13,527,361
May	12,596,462	13,772,754	14,220,398	15,738,216	5,077,088	13,003,107	18,400,051	13,258,297
June	14,891,561	17,593,898	17,257,483	16,983,727	20,723,758	15,116,808	20,041,040	17,515,468
July	17,664,347	20,695,494	21,573,307	17,908,718	22,665,767	21,505,731	22,601,463	20,659,261
August	15,685,285	20,246,074	21,651,084	17,956,509	20,787,790	22,388,703	22,069,441	20,112,127
September	13,478,919	15,127,138	15,114,996	17,663,071	16,699,467	19,386,817	18,995,125	16,637,933
October	12,124,284	12,439,545	12,648,143	18,486,376	14,821,684	18,168,208	16,143,861	14,976,014
November	8,979,922	9,885,085	9,885,085	16,237,262	13,175,982	13,902,786	13,555,697	12,231,688
December	8,829,998	12,450,929	9,633,145	14,457,902	12,218,825	12,835,442	12,889,078	11,902,188
Total	149,498,347	165,039,582	171,750,685	183,073,101	183,135,838	186,841,043	196,827,035	176,595,090

Totalized Treated Water (gal)								
Month	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Average**
January	10,037,933	9,437,047	10,385,405	10,617,637	12,176,591	12,166,982	11,795,854	10,945,350
February	10,389,175	8,332,837	8,124,537	9,428,274	10,853,290	12,549,872	12,266,644	10,277,804
March	11,287,161	11,008,274	10,386,129	10,786,097	11,570,467	13,342,346	11,844,494	11,460,710
April	12,418,422	10,491,886	9,926,936	10,968,340	14,085,902	12,881,391	14,624,322	12,199,600
May	14,129,995	15,251,919	11,197,571	14,750,151	4,338,391	14,339,976	16,960,296	12,995,471
June	16,700,037	16,354,611	14,426,996	17,298,038	18,189,831	15,979,755	18,292,474	16,748,820
July	20,223,091	19,327,410	19,313,055	21,271,481	22,007,286	19,848,762	20,632,626	20,374,816
August	18,828,868	18,915,206	19,985,410	20,941,829	20,851,156	20,251,817	16,781,594	19,507,983
September	15,077,211	16,474,680	16,481,367	19,012,519	16,381,309	17,953,175	13,955,361	16,476,517
October	13,857,640	13,273,656	15,578,711	17,229,008	14,361,529	17,240,310	12,834,165	14,910,717
November	9,992,095	11,004,266	11,862,592	15,219,599	12,896,996	13,374,215	13,473,081	12,546,121
December	10,112,003	10,677,165	10,752,348	12,851,181	11,767,130	12,410,913	12,460,812	11,575,936
Total	163,053,629	160,548,956	158,421,059	180,374,155	169,479,878	182,339,514	175,921,723	170,019,845

WTP Backwash (gal)								
Month	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Average**
January	680,791	751,668	905,851	902,345	1,198,759	978,961	748,894	881,038
February	754,474	677,988	753,839	827,400	1,046,495	823,714	599,440	783,336
March	680,595	770,307	902,741	901,982	746,119	597,105	748,651	763,929
April	831,733	752,459	754,073	828,699	819,810	598,549	896,204	783,075
May	1,056,907	902,505	903,996	1,472,816	295,738	747,636	1,352,003	961,657
June	904,669	904,859	902,329	1,583,092	1,046,193	601,482	973,478	988,015
July	1,055,292	980,977	1,506,820	1,201,788	1,122,453	898,524	899,531	1,095,055
August	904,480	979,707	1,204,936	1,052,606	1,045,770	747,030	823,103	965,376
September	909,185	827,299	1,053,594	1,125,044	827,700	974,222	824,829	934,553
October	831,779	753,861	904,420	899,622	752,959	1,199,741	601,352	849,105
November	678,944	981,757	828,948	900,076	600,119	600,469	601,161	741,639
December	677,362	906,076	829,248	899,637	809,101	755,070	753,278	804,253
Total	9,966,213	10,189,463	11,450,794	12,595,108	10,311,216	9,522,503	9,821,924	10,551,032

WTP % Backwash								
Month	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Average**
January	6.78%	7.97%	8.72%	8.50%	9.84%	8.05%	6.35%	8.03%
February	7.26%	8.14%	9.28%	8.78%	9.64%	6.56%	4.89%	7.79%
March	6.03%	7.00%	8.69%	8.36%	6.45%	4.48%	6.32%	6.76%
April	6.70%	7.17%	7.60%	7.56%	5.82%	4.65%	6.13%	6.52%
May	7.48%	5.92%	8.07%	9.99%	6.82%	5.21%	7.97%	7.35%
June	5.42%	5.53%	6.25%	9.15%	5.75%	3.76%	5.32%	5.88%
July	5.22%	5.08%	7.80%	5.65%	5.10%	4.53%	4.36%	5.39%
August	4.80%	5.18%	6.03%	5.03%	5.02%	3.69%	4.90%	4.95%
September	6.03%	5.02%	6.39%	5.92%	5.05%	5.43%	5.91%	5.68%
October	6.00%	5.68%	5.81%	5.22%	5.24%	6.96%	4.69%	5.66%
November	6.79%	8.92%	6.99%	5.91%	4.65%	4.49%	4.46%	6.03%
December	6.70%	8.49%	7.71%	7.00%	6.88%	6.08%	6.05%	6.99%
Total	6.27%	6.67%	7.45%	7.25%	6.36%	5.32%	5.61%	6.42%

City Usage Data-Based on Billing

Year	Month	Residential (IC)	Commercial (IC)	Residential (OC)	Commercial (OC)	City Use No Charge	City Use Charge	Total	Residential Total	Commercial Total	City Total	Annual Total Metered
2015	1	4,368,000	2,797,000	335,000	278,000	20,000	321,000	8,119,000	4,703,000	3,075,000	341,000	
	2	3,781,000	2,488,000	303,000	340,000	20,000	206,000	7,138,000	4,084,000	2,828,000	226,000	
	3	4,262,000	3,034,000	320,000	432,000	31,000	343,000	8,422,000	4,582,000	3,466,000	374,000	
	4	3,967,000	2,832,000	301,000	370,000	29,000	326,000	7,825,000	4,268,000	3,202,000	355,000	
	5	4,604,000	3,047,000	331,000	400,000	33,000	431,000	8,846,000	4,935,000	3,447,000	464,000	
	6	6,022,000	4,432,000	458,000	484,000	40,000	390,000	11,826,000	6,480,000	4,916,000	430,000	
	7	8,098,000	6,593,000	668,000	698,000	80,000	370,000	16,507,000	8,766,000	7,291,000	450,000	
	8	7,414,000	6,391,000	692,000	522,000	88,000	441,000	15,548,000	8,106,000	6,913,000	529,000	
	9	7,239,000	6,869,000	626,000	579,000	102,000	525,000	15,940,000	7,865,000	7,448,000	627,000	
	10	6,157,000	5,243,000	506,000	850,000	69,000	489,000	13,314,000	6,663,000	6,093,000	558,000	
	11	4,841,000	3,856,000	400,000	1,748,000	41,000	358,000	11,244,000	5,241,000	5,604,000	399,000	
	12	5,210,000	35,000	409,000	864,000	28,000	553,000	7,099,000	5,619,000	899,000	581,000	**131,828,000**
2016	1	4,394,000	3,809,000	335,000	224,000	23,000	587,000	9,372,000	4,729,000	4,033,000	610,000	
	2	3,247,000	2,056,000	263,000	185,000	14,000	707,000	6,472,000	3,510,000	2,241,000	721,000	
	3	4,159,000	2,839,667	318,000	296,000	27,333	631,333	8,271,333	4,477,000	3,135,667	658,667	
	4	4,416,000	3,647,000	391,000	250,000	43,000	446,000	9,193,000	4,807,000	3,897,000	489,000	
	5	4,196,000	2,970,000	323,000	322,000	59,000	440,000	8,310,000	4,519,000	3,292,000	499,000	
	6	6,462,000	4,780,000	515,000	516,000	178,000	577,000	13,028,000	6,977,000	5,296,000	755,000	
	7	7,613,000	6,552,000	681,000	710,000	75,000	562,000	16,193,000	8,294,000	7,262,000	637,000	
	8	6,017,000	5,241,000	506,000	485,000	78,000	494,000	12,821,000	6,523,000	5,726,000	572,000	
	9	8,158,000	7,295,000	685,000	721,000	108,000	671,000	17,638,000	8,843,000	8,016,000	779,000	
	10	6,616,000	5,448,000	562,000	858,000	68,000	475,000	14,027,000	7,178,000	6,306,000	543,000	
	11	4,544,000	3,736,000	341,000	1,313,000	32,000	808,000	10,774,000	4,885,000	5,049,000	840,000	
	12	4,996,000	3,439,000	370,000	471,000	29,000	542,000	9,847,000	5,366,000	3,910,000	571,000	**135,946,333**

City Usage Data-Based on Billing

Year	Month	Residential (IC)	Commercial (IC)	Residential (OC)	Commercial (OC)	City Use No Charge	City Use Charge	Total	Residential Total	Commercial Total	City Total	Annual Total Metered
2017	1	4,221,000	2,925,000	307,000	225,000	25,000	433,000	8,136,000	4,528,000	3,150,000	458,000	
	2	3,960,000	2,529,000	315,000	155,000	21,000	976,000	7,956,000	4,275,000	2,684,000	997,000	
	3	4,260,000	2,794,000	312,000	192,000	26,000	1,000,000	8,584,000	4,572,000	2,986,000	1,026,000	
	4	3,803,000	2,897,000	539,000	191,000	34,000	631,000	8,095,000	4,342,000	3,088,000	665,000	
	5	3,921,000	2,978,000	390,000	244,000	35,000	817,000	8,385,000	4,311,000	3,222,000	852,000	
	6	4,824,000	3,684,000	367,000	458,000	24,000	1,075,000	10,432,000	5,191,000	4,142,000	1,099,000	
	7	5,904,000	5,226,000	500,000	397,000	80,000	825,000	12,932,000	6,404,000	5,623,000	905,000	
	8	6,892,000	5,403,000	593,000	436,000	79,000	633,000	14,036,000	7,485,000	5,839,000	712,000	
	9	8,532,000	7,682,000	732,000	770,000	118,000	938,000	18,772,000	9,264,000	8,452,000	1,056,000	
	10	5,926,000	4,924,000	542,000	700,000	68,000	826,000	12,986,000	6,468,000	5,624,000	894,000	
	11	5,426,003	4,677,000	417,000	1,624,000	47,000	1,008,000	13,199,003	5,843,003	6,301,000	1,055,000	
	12	4,689,001	3,347,000	410,000	497,000	26,000	758,000	9,727,001	5,099,001	3,844,000	784,000	**133,240,004**
2018	1	4,359,002	3,803,000	377,000	187,000	33,000	742,000	9,501,002	4,736,002	3,990,000	775,000	
	2	4,170,000	2,730,000	342,000	158,000	28,000	897,000	8,325,000	4,512,000	2,888,000	925,000	
	3	3,955,000	2,691,000	322,000	264,000	25,000	551,000	7,808,000	4,277,000	2,955,000	576,000	
	4	3,978,000	3,114,000	338,000	151,000	39,000	769,000	8,389,000	4,316,000	3,265,000	808,000	
	5	4,500,000	3,132,000	400,000	250,000	40,000	1,090,000	9,412,000	4,900,000	3,382,000	1,130,000	
	6	6,296,000	4,450,000	538,000	357,000	60,000	1,319,000	13,020,000	6,834,000	4,807,000	1,379,000	
	7	6,966,000	5,637,000	581,000	463,000	78,000	1,003,000	14,728,000	7,547,000	6,100,000	1,081,000	
	8	7,833,000	6,061,000	670,000	617,000	111,000	1,183,000	16,475,000	8,503,000	6,678,000	1,294,000	
	9	7,753,000	6,307,000	662,000	472,000	212,000	2,324,000	17,730,000	8,415,000	6,779,000	2,536,000	
	10	6,799,000	5,690,000	612,000	840,000	75,000	3,051,000	17,067,000	7,411,000	6,530,000	3,126,000	
	11	5,133,502	3,341,000	387,000	1,784,000	44,000	3,158,000	13,847,502	5,520,502	5,125,000	3,202,000	
	12	4,430,000	2,978,000	351,000	922,000	32,000	4,061,000	12,774,000	4,781,000	3,900,000	4,093,000	**149,076,504**

City Usage Data-Based on Billing

Year	Month	Residential (IC)	Commercial (IC)	Residential (OC)	Commercial (OC)	City Use No Charge	City Use Charge	Total	Residential Total	Commercial Total	City Total	Annual Total Metered
2019	1	3,810,000	2,490,000	291,000	337,000	27,000	1,984,000	8,939,000	4,101,000	2,827,000	2,011,000	
	2	4,044,000	2,667,000	334,000	237,000	21,000	2,161,000	9,464,000	4,378,000	2,904,000	2,182,000	
	3	3,784,000	2,814,000	288,000	242,000	38,000	1,963,000	9,129,000	4,072,000	3,056,000	2,001,000	
	4	5,675,000	4,175,000	507,000	350,000	51,000	3,498,000	14,256,000	6,182,000	4,525,000	3,549,000	
	5	4,997,000	4,032,000	446,000	420,000	49,000	2,455,000	12,399,000	5,443,000	4,452,000	2,504,000	
	6	7,201,000	5,816,000	634,000	582,000	68,000	2,652,000	16,953,000	7,835,000	6,398,000	2,720,000	
	7	8,330,000	7,231,000	692,000	588,000	81,000	2,918,000	19,840,000	9,022,000	7,819,000	2,999,000	
	8	7,493,000	6,114,000	660,000	559,000	67,000	1,968,000	16,861,000	8,153,000	6,673,000	2,035,000	
	9	6,363,000	5,759,000	628,000	744,000	56,000	2,445,000	15,995,000	6,991,000	6,503,000	2,501,000	
	10	4,528,000	3,488,000	395,000	1,356,000	31,000	1,748,000	11,546,000	4,923,000	4,844,000	1,779,000	
	11	5,139,000	3,601,000	476,000	694,000	29,000	1,796,000	11,735,000	5,615,000	4,295,000	1,825,000	
	12	3,581,784	2,430,000	347,000	225,000	17,000	1,347,000	7,947,784	3,928,784	2,655,000	1,364,000	**155,064,784**
2020	1	3,581,784	2,430,000	347,000	225,000	17,000	1,347,000	7,947,784	3,928,784	2,655,000	1,364,000	
	2	4,434,679	2,743,000	34,000	181,000	20,000	1,869,000	9,281,679	4,468,679	2,924,000	1,889,000	
	3	4,140,163	2,727,000	320,000	233,000	20,000	1,953,000	9,393,163	4,460,163	2,960,000	1,973,000	
	4	4,402,633	2,699,000	426,000	284,000	18,000	2,387,000	10,216,633	4,828,633	2,983,000	2,405,000	
	5	5,204,697	2,495,095	484,000	320,000	10,000	2,018,000	10,531,792	5,688,697	2,815,095	2,028,000	
	6	5,247,093	2,952,268	559,103	279,000	24,000	1,713,000	10,774,464	5,806,196	3,231,268	1,737,000	
	7	6,651,024	490,058	643,175	433,000	81,000	2,009,000	10,307,257	7,294,199	923,058	2,090,000	
	8	8,121,408	6,020,751	830,928	460,000	55,272	1,796,000	17,284,359	8,952,336	6,480,751	1,851,272	
	9	8,373,371	6,133,586	804,714	441,000	57,320	2,107,000	17,916,991	9,178,085	6,574,586	2,164,320	
	10	8,119,192	5,951,745	792,834	626,000	45,007	2,564,000	18,098,778	8,912,026	6,577,745	2,609,007	
	11	5,141,951	3,977,808	500,245	1,528,000	40,596	1,314,000	12,502,600	5,642,196	5,505,808	1,354,596	
	12	5,696,966	3,416,662	447,433	1,032,000	24,200	4,382,000	14,999,261	6,144,399	4,448,662	4,406,200	**149,254,761**

City Usage Data-Based on Billing

Year	Month	Residential (IC)	Commercial (IC)	Residential (OC)	Commercial (OC)	City Use No Charge	City Use Charge	Total	Residential Total	Commercial Total	City Total	Annual Total Metered
2021	1	4,185,967	2,565,999	341,036	216,000	17,295	2,389,000	9,715,297	4,527,003	2,781,999	2,406,295	
	2	3,806,310	2,478,872	293,142	197,000	18,141	2,685,000	9,478,465	4,099,452	2,675,872	2,703,141	
	3	4,810,469	3,116,674	392,274	230,000	24,874	1,891,000	10,465,291	5,202,743	3,346,674	1,915,874	
	4	4,382,181	2,983,773	372,220	241,000	31,584	2,601,000	10,611,758	4,754,401	3,224,773	2,632,584	
	5	5,085,604	3,421,886	413,664	382,000	31,262	1,814,000	11,148,416	5,499,268	3,803,886	1,845,262	
	6	6,000,573	4,198,206	508,403	398,000	46,784	1,954,000	13,105,966	6,508,976	4,596,206	2,000,784	
	7	8,590,999	7,201,195	693,361	516,000	66,925	2,487,000	19,555,480	9,284,360	7,717,195	2,553,925	
	8	7,506,437	5,834,666	646,700	445,000	62,598	1,964,000	16,459,401	8,153,137	6,279,666	2,026,598	
	9	8,709,578	6,643,190	751,075	501,000	62,334	2,240,000	18,907,177	9,460,653	7,144,190	2,302,334	
	10	7,797,783	6,065,170	594,630	638,000	58,732	2,201,000	17,355,315	8,392,413	6,703,170	2,259,732	
	11	4,670,607	3,310,494	381,269	1,426,000	29,120	2,215,000	12,032,490	5,051,876	4,736,494	2,244,120	
	12	5,700,914	3,566,905	501,714	816,000	28,029	2,836,000	13,449,562	6,202,628	4,382,905	2,864,029	**162,284,618**

APPENDIX E: FEASIBILITY EVALUATION

TECHNICAL MEMORANDUM - FINAL

City of Bandon – Supplemental Groundwater Supply Feasibility Evaluation

To: Dan Chandler, JD, ICMA-CM / City of Bandon

CC: Steve Major, PE / The Dyer Partnership Engineers & Planners, Inc.

From: Ryan Dougherty, PE, RG / GSI Water Solutions, Inc.[1]
Kim Grigsby / GSI Water Solutions, Inc.
Ted Ressler, RG, CWRE / GSI Water Solutions, Inc.[1]
Ronan Igloria, PE / GSI Water Solutions, Inc.

Date: June 10, 2022

1. Introduction

This technical memorandum was prepared by GSI Water Solutions, Inc. (GSI) for the City of Bandon (City) to document the results of an evaluation of the feasibility of developing a municipal groundwater supply for supplemental/emergency use.

The City is evaluating alternatives to supplement their existing source water supplies from Ferry and Geiger Creek, which are vulnerable to low flow conditions induced by droughts, climate change, harmful algal blooms, and earthquake hazards. The City has identified off-channel reservoir storage and/or development of a groundwater supply as potential alternatives to supplement source water supplies on an emergency or seasonal basis. Based on the City's 2020 Water System Master Plan and discussions with the City, GSI understands that a supplemental source water supply should be capable of providing approximately 300-500 gallons per minute (gpm) for 30 days to be feasible.

The objective of this evaluation was to perform a reconnaissance-level study to assess the feasibility of developing a supplemental/emergency municipal groundwater supply capable of meeting the City's target capacity of approximately 300-500 gpm for 30 days.

The remainder of this technical memorandum is organized as follows:

- Section 2 – Hydrogeology: Evaluates the local hydrogeologic setting and summarizes the characteristics of the local hydrogeologic units.
- Section 3 – Water Rights: Summarizes alternatives to obtain water use authorization for a new municipal groundwater supply source.
- Section 4 – Well Siting, Preliminary Test Well Design, and Planning Level Costs: Evaluates locations for new wells, develops a preliminary test well design, and provides planning level cost estimates for exploratory drilling/testing and a full-scale wellfield.

[1] Ryan Dougherty and Ted Ressler led the analysis and documentation for Sections 2 and 4 of the technical memorandum while at GSI Water Solutions, Inc. but have since departed the firm. in the time since the draft of the technical memo was submitted in January 2022. GSI finalized the technical memorandum based on review comments from City of Bandon, which did not affect Sections 2, 4 and 5.

- Section 5 – Results and Recommendations: Summarizes the results of this preliminary feasibility evaluation and provides GSI's recommendations regarding the sequencing of activities to further evaluate site-specific feasibility of a supplemental/emergency municipal groundwater supply system.

2. Hydrogeology

This section describes the local hydrogeologic setting and summarizes the characteristics of the local hydrogeologic units. Geologically, the City of Bandon is located in southern portion of the Coast Range geologic province, which generally consists of benches of wave-cut marine terraces and accreted/uplifted marine sediments to the east which form the topographic highs of the Coast Range (Orr, 1999).

2.1 Hydrogeologic Setting Overview

To evaluate the hydrogeologic setting in the vicinity of the City, GSI reviewed available geologic reports[2], geologic spatial data[3], and well logs[4] to develop a conceptual model of the local hydrogeologic system. Following review of available geologic information, GSI developed a map of surficial geology (Figure 2) and two cross sections (Figures 3 and 4) to further characterize the occurrence, extent, and thickness of hydrogeologic units in the vicinity of the City. A summary of the major hydrogeologic units in the vicinity of the City is provided below, from youngest to oldest (from the ground surface downward, if present):

- Alluvial Deposits (Aa, Ha): This hydrogeologic unit primarily consists of unconsolidated sand, gravel, and silt deposited along active stream channels and floodplains (see Figure 2). The thickness of this unit is generally less than 20 feet, with thicknesses decreasing with distance away from active stream channels. When present, groundwater within this unit exists under unconfined conditions and is typically hydraulically connected to nearby surface waters. Overall, the alluvial deposits are not considered to be a suitable hydrogeologic unit (aquifer) for a supplemental groundwater supply due to their limited extent and thickness.
- Coastal Dune Deposits (Abs, Qds): This hydrogeologic unit primarily consists of unconsolidated sand deposited by wave and wind processes in active near-shore and back-beach settings. In the vicinity of the City, the extent of this unit is limited to the west of Highway 101 (see Figure 2). The thickness of this unit is typically less than 30 feet, with thicknesses decreasing inland (to the east). When present, groundwater within this unit exists under unconfined conditions and is typically hydraulically connected to nearby surface waters. Overall, the coastal dune deposits are not considered to be a suitable hydrogeologic unit (aquifer) for a supplemental groundwater supply due to their limited extent and thickness which in turn can produce issues related to long-term sustainability (see discussion of Pacific Dunes Golf Course Well in BCWCD, 2004).
- Marine Terrace Deposits (Qmtw, Qmtp, Qmtd): This hydrogeologic unit primarily consists of unconsolidated sand and gravel interbedded with clay and silt that were deposited in ancestral nearshore marine environments. This unit is regionally extensive and is present throughout the local area, with thicknesses commonly between 50-100 feet. Groundwater within this unit exists under unconfined conditions and is likely hydraulically connected to nearby surface waters in many locations. The majority of local wells are completed in the marine terrace deposits due to the unit's relative thickness and abundance of permeable material, which in turn produces relatively moderate well yields (~15-75 gpm). Overall, the marine terrace deposits may be a suitable hydrogeologic unit (aquifer) for a supplemental groundwater supply.

  The marine terrace deposits is a collection of various subunits including the Whiskey Run (Qmtw), Pioneer Terrace (Qmtp), and Seven Devils (Qmtd) subunits. These three subunits are the most extensive subunits in the vicinity of the City (see Figure 2). Of these three subunits, the Pioneer

[2] See BCWCD, 2004; Orr, 1999
[3] See DOGAMI, 2014 and DOGAMI, 2021
[4] OWRD, 2019

Terrace subunit is anticipated to the have the largest saturated thickness, highest potential well yield, and greatest sustainability. Within the City's watershed, the Pioneer Terrace subunit is estimated to have thickness of 35-100 feet, with thicknesses increasing to the east (upland) and away from Ferry and Geiger Creek (see Figures 3 and 4).

A hydrogeologic study prepared for the Bandon Cranberry Water Control District (BCWCD, 2004) in cooperation with the Oregon Water Resources Department (OWRD) estimated the following hydraulic properties for the marine terrace deposits at a site approximately 0.25-miles north of the City's watershed[5]. These hydraulic parameters provide the basis for evaluating the feasibility of a supplemental groundwater supply and also developing a preliminary well design and wellfield layout.

Table 1. Reported Hydraulic Properties of the Marine Terrace Deposits

Parameter	Symbol	Units	Reported Value
Hydraulic Gradient	i	dimensionless	0.02
Transmissivity	T	gpm/ft	3,740
Horizontal Hydraulic Conductivity	K_h	feet/day	10
Vertical Hydraulic Conductivity	K_v	feet/day	0.042
Specific Yield / Storativity	s	dimensionless	0.0002

Based on review of these hydraulic parameters, GSI anticipates that a new properly-designed water supply well could achieve a sustainable yield of 75-100 gpm, assuming that at least 50 feet of saturated and screenable aquifer material (relatively clean sand and gravel) is present at potential well sites.

- Consolidated Marine Rocks (KJs, Tefm): This hydrogeologic unit primarily consists of clay, siltstone, and claystone deposited in ancient marine environments. This unit generally represents the oldest and deepest geologic unit in the local area, and is also considered to be part of Oregon's oldest geologic terrane. The thickness of this unit is estimated to be over 1,000 feet. Groundwater within this unit is commonly saline and well yields are low (<20 gpm). Overall, the consolidated marine rocks are not considered to be a suitable hydrogeologic unit (aquifer) for a supplemental groundwater supply due to their low well yields and water quality issues (saline).

2.2 Hydrogeologic Feasibility Results

Based on GSI's review available information describing the local and regional hydrogeologic setting, one geologic unit (marine terrace deposits) appears favorable for the development of a supplemental groundwater supply with a 30-day capacity of 300-500 gpm. GSI anticipates that a single new properly designed water supply well could potentially achieve a yield of 75-100 gpm, assuming that at least 50 feet of saturated and screenable aquifer material is present at specific well sites. Based on these assumptions, a total of three to six wells may be necessary to meet the target capacity of 300-500 gpm. Within the City's watershed, the thickness of the marine terrace deposits appears to range from approximately 35-100 feet, with thickness generally increasing to the east (upland) and away from Ferry and Geiger Creek (see Figures 3 and 4).

[5] See Gardner Site in Table 5.4 of BCWCD, 2004; located approximately 0.25-miles northwest of the City's watershed

3. Water Rights

The use of groundwater for municipal water supply requires a water right from OWRD. This section summarizes two options the City could potentially pursue to obtain authorization to use groundwater for municipal water supply. A detailed discussion of each option is included in Attachment A.

3.1 Groundwater Permit Application

GSI conducted an evaluation of the opportunity for the City to obtain a new groundwater permit based on OWRD's review criteria. As detailed in Attachment A, it is likely that OWRD would find the following with respect to the department's review criteria for new groundwater permits:

1. Whether Water is Available: Although groundwater is available for the proposed use, the use would have the potential to cause substantial interference (PSI) with surface water[6], and additional surface water use is not available any month of the year. A map showing areas in the vicinity of the City that would trigger PSI is shown on Figure 5. Accordingly, OWRD is expected to find that water is not available for the proposed use.
2. Basin Program Rules: The use of groundwater for municipal use is consistent with the basin program rules.
3. Injury to Existing Water Rights: There is uncertainty as to whether the proposed use would cause injury to existing water users. These uncertainties can only be resolved after an application has been submitted and OWRD's groundwater section has completed its review. Based on GSI's estimations of pumping interference from a new full-scale wellfield, two existing water users would be impacted, which are discussed below:
   - *ODFW Fish Hatchery*: The Oregon Department of Fish and Wildlife's (ODFW's) hatchery has a water right certificate for non-consumptive use of water from Ferry Creek. ODFW's water right certificate (7904) has a priority date of 7/20/1925, which is junior to some of the City's existing water rights (including Certificate 9754, see Section 3.3). It is possible that OWRD would determine that a full-scale wellfield would cause injury to ODFW's fish hatchery, even though a groundwater system by nature would result in less direct stream depletion than the City's existing surface water intakes on Ferry Creek.
   - *Exempt (Domestic) Wells*: There are existing exempt (domestic) wells located a few hundred feet north of the City's water treatment plant (along Houston Lane, Melton Road). These wells are exempt from needing a water right to use groundwater. Some of these wells are shallow (<50 feet) and therefore pumping interference from a full-scale wellfield could preclude the exempt wells from obtaining groundwater. It is possible that OWRD would determine that there may be injury to existing exempt (domestic) wells from a full-scale wellfield depending on where the wells are located. New wells located near the City's water treatment plant would likely cause injury to the exempt wells while new wells located south of Ferry Creek would not likely result in injury to the exempt wells.
4. Consistency with OWRD Administrative Rules: As part of their evaluation under the Division 33 rules, ODFW and the Department of Environmental Quality (DEQ) would be expected to recommend either denial of the application or require that the City provide mitigation to address impacts to listed fish species in the affected surface water source.

[6] A proposed groundwater use that has a hydraulic connection to local surface water sources may be classified as PSI if several criteria are met relating to the distance of the well from local surface waters, the proposed pumping rate, and minimum perennial streamflows. If OWRD finds PSI with a surface water, then the use of groundwater is subject to regulatory limitations that are applicable to the surface water source.

Based on the expected finding that water is not available for the proposed use, and expected recommendations from ODFW and DEQ, OWRD would likely deny an application for a new municipal groundwater permit from wells in the area of the City.

Potential to Mitigate for Surface Water Impacts

To obtain a new groundwater permit, the City would likely need to resolve the concerns described above regarding PSI, surface water not being available, and impacts to listed fish species. Historically, the method to resolve these issues has typically been to provide mitigation. Mitigation has been provided in the form of transferring a surface water right instream in the affected surface water source, or possibly cancelling a water right certificate that authorizes use from the affected surface water source. However, OWRD has recently announced that it will generally not accept mitigation when water is not available. OWRD would be unlikely to accept mitigation from the City due to water not being available from Ferry Creek.

3.2 Surface Water to Groundwater Transfer

Since it appears unlikely that the City would obtain OWRD approval of an application for a new groundwater permit, GSI evaluated the opportunity for the City to change a portion of one of the City's existing surface water rights to allow the appropriation of the water from a new well. This change is referred to as a surface water to groundwater transfer. (This process allows only a change from a surface water point of diversion to a groundwater point of appropriation [well]; i.e., the original surface water point of diversion could not be retained as an additional or supplemental point of diversion for the portion of the water right included in the transfer. The surface water to groundwater transfer process is more streamlined than the permit application process, and consequently may pose less of a challenge than obtaining a new groundwater permit.

As detailed in Attachment A, it is likely that OWRD would find the following with respect to the department's review criteria for surface water to groundwater transfers:

1. Injury to Existing Water Rights: There is uncertainty as to whether the proposed use would cause injury to existing water users. In its evaluation of injury, OWRD considers the potential for injury at the point on the stream nearest to the proposed well(s). The nearest point of the proposed wells to Ferry Creek is in the same general location as the current point of diversion with a junior instream water right (79554). If this point was determined to be upstream from the current point of diversion, OWRD could find injury to the instream water right. These uncertainties can only be resolved after an application has been submitted and OWRD's groundwater section has completed its review. The existing water users that would potentially be impacted are identical to those discussed in Section 3.1 (ODFW Fish Hatchery and Exempt Domestic Wells).
2. No Enlargement of Water Right: The surface water to groundwater transfer would not propose to enlarge the City's water right selected for transfer.
3. Hydraulic Connection with the Authorized Surface Water Source: The proposed aquifer (marine terrace deposits) is hydraulically connected to local surface water based on GSI's review of hydrogeologic information (Section 2).
4. Proposed Change will affect the Authorized Surface Water Source "Similarly": The proposed groundwater use must affect the authorized surface water source "similarly"[7]. GSI used the Jenkins (1970) and Hunt (1999) streamflow depletion models to evaluate the furthest distance that new wells could be located from surface waterbodies to meet OWRD's "similarly" conditions. Input parameters for these stream depletion models were based on hydraulic properties for the marine terrace deposits (see Table 1, based on BCWCD, 2004). Results of the stream depletion modeling

[7] OWRD defines "similarly" to mean that the use of groundwater at the new wells affects the surface water source specified in the subject water rights and would result in stream depletion of at least 50 percent of the rate of appropriation within 10 days of continuous pumping.

suggest that new wells could be located over 3,000 feet from surface waterbodies (or anywhere within the City's watershed).

5. Well(s) Located within Appropriate Distance of Authorized Surface Water Source: The proposed well locations must be within 500 feet of the surface water source and within 1,000 feet upstream or downstream of the original point of diversion; or a licensed geologist must prepare a report demonstrating that the "similarly' criteria are met.

   As described in bullet number four above, results of the stream depletion modeling suggest that new wells could be located over 3,000 feet from surface waterbodies (or anywhere within the City's watershed). Although preliminary and not utilizing site-specific hydrogeologic information, since the input parameters for the stream depletion model analysis presented here are based on hydraulic properties that OWRD co-authored (BCWCD, 2004), we have reasonable confidence that a surface water to groundwater transfer to wells completed in the marine terrace deposits may be possible anywhere within the City's watershed.

Based on the evaluation of OWRD's review criteria for surface water to groundwater transfers, GSI concluded that the agency would likely approve such a transfer application; however, the City should be aware that the approval order may include multiple conditions. First, in order to preclude enlargement of the right being transferred OWRD would limit the City's use of groundwater to the amount of water legally available at the original point of diversion (on the surface water source). In some cases OWRD has required a measuring device at both the original point of diversion and the well to ensure compliance with this requirement. If OWRD limits appropriation from the well to the amount of water available at the original point of diversion and requires a measuring device to document that amount, there may be little benefit derived from a surface water to groundwater transfer. . OWRD is expected to include a general condition precluding enlargement; however, the specific condition requirements cannot be determined without going through the application process. Second, the transfer approval order would likely also note that all restrictions that existed at the original surface water point of diversion shall apply to the proposed well(s). Finally, as part of the surface water to groundwater transfer process, the right would be conditioned to allow OWRD to subordinate the right to any existing groundwater rights that are injured as the result of the transfer.

3.3 Water Rights Next Steps

It should be noted that GSI's water rights evaluation focused on technical criteria and processes of each water rights alternative; a deeper understanding of the City's water rights portfolio by GSI (status, development to date, infrastructure capacity, etc.) would be needed to further assess feasibility and to develop a potential implementation strategy.

As a next step the City should evaluate its surface water rights, shown below on Table 2, to consider its options for a surface water to groundwater transfer. There are several water right attributes to consider in making this evaluation, including status (permit vs. certificate), development deadline and need for a permit extension or certificate request, amounts of water developed to date, and available streamflow as compared to water right authorization.

Table 2. City's Existing Surface Water Rights

Water Right	Source	Maximum Authorized Rate (cfs)	Maximum Authorized Rate (mgd)	Priority Date	Status
Certificate 9754	Mill Cr., Ferry Cr., and stored water from 2 reservoirs	2.0	1.3	1/24/1910	Certificate right
Permit S-27233	Ferry Cr.	3.0	1.9	3/7/1961	Permit, 10/1/2000 development deadline
Permit S-27232	Geiger Cr.	3.0	1.9	3/7/1961	Permit, 10/1/2000 development deadline
Permit S-3011	Geiger Cr. and Geiger Cr. Reservoir	3.4	2.2	6/19/1916	Extended domestic use permit, 10/30/2050 development deadline
Transfer T-12632	Geiger Cr. and Geiger Cr. Reservoir	1.6	1.0	6/19/1916	Transfer to change from domestic to municipal, 10/1/2022 deadline

Given the expected outcome of each water right alternative, we recommend that the City complete a water rights review to further evaluate a surface water to groundwater transfer. If further evaluation suggests that a surface water to groundwater transfer is feasible, we recommend submitting a transfer application. As the application is processed and more information about the agencies' evaluations are obtained, the preferred course of action will become clearer. OWRD's processing of a surface water to groundwater transfer would likely require 18 to 24 months to complete. To expedite OWRD's review, the Reimbursement Authority process could be used, which would likely reduce the timeline to 8 to 12 months.

4. Well Siting, Preliminary Well Design, and Planning Level Costs

This section identifies potential well locations, develops a preliminary well design, and provides planning level cost estimates for a single test well and also for a full-scale wellfield.

4.1 Well Siting Evaluation

4.1.1 Well Siting Methods

Potential well locations were identified based on the following five criteria: regulatory setbacks for water supply wells, proximity to existing water system infrastructure, hydrogeology/potential yield, pumping interference, and water right considerations. A discussion of the methods and results for each of the five criteria is provided below. Given the reconnaissance scale nature of this assessment, other criteria such as cultural/social impacts, proximity to power, and general site improvements necessary to install a new water supply well (grading, tree removal, etc.) were not considered in the well siting evaluation.

Regulatory Setbacks

The Drinking Water Services section of the Oregon Health Authority (OHA)[8] and OWRD[9] promulgate standards for the siting of water supply wells in the form of setback requirements. While some setback requirements can be negotiated and waived if certain construction measures are implemented or if certain hydrogeologic conditions are demonstrated, this well siting evaluation attempted to identify and delineate potential locations for new water supply wells that can meet regulatory setbacks outright without a waiver. Key setback requirements for the siting of a new water supply wells include the following:

[8] See OAR 333-061-0050 (2)(a)(A-F) and 333-061-0032(7)(a) for OHA setback requirements
[9] See OAR 690-210-0030 for OWRD setback requirements

Table 3. Key Regulatory Setbacks for Potable Water Supply Wells

Setback Distance (feet)	Setback Description	Regulatory Authority
5	Any permanent structure not including pump houses	OWRD
50	Septic tanks, gravity feed sewer lines (sanitary or stormwater)	OWRD, OHA
100	Chemical or fuel storage, long-term parking lots/structures, septic systems	OWRD, OHA
100	Area within 100 feet of well shall be owned/controlled by the water supplier	OHA
500	Hazardous waste storage, disposal, or treatment (including UICs)	OWRD
*	*Shall not be located in floodplains or within 100 feet of public or private roads	OHA

Notes
UIC = underground injection control facility (drywell)
* these setbacks are automatically waived by OHA if the wellhead is completed at least two feet above the 100-year flood level (or two feet above ground surface for the setback from roads) and is secured (locked pump house, fencing, etc.)

To determine appropriate locations for new water supply wells based on regulatory setbacks, GSI obtained and reviewed geospatial data[10] for features with an associated regulatory setback. These features were imported into ArcMap 10.6.1 and a processing tool was used to create buffers from each feature for its associated regulatory setback to identify and delineate areas within which new water supply wells can meet all applicable regulatory setbacks outright.

Results of this analysis are presented on Figure 6; the green shaded areas of Figure 6 are areas that are able to meet all applicable regulatory setbacks outright.

Proximity to Existing Water System Infrastructure

Well locations that are closer to existing water system conveyance piping will require less installation of new piping, saving on project costs. This well siting evaluation attempted to 1) identify well locations that are close to existing water system conveyance piping and 2) avoid well locations that would require stream crossings for conveyance.

Hydrogeology / Potential Yield

Based on GSI's understanding of the hydrogeologic setting (Section 2), a minimum thickness of 50 feet of screenable saturated aquifer material is anticipated to be necessary to meet the target sustainable capacity of a single new well (75-100 gpm). This well siting evaluation attempted to identify potential well locations with over 50 feet of saturated aquifer material.

Additionally, GSI anticipates that a minimum of three to six water supply wells may be necessary to meet the target capacity for a supplemental groundwater supply (300-500 gpm for 30-days). Therefore, this well siting evaluation attempted to identify at least six potential well locations.

Pumping Interference

Pumping interference occurs when the pumping operations of one well reduce the available drawdown and production capacity of a neighboring well. This phenomenon is commonly observed when wells are in close proximity and draw groundwater from the same aquifer system.

GSI estimated pumping interference for various well spacings[11] to determine a minimum separation distance that should be maintained between new wells. Based on this exercise a target separation distance

[10] Utilities and building footprints obtained from AWS in July 2021; Groundwater Administrative Areas from OWRD; Potential Contaminant Sources from DEQ Facility Profiler, 2021
[11] Well interference (drawdown) was calculated using the Cooper-Jacob method for the following pumping scenario: unconfined aquifer conditions; individual well pumping rates of 75-100 gpm, pumping duration of 30 days, hydraulic parameters for the marine terrace deposits (see Table 1)

of at least 400 feet should be maintained between wells to minimize interference effects, to the extent possible.

Water Right Considerations

As discussed in Section 3.2, to obtain authorization for a supplemental groundwater system via a surface water to groundwater transfer, the proposed well locations must be within 500 feet of the surface waterbody and also within 1,000 feet upstream/downstream of the original point of diversion unless evidence is provided that demonstrates that use of groundwater from a well at a greater distance will affect the surface water similarly[12] to use from the original point of diversion.

Based on stream depletion modeling (see Section 3.2), GSI believes it is likely that OWRD would grant approval for new wells located anywhere within the City's watershed because the input parameters for the stream depletion models are based on hydraulic properties that OWRD co-authored. However, as a contingency plan this well siting evaluation also identified backup well locations within the prescriptive delineations (within 500 feet by 1,000 feet of original point of diversion) in the event that OWRD does not agree with the stream depletion model results.

Further, OWRD will only approve of well locations that do not cause injury to existing water users. Based on GSI's estimations of pumping interference, two existing local water users would be impacted, which are discussed in Section 3.1 and summarized below:

- ODFW Fish Hatchery: The Oregon Department of Fish and Wildlife's (ODFW's) hatchery has a water right certificate for non-consumptive use of water from Ferry Creek. It is possible that OWRD would determine that the proposed well locations would cause injury to ODFW's fish hatchery, despite the fact that a groundwater system by nature would result in less direct stream depletion than the City's existing surface water intakes.
- Exempt (Domestic) Wells: There are existing exempt (domestic) wells a few hundred feet north of the City's water treatment plant (along Houston Lane, Melton Road). Pumping interference from a full-scale wellfield could preclude the exempt wells from obtaining groundwater. GSI believes it is possible that OWRD would determine injury to existing exempt (domestic) wells from a full-scale wellfield located near the City's water treatment plant.

Due to the possibility that OWRD may determine injury to existing exempt (domestic) wells from a full-scale wellfield located near the City's water treatment plant, backup well locations that are far from existing exempt wells were identified as a contingency plan. These backup well locations are identified on Figure 6.

4.1.2 Well Siting Results

Results of the well siting evaluation are presented on Figure 6. A preferred group and two backup group well locations were identified, with six well locations per group (total of eighteen well locations). Key results for each group are summarized below:

- Preferred Well Locations: The preferred well locations are able to meet all applicable regulatory setbacks outright and are close to existing water system infrastructure. The thickness of the marine terrace deposits at these locations is estimated to be between 80-100 feet, which exceeds the minimum thickness of 50 feet of screenable saturated aquifer material anticipated to be necessary to produce a sustainable well yield of 75-100 gpm. With respect to pumping interference, all six of the preferred well locations maintain a separation distance of at least 400 feet from one another. In terms of water right considerations, the preferred well locations would require evidence of similar stream depletion to facilitate a surface water to groundwater transfer. GSI believes it is likely that

[12] OWRD defines "similarly" to mean that the use of groundwater at the new wells affects the surface water source specified in the subject water rights and would result in stream depletion of at least 50 percent of the rate of appropriation within 10 days of continuous pumping.

OWRD would be in agreement that the similar stream depletion conditions are satisfied by the preferred well locations, however OWRD may determine that the preferred well locations cause injury to existing exempt (domestic) wells north of the City's water treatment plant. Overall, development of a supplemental groundwater supply at the preferred well locations appears most favorable although there are some uncertainties that cannot be resolved until a water right transaction is submitted and reviewed by OWRD.

- Backup Well Locations: The backup well locations represent contingency locations in the event that OWRD does not agree with the stream depletion modeling results or determines that a full-scale wellfield near the City's water treatment plant will cause injury to existing exempt (domestic) wells. Two additional series of backup well locations were identified, which are discussed below:
  - *B Series Backup Wells*: This series of backup well locations were sited on the north side of Ferry Creek to prioritize proximity to the City's water treatment plant. Two of the backup well locations are unable to meet all applicable regulatory setbacks outright and would require a waiver from OWRD/OHA (locations 5b and 6b on Figure 6, within 500 feet of HAZWASTE site). The thickness of the marine terrace deposits at these locations is estimated to be 30-50 feet, which could be insufficient to produce a sustainable well yield of 75-100 gpm/well. With respect to pumping interference, a majority of the backup well locations are unable to maintain a separation distance of at least 400 feet. Overall, development of a supplemental groundwater supply at the B Series backup well locations is less favorable than the C Series and may not be feasible due to the limited aquifer thickness.
  - *C Series Backup Wells*: This series of backup well locations were sited on the south side of Ferry Creek to prioritize hydrogeologic feasibility (thickness of marine terrace deposits). All six of the backup well locations are able to meet all applicable regulatory setbacks outright. The thickness of the marine terrace deposits at these locations is estimated to be 60-90 feet, which could be sufficient to produce a sustainable well yield of 75-100 gpm/well. With respect to pumping interference, a majority of the backup well locations are able to maintain a separation distance of at least 400 feet and the potential for injury to existing groundwater users is low. Overall, development of a supplemental groundwater supply at the C Series backup well locations is more favorable than the B Series and appears feasible, but may be more expensive due to the additional conveyance that would be required.

4.2 Preliminary Well Design

To develop a preliminary well design, the anticipated hydrogeologic setting of the preferred well locations (thickness of the marine terrace deposits) was considered in conjunction with the following criteria to develop a preliminary design for a new water supply well:

- The well design should conform to regulatory standards[13] for the construction of water supply wells.
- Selecting a casing and screen diameter that maximizes yield without incurring unnecessarily large construction costs.
- Maximizing the design screen capacity and minimizing well losses (inefficiencies) and resultant drawdown.

The resulting preliminary well design is presented on Figure 7 and includes the following key construction features: a total depth of 110 feet; a casing diameter of 12-inches; a sump/pump chamber length of ten feet; a screen length of 50 feet with an accompanying filter pack; and a seal depth of 20 feet. The location and slot-size of the screen is conceptual and would be dependent on encountered subsurface conditions.

[13] See OAR 690-210 for minimum well construction standards for water supply wells

Based on an assumed seasonal low static water level of 20 feet below ground surface (bgs), GSI estimated the 30-day pumping water level of the well to be 75 feet bgs, which includes allowances for pumping interference between a full-scale wellfield. The expected pumping water level would result in a portion of the well screen being dewatered, which is generally not recommended as dewatering of the screen can result in conditions that can enhance biological growth in the well (biofouling) which in turn can require more frequent well maintenance/rehabilitation. While screen dewatering is not ideal, it is common practice for water systems with shallow alluvial wells and usually manifests in the form of additional maintenance costs rather than a fatal flaw. The City's intended use of a groundwater supply (supplemental rather than primary) would help to mitigate the potential screen dewatering problems as the screen would be dewatered and rewetted less frequently.

4.3 Planning Level Cost Estimates

A planning level cost estimate for a new supplemental groundwater system was developed in cooperation with the Dyer Partnership Engineers & Planners, Inc. (Dyer) using recent contractor costs (including prevailing wage rates) and equipment/material costs. The planning level cost estimate includes general allowances for design, permitting, construction oversight, and contingencies and is provided as a range to account for differences between potential well locations and the number of wells that may be required to meet the target capacity of 300-500 gpm for 30 days. The planning level cost is further divided by the following project phases:

1. Phase I – Exploratory Drilling and Testing Program: The scope of this phase involves water rights transactions, exploratory drilling to confirm the geologic setting (thickness of marine sediments), and the installation of one test well and one observation well. The purpose of this phase is to confirm the feasibility of a groundwater system, and if favorable, finalize the design of a full-scale wellfield.
2. Phase II – Full-Scale Wellfield: The scope of this phase involves drilling, constructing, and testing the total number of wells necessary to meet the target capacity of 300-500 gpm for 30 days. GSI anticipates that a total of two to five additional wells (beyond the initial test well) will be necessary to meet the target capacity.
3. Phase III – Water System Integration: The scope of this phase involves the design, permitting, and construction of above-ground facilities necessary to integrate the full-scale wellfield with the City's existing water system (well houses, permanent pumping systems, conveyance, etc.).

The resulting planning level cost estimates for each phase are provided below on Table 4. These cost estimates should be refined once well locations are finalized (after obtaining OWRD's approval of well locations through water rights transactions).

Table 4. Groundwater System Planning Level Cost Estimates

Item	Cost Estimate	
	Low	High
Phase I: Exploratory Drilling and Testing Program		
Well Drilling, Construction, and Testing	$140,000	$250,000
Construction Support (20%)	$28,000	$50,000
Water Rights Permitting (10%)	$14,000	$25,000
Final Wellfield Design (5%)	$7,000	$12,500
Phase I Subtotal	**$189,000**	**$337,500**
Phase II: Full-Scale Wellfield	**2 Wells**	**5 Wells**
Well Drilling, Construction, and Testing	$315,000	$850,000
Construction Support (20%)	$63,000	$170,000
OHA Plan Review Permitting (5%)	$15,750	$42,500
Phase II Subtotal	**$393,750**	**$1,062,500**
Phase III: Water System Integration		
Site Prep Work (Grading, Clearing, Power)	$251,000	$509,000
Wellhead Completions, Pumping Systems	$235,700	$471,500
Conveyance	$140,600	$276,200
Design and Construction Support (20%)	$125,500	$251,300
Permitting (10%)	$62,750	$125,650
Phase III Subtotal	**$815,550**	**$1,633,650**
New Groundwater System Subtotal	**$1,398,300**	**$3,033,650**
Project Contingency (30%)	**$419,490**	**$910,095**
New Groundwater System Total	**$1,817,980**	**$3,943,745**

Notes
- The Phase I program includes drilling one exploratory sonic borehole with completion as an observation well and drilling, constructing, and testing one test well
- The Phase I and Phase II planning level cost estimates do not account for tree clearing, grading, or access limitations
- While contingencies are built into the individual cost estimates for each phase of work, and additional 30% planning level contingency has been applied to the project subtotal to further account for variations in final quantities, market conditions, construction conditions, etc.

5. Results and Recommendations

GSI completed a reconnaissance-level study to assess the feasibility of developing a supplemental municipal groundwater supply capable of meeting the City's target capacity of approximately 300-500 gpm for 30 days. Overall, development of a supplemental groundwater system capable of meeting the City's target capacity appears feasible in terms of hydrogeology and water rights, although the following uncertainties must be resolved to confirm the project's feasibility:

- The two identified water rights alternatives (new groundwater permit application with instream mitigation and/or surface water to groundwater transfer) each have uncertainties and risks that cannot be resolved until OWRD has reviewed the submitted applications. The uncertainties, risks, and benefits associated with each alternative are summarized below:
  - New Groundwater Permit Application: Uncertainties associated with this alternative include: 1) whether OWRD would accept mitigation to resolve impacts to stream flows and listed fish species from a new use of groundwater, and 2) whether OWRD would determine that some or all of the identified well locations will cause injury to existing water users. The primary benefits of this alternative are that: 1) use of groundwater would typically not be subject to curtailment if OWRD were to regulate surface water (due to low flow), and 2) groundwater pumping would not be limited to the amount of streamflow (the City could pump groundwater at rates above the rate of available surface water).
  - Surface Water to Groundwater Transfer: Uncertainties associated with this alternative include: 1) whether OWRD would agree with GSI's stream depletion modeling, and 2) whether OWRD would determine that some or all of the identified well locations will cause injury to existing water users. Risks associated with this alternative include: 1) the City's use of groundwater would be limited to the amount of water lawfully available at the original point of diversion (on the surface water source) and 2) the right would be conditioned to allow OWRD to subordinate the right to any existing groundwater rights that are injured as the result of the transfer. The primary benefit of this alternative is that the transfer could be reverted if a groundwater system is determined to be unfeasible after drilling/testing.
- Based on GSI's understanding of the hydrogeologic setting, a minimum thickness of 50 feet of screenable saturated aquifer material is anticipated to be necessary to meet the target sustainable capacity of a single new well (75-100 gpm). Within the City's watershed, the thickness of the marine terrace deposits is estimated to range from 35-100 feet, with thicknesses increasing to the east (upland) and away from Ferry and Geiger Creek (see Figures 3 and 4). The actual thickness of screenable material and productivity of the aquifer must be verified with an exploratory drilling and testing program to confirm the feasibility of a supplemental groundwater supply.

Based on the preliminary feasibility results, GSI performed a well siting evaluation to identify potential well locations. Results of the well siting evaluation are presented on Figure 6, which identified six preferential well locations near the City's water treatment plant and twelve backup well locations as a contingency plan to account for the uncertainties associated with each water right alternative.

Following the identification of potential well locations a preliminary well design and planning level cost estimates for a new supplemental groundwater system were developed with the support of Dyer. The resulting preliminary well design is presented on Figure 7 and consists of a 110-foot deep, 12-inch diameter well with 50 feet of screen and accompanying filter pack. The planning level cost estimates include general allowances for design, permitting, construction oversight, and contingencies and were provided as a range to account for differences between potential well locations and the number of wells that may be required to meet the target capacity of 300-500 gpm for 30 days. The resulting planning level costs of a new supplemental groundwater system are provided on Table 4 and are estimated to range from approximately

$1.8 million to $3.9 million depending on the location and number of wells necessary to meet the City's target capacity.

If the City wishes to further pursue development of supplemental groundwater supply, the following sequence and schedule of activities is recommended:

1. Water Rights Transactions: Based on the expected outcome of each water rights alternative, GSI recommends further evaluating a surface water to groundwater transfer. GSI estimates that water rights permitting may cost between $14,000 -$25,000 (see Table 4) and take up to 3 months for preparation of the water right application plus up to 24 months for OWRD's review (or potentially 8-12 months if OWRD's Reimbursement Authority process is used). GSI does not recommend proceeding with exploratory drilling/testing until OWRD has reviewed the applications and issued preliminary decisions (a proposed final order and/or a draft preliminary determination) confirming the agency can approve the application, including the proposed well locations. GSI only recommends proceeding with the exploratory drilling and testing program if the Preferred or C Series Backup Well locations are approved by OWRD.
2. Exploratory Drilling and Testing Program: Develop bid documents for public procurement of a contractor to drill, construct, and test one test well and one observation well. GSI estimates that the exploratory drilling and testing program may cost between $189,000 - $337,500 (see Table 4) and take 4 months to develop contract documents and solicit/procure a contractor and another 3 months to drill, construct, and test the test well and observation well (subject to the availability of drilling contractors). If results of the exploratory drilling and testing program are favorable, GSI recommends finalizing the full-scale wellfield design and revising the planning level costs and schedule to construct and integrate a full-scale wellfield.

6. References

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ATTACHMENT A

Water Rights Feasibility Details

DRAFT ATTACHMENT A

City of Bandon – Water Rights Feasibility Details

To: Dan Chandler, JD, ICMA-CM / City of Bandon

CC: Steve Major, PE / The Dyer Partnership Engineers & Planners, Inc.

From: Ryan Dougherty, PE, RG / GSI Water Solutions, Inc.
Kim Grigsby / GSI Water Solutions, Inc.
Ted Ressler, RG, CWRE / GSI Water Solutions, Inc.

Date: December 27, 2021

1. Introduction

The use of groundwater for municipal water supply requires a water right from the Oregon Water Resources Department (OWRD). This attachment provides details associated with two options the City of Bandon (City) could potentially pursue to obtain authorization to use groundwater for municipal water supply.

1.1 Groundwater Permit Application

GSI conducted an evaluation of the opportunity for the City to obtain a new groundwater right that would authorize the use of groundwater for municipal purposes. As further described below, seeking a new groundwater permit would be challenging and it is likely OWRD would deny such a request.

1.1.1 Groundwater Permit Application Review Criteria

GSI's evaluation considered each of the review criteria that OWRD would consider when processing an application for a new groundwater permit. OWRD will review a permit application according to the following criteria:

1. Whether water is available
2. Whether the proposed use is consistent with its basin program rules
3. Whether the proposed use would cause injury to an existing water right
4. Whether the proposed use is consistent with other rules of the Water Resources Commission

The methods and likely outcome for each of these four criteria are discussed in further detail in the following subsections.

Whether Water is Available

Groundwater Availability

When reviewing a groundwater permit application, OWRD will first consider whether groundwater is available. Generally, OWRD will review local groundwater level hydrographs to determine whether groundwater is available for further development (i.e. groundwater levels are stable). In this case, GSI anticipates that OWRD would find that groundwater is available for the proposed use from the marine

terrace deposits as multiple local wells with recent (post-2010) water level data suggest that water levels are relatively stable[1].

Potential for Substantial Interference with Surface Water

In addition to groundwater availability, OWRD will determine if the proposed use of groundwater would have the potential for substantial interference (PSI) with surface water. If OWRD finds PSI with surface water, then it subjects the groundwater use to regulatory limitations that are applicable to the adjacent surface water source, such as surface water availability. In making a PSI determination, OWRD will first consider whether a well is developing water from a confined or unconfined aquifer. Next, OWRD will determine whether the aquifer is hydraulically connected to surface water. In making this determination, OWRD will assume that a well less than one-quarter mile from a surface water source that produces water from an unconfined aquifer is hydraulically connected to the surface water. Finally, if the well is determined to produce water from an aquifer that is hydraulically connected to surface water, OWRD will determine whether it has the potential to cause substantial interference (PSI) with surface water. OWRD will assume that use of hydraulically connected groundwater will have PSI with surface water if it meets any of the four criteria:

1. The well is less than one-quarter mile from the surface water
2. The well is less than one mile from the surface water and groundwater would be pumped at a rate greater than five cubic feet per second (cfs)
3. The well is less than one mile from the surface water and groundwater would be pumped at a rate greater than one percent of the pertinent minimum perennial streamflow, senior instream water right, or the natural stream flow that is expected 80 percent of the time
4. The well is less than one mile from the surface water and groundwater pumped for a period of 30 days would cause stream depletion greater than 25 percent of the rate of appropriation.

To determine whether the City's proposed use of groundwater would have PSI with surface water, GSI first concluded that the City would develop groundwater from an unconfined aquifer that would be hydraulically connected to surface water (marine terrace deposits). GSI then created buffers from surface water sources in the City's watershed to assess how far from surface water new wells could be located. Although GSI determined that wells could be located more than one-quarter mile from surface water, GSI concluded there are essentially no locations near the City that exceed one mile from surface water. Thus, as shown in Figure 5, any proposed well included in a permit application would be less than one mile from surface water.

In the next step of a PSI evaluation for wells within one mile of surface water, OWRD will consider whether the proposed pumping rate would be more than one percent of specified flows rates for surface water sources within one mile from the proposed new well. In evaluating this criteria, GSI calculated one percent of the specified flow rates for surface water sources near the City (based on relevant minimum perennial streamflow, instream water right, or natural stream flow expected 80 percent of the time). The resulting pumping rates that would trigger PSI are provided below on Table 1.

Table 1. Pumping Rates Triggering PSI

Surface Water Source	Pumping Rate Limit (gpm)
Ferry Creek	1.3
Geiger Creek	1.8
Johnson Creek	0.09
Crooked Creek	4.5

As shown in Table 1, these flows are significantly lower than the City's target capacity for a supplemental groundwater supply (300-500 gpm). Therefore, a groundwater permit application for approximately 300-500 gpm would trigger PSI.

[1] See water levels of COOS-3902, COOS-51116, and COOS-5117

Surface Water Availability

When OWRD concludes that a proposed use of groundwater would have PSI with surface water, the agency then considers whether surface water is available for the proposed use. OWRD would consider its Water Availability Analysis at 80 percent exceedance to make this determination. GSI reviewed OWRD's Water Availability Analysis for Ferry Creek, Johnson Creek, and Crooked Creek, and found that surface water is not available for new appropriation during any month of the year from these sources (OWRD's Water Availability Analysis does not have a report for Geiger Creek, so the agency would use the report for Ferry Creek, to which Geiger Creek is a tributary). Since surface water is not available, OWRD would conclude that water was not available for the City's proposed use of groundwater.

Basin Program Rules

OWRD will also consider whether the proposed use is consistent with the rules in the relevant basin program. The City and surrounding area is within OWRD's South Coast Basin. The basin program rules for that basin "classify" (allow) the use of groundwater for municipal use in the area near the City. Accordingly, OWRD should find that the use of groundwater for municipal purposes is consistent with the basin program rules.

Injury to Existing Water Rights

Next, OWRD will evaluate whether the proposed use will cause "injury" (excessive pumping interference) to existing water users. Injury can occur when the pumping operations of one well preclude an existing water user from obtaining their authorized/customary quantity of water. This phenomenon is commonly observed when wells are in close proximity and draw groundwater from the same aquifer system.

GSI evaluated the potential for injury (excessive pumping interference) from new wells located in the City's watershed[2]. Based on GSI's estimations of pumping interference, two existing water users would be impacted, which are discussed below:

- ODFW Fish Hatchery: The Oregon Department of Fish and Wildlife's (ODFW's) hatchery has a water right certificate for non-consumptive use of water from Ferry Creek. ODFW's water right certificate (7904) has a priority date of 7/20/1925, which is junior to some of the City's existing water rights (including Certificate 9754, see subsequent section). GSI believes it is unlikely that OWRD would determine that a full-scale wellfield would cause injury to ODFW's fish hatchery because a groundwater system by nature will result in less direct stream depletion than the City's existing surface water intakes.
- Exempt (Domestic) Wells: There are existing exempt (domestic) wells a few hundred feet north of the City's water treatment plant (along Houston Lane, Melton Road). These wells are exempt from needing a water right to use groundwater. Some of these wells are shallow (<50 feet) and therefore pumping interference from a full-scale wellfield could preclude the exempt wells from obtaining groundwater. GSI believes it is possible that OWRD would determine injury to existing exempt (domestic) wells from a full-scale wellfield depending on where the wells are located. New wells located near the City's water treatment plant would likely cause injury to the exempt wells while new wells located south of Ferry Creek would not likely result in injury to the exempt wells.

Overall, there is uncertainty as to whether OWRD would determine that the proposed use would cause injury to existing water users. As described above, the probability of causing injury (particularly to exempt wells) largely depends on where the new wells will be located. The identification and evaluation of potential well locations is discussed in the main body of the technical memorandum in Section 4.1.1. The uncertainties

[2] Well interference (drawdown) was calculated using the Cooper-Jacob method for the following pumping scenario: unconfined aquifer conditions; individual well pumping rates of 75-100 gpm, pumping duration of 30 days, hydraulic parameters for the marine terrace deposits (see Table 1)

associated with causing injury to existing water users can only be resolved after an application has been submitted and OWRD's groundwater section has completed their review.

Consistency with OWRD Administrative Rules

Finally, OWRD will evaluate whether the proposed use of water is consistent with other OWRD administrative rules. Generally, the rules that OWRD considers for a groundwater application determined to have PSI would be those related to well construction and additional public interest review for impacts to fish listed under the state and federal Endangered Species Act. First, new wells should be constructed to comply with the relevant rules. Second, the Oregon Department of Fish and Wildlife (ODFW) and the Department of Environmental Quality (DEQ) would review the application for impacts to listed fish species. Since listed fish species are present and surface water is not available during any month, both agencies would likely recommend that OWRD either deny the application, or that the City provide mitigation to offset impacts to the affected surface water source.

1.1.2 Groundwater Permit Application Summary

GSI evaluated OWRD's review criteria for a new groundwater permit to determine the expected outcome of OWRD's review of a permit application filed by the City requesting the use of groundwater for municipal purposes. GSI concluded that OWRD would likely find the following with respect to the four review criteria:

1. Whether Water is Available: Although groundwater is available for the proposed use, the use would have PSI with surface water, and surface water is not available any month of the year. Accordingly, OWRD is expected to find that water is not available for the proposed use.
2. Basin Program Rules: The use of groundwater for municipal use is consistent with the basin program rules.
3. Injury to Existing Water Rights: There is uncertainty as to whether the proposed use would cause injury to existing water users. These uncertainties can only be resolved after an application has been submitted and OWRD's groundwater section has completed their review.
4. Consistency with OWRD Administrative Rules: ODFW and DEQ would be expected to recommend either denial of the application or require that the City provide mitigation to address impacts to listed fish species in the affected surface water source.

Based on the expected finding that water is not available for the proposed use, and recommendations from ODFW and DEQ, OWRD would likely deny an application for a new municipal groundwater permit from wells in the area of the City. Historically, one option to potentially change this outcome could be to provide mitigation to offset the impacts to surface water, as described below.

Potential to Mitigate for Surface Water Impacts

To obtain a new groundwater permit, the City would likely need to resolve the concerns described above regarding PSI, surface water not being available, and impacts to listed fish species. The method to resolve these issues has historically been to provide mitigation. However, OWRD has recently announced that it intends to stop allowing applicants to provide mitigation when water is not available for a proposed use. Further discussions with OWRD will be required to determine if OWRD will be implementing this new policy.

1.2 Surface Water to Groundwater Transfer

Since it appears unlikely that the City would obtain OWRD approval of an application for a new groundwater permit, GSI evaluated the opportunity for the City to change a portion of one of the City's existing surface water rights to allow the appropriation of the water from a new well. This change is referred to as a surface water to groundwater transfer. As described below, the surface water to groundwater transfer process is much more streamlined than the permit application process and is limited to an evaluation of injury to existing rights, enlargement of the right being modified, and "similar source" criteria. Consequently, this

process may pose less of a challenge than obtaining a new groundwater right. It should also be noted that this evaluation is focused on the technical criteria and process; a deeper understanding of the City's water rights portfolio by GSI (status, development to date, infrastructure capacity, etc.) would be needed to further assess feasibility and to develop a potential implementation strategy.

OWRD can approve a surface water to groundwater transfer, if all of the following criteria are met:

1. The change would not cause injury to other existing water rights
2. The proposed change would not enlarge the right to be changed
3. The aquifer is hydraulically connected to the authorized surface water source
4. The proposed change would affect the surface water source similarly[3]
5. The well is located within 500 feet of the surface water source and within 1,000 feet upstream or downstream of the original point of diversion; or a licensed geologist prepares a report demonstrating that the above criteria are met.

GSI evaluated these review criteria to assess the expected outcome of OWRD's review of a transfer application requesting to change one of the City's surface water rights to allow the use of groundwater from one or more wells. GSI's review assumed that the City would develop groundwater from an unconfined aquifer that would be hydraulically connected to surface water (marine terrace deposits); therefore, the expected outcomes of the first three criteria would be the same as that of the groundwater permit application (see Section 3.1.2 for summary of expected outcomes). The remaining two criteria (criteria numbers four and five above) are evaluated below through a stream depletion analysis.

To evaluate the effect of a proposed transfer on surface water, GSI completed a preliminary analysis similar to that used by OWRD in their review of a surface water to groundwater transfer. Specifically, the Jenkins (1970) and Hunt (1999) streamflow depletion models were used to evaluate the furthest distance that new wells could be located from surface waterbodies to meet the conditions for a surface water to groundwater transfer (affecting the surface water source similarly[7]). Input parameters for these stream depletion models were based on hydraulic properties for the marine terrace deposits (see Table 1, based on BCWCD, 2004). Results of the stream depletion modeling suggests that new wells could be located over 3,000 feet from surface waterbodies (or anywhere within the City's watershed). Although preliminary and not utilizing site-specific hydrogeologic information, since the input parameters for the stream depletion model analysis presented here are based on hydraulic properties that OWRD co-authored , we have reasonable confidence that a surface water to groundwater transfer to wells completed in the marine terrace deposits may be possible anywhere within the City's watershed.

Based on the evaluation of OWRD's review criteria, GSI concluded that the agency would likely approve such a transfer application; however, the City should be aware that the approval order may include multiple conditions. First, in order to preclude enlargement of the right being transferred OWRD would limit the City's use of groundwater to the amount of water lawfully available at the original point of diversion (on the surface water source). In some cases OWRD has required a measuring device at the original point of diversion and the well to ensure compliance with this requirement. Second, the transfer approval order would likely also note that all restrictions that existed at the original surface water point of diversion shall apply to the proposed well(s). Finally, as part of the surface water to groundwater transfer process the right would be conditioned to allow OWRD to subordinate the right to any existing groundwater rights that are injured as the result of the transfer.

[3] OWRD defines "similarly" to mean that the use of groundwater at the new wells affects the surface water source specified in the subject water rights and would result in stream depletion of at least 50 percent of the rate of appropriation within 10 days of continuous pumping.

APPENDIX F: COMMENTS