City of Rockaway Beach

Tillamook County, Oregon

Water System Master Plan Update

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Project No. 2004-027-40

REGISTERED PROFESSIONAL ENGINEER
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Executive Summary ES

ES.1 INTRODUCTION

The City of Rockaway Beach owns and operates a municipal water system (#OR4100708). The City provides water service to residential, commercial, and public services within the City's urban growth boundary and adjacent area to the south (Oceanlake Development).

In accordance with OAR 690-086-0140, the City has developed and maintained a Water Master Plan of its system. The most recent Master Plan was completed in 2009, however, since this time a number of improvements have been completed. In order to update these changes as well as re-evaluate water demands and system needs, the City commissioned HBH Consulting Engineers, Inc. to update its Water System Master Plan.

The purpose of this Water System Master Plan is to furnish the City of Rockaway Beach with a comprehensive planning document that provides engineering assessment of system components and guidance for future planning and management of the water system over the next 20 years. This document satisfies the Oregon Drinking Water Program (DWP) requirements for water master plans.

ES.2 STUDY AREA & POPULATION

The City of Rockaway Beach is located approximately 75 miles west of Portland and 15 miles north of the City of Tillamook in Tillamook County, Oregon. State Highway 101, the main north-south coastal route, bisects the City. The Rockaway Beach city limits and urban growth boundary (UBG) are located in Township 1 & 2 North, Range 10 West W.M.

ES.2.1 Study Area

The planning area for this Water System Master Plan is primarily the area encompassed by the existing Rockaway Beach UGB. In addition, the planning area also includes the Oceanlake Development, which is located south of the UGB. Any other areas that might be affected by the system or proposed improvements (e.g. facility sites, interconnection, etc.) to the system are also considered.

The existing UGB covers an area of approximately 1,453 acres. A variety of land uses exist within the UGB including single family/duplex, residential, low density residential, residential resort, special residential resort, commercial, special wetlands area, waterfront development, residential manufacturing dwelling, and open space. The majority of the land use is zoned residential (74%).

The study area is described in detail in Section 2 of this Plan.

ES.2.2 System Population

The current full-time population served by the water system is estimated at 1,800 people. This does not include part time residents or tourists that are also served by the water system. The US Census currently estimates that only 38% of homes in the City are occupied by full-time residents.

Over the past decade, growth in the City's population has been relatively stagnant with an average annual growth rate (AAGR) of only 0.34%. It is assumed that this rate will increase as the area's economic conditions improve. Future growth for the 20-year planning period has been projected at an average annual rate of 1.0%. Based on this assumption, the projected full-time population of the water system will be 2,220 persons by the year 2033.

Full analysis of the water system's current and future population is provided in Section 2.

ES.3 WATER USAGE & SYSTEM DEMANDS

Billing and Daily Monitoring Reports (DMRs) were obtained from the City for the years 2010 through 2012. These records were used to update user characteristics as well as water demands. Detailed analyses of water usage and demand for the City of Rockaway Beach are presented in Section 5.

ES.3.1 Water Customers & Consumption

The following table lists the current number of residential and non-residential customers and the corresponding water usage. Total water consumption for all users in 2012 was over 54.66 million gallons. The majority of this usage (93.5%) is contributed to residential customers. Non-residential usage has significantly declined over the past several years. Compared to the average 2004-2006 water sales, current non-residential usage has declined by over 82% with overall water consumption decreasing by nearly 25%.

Table ES-1 - Current Water Account & Water Consumption

Users	Accounts	Water Consumption (gallons/yr)
Residential	2,406	51,129,600
Non-Residential	84	3,534,800
Total	2,490	54,664,400

Average residential usage was used to determine the number of Equivalent Dwelling Units (EDUs) served by the City's water system. Non-residential users (commercial, industrial, public facility, etc.) can be described as an EDUs based on their water consumption compared to the average consumption of a residential unit. Based on analysis of recent billing records, the average residential account consumes approximately 60 gpd. The City's non-residential water usage was translated to EDUs by dividing total daily commercial consumption by the average residential usage rate. Future EDUs were projected using the same rate of growth used for population analysis (AAGR = 1.0%). As shown in the following table, nearly 600 additional EDUs are expected to be added to the system by the end of the 20-year planning period

Table ES-2 - Rockaway Beach Water EDU Summary

	Residential EDUs	Non-Residential EDUs	Total System EDUs
Current	2,406	167	2,573
20-Year Projection (AAGR = 1.0%)			3,171

ES.3.2 Water Demands

Daily records from the City's water treatment plant were reviewed to determine current water demands. The average, maximum month, and peak day demands are shown in the following table.

Table ES-3 - Rockaway Beach Water Demand Summary

Demand Condition	Water Demand (mgd)
Average Day	0.299
Maximum Month	0.375
Maximum Day	0.644

Over the past three years the average water demand per EDU has equaled approximately 120 gpd. Projected water demands for the City were calculated using peaking factors and unit demands coupled with projected EDUs. The following table presents the 20-year projected water demand for the City of Rockaway Beach.

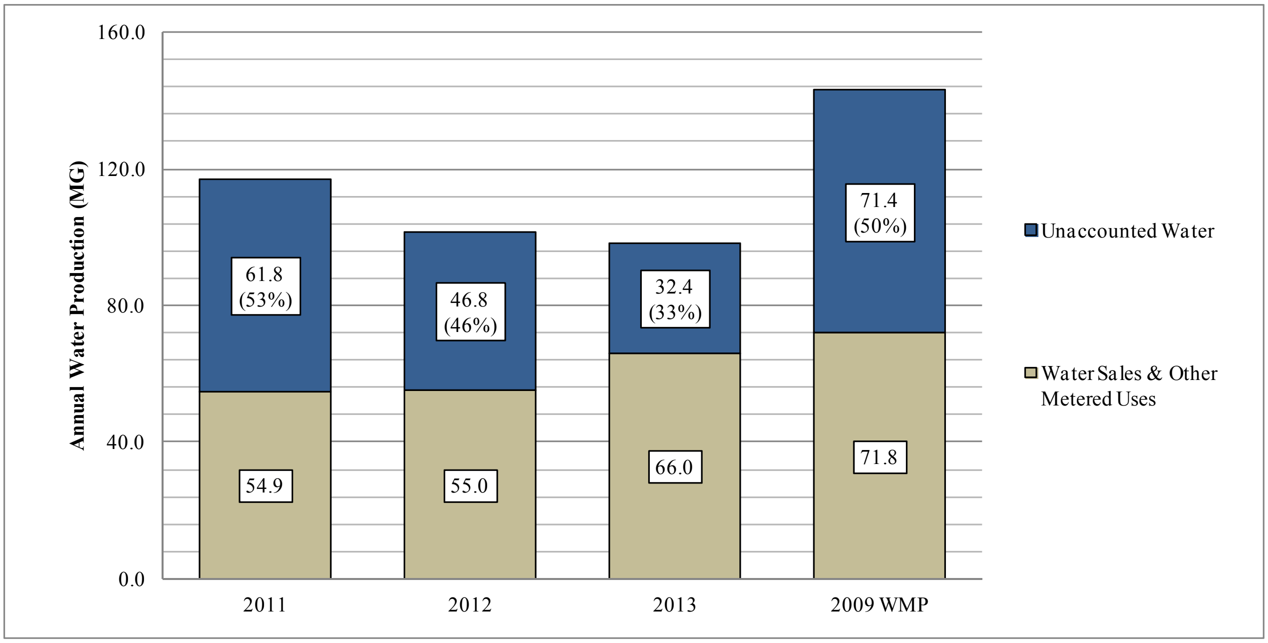
Table ES-4 - Future Rockaway Beach Water Demand

Demand Condition	Peaking Factor	Unit Demand (gpd/EDU)	20-Yr Water Demand (mgd)
Average Day	1.0	120	0.381
Maximum Month	1.3	155	0.492
Maximum Day	3.0	360	1.142

ES.3.3 Unaccounted Water

Not all water produced is consumed by a water system's users. A portion of treated water is also required for backwashing filters, system flushing, and sampling. The difference between total water produced and the total metered usage of system customers and operations is defined as unaccounted water. As the following graph shows, unaccounted water in the City's system averages at nearly 50%.

Figure ES-1 – Rockaway Beach Water Production Audit



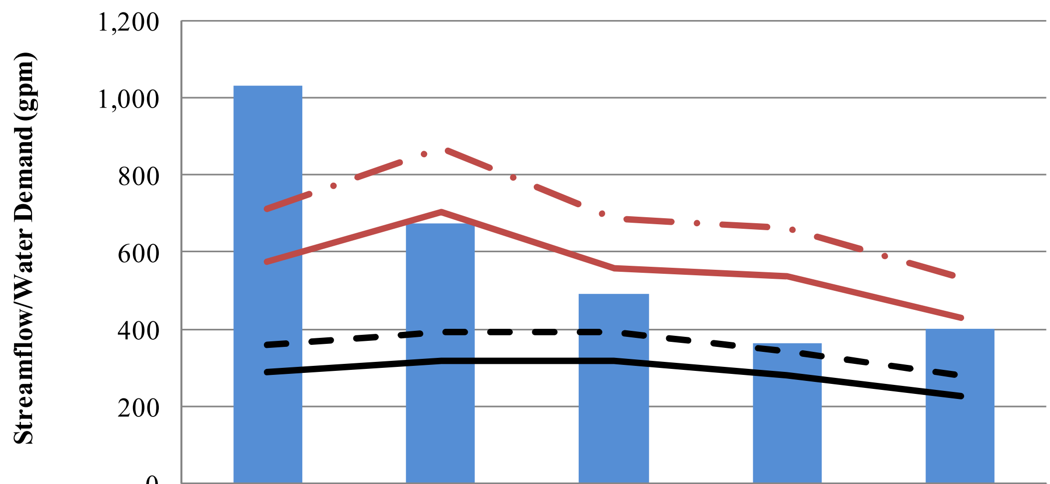
ES.4 EXISTING SYSTEM INVENTORY & ANALYSIS

The existing water system is described in Section 4 of this Plan. The system includes a surface water intake and raw water impoundment; ultramembrane treatment plant with pre-treatment and hypochlorite disinfection; three reservoirs that provide over 3 million gallons of storage; three pumping facilities, and approximately 31 miles of pipelines. The age, condition, capacity, and performance of these components vary considerably. Section 7 of this Plan provides detailed assessment of the City's water system facilities as well as develops and evaluates a number of alternatives improvements.

ES.4.1 Water Supply

The City utilizes surface water from Jetty Creek to supply its water system. The existing raw water intake consists of a small in-channel raw water storage impoundment created by a low concrete dam and a direct raw water intake line to a duplex pump station. Although the two 1.0 cfs water rights that have allocated are sufficient to meet the City's water needs, low flows in summer can make it difficult to supply adequate water (Figure ES-2).

Figure ES-2 - Jetty Creek Reliable Summer Streamflows & City Water Demands[1]



	Jun	Jul	Aug	Sept	Oct
95% Probability	1032	673	494	364	399
Current Average Day	291	316	316	279	228
Current Peak Day	576	702	556	537	431
20-Yr Average Day	359	391	391	344	281
20-Yr Peak Day	712	868	688	664	533

Based on the analysis of the existing water source and intake facilities, the following system deficiencies have been noted:

- Limited source capacity during summer months is insufficient to meet current and future peak water demand
- Seasonal spikes in turbidity, particularly following rain events, impair treatment capabilities
- Existing intake screen and piping in poor condition
- Large screen openings in the existing intake screen do not prevent pine needles and other debris from entering into system which increases wear of pumps and impair treatment
- Sedimentation within raw water impoundment requires annual maintenance for removal
- Existing dam acts as a fish barrier

ES.4.2 Water Treatment

The City recently completed a number of improvements to its water treatment plant (WTP). In 2009, the City was award a grant from the American Recovery Act (ARA) to upgrade its water treatment facility. Improvements included installing a new ultramembrane filtration system. Additionally, the City installed new pumps, chemical systems, and updated the system's electrical and control equipment. This work was completed in 2011. In 2013, the City installed four pressure filters to provide pre-treatment for the membrane system.

Table ES-5 - Water Treatment Plant Summary

Filtration Type	Ultramembrane - WesTech Polymen UF 120S2
Design Capacity	900 gpm
Virus Removal Credit (Filter)	1.0
Cyotosporidium Removal Credit (Filter)	4.0
Giardia Log Removal Credit (Filter)	4.0
Giardia Log Removal Credit (Disinfection)	0.5

As shown in the above table, the existing WTP has a capacity of approximately 700 gpm. As noted in Section 6, the water treatment plant should be sized to meet maximum daily demand in 18 hours or less of operation. Based on the current water demands, the WTP has an existing surplus capacity of approximately 200 gpm. Projected 20-year peak demands are expected to exceed existing capacity by 160 gpm. As a result, the WTP would need to operate for over 21 hours to meet demands.

Table ES-6 – Water Treatment Plant Capacity Assessment

	Required Capacity (gpm)	Treatment Surplus (gpm)
Current Demands	700	200
20-Year Demands	1,060	**-160**

The City's water treatment facility is now in good working condition, however the existing capacity may not be sufficient to meet the 20-year projected peak day demands in an 18-hour operation limit. The treatment system can be expanded by adding additional membrane modules to the skid. The City should monitor water demands and make recommendations for potential upgrades to the treatment facility as needed in updates to this Master Plan.

ES.4.3 Reservoirs

The City's water system includes three reservoirs that combine to provide 3.6 million gallons (mg) of treated water storage.

Table ES-7 - Summary of Storage Reservoir Facilities

	3rd Avenue Reservoir	McMillan Creek Reservoir	Pacific View Estates Reservoir
Capacity	1.0	1.9 MG	0.17 MG
Year Constructed	1975	2008	1978
Material	Concrete	Glass Fused Steel	Concrete

Storage needs are based on criteria detailed in Section 6 and include water storage for equalization, emergency, and fire protection. Combined, the City's existing facilities can provide sufficient storage to meet the overall needs of the system. However, several of the pressure zones may need addition storage by the end of the 20-year planning period.

Table ES-8 - Storage Requirements for Rockaway Beach Water System

	MDD (mgd)	Storage Requirements			Existing Storage (MG.)	Excess Storage Available (MG.)
		Equalization and Emergency 1.25 x MDD (MG.)	Fire Storage (MG.)	Total Storage (MG.)		
Overall System						
Existing	0.76	0.95	0.54	1.49	3.17	1.68
20-year	1.14	1.43	0.54	1.97	3.17	1.20
McMillan Creek Pressure Zone						
Existing	0.39	0.48	0.54	1.02	1.90	0.88
20-year	0.58	0.73	0.54	1.27	1.90	0.63
3rd Avenue Pressure Zone						
Existing	0.36	0.45	0.54	0.99	1.00	0.01
20-year	0.55	0.68	0.54	1.22	1.00	**-0.22**
Pacific Pressure Zone						
Existing	0.01	0.01	0.12	0.13	0.17	0.04
20-year	0.01	0.01	0.12	0.13	0.17	0.04

It should be noted that the usable storage in McMillan Creek is reduced due to low pressures that result when the reservoir is less than half full. This reduces the available storage to approximate 930,000 gallons. As a result, the pressure zone does not have adequate capacity to meet current or future storage needs.

Table ES-9 - Impact of Reduced Available Storage in McMillan Creek Reservoir

	Storage Requirement	Usable Storage	Storage Surplus
Overall System			
Existing	1.49	2.1	0.61
20-year	1.97	2.1	0.13
McMillan Creek Pressure Zone			
Existing	1.02	0.93	**-0.09**
20-year	1.27	0.93	**-0.34**

The following provides a summary of noted deficiencies of the City's reservoirs:

- An estimated 54% of the storage in McMillan Creek Reservoir is not available for use due to low pressures that results when the tank is less than half full (see Table ES-9). As a result of the reduced capacity, the McMillan Creek Pressure Zone does not have sufficient storage available to meet current and future water storage needs.
- The 3rd Avenue Reservoir is in poor conditions and needs rehabilitation. Additionally, the facility may not have sufficient storage capacity to meet the storage needs of the system through the 20-year planning period.
- Work to abandon the Scenic View Reservoir has not been completed.

ES.4.4 Pump Stations

The City's water system includes three pump stations. Two of these stations are primarily used to pump water from one pressure zone to a reservoir located in another pressure zone. The remaining pump station is required to increase service pressure to customers in the upper Pacific View pressure zone. A summary of these pump station is provided below.

Table ES-10 - Summary of System Pressure Zones

	3rd Avenue Pump Station	Rock Creek Pump Station	Pacific View Pump Station
No. Pumps	2	2	1
Pump Make/Model	Cornell/ 2STG 7CC		Peerless/610A
Motor Size	15 Hp		7.5 Hp
Pump Capacity (each)	200 gpm	200 gpm	50 gpm
Hydropneumatic Tank	NA	NA	530 gallon
Feed	McMillan Creek PZ	3rd Avenue Zone	Pacific View Estates Reservoir
Discharge	3rd Avenue Reservoir	Pacific View Estates Reservoir	Pacific View Estates Zone

Deficiencies regarding the City's existing pump stations include:

- The 3rd Avenue PS is undersized for current demands resulting pumps that have high daily run times and have to be rebuilt regularly. When the pumps are in operation they reduce the pressure in the McMillan Creek Pressure Zone. The pump station is currently a confined space and has no rail system for pulling the pumps.
- The 4" CL150 PVC main that conveys water from the Rock Creek PS to the Pacific View Reservoir at the creek crossing is in poor condition and needs replacement.
- The Pacific View PS needs a new control panel and upgrades to the power supply as well as improvements to the building interior. Additionally, the station cannot supply fire protection.

ES.4.5 Distribution System

The City's distribution system is divided into four pressure zones. Treated water from the WTP is pumped to the McMillan Creek Reservoir. The 3rd Avenue PS pumps water from the McMillan Creek Pressure Zone to the 3rd Avenue Reservoir. The Nehalem Ave/Ocean St Pressure Zone is supplied from the 3rd Avenue Pressure Zone through a PRV valve. The Pacific View Pressure Zone is also supplied from the 3rd Avenue Pressure Zone by the Rock Creek PS which pumps water to the Pacific View Reservoir.

Table ES-11 - Summary of System Pressure Zones

Pressure Zone	Supply	Area (acres)	Min. Service Elevation	Max. Service Elevation
McMillan Creek	WTP & McMillan Creek Reservoir	930.9	0 ft	115 ft
3rd Avenue	3rd Ave PS & Reservoir	91.1	5 ft	142 ft
Nehalem Ave. & Ocean St.	3rd Ave Zone PRV	396.0	3 ft	79 ft
Pacific View	Pacific View Estates Reservoir	68.5	182 ft	347 ft

The City's transmission and distribution system consists of water pipelines as well as a number of valves, fire hydrants, and customer meters. The system is generally configured in a north-south layout with several sub-sections feeding off the main pipeline that runs parallel with Highway 101. The existing distributions system includes approximately 31 miles of 2-inch to 12-inch piping. Existing pipe material consists of AC, PVC, HDPE, and Steel water mains.

Table ES-12 - Pipe Inventory

Pipe Size (inches)	Length					Percentage
	AC	PVC	HDPE	Steel	Total	
2	-	-	-	600	600	0.4%
4	29,400	24,000	300	-	53,700	32.6%
6	7,600	22,700	500	-	30,800	18.7%
8	12,100	43,200	600	-	55,900	33.9%
10	-	12,700	400	-	13,100	7.9%
12	-	10,800	-	-	10,800	6.5%
Totals	49,100	113,400	1,800	600	164,900	100.0%

The following provides a summary of the deficiencies associated with the City's existing distribution system:

- The calculated pressure of several areas located at higher elevation in the McMillan Creek Pressure Zone drop below 20 psi as the water level in the reservoir drops below 18ft.
- High points and undersized piping limit the capacity and impair hydraulics of the distribution system so that performance criteria are not met during many existing and future conditions.
- Deteriorating water quality experienced in the southern portion of the system due to long pipeline runs.
- Water loss in the system is nearly 50%, some of which is likely caused by leakage in the distribution system.
- The piping network includes pipelines that are composed of AC material that are at or near the end of their useful life and should be replaced.

ES.5 RECOMMENDED CAPITAL IMPROVEMENT PLAN

Details on the recommended capital improvement plan (CIP) for the City's water system is provided in Section 8. These recommendations are based on evaluations of system improvement alternatives developed in Section 7.

ES.5.1 Priority 1 Projects

Highest priority improvements should be completed within the next five years or as soon as funding is available. Priority 1 projects are listed below:

- Intake screen and piping improvements
- Abandon Scenic View Reservoir
- Rehabilitate 3rd Avenue Reservoir
- Relocated 3rd Avenue PS
- Rehabilitate existing Pacific View PS
- Replace section of Rock Creek Transmission Line
- Distribution System Improvements - Phase 1

ES.5.2 Priority 2 Projects

Moderate priority projects should be completed in next 5 to 10 years and include:

- Expansion of raw water impoundment
- Construct new 80 gpm pump station near Nacarney Street
- New interconnection between the pressure zones of 3rd Avenue and Pacific View
- Construct new 350,000 gallon Oceanlake Reservoir
- Construct new 150 gpm Oceanlake PS
- Distribution System Improvements - Phase 2

ES.5.3 Priority 3 Projects

Priority 3 projects can be completed in the latter half of the planning period or as additional funding becomes available. Priority 3 improvements include:

- Construct new 20 gpm pump station near old Scenic View Reservoir site
- Fire demand pump station in Pacific View Estates Pressure Zone
- Distribution System Improvements - Phase 3

ES.5.4 RECOMMENDED IMPROVEMENTS COST SUMMARY

A summary of the recommended capital improvement projects costs is provided in the following table. The estimated cost for all system improvements is $10.72 million. Funding options for proposed improvement projects are discussed in greater detail in Section 9.

Table ES-13 - Recommended Capital Improvement Costs Summary

Capital Imrovement Project	Preliminary Estimated Cost
Priority 1	
Intake Screen	$ 51,000
Abandon Scienic View Reservoir	$ 10,000
Rehabilitate 3rd Ave Reservoir	$ 123,000
3rd Avenue PS Relocation	$ 315,000
Rehabiliation Pacific View Estates BPS	$ 37,500
Rock Creek Transmission Line	$ 45,000
Distribution System Improvements Ph 1	$ 2,934,000
Total Priority 1	*$ 3,515,500*
Priority 2	
Raw Water Impoundment Improvements	$ 573,000
Necarney BPS	$ 217,000
3rd Ave-Pacific View Connection	$ 84,000
Oceanlake Reservoir	$ 1,029,000
Oceanlake Pump Station	$ 243,000
Distribution System Improvements Ph 2	$ 2,493,000
Total Priority 2	*$ 4,639,000*
Priority 3	
Scenic View BPS	$ 126,000
Pacific View Fire Demand PS	$ 220,500
Distribution System Improvements Ph 3	$ 2,221,500
Total Priority 3	*$ 2,568,000*
Total Improvements	**$ 10,722,500**

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SECTION 1

Introduction

Section 1 Introduction

1.1 BACKGROUND

The City of Rockaway Beach is located approximately 75 miles west of Portland and 15 miles north of Tillamook on Highway 101 in Tillamook County, Oregon (See Figure 1-1). The City provides water service to customers within its Urban Growth Boundary (UGB), which includes Rockaway Beach, Manhattan Beach, and Nedonna Beach, as well as the Oceanlake development located southeast of the UGB. The system currently serves an estimated 1,800 permanent residents as well as a large number of transient and seasonal residents through a total of 2,257 residential and commercial connections.

The City's existing water system (#OR4100708) consists of a surface water intake, treatment plant, three reservoirs, two pump stations, and approximately 31 miles of pipelines. Water from Jetty Creek is pumped to t a 900 gpm packaged ultramembrane treatment plant manufactured by WesTech. Treated water is pumped to the 1.9-million gallon (mg) McMillan Creek Reservoir, which gravity feeds the McMillan Creek pressure zone. The 200-gpm 3rd Avenue pump station conveys water from this lower zone to the 1.0-mg 3rd Avenue Reservoir. This reservoir feeds the 3rd Avenue pressure zone as well as the Nehalem Ave/Ocean St. pressure zone through a 6-inch PRV. The 200-gpm Rock Creek pump station conveys water from the 3rd Avenue zone to the 0.17-mg Pacific View Reservoir and booster pump station. The current peak day demand of the system is nearly 0.76 million gallons per day (mgd). This is projected to increase to over 1.14 mgd by the end of the 20-year study period.

The City completed a Water Master Plan in 2009. Since this time, a number of improvements have been completed including the new membrane treatment plant and McMillan Creek Reservoir. Although the remaining facilities generally have adequate capacity to meet service requirements, a number of the components are nearing the end of their useful life and need rehabilitation or replacement. Additionally, undersized pipelines and high points within service areas limit the capacity of the distribution network resulting in reduced capacity, low pressures, and poor hydraulic performance. The system has also experienced recent problems with the formation of disinfection by-products (DBPs).

The City of Rockaway Beach requires an update to its Water System Master Plan in order to provide accurate information on its existing facilities, re-evaluate needed system improvements, update improvement project costs, and develop a Capital Improvement Plan to guide the City's management of its water system through the upcoming 20-year planning period.

1.2 STUDY OBJECTIVE

The purpose of this Water System Master Plan is to furnish the City of Rockaway Beach with a comprehensive planning document that provides engineering assessment of system components and guidance for future planning and management of the water system over the next 20 years. This document satisfies the Oregon Drinking Water Program (DWP) requirements for water master plans.

Principal Plan objectives include:

- Update current and projected system population;
- Update current and projected system water demands;
- Update existing infrastructure inventory and system mapping;
- Evaluate existing water system components;
- Develop recommendations for improvements needed to meet future needs and/or address deficiencies;
- Develop Capital Improvement Plan (CIP) for 20-year planning period; and
- Discuss financing options and impacts to water rates.

Supporting technical documentation is included to aid in grant and loan funding applications and meet the requirements of the Oregon Economic and Community Development Department (OECDD), the Oregon Water Resource Department (WRD), the Rural Utilities Service (RUS), as well as the Oregon Drinking Water Program (DWP).

1.3 SCOPE OF STUDY

1.3.1 Planning Period

OAR 690-086-0140 suggests that demands be projected over 20 years, which is a typical planning period for water master plans. The planning period for this Water System Master Plan is 20 years, ending in the year 2033.

1.3.2 Planning Area

The primary planning area for this Study generally coincides with the Rockaway Beach Urban Growth Boundary (UGB) with addition of the area southeast of the UGB that the City is required to serve known as the Oceanlake Development (Refer to Figure 2-3). Additional areas will be included, such as the intake and treatment plant location, and the storage reservoir and transmission line locations. Adjacent lands and waters that are affected by the system, or will be affected by proposed improvements, will also be considered.

1.3.3 Work Tasks

In compliance with Oregon Drinking Water Program plan elements and standards, this study provides descriptions, analyses, projections, and recommendations for the City's water system over the planning period.

The following elements are included:

- → Study area characteristics including land use and population trends and projections
- → Current water usage quantities and allocations
- → Projected water demands
- → Existing regulatory environment including regulations, rules and plan requirements
- → Description of the existing water system including supply, treatment, storage and distribution
- → Existing system capacity analysis and evaluation
- → Improvement alternatives and recommendations with associated costs
- → A summary of recommendations
- → Capital Improvement Plan (CIP)
- → Funding options
- → Maps of the existing system and recommended improvements

1.4 AUTHORIZATION

The City of Rockaway Beach contracted with HBH Consulting Engineers, Inc. to prepare this Water System Master Plan Update. Included in the contract is a Scope of Engineering Services on which the scope of this Plan is based.

1.5 ACKNOWLEDGMENTS

This Master Plan was produced in cooperation with the City of Rockaway Beach. In particular, the following persons should be acknowledged for the important roles they played in the preparation, review, and development of this Plan:

Luke Shepard .... City of Rockaway Beach Public Works Director
Kenneth Christensen .... City of Rockaway Beach Water Plant Operator

In addition to these key personnel, we wish to thank the City of Rockaway Beach City Council for providing support and input on this project.

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H B H Consulting Engineers	City of Rockaway Beach *WATER SYSTEM MASTER PLAN*	LOCATION MAP City of Rockaway Beach Tillamook County, Oregon	FIG. 1-1

SECTION 2

Study Area

Study Area

Section 2

2.1 PHYSICAL ENVIRONMENT

2.1.1 Location

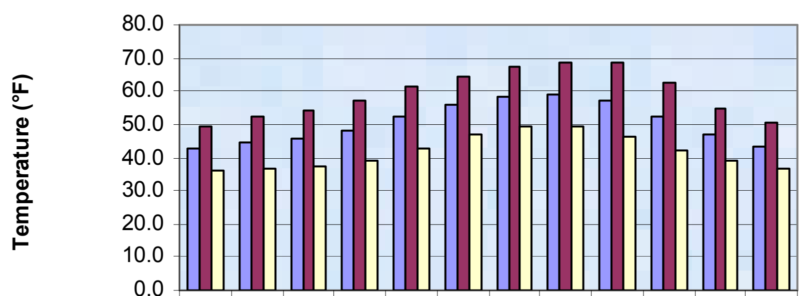
The City of Rockaway Beach is located approximately 75 miles west of Portland and 15 miles north of the City of Tillamook in Tillamook County, Oregon. State Highway 101, the main north-south coastal route, bisects the City. The City is also on a north-south rail line owned and operated by the Port of Tillamook Bay. The area provides recreational opportunities for boating and camping with ample public access to ocean beaches. The area also has a State park to the immediate north and several State waysides and a County park.

The City provides water service to residential, commercial, and public services within the City's urban growth boundary (UGB). The UBG includes the City of Rockaway Beach, unincorporated areas of Nedonna Beach, and a portion of Twin Rocks. The total area encompasses approximately 1453 acres (2.27 square miles). The Rockaway Beach city limits and urban UBG are located in Township 1 & 2 North, Range 10 West W.M. The City and surrounding area is shown in Figure 2-3.

2.1.2 Climate

Climate information for Rockaway Beach was obtained using records from the Western Regional Climate Center collected at the nearby weather station in Tillamook. The area generally has mild summers and winters with typical summer temperatures of 49-67°F and winter temperatures of 37-51°F. Annually, the average temperature is 50.6°F. The record high temperature listed is 102°F occurring on July 11, 1961. The record low is 1°F, which occurred on January 31, 1950.

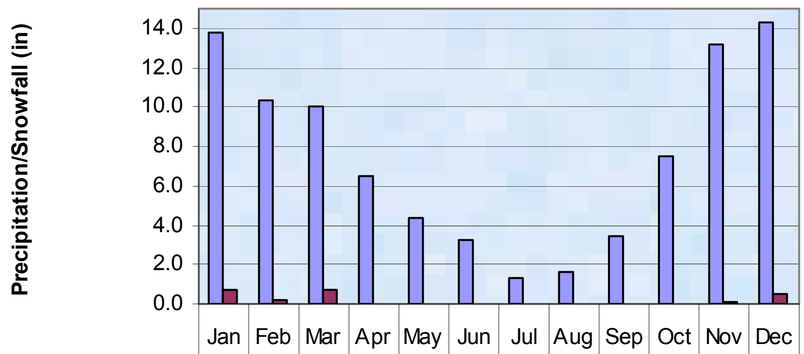
Figure 2-1 - Temperature



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	42.8	44.7	45.8	48.1	52.1	55.9	58.4	59.1	57.4	52.4	47.1	43.6
Avg. Max.	49.6	52.6	54.3	57.1	61.1	64.6	67.4	68.5	68.3	62.4	54.9	50.3
Avg. Min.	36.0	36.7	37.2	39.0	43.0	47.2	49.4	49.6	46.5	42.4	39.2	36.8

Most of the area's 90 inches of annual precipitation is in the form of rainfall. Snowfall does occur some winters but accumulations are usually short-lived. Almost half (43%) of yearly precipitation occurs during the winter months (Dec.-Feb.). On average, about 7% of the annual precipitation occurs during summer months (Jun.-Aug.). Fall is typically wetter than spring with 27% of the annual rainfall occurring in fall and 23% in the spring on average.

Figure 2-2 - Precipitation



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. Precip.	13.8	10.3	10.1	6.5	4.4	3.3	1.4	1.7	3.4	7.5	13.2	14.2
Avg. Snow	0.7	0.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5

The highest annual precipitation recorded was 122.7 inches in 1996. The driest year was 1985 with 61.2 inches of precipitation. On January 23, 1982 a record of 5.22 inches of rain fell in one day. The record snowfall of 24.5 inches occurred in 1951.

2.1.3 Geology

Information on the area's geology was derived using the *1994 Geologic Map of the Tillamook Highlands, Northwest Oregon Coast Range* by Ray E. Wells, Parke D. Snavely, Jr., Norman S. MacLeod, Michael M. Kelly, and Michael J. Parker. The City is mostly underlain by surficial deposits of "Qb" beach and sand dune deposits (Holocene). Other areas within the City, mainly at higher elevations, are underlain by surfical deposits, volcanic and sedimentary rocks, and intrusive rocks. These include "Qls" landslide deposits (Holocene and Pleistocene), "Qt" older fluvial and estuarine deposits (Pleistocene), "Tsg" Sandstone of Garibaldi (lower Miocene or Oligocene), "Tn" Nestucca Formation (upper Eocene), and "Tigr" Grande Ronde Basalt (middle Miocene).

2.1.4 Topography

The study area is situated between Tillamook Bay to the south and Nehalem Bay to the north on a narrow strip of land between the Pacific Ocean and the Coast Range Mountains rising to the east. The majority of the study area is located on a gently sloping terrace rising from sea level to approximately 100 feet above sea level. The highest point in the UGB is approximately 520ft. The highest point in the distribution system is at the Pacific View Reservoir, which has a base elevation of 400ft. The lowest elevation served is near sea level. The topography of the area can be seen in Figure 2-3.

2.2 LAND USE

Within the 1453-acre UGB, a variety of land uses exist including single family/duplex, residential, low density residential, residential resort, special residential resort, commercial, special wetlands area, waterfront development, residential manufacturing dwelling, and open space. There is also a conditional use overlay within the zoning. Current zoning within the City Limits and UGB is shown in Figure 2-4. Most land within the UGB is zoned for residential use (74.2%). Special Wetlands Area is the second largest sector (18.4%), followed by Commercial (5.2%). A summary of the existing land use is shown below in Table 2-1.

Table 2-1 - Land Use in the Rockaway Beach UGB

Zoning	Acres	% of UGB Land
Single Family/Duplex (R1)	366	25.2
Residential (R2)	396	27.3
Low Density Residential (R3)	153	10.5
Residential Resort (RR)	112	7.7
Special Residential Resort (SRR)	3	0.2
Commercial (C1)	76	5.2
Special Wetlands Area (SA)	267	18.4
Waterfront Development (WD)	9	0.6
Residential Manufactured Dwelling (RMD)	51	3.5
Open Space (OS)	20	1.4
Conditional Use (CU Overlay)	123	8.5
Totals (not including CU)	**1,453**	***100.0***

2.3 POPULATION

2.3.1 Existing Population

The year 2012 population of Rockaway Beach was 1,320 as certified by the Portland State University Population Research Center. The 2000 and 1990 census populations were 1,267 and 970, respectively. Annual population estimates for the City are presented in Table 2-2. Based on these population values, the rate of growth within the City has decreased over the past several decades. Between 1990 and 2000, the average annual growth rate (AAGR) in Rockaway Beach equaled 2.71%. This rate decreased to 0.34% between 2000 and 2012.

Table 2-2 - Population Estimates

Year	City Population	AAGR
1990	970	
2000	1267	2.71%
2001	1290	1.82%
2002	1290	0.00%
2003	1300	0.78%
2004	1320	1.54%
2005	1345	1.89%
2006	1345	0.00%
2007	1360	1.12%
2008	1375	1.10%
2009	1380	0.36%
2010	1312	-4.93%
2011	1320	0.61%
2012	1320	0.00%
AAGR 1990-2012		1.41%
AAGR 2000-2012		0.34%

1990, 2000, and 2010 are Census Populations
2001 to 2007 are Population Research Center Estimates

The population data in the above table only includes permanent residents living within the Rockaway Beach city limits. The City also provides water service to those living in the unincorporated community of Nedonna Beach as well as a large number of seasonal residents in the area. The permanent population served by the City's water system was estimated by multiplying the number of residential connections by the percentage of households occupied year round and the estimated number of people per household. The 2010 Census data estimated that 38% of the houses in Rockaway are occupied by permanent residents. The Rockaway Beach Comprehensive Plan lists an average of 1.9 people per household. The results of this analysis are shown in Table 2-3 and indicate the existing permanent population of the system is approximately 1,800. This is an increase of 0.84% compared to 2011 permanent population estimate.

Table 2-3 - Total Water System Permanent Population

Estimated Permanent Population	2011	2012
In-City	1,408	1,431
Rural	378	370
Total Full-Time Population	1,786	1,801

2.3.2 Projected Population

As previously noted, the rate at which growth is occurring in Rockaway Beach has declined over the past decade. It is expected that as the economy recovers, the rate of the water system's population growth will begin to increase. Recent estimates of full-time populations indicate growth of 0.8%. For the purposed of this Water Master Plan, future growth in the system population will be estimated at a conservative rate of 1.0%.

Table 2-4 lists the estimated future permanent population of the City's water system presented in 5-year increments. As this table shows, it is expected that the systems population will increase by nearly 400 persons over the upcoming 20-year period or an estimated 20 people per year.

Table 2-4 - Projected Permanent Population of Water System

Year	Permanent Population
2013	1,819
2018	1,912
2023	2,009
2028	2,112
2033	2,220

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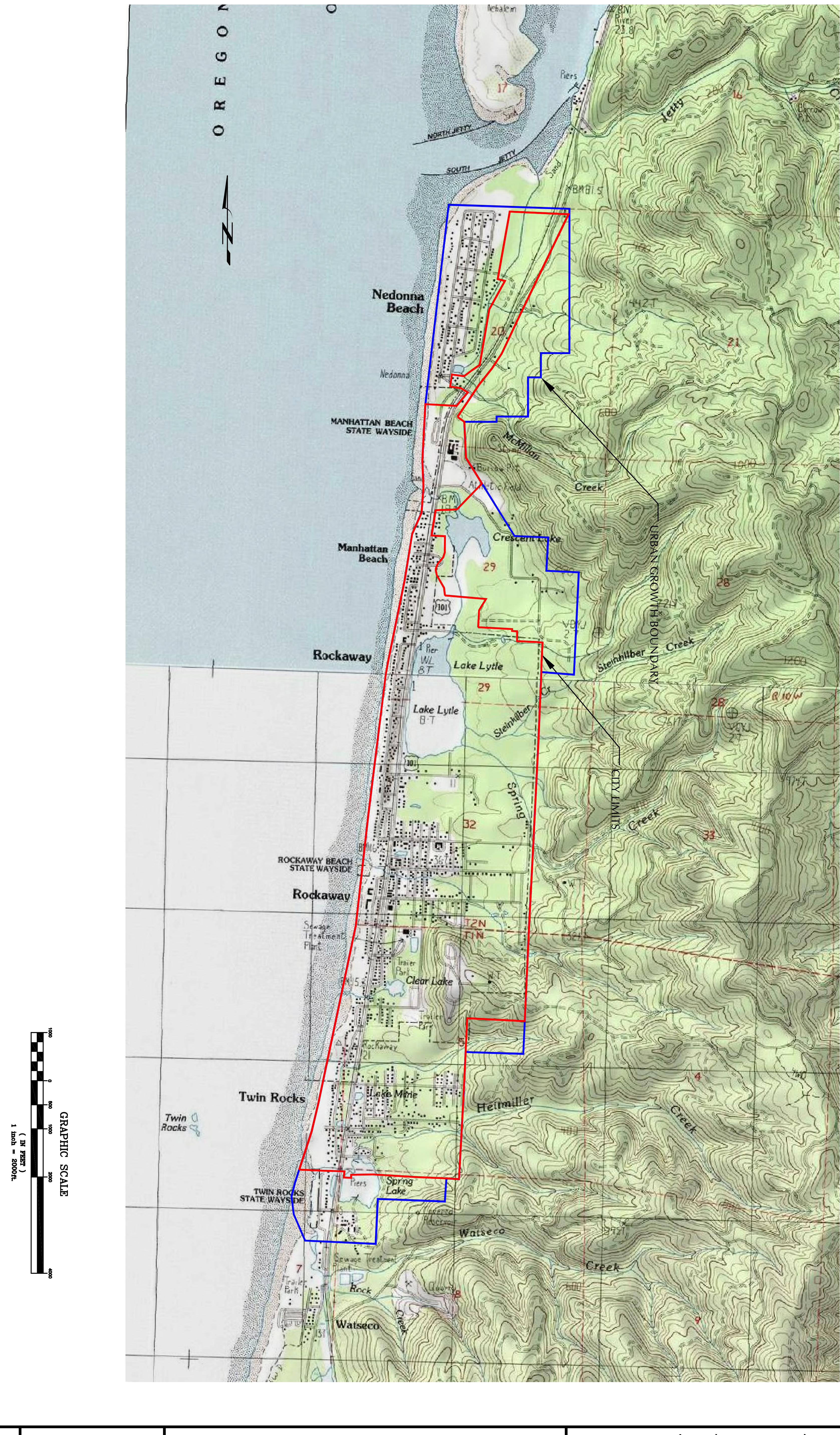

FIG. 2-3	DRAWN BY: CLL DATE: July 2013	VICINITY MAP	City of Rockaway Beach *WATER SYSTEM MASTER PLAN*	HBH Consulting Engineers

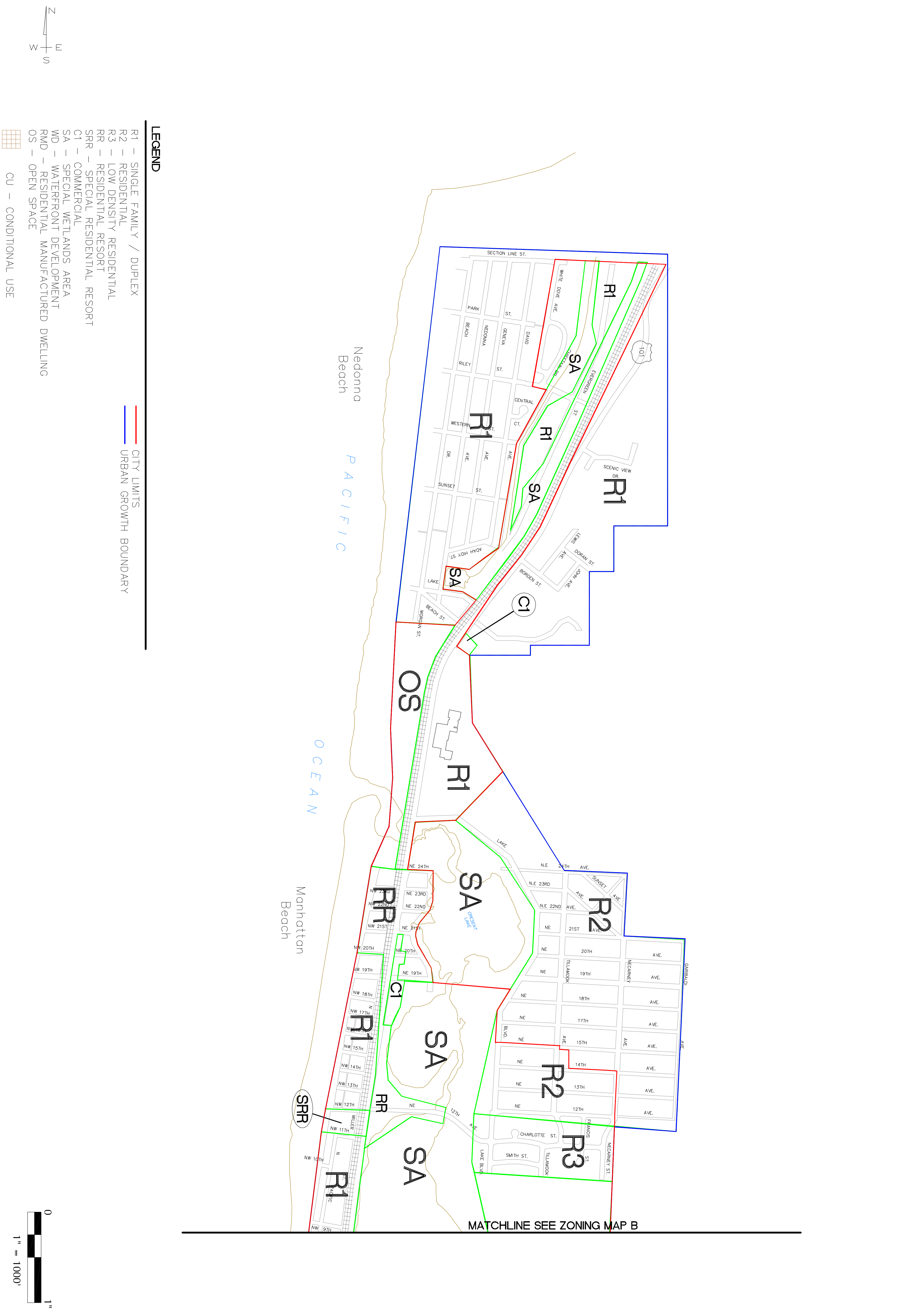

FIG. 2-4A	DRAWN BY: AGK DATE: July 2008	ZONING MAP A	City of Rockaway Beach *WATER SYSTEM MASTER PLAN*

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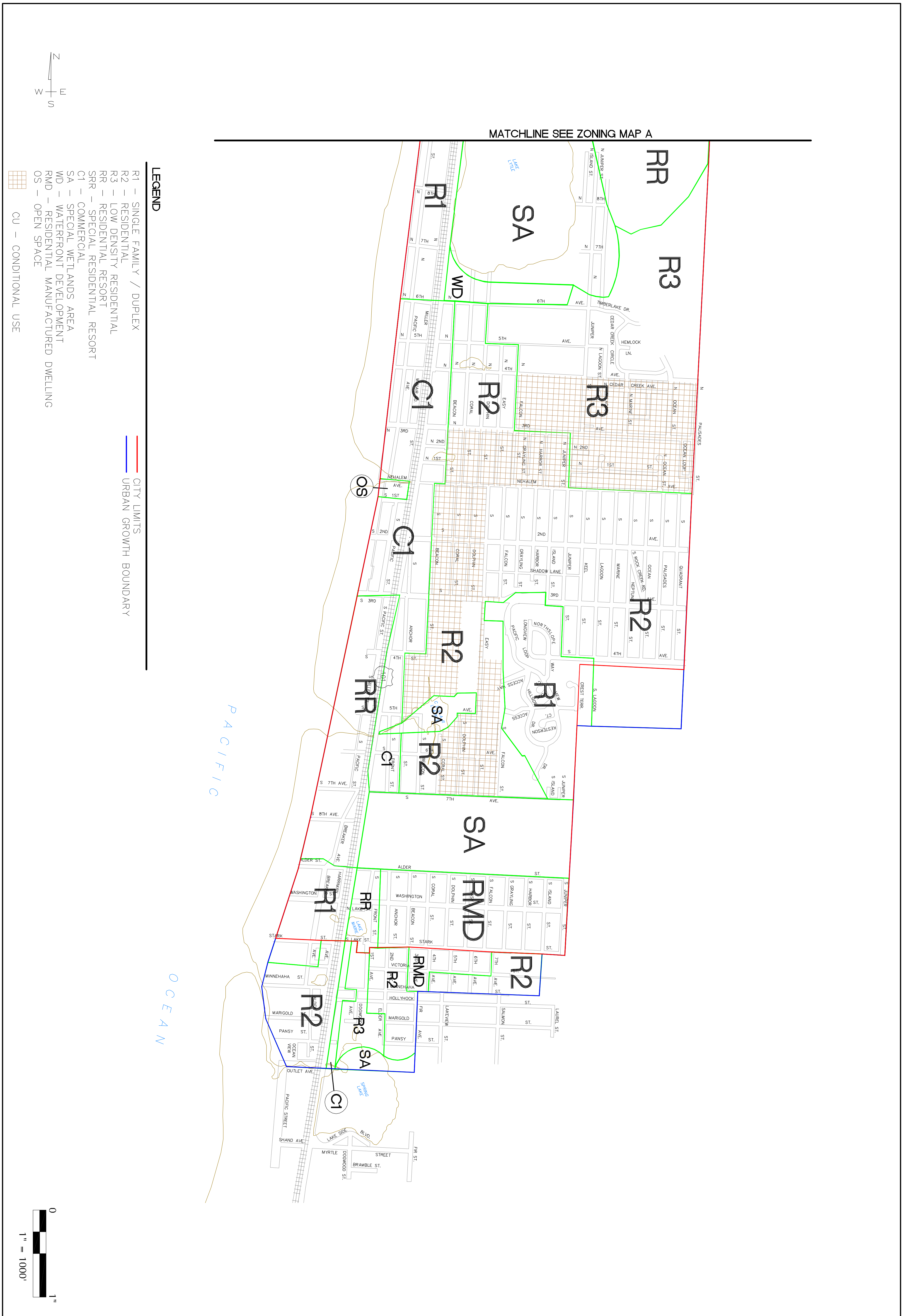
Consulting Engineers



DRAWN BY: AGK

DATE: July 2008

ZONING MAP B

City of Rockaway Beach
WATER SYSTEM MASTER PLAN

HBH Consulting Engineers

FIG. 2-4B

SECTION 3

Regulatory Conditions

Section 3

Regulatory Conditions

3.1 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 assure that water system facilities are free of public health hazards, and to assure that water system operation and maintenance are performed as required. This includes, but is not limited to, the following:

- Routinely collect and submit water samples for laboratory analyses at the frequencies and sampling points prescribed by OAR 333-061-0036 “Sampling and Analytical Requirements”.
- Take 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 and Record Keeping”.
- Continue to report as prescribed by OAR 333-061-0040, the results of analyses or measurements which indicate that maximum contaminant levels (MCLs) have not been exceeded.
- Notify all customers of the system, as well as the general public in the service area, when the maximum contaminant levels have been exceeded.
- Notify all customers served by the system when the reporting requirements are not being met, or 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.
- Maintain monitoring and operating records and make these records available for review when the system is inspected.
- Maintain a pressure of at least 20 pounds per square inch (psi) at all service connections at all times (at the property line).
- Follow-up on complaints relating to water quality from users and maintain records and reports on actions undertaken.
- Conduct an active program for systematically identifying and controlling cross connections.
- Submit, to the DWP, 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.
- Assure that the water system is in compliance with OAR 333-061-0205 “Water Personnel Certification Rules - Purpose” relating to certification of water system operators.

3.2 PUBLIC WATER SYSTEM REGULATIONS

Water providers should always be informed of current standards, which can change over time, and should also be aware of pending future regulations. Specific information on the regulations concerning public water systems may be found in the Oregon Administrative Rules (OAR), Chapter 333, Division 61.

Drinking water regulations were established in 1974 with the signing of the Safe Drinking Water Act (SDWA). This act 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. The SDWA and associated regulations have been amended several times since inception with the goal of further protection public health.

SDWA requires EPA to regulate contaminants which present health risks and are known, or are likely, to occur in public drinking water supplies. For each contaminant requiring federal regulation, EPA sets a non-enforceable health goal, or maximum contaminant level goal (MCLG). This is the level of a contaminant in drinking water below which there is no known or expected risk to health. EPA is then required to establish an enforceable limit, or maximum contaminant level (MCL), which is as close to the MCLG as is technologically feasible, taking cost into consideration. Where analytical methods are not sufficiently developed to measure the concentrations of certain contaminants in drinking water, EPA specifies a treatment technique, instead of an MCL, to protect against these contaminants.

Water systems are required to collect water samples at designated intervals and locations. The samples must be tested in State approved laboratories. The test results are then reported to the State, which determines whether the water system is in compliance or violation with the regulations. There are three main types of violations:

> (1) MCL violation — occurs when tests indicate that the level of a contaminant in treated water is above EPA or the State's legal limit (States may set standards equal to, or more protective than, EPA's). These violations indicate a potential health risk, which may be immediate or long-term.
>
> (2) Treatment technique violation — occurs when a water system fails to treat its water in the way prescribed by EPA (for example, by not disinfecting). Similar to MCL violations, treatment technique violations indicate a potential health risk to consumers.
>
> (3) Monitoring and reporting violation — occurs when a system fails to test its water for certain contaminants, or fails to report test results in a timely fashion. If a water system does not monitor its water properly, no one can know whether or not its water poses a health risk to consumers.

If a water system violates EPA/State rules, it is required to notify the State and the public. States are primarily responsible for taking appropriate enforcement actions if systems with violations do not return to compliance. States are also responsible for reporting violation and enforcement information to EPA quarterly.

A general summary of current rules for water system serving less than 10,000 persons is included in the following pages.. This Section is not meant to be a comprehensive list of all requirements but a summary of the general requirements.

3.2.1 Total Coliform Rule

There are a variety of bacteria, parasites, and viruses which can potentially cause health problems if humans ingest them in drinking water. Testing water for each of these potential pathogens (disease causing agents) would be difficult and expensive. Instead, water quality and public health workers measure coliform levels to determine the adequacy of water treatment and the integrity of the distribution system. The presence of any coliforms in drinking water suggests that there may be a pathway for pathogens and/or fecal contamination to enter the drinking water distribution system (pipes, storage facilities, etc.). Thus, total coliforms are used to determine the vulnerability of a system to fecal contamination. The absence of total coliforms in the distribution system minimizes the likelihood that fecal pathogens are present.

The Total Coliform Rule (TCR), which was published in 1989, set both health goals (Maximum Contaminant Level Goals) and legal limits (Maximum Contaminant Levels) for the presence of total coliforms in drinking water. The purpose of the 1989 TCR is to protect public health by ensuring the integrity of the drinking water distribution system and monitoring for the presence of microbial contamination. The rule requires all public water systems (PWSs) to monitor for the presence of total coliforms in the distribution system at a frequency proportional to the number of people served (Table 3-1).

Table 3-1 - Coliform Sampling Requirements for Small Systems

Population	Samples per Month
Less than 1,000	1
1,001 - 2,500	2
2,501 - 3,300	3
3,301 - 4,100	4
4,101 - 4,900	5

Compliance is based on the presence or absence of total coliforms in any calendar month (or quarter). If any sample is coliform-present, a set of at least three repeat samples must be collected within 24 hours. Small water systems that collect one routine sample per month or fewer must collect a fourth repeat sample. Repeat sampling continues until the maximum contaminant level is exceeded or a set of repeat samples with coliform-absent results is obtained. Small systems (fewer than 40 samples/month) are allowed no more than one coliform-present sample per month, including any repeat sample results. Larger systems (40 or more samples/month) are allowed no more than five percent coliform-present samples in any month, including any repeat sample results. When a routine or repeat sample tests positive for total coliforms, it must also be analyzed for fecal coliforms or E. coli, which are types of coliform bacteria that are directly associated with fresh feces. A positive result for fecal coliforms or E. coli can signify an acute MCL violation, which necessitates rapid state and public notification because it represents a direct health risk. Often, an acute violation due to the presence of fecal coliform or E. coli will result in a “boil water” notice. The system must also take at least 5 routine samples the next month of operation if any sample tests positive for total coliforms.

On February 13, 2013, EPA revised the 1989 TCR. EPA anticipates greater public health protection under the Revised Total Coliform Rule (RTCR) requirements, which are largely based on recommendations by a federal advisory committee. Public water systems (PWSs) and primacy agencies must comply with the requirements of the Revised Total Coliform Rule (RTCR) by April 1, 2016. Until then, PWSs and primacy agencies must continue complying with the 1989 TCR.

3.2.2 Surface Water Treatment Rules

The Surface Water Treatment Rules (SWTR) seeks to prevent waterborne diseases caused by viruses, *Giardia lamblia* and *Cryptosporidium*. These disease-causing microbes are present at varying concentrations in most surface waters. The original SWTR was adopted in 1989 and used turbidity to measure the performance of filtration systems (Table 3-2). In 1998 the Interim Enhanced Surface Water Treatment Rule (IESWTR) was established with required improved filtration performance by lowering the turbidity standard in order to reduce the public health risk associated with *Cryptosporidium.* This rule only applies to systems serving 10,000 or more people, however the 2002 Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) extended this requirement to all systems. Additionally the Filter Backwash Recycling Rule (FBRR) was authorized in 2001 to reduce pathogen concentrations in the finished water by properly managing the backwash water and waste streams at water treatment plants. An overview of the requirements of these rules is provided in Table 3-4.

Table 3-2 - Effluent Turbidity Requirements

Turbidity Requirements	Monitoring/ Recording Frequency	SWTR	IESWTR ≥ 10,000 people	LT1ESWTR < 10,000 people
CFE 95% Value	Every 4 hours (Min.)	≤ 0.5 NTU	≤ 0.3 NTU	≤ 0.3 NTU
CFE Maximum Value	Every 4 hours (Min.)	5 NTU	1 NTU	1 NTU

The most recent change to the SWTR is the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) requires additional treatment for *Cryptosporidium* at those surface water or GWUDI systems with significant levels of *Cryptosporidium* in their source waters. Based on source monitoring, a system's is designated with a bin classification to determine if additional treatment is required (Table 3-3).

Table 3-3 - LT2ESWTR Treatment Requirements

Cryptosporidium Concentration (oocysts/L)	Bin Classification	Additional *Cryptosporidium* Treatment Required			Alternative Filtration
		Conventional Filtration	Direct Filtration	Slow Sand or Diatomaceous Earth Filtration	
< 0.075	1	*No Additional Treatment Required*			
0.075 - <1.0	2	1.0-log	1.5-log	1.0-log	(1)
1.0 to <3.0	3	2.0-log	2.5-log	2.0-log	(2)
≥ 3.0	4	2.5-log	3.0-log	2.5-log	(3)

(1) As determined by the State such that total removal/inactivation > 4.0-log
(2) As determined by the State such that total removal/inactivation > 5.0-log
(3) As determined by the State such that total removal/inactivation > 5.5-log

Table 3-4 - Overview of SWDR Requirements for Water Systems Using Conventional or Direct Filtration

Requirement		SWTR 1989	IESWTR 1998	LT1ESWTR 2002	FBRR 2001
Population	≥ 10,000	☑	☑		☑
	< 10,000	☑	N/A (except for sanitary survey provision)	☑	☑
Regulated Pathogens	99.99% (4-log) removal/inactivation of viruses	☑	Regulated under SWTR	Regulated under SWTR	Regulated under SWTR
	99.9% (3-log) removal/inactivation of *Giardia lamblia*	☑	Regulated under SWTR	Regulated under SWTR	Regulated under SWTR
	99% (2-log) removal/inactivation of *Cryptosporidum*		☑	☑	Regulated under SWTR
Residual Disinfectant Requirements	Entrance to distribution system (≥ 0.2 mg/L)	☑	Regulated under SWTR	Regulated under SWTR	
	Detectable in the distribution system	☑	Regulated under SWTR	Regulated under SWTR	
Turbidity Performance Standards	Combined Filter Effluent	☑	☑	☑	
	Individual Filter Effluent		☑	☑	
System must profile inactivation levels and generate benchmarks, if required			☑	☑	
Sanitary Surveys	Every 3 years for community drinking water systems		☑	Regulated under IESWTR	
Covered Finished Reservoirs & Water Storage Facilities (new construction)			☑	☑	
Operated by Qualified Personnel as Specified by State		☑	Regulated under SWTR	Regulated under SWTR	Regulated under SWTR

3.2.3 Groundwater Rule

EPA published the Ground Water Rule (GRW) in 2006. The purpose of the rule is to provide for increased protection against microbial pathogens in public water systems that use ground water sources. The targeted, risk-based strategy addresses risks through an approach that relies on four major components:

- Periodic sanitary surveys of systems that require the evaluation of eight critical elements of a public water system and the identification of significant deficiencies (e.g., a well located near a leaking septic system).

- Triggered source water monitoring when a system (that does not already treat drinking water to remove 99.99 percent (4-log) of viruses) identifies a positive sample during its Total Coliform Rule monitoring and assessment monitoring (at the option of the state) targeted at high-risk systems.

- Corrective action is required for any system with a significant deficiency or source water fecal contamination.

- Compliance monitoring to ensure that treatment technology installed to treat drinking water reliably achieves 99.99 percent (4-log) inactivation or removal of viruses.

3.2.4 Disinfectants and Disinfection Byproducts (Stage 1 & 2)

Disinfection treatment chemicals used to kill microorganisms in drinking water can react with naturally occurring organic and inorganic matter in source water, called DBP precursors, to form disinfection byproducts (DBPs). Some disinfection byproducts have been shown to cause cancer and reproductive effects in lab animals and suggested bladder cancer and reproductive effects in humans. The challenge is to apply levels of disinfection treatment needed to kill disease-causing microorganisms while limiting the levels of disinfection byproducts produced. The primary disinfection byproducts of concern in Oregon are the trihalomethanes (TTHM) and the haloacetic acids (HAA5).

Disinfection byproducts must be monitored throughout the distribution system at frequencies daily, monthly, quarterly or annually, depending on the population served, type of water source, and the specific disinfectant applied, and in accordance with an approved monitoring plan. Disinfectant residuals must be monitored at the same locations and frequency as coliform bacteria. The 2010 Stage 2 DBP rule builds on existing regulations by requiring water systems to meet disinfection byproduct (DBP) MCLs at each monitoring site in the distribution system. Whereas the Stage 1 Rule controls average DBP levels across distribution systems, the Stage 2 Rule controls the occurrence of peak DBP levels within distribution systems.

Compliance with the DBP rule is determined based on meeting maximum contaminant levels (MCLs) for disinfection byproducts and maximum levels for disinfectant residual (MRDLs) over a running annual average of the sample results (Table 3-5).

Table 3-5 - Contaminants and Disinfectants Regulated by DBP Rule

	Stage 1 DBPR		**Stage 2 DBPR**	
Regulated Contaminants	MCL (mg/L)	MCLG (mg/L)	MCL (mg/L)	MCLG (mg/L)
TTHM	0.08		Unchanged	
Chloroform		---		0.07
Bromodichloromethane		Zero		Unchanged
Dibromochloromethane		0.06		Unchanged
Bromoform		Zero		Unchanged
HAA5	0.060		Unchanged	
Monocloroacetic acid		---		0.07
Diochloroacetic acid		Zero		Unchanged
Trichloroacetic acid		0.3		0.2
Bromate (plants that use ozone)	0.010	Zero	Unchanged	Unchanged
Chlorite (plants that use chlorine dioxide)	1.0	0.8	Unchanged	Unchanged
Regulated Disinfectants	MRDL (mg/L)	MRDLG (mg/L)	MRDL (mg/L)	MRDLG (mg/L)
Chlorine	4.0 as Cl_2	4	Unchanged	Unchanged
Chloramines	4.0 as Cl_2	4	Unchanged	Unchanged
Chlorine dioxide	0.8	0.8	Unchanged	Unchanged

Total organic carbon (TOC) is an indicator of the levels of DBP precursor compounds in the source water. Systems using surface water sources and conventional filtration treatment must monitor source water for TOC and alkalinity monthly and practice enhanced coagulation to remove TOC if it exceeds 2.0 mg/L as a running annual average.

Table 3-6 - TOC Removal Requirements

Source Water TOC (mg/L)	**Source Water Alkalinity (mg/L as $CaCO_3$)**		
	0 - 60	**>60 - 120**	**> 120**
> 2.0 to 4.0	35.0%	25.0%	15.0%
> 4.0 to 8.0	45.0%	35.0%	25.0%
> 8.0	50.0%	40.0%	30.0%

3.2.5 Lead and Copper

The Lead and Copper Rule (LCR) was established by the EPA in 1991. Lead (Pb) and copper (Cu) enter drinking water mainly from corrosion of plumbing materials containing lead and copper. The rule is intended to minimize the lead and copper levels in the drinking water, primarily by reducing water corrosivity. The LCR sets action levels (AL) of 0.015 mg/L and 1.3 mg/L for lead and copper, respectively, based on the 90th percentile level of tap water samples. Exceeding an AL level triggers additional requirements for the water system including water quality parameter (WQP) monitoring, corrosion control treatment, source water monitoring/treatment, public education, and lead service line replacement.

The water system must collect first-draw samples at taps in homes and building that are at high risk of lead or copper contamination. The number of samples that must be analyzed is based on the system size (Table 3-7). Typically, the system is required to conduct monitor every 6 months. If AL are exceeded the system must conduct WQP monitoring every 6 months prior to installation of a corrosion control treatment and every 2 weeks thereafter.

Table 3-7 - Lead and Copper Sampling Requirements

Size Category	System Size	Number of Pb/Cu Tap Sites Sample		Number of WQP Tap Sample Sites	
		Standard	*Reduced*	*Standard*	*Reduced*
Large	> 100,000	100	50	25	10
	50,001 - 100K	60	30	10	7
Medium	10,001 - 50K	60	30	10	7
	3,301 - 10K	40	20	3	3
Small	501 - 3,300	20	10	2	2
	101 - 500	10	5	1	1
	≤ 100	5	5	1	1

Systems may eligible for reduced sampling requirements if the following conditions are met

Annual Monitoring Requirements:

- PWS serves ≤ 50,000 people and is below both ALs for 2 consecutive 6-month monitoring periods, or
- Any PWS that meets optimal WQPs and is less tan lead AL for 2 consecutive 6-month monitoring periods

Triennial Monitoring Requirement:

- PWS serves ≤ 50,000 and is below both ALs for 3 consecutive years of monitoring; or
- Any PWS that meets OWQP specifications and is less than lead AL for 3 consecutive years of monitoring; or
- Any PWS with 90th percentile lead and copper levels ≤ 0.005 mg/L and ≤ 0.65 mg/L, respectively, for 2 consecutive 6-month monitoring periods

Monitoring Every 9 yrs:

- PWS serving ≤ 3,300 people and meets monitoring waiver criteria

3.2.6 Inorganic Contaminants

The level of many inorganic contaminants is regulated for public health protection. These contaminants are both naturally occurring and can result from agriculture or industrial operations. Inorganic contaminants most often come from the source of water supply, but can also enter water from contact with materials used for pipes and storage tanks. Regulated inorganic contaminants include arsenic, asbestos, fluoride, mercury, nitrate, nitrite, and others. Compliance is achieved by meeting the established MCLs for each contaminant. Systems that cannot meet one or more MCL must either install treatment systems (such as ion exchange or reverse osmosis) or develop alternate sources of water.

- Sample quarterly for Nitrate (reduction to annual may be available) for surface water systems and sample annually for groundwater sources
- Communities with Asbestos Cement (AC) pipe must sample every 9 years for Asbestos
- Sample annually for Arsenic for surface water systems and sample every three years for groundwater sources.
- Sample surface water annually and groundwater sources every three years for all other inorganics. Waivers are available based on monitoring records showing three samples below MCLs. MCLs vary based on contaminant

3.2.7 Organic Chemicals

Organic contaminants are regulated to reduce exposure to harmful chemicals through drinking water. Examples include acrylamide, benzene, 2,4-D, styrene, toluene, and vinyl chloride. Major types of organic contaminants are Volatile Organic Chemicals (VOCs) and Synthetic Organic Chemicals (SOCs). Organic contaminants are usually associated with industrial or agricultural activities that affect sources of drinking water supply, including industrial and commercial solvents and chemicals, and pesticides. These contaminants can also enter from materials in contact with the water such as pipes, valves and paints and coatings used inside water storage tanks.

At least one test for each contaminant from each water source is required during every 3-year compliance period. Public water systems serving more than 3,300 people must test twice during each 3-year compliance period for SOCs. Public water systems using surface water sources must test for VOCs annually. Compliance is achieved by meeting the established MCL for each contaminant. Quarterly follow up testing is required for any contaminants that are detected above the specified MCL. Only those systems determined by the State to be at risk must monitor for dioxin. Water systems using polymers containing acrylamide or epichlorohydrin in their water treatment process must keep their dosages below specified levels. Systems that cannot meet one or more MCL must either install or modify water treatment systems (such as activated carbon and aeration) or develop alternate sources of water.

- At least one test for each contaminant (for each water source) every 3-year compliance period
- Sample twice each compliance period for each SOCs when system over 3,300 people
- Test VOCs annually
- Quarterly follow up testing required for any detects above MCL
- Maintain polymer dosages in treatment process below specified levels
- MCLs vary based on contaminant

3.2.8 Radiologic Contaminants

Radioactive contaminants, both natural and man-made, can result in an increased risk of cancer from long-term exposure and are regulated to reduce exposure through drinking water. Rules were recently revised to include a new MCL for uranium, and to clarify and modify monitoring requirements. Initial monitoring tests, quarterly for one year at the entry point from each source, must be completed by December 31, 2007 for gross alpha, radium-226, radium-228 and uranium. A single analysis for all four contaminants collected between June 2000 and December 2003 will substitute for the four initial samples. Gross alpha may substitute for radium-226 if the gross alpha result does not exceed 5 pCi/L and may substitute for uranium monitoring if the gross alpha result does not exceed 15 pCi/L. Subsequent monitoring is required every three, six, or nine years depending on the initial results, with a return to quarterly monitoring if the MCL is exceeded. Compliance with MCLs is based on the average of the four initial test results, or subsequent quarterly tests. Community water systems that cannot meet MCLs must install treatment (such as ion exchange or reverse osmosis) or develop alternate water sources.

- Conduct initial quarterly tests for one year by 12-31-2007 (prior tests may be accepted)
- Subsequent monitoring every 3, 6, or 9 years depending on initial results
- Comply with MCLs based on average of tests
- New MCL of 30 µg/L for Uranium. Other MCLs vary based on contaminant

3.3 FUTURE WATER SYSTEM REGULATIONS

The 1996 Safe Drinking Water Act (SDWA) requires EPA to review and revise as appropriate each current standard at least every six years. Data continues to be collected on contaminants currently unregulated in order to support development of future drinking water standards. Drinking water contaminant candidate lists (DWCCL) are prepared and revised every five years. In addition, rule revisions and new rules will occur to further address health risks from disinfection byproducts and pathogenic organisms. Rules such as the Long-Term Enhanced Surface Water Treatment Rule (LT1ESWTR and LT2ESWTR), the Groundwater Rule, and the Disinfectants/Disinfection Byproducts (Stage 1 D/DBP and Stage 2 D/DBP) Rule have recently gone into effect.

Water suppliers should be aware of and familiar with these mandates and deadlines, and plan strategically to meet them. DHS, under the Primacy Agreement with the EPA, has up to two years to adopt each federal rule after it is finalized. Water suppliers generally have at least three years to comply with each federal rule after it is finalized; however, some of these rules will likely establish a significant number of compliance dates for water suppliers that will occur prior to state adoption of the rules. These "early implementation" dates will likely have to be implemented in Oregon directly by the EPA, because the state program will not yet have the rules in place or the resources to carry them out.

These anticipated rules are described generally below. Additional details will be found in the final EPA rules once they are promulgated.

3.3.1 Radon Rule

All community water systems using groundwater sources will conduct quarterly initial sampling at distribution system entry points for one year. Subsequent sampling will occur once every 3 years. The Radon MCL is expected to be 300 pCi/L. An alternative MCL (AMCL) of 4,000 pCi/L is proposed if the State develops and adopts an EPA-approved statewide Multi-Media Mitigation (MMM) program. Local communities may have the option of developing an EPA-approved local MMM program in the absence of a statewide MMM program, and meeting the AMCL.

3.3.2 Distribution Rule

Under this rule, current requirements for coliform bacteria will be revised, emphasizing fecal coliforms and *E. coli*, and focusing on protection of water within the distribution system. The rule will apply to all public water systems and will involve identifying and correcting sanitary defects and hazards in water systems and using best management practices for disinfection to control coliform bacteria in the system.

In summary, the rules are getting tougher with increased treatment standards and lower MCLs. 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 see if compliance will be a problem. Advanced planning will allow a utility more time to make any necessary modifications to treatment techniques. Additional information can be found at www.epa.gov/safewater/standards.html. EPA's timeline for rule implementation milestones and requirements is shown on the following web page. The latest updated version of this timeline can be seen at www.epa.gov/safewater/pws/imp_milestones.pdf.

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SECTION 4

Existing Water System

Section

Existing Water System

4

The City of Rockaway Beach owns and operates a community drinking water system (OR4100708). The system consists of a surface water supply, membrane treatment system, pump stations, storage reservoirs, and approximately 31 miles of piping. The following section provides detailed information on each component of the City's water system. This information is based on previous engineering reports, record drawings, staff interviews and field inspections. The existing water system is shown on Figure 4-4.

4.1 WATER SUPPLY

4.1.1 Rockaway Beach Water Rights

The City of Rockaway Beach holds nine surface water rights and three groundwater rights. In total, these rights allocate a maximum water diversion rate of 12.5 cfs or 5,610 gpm, however the City currently only utilizes the rights associated with Jetty Creek (S34498 and S46245). Until recently, the City was also actively using the three groundwater rights, but had to cease these withdrawals due to poor water quality. Table 4-1 below gives a summary of Rockaway Beach's water rights. Copies of the water rights can be found in Appendix A.

Table 4-1– Rockaway Beach Water Rights Summary

Source	Certificate Number	Permit Number	Priority Date	Maximum Diversion Rate (CFS)	Maximum Diversion Rate (GPM)
Jetty Creek	47952	S34498	12/8/1969	1.00	448
Jetty Creek	88869	S46245	6/24/1981	1.00	448
McMillan Creek	26097	S17176	7/31/1946	0.26	116
McMillan Creek	30421	S25396	3/17/1958	0.26	116
McMillan Creek	30423	S26296	7/30/1959	0.50	224
Heitmiller Creek	2201	S925	10/18/1911	2.50	1,120
Heitmiller Creek	38987	S27861	2/16/1962	0.50	224
Spring Creek	936	S1081	2/15/1912	0.50	224
Rock Creek	2386	S51	6/28/1909	5.00	2,240
Well No. 1 (West)	82449	G9365	6/10/1981	0.39	175
Well No. 2 (East)	82449	G9365	6/10/1981	0.39	175
Well No. 3 (Manhattan)	None	G15325	2/28/2002	0.22	100
Total				**12.52**	**5,610**

The two Jett Creek water rights each permit the City to divert up to 1.0 cfs or 448 gpm. Both of these permits have been certified by the Oregon Water Resource Department (OWRD). In 2012, the City submitted application to transfer its senior water right (Cert. No. 47952) to a point of diversion (POD) approximately 220 northeast of the current location. This application is still under review by the OWRD.

4.1.2 Raw Water Source Description

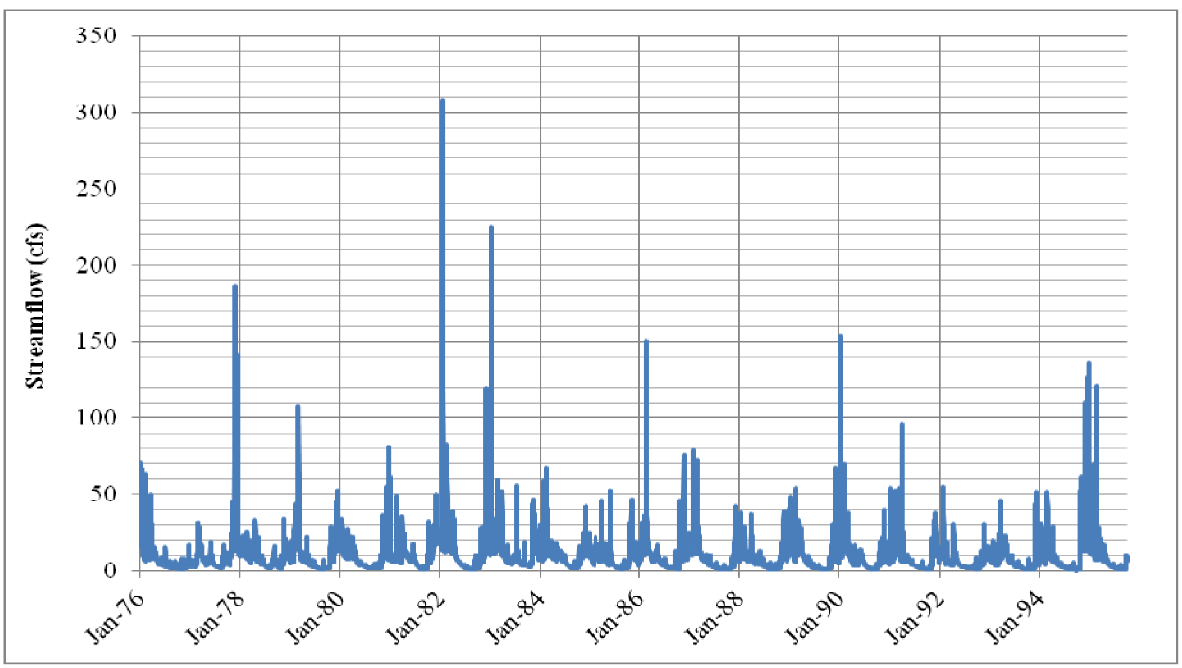
Jetty Creek is located north of Rockaway Beach and is the main source of water for the City. Jetty Creek is part of the Cook Creek/Lower Nehalem River Watershed in the Nehalem Sub-Basin of the Northern Oregon Coastal Basin. The creek carries year-round stream flow from the western flank of the Oregon Coast Range into Nehalem Bay through a steep sided valley. Jetty Creek flows in a generally west to southwest direction. The total watershed area is approximately 2.3 square miles with elevations range from sea level at the mouth of the Jetty Creek to approximately 650 feet inland with a mean basin slope (computed from 30m DEM) of 17.1 degrees.

The land in the Jetty Creek watershed is privately owned and closed to public access. Forestry is the major land use activity in the watershed. No change in current land use is anticipated in the foreseeable future. Extensive logging in the area upstream of the City's intake began in the summer of 2012.

Historic Stream Flows

Hydrologic data for Jetty Creek were obtained from the Oregon State Water Resources Department. The gauging station (Gauge: 14301250) on Jetty Creek is located 300 feet upstream of the City's water treatment plant. The period of record reviewed dated from 1979 to 1995. Figure 4-1 below shows the historical data for the gauging station.

Figure 4-1 - Jetty Creek Historic Stream Flows (Gauge: 14301250)



Based on the period of recorded analyzed, the average flow in the creek is 9.8 cfs. These flows vary considerably based on seasonal conditions. Highest streamflows typically occur in winter months and low flow conditions are usually observed in late summer and early fall. The maximum flow of 308 cfs was recorded on January 23, 1982. A minimum flow of 0.57 cfs was recorded on September 28, 1994. The following table shows monthly average, maximum, and minimum stream flow recorded between 1975 to 1995

Table 4-2 - Seasonal Minimum In-Stream Water Rights

	Stream Flow (cfs)		
	Average	**Max**	**Min**
January	17.6	308	2.5
February	18.0	150	2.5
March	14.8	107	3.0
April	11.0	96	2.9
May	7.0	22	3.0
June	5.3	53	1.5
July	3.3	56	1.1
August	2.0	9	0.9
September	2.5	19	0.6
October	4.2	62	0.8
November	13.7	117	0.8
December	19.0	187	1.8

Water Quality

Jetty Creek is the primary source for the water system and generally provides good quality water, expect immediately following storm events when runoff results in high turbidities. Winter storms increase sediment runoff into Jetty Creek. Also the higher streamflows in winter agitate settled particle at the bottom of the streambed and re-suspend them in the water. These actions result in increased turbidity in the water of Jetty Creek. The problems concerning sediment in the creek have significantly increased as a result of the extensive logging in the watershed upstream of the City's intake.

Records are kept by the City for the raw water influent from Jetty Creek. These records include turbidity, pH, and temperature. The following table compares a summary of these data for the previous two years with data analyzed from 2002 to 2007

Table 4-3 - Summary of Raw Water Characteristics

Water Quality Parameter	2002-2007 Analysis	2011	2012
Turbidity (NTU)			
Average	1.5	4.2	3.0
Minimum	0.4	0.5	0.5
Maximum	41.1	47.0	30.0
pH			
Average	8.0	7.6	6.7
Minimum	5.8	6.2	6.0
Maximum	9.0	9.2	8.1
Temperature (°C)			
Average	12.8	10.1	11.1
Minimum	5.0	4.0	5.4
Maximum	18	18.1	17.3

Flow Restrictions

There are several stream flow dependent species in Jetty Creek that have been identified by the Oregon Department of Fish and Wildlife (ODFW) and US Fish & Wildlife as sensitive or threatened. These include:

- Coho Salmon – listed federally as a threatened species and by ODFW as a sensitive-critical species
- Coastal Cutthroat Trout – listed by ODFW as a sensitive-vulnerable species.
- Coastal Steelhead – listed by ODFW as a sensitive-vulnerable species.
- Chum Salmon – listed by ODFW as a sensitive-critical species.

In 1968, legislation was passed to allow minimum stream flow requirements to be established in some reaches of rivers and streams in Oregon to protect fish and other wildlife. An in-stream water right to support aquatic life was established for Jetty Creek by Oregon Water Resource Department (OWRD) to ODFW in May of 1981 (Certificate 59625). The ODFW water right is junior to the City's 1969 water right on Jetty Creek but senior to its 1981 water right. As a result, the City cannot withdrawal its full water right from Jetty Creek unless the minimum flow requirement for aquatic life is achieved. If necessary the City may implement strict water curtailment restrictions to circumvent the in-stream water right. The minimum flow requirements and seasonal time frames are shown in Table 4-4.

Table 4-4 - Seasonal Minimum In-Stream Water Rights

Time Period	Minimum Flow (CFS)
Oct 1 - Oct 15	2.0
October 16 – March 31	5.0
April 1 – September 30	0.5

4.1.3 Raw Water Intake

The raw water intake is located on Jetty Creek in Township 2N, Range 10W, Section 17 NE SE adjacent to the City's water treatment plant. The existing raw water intake consists of a small in-channel raw water storage impoundment created by a low concrete dam and a direct raw water intake line to a duplex pump station. The entirety of Jetty Creek's streamflow is directed through the impoundment, where it is temporarily stored before either being diverted to the City's WTP or spilling over the dam to the lower reach of Jetty Creek and ultimately discharging to the Pacific Ocean. The raw water pump station delivers the raw water to the City's water treatment facility located adjacent to the pumping station.

Based on site survey information, the City's impoundment has a maximum surface area of roughly 3,000 square feet or 0.07acres. The bottom of the impoundment is at an approximate elevation of 38 feet. The top of the impoundment dam spillway is at an approximate elevation of 42 feet giving the impoundment a maximum depth of approximately 4 feet. The existing impound has an estimated maximum volume of approximately 50,000 gallons. Due to accumulation of sediment upstream of the dam, the impoundment is cleaned out and deepened annually.

The water level in the impoundment is maintained by a concrete dam that is approximately 21.5 feet in length. The existing spillway has dimensions of roughly 11.5 feet across by 1 foot depth. An attempt was made to provide for fish passage through the City's diversion by constructing a fish ladder within the foot print of the diversion dam. However, the fish ladder is undersized and too steep to allow for successful passage through the impoundment structure. The City is currently not required to provide fish passage.

Raw water from Jetty Creek is diverted through a 12-in vertical screen pipe that tees into a 42-in DIP and discharges to the intake pump station wetwell. The bottom of the wetwell is at an elevation of 285.2 feet. The intake pump station was replaced in 2010 as part of the WTP improvements. The station consists of two horizontal, end-section centrifugal Goulds pumps, each with a pumping rate of approximately 500 gpm. The pumps discharge raw water to the WTP through 8-in piping.

4.2 WATER TREATMENT

The original WTP was constructed in 1975. In 2009, the City of Rockaway Beach received American Recovery and Reinvestment Act (ARRA) funding to replace its old and deteriorating conventional filtration water treatment plant (WTP) with a new packaged ultramembrane filtration system manufactured by WesTech. Construction on the new facility began in 2010 and was completed in 2011. In addition to replacing the treatment equipment, the project also replaced intake pumps, retrofitted the existing intake pump station, remodeled the treatment building, updated electrical and mechanical equipment, and installed three new distribution pumps.

The WTP is located adjacent to the Jetty Creek intake north of the City. The treatment system housing consists of a concrete slab on grade metal sided facility containing a chemical storage area and a combined membrane plant operations and storage room. A separate wooden building adjacent to the WTP contains office space and houses the distribution pumps and controls. The City has an emergency backup generator located at the WTP that can be used to operate plant production during power outages.

Table 4-5 provides a summary of the WTP system. Additional details on treatment components are provided in the following pages.

Table 4-5 - Water Treatment Plant Summary

Year Constructed	2010
Type	Ultramembrane - WesTech Polymen UF 120S2
Design Capacity	1.15 mgd
Disinfection	Hypochlorite
Virus Removal Credit (Filter)	1.0
Cyotosporidium Removal Credit (Filter)	4.0
Giardia Log Removal Credit (Filter)	4.0
Giardia Log Removal Credit (Disinfection)	0.5

Water system security measures at the City's WTP comply with requirements of OAR 333-061. The treatment plant has exterior security lighting, fenced parameters, and all enclosures are locked. The access road to the plant is also gated. All access points to treatment facilities are locked and can only be accessed by City personnel.

4.2.1 Treatment Process Components

Raw water from the intake pump station is pretreated using chemically injection and pressure filters then pumped to one of two membrane filtration skids for treatment. Filtered water is then disinfected using sodium hypochlorite and discharged to the WTP clearwell. Discharge pumps convey water from the wetwell to the McMillan Reservoir. A process flow schematic of the treatment system with design parameters is shown in Figure 4-2.

Chemical Feed Systems

Raw water from Jetty creek is injected with caustic soda for corrosion control and aluminum chloride hydrate (ACH) as a filtering aid. A static mixer combines the chemicals into the raw water prior to membrane pre-filter.

The corrosion control was added to maintain raw water pH. Previously, the City had blended water from Jetty Creek with water from its wells to achieve proper influent pH. However, due to the poor quality of these groundwater sources, the wells are no longer in regular use. The feed system consists of packaged skid manufactured by ProMinet utilizing a gamma L-series metering pump (GALA0708) with a maximum rated capacity of 1.9 gph @ 101 psig. The system is automated to allow adjustment to the dosage in relation to the raw water pH level.

In-line coagulation is necessary to aid in the removal of TOC and other suspended solids in the raw water. TOC have been particularly problematic for the City and have contributed to TTHM and DBP violations in the past. As part of the WTP improvements, the City re-installed the existing chemical feed pump and 8" mechanical mixer to deliver ACH to the raw water stream to aid the filtration process.

All chemicals used in the water treatment process are stored in the attached chemical storage room at the treatment plant. Individual chemicals are stored in polyethylene drums. All open drums are located in an overspill containment facility in the chemical room. The City usually keeps one month's operational volume of each chemical on hand during normal operations.

Pressure Filters

Four vertical pressure filters were installed by the City in 2013 to provide pre-treatment prior to the membrane system. These roughing filters were necessary because of lower than expected performance capabilities of the ultramembrane system. Each filter has a 6-ft tall, 6-ft diameter steel tank that is filled with mixed media filtering material. The overall filter height is approximately 10 feet. The tanks combine to provide 112 ft^2 of filtering area resulting in a capacity of 480 gpm.

Table 4-6 - Pressure Filters

Total Rate of Flow	480 gpm
Filtering Area (Total)	112 ft^2
Filtering Area (per Tank)	28 ft^2
Filtering Rate	4.3 gpm/ft^2
Backwash Rate(Water Only)	15.0 gpm/ft^2
Combined Backwash	5 gpm/ft^2 + 3 $SCFM/ft^2$
Working Pressure	75 psi
Filter Media	10-inch Graded Gravel 12-inch Filter Sand 18-inch Anthracite
Tank Material	Steel

Membrane Filter System

The City utilizes two AltaFilter ™ ultrafiltration units manufactured WesTech Engineering, Inc (Model UF120Sc). Each treatment train contains 18 membrane modules mounted on galvanized carbon steel frame. The system can be expanded to include up to 24 modules per train. In addition to the modules, each skid includes pumps piping, valves, instrumentation and controls.

Each treatment unit is equipped with a 120 micron strainer manufactured by Valve and Filter Co (Model V-500). The strainer removes any large debris which might damage the hollow fiber membrane. As debris collects on the 200 micron screen, the pressure drop across the screen is monitored and the filter is automatically flushed when the set-point is reached. Forward flow is not interrupted during the filter flushing.

After pre-filtration, water is treated using the ultramembrane modules where water flows in an outside/in direction through the membrane fibers. Each carbon steel module is packed with Polymem™ ultrafiltration hollow fiber membranes that provide an estimated 1,227 ft^2 of surface treatment area. Membrane material is composed of hydrophilic polysulfone with a pore size of 0.01 micron and can operate under a maximum pressure of 35 psi. The design treatment capacity of each module is 48 gpm.

Table 4-7 - Ultramembrane Water Treatment

Type	Ultramembrane Filtration
Manufacturer/Model	WesTech/AltaFilter UFA71A
Number of Membrane Modules	36
Membrane Area (Per Module)	1,227 ft2
Membrane Area (Total)	4,172
Design Flow Rate	1.15 MGD
Backwash Pump Size	50 HP
Backwash Tank Size	3,650 Gal
Air Compressor Capacity	11.9 CFM @ 90 psig
Receiver	60 Gal
CIP Tank Size	75 Gal
Heater	18 KW
CIP/Neutralization Pump	3 HP
CIP/Neutralization Dosing Pumps	LMI
CIP Neutralization Tank	3,000 Gal

In addition to treatment processes, the system also performs a number of auxiliary maintenance processes needed to maintain treatment performance. These include filter backwash cycles, chemical cleaning, and integrity testing.

A compressed air system is used to supply air to various pneumatically actuated valves as well as backwash and PDT operations. The system includes two single stage, rotary screw air compressors manufactured by Atlas Copco (GX4FF) with filter regulators, dryer, and receiver. The compressor can provide a maximum 16.6 cfm @ 145 psig and has a 5Hp motor. The receiver capacity is 60 gallons. The system has a noise level rating of 62 DBA at 3 feet.

All plant operations are automatically controlled via Allan Bradley CompactLogix programmable logic controller (PLC) using RSLogix 5000 software with door mounted Arista industrial panel touch screen HMI interface. The PLC is programmed for automatic operation of the system, provides data logging and trending of historical data, and allows remote monitoring and control of the various facilities. In addition, all safety and equipment protection interlocks and shutdown alarms are programmed at the PLC level. Manual processes are typically needed only for routine maintenance, such as chemical change out and for cleaning of the membrane treatment modules.

Disinfection

As part of the 2010 WTP improvements, the City installed a new hypochlorite disinfection system to replace the previous system that relied on chlorine gas for disinfection. Additionally the hypochlorite system also aids in the filter's chemical cleaning process as well as periodically being used during the filter backwash cycle. A new ventilation system was also installed as part of the WTP improvements.

Treated water from the ultrafiltration treatment trains is disinfected using sodium hypochlorite prior to being discharged to the WTP clearwell. The system includes a ProMinent prepackaged system utilizing two Gamma L-series positive displacement, diaphragm metering pumps (Model 0220). The pumps feed from a 600 gallon HDPE storage tank containing a 0.8% solution of hypochlorite. The WTP's clearwell is located under the control/pump building and acts as the chlorine contact chamber for the system. The baffled clearwell has a nominal usable volume of approximately 23,000 gallons, an overflow depth of 7.2 feet (100% depth), and a calculated baffle factor of 67%.

OAR requires that treatment be sufficient to achieve at least 99.9% (3-log) inactivation and/or removal of *Giardia lamblia* cysts and at least 99.99% (4-log) inactivation and/or removal of viruses as determined by OHD. The filtration process is assumed to provide a portion of the removal and disinfection must provide the remainder of inactivation. The City’s membrane treatment plant is credited with 2.5-log removal for Giardia Cysts; therefore an additional 0.5-log inactivation is required by disinfection.

Inactivation credit for chlorination systems is determined based on “CT” which is the residual concentration (C) in mg/L times the contact time (T) in minutes. Contact times for the City’s WTP were determined by a tracer study conducted by HBH Consulting Engineers, Inc. on April 23, 2012. This test concluded the contact time for operators to use under two flow conditions: less than 500 gpm and 501-900 gpm. The result of this study is provided in the following table.

Table 4-8 - Contact Times for Various Flow Conditions

	Flow Rate (gpm)	
	0 - 500	**501- 900**
Measured Contact Time (min)	31	23
Pipeline Contact Time (min)	6.3	N/A[1]
Contact Time for Reporting (min)	**37**	**23**

[1] The 900 gpm test measured the contact time at the first user, rather than at the clearwell. Therefore, no additional “pipeline contact time” is added.

CT requirements are affected by both pH and temperature. Treated water pH typically ranges between 7.0 to 8.0. During summer months, water temperature varies between 10°C to 15°C while non-summer temperatures are typically 5°C to 10°C.

The following table lists the chlorine residual level necessary to meet the required CT values for 0.5-log inactivation of Giardia cysts as provided by the Oregon Drinking Water Program at various flow and operation conditions.

Table 4-9 - Require Disinfection Chlorine Concentration for Various Flow & Operating Conditions

	Non-Summer Conditions (Temp between 5-10 °C)		Summer Conditions (Temp between 10-15 °C)	
WTP Flows 500 gpm or Less				
pH	7.0 - 7.49	7.5-8.0	7.0 - 7.49	7.5-8.0
Required CT	31	37	23	28
Contact Time (min)	37	37	37	37
Minimum Chlorine Residual (mg/L)	0.85	1.0	0.63	0.75
Recommended Chlorine Residual (mg/L)	**1.0**	**1.2**	**0.76**	**0.91**
WTP Flows 501 gpm to 900 gpm				
pH	7.0 - 7.49	7.5-8.0	7.0 - 7.49	7.5-8.0
Required CT	31	37	23	28
Contact Time (min)	23	23	23	23
Minimum Chlorine Residual (mg/L)	1.3	1.6	1.0	1.2
Recommended Chlorine Residual (mg/L)	**1.62**	**1.93**	**1.22**	**1.46**

Recommended chlorine residuals add a factor of safety of 20%. This safety factor should be adjusted based on TTHM formation results or to ensure appropriate residual in all portions of the distribution system is maintained. OAR also requires that the residual in the distribution system not be less than 0.2 mg/L for more than 4 hours.

The City typically maintains a chlorine residual of 1.4 mg/L after disinfection. This concentration is adequate for all summer and non-summer operating conditions when WTP flows are 500 gpm or less. This residual level is inadequate for flows between 501 gpm to 900 gpm and must be increased to recommended values presented in Table 4-9.

Service Pump

New service pumps were installed in the WTP clearwell as part of the 2010 WTP improvements. These pumps deliver treated water from the clearwell to the McMillan Reservoir. All three are vertical turbine pumps manufactured by Goulds (Model 9RCLC) and are equipped with a 30 Hp premium efficient motor operated by a VFD. Each pump has can deliver up to 400 gpm at 140' TDH. When all three pumps are operated, the combined capacity is 1,100 gpm at 230' TDH.

The WTP service pumps are automatically operated based on the water level in the clearwell. Typically, the SCADA system operates the pumps such that the clearwell is 85% to 95% full. This corresponds to a water depth of 6.1 feet to 6.8 feet.

4.2.2 Treatment Performance

Effluent water quality from the City's WTP is monitored daily for turbidity, chlorine residual (Cl_2), and pH. A summary of these parameters are presented in the following table. As this table shows, the City's WTP consistently meets treatment performance requirements with a 3-year average effluent turbidity of 0.4 NTU and a maximum value of 0.26 NTU.

Table 4-10 - WTP Effluent Water Quality

	2010	2011	2012	Average
Turbidity (NTU)				
Minimum	0.01	0.01	0.02	0.01
Maximum	0.26	0.1	0.08	0.15
Average	0.06	0.03	0.04	0.04
Cl_2 (mg/L)				
Minimum	0.7	0.4	0.3	0.5
Maximum	3.6	3.5	2.4	3.2
Average	2.0	1.6	1.3	1.6
pH				
Minimum	7.2	6.9	7.2	7.1
Maximum	8.3	76	8.4	30.9
Average	7.5	7.7	7.6	7.6

4.2.3 Compliancy Violations

The City provides information on the water system performance in its annual Consumer Confidence Report. The most recent report is provided in Appendix B.

The Rockaway Beach water system has repeatedly exceeded the Maximum Concentration Limit (MCL) for Total Trihalomethanes (TTHM) and Haloacentic Acids (HAA5), both of which are disinfection byproducts (DBP). The MCL for TTHM and HAA5 are 0.080 mg/L and 0.060 mg/L, respectively. Table 4-11 lists all TTHM and HAA5 violations reported by the City over the past three years. As this table shows, the system has had 14 TTHM violations and 6 HAA5 violations since 2011.

TTHMs and HAA5 can result from source, treatment and operational causes. The City's primary source, Jetty Creek, experiences high levels of Total Organic Carbon (TOC). Unless these compounds are removed during the treatment process, they can react with chlorine disinfectant to form DBP including TTHMs and HAA5. Consequently, DBP issues can be compounded when systems' chlorine disinfection concentrations exceed levels needed for inactivation of pathogens. An additional factor affecting TTHM and HAA5 levels is high water age. High water age provides DBP precursors (such as TOC) more time to react with chlorine resulting in higher TTHM and HAA5 levels.

Table 4-11 - Recently Reported Water System Violations

Sample Date	Contaminant	Result	MCL
9/24/2013	TOTAL TRIHALOMETHANES (TTHM)	0.0871	0.08
9/24/2013	TOTAL TRIHALOMETHANES (TTHM)	0.1158	0.08
07/01/2013	TOTAL TRIHALOMETHANES (TTHM)	0.0924	0.08
07/01/2013	TOTAL TRIHALOMETHANES (TTHM)	0.1098	0.08
07/01/2013	TOTAL HALOACETIC ACIDS (HAA5)	0.074	0.06
040/3/2013	TOTAL TRIHALOMETHANES (TTHM)	0.1046	0.08
04/03/2013	TOTAL TRIHALOMETHANES (TTHM)	0.0932	0.08
04/03/2013	TOTAL HALOACETIC ACIDS (HAA5)	0.0717	0.06
10/10/2012	TOTAL TRIHALOMETHANES (TTHM)	0.0945	0.08
10/10/2012	TOTAL TRIHALOMETHANES (TTHM)	0.1019	0.08
10/10/2012	TOTAL HALOACETIC ACIDS (HAA5)	0.0826	0.06
10/10/2012	TOTAL HALOACETIC ACIDS (HAA5)	0.0818	0.06
05/21/2012	TOTAL TRIHALOMETHANES (TTHM)	0.1044	0.08
10/07/2011	TOTAL HALOACETIC ACIDS (HAA5)	0.0718	0.06
10/07/2011	TOTAL TRIHALOMETHANES (TTHM)	0.1452	0.08
10/07/2011	TOTAL TRIHALOMETHANES (TTHM)	0.1487	0.08
10/07/2011	TOTAL HALOACETIC ACIDS (HAA5)	0.0739	0.06
07/08/2011	TOTAL TRIHALOMETHANES (TTHM)	0.1262	0.08
07/08/2011	TOTAL TRIHALOMETHANES (TTHM)	0.1654	0.08
04/28/2011	TOTAL TRIHALOMETHANES (TTHM)	0.1158	0.08

The City is currently in the process of addressing the underlying cause of its TTHM and HAA5 issues. The City recently installed pressure filters to pre-treat raw water from Jetty Creek prior to membrane filtration. This pretreatment process will increase the removal rate of TOC in the raw water and increase the membrane performance. In addition, a number of operational procedures have been developed to further reduce the likelihood of TTHMs or HAA5 in the system.

These actions include:

→ <u>Storage Tank Operation/Excess Storage Capacity</u>: Manage volume of water in storage tanks based on anticipated demand rather than maintaining completely full levels. It is important to note that minimum fire suppression storage will be maintained.

→ <u>Distribution System Flushing</u>: Increased line flushing will reduce stagnant and high age water from the system, remove settled material that can contribute to DBP formation, and allows operators to reduce chlorine concentrations.

→ <u>Treatment Process - Optimization of TOC Removal</u>: It is critical for the operator to monitor the effectiveness of the TOC removal, particularly when the source water changes (such as periods of high color).

→ <u>Treatment Process - Optimization of Chlorine Residual</u>: The operator will lower the chlorine residual in the contact chamber to levels recommended in the Disinfection Profile Study provided by the Oregon Drinking Water Program.

The City provides information on the water system performance in its annual Consumer Confidence Report. The most recent report is provided in Appendix B.

4.3 WATER STORAGE

The City's water system includes three reservoirs that combine for a total storage capacity of 3.07 million gallons of treated water. The City's 2009 Water Master Plan provided detailed information on these reservoirs. Below is a summary of the City's storage facilities.

Table 4-12 - Summary of Storage Reservoir Facilities

	McMillan Creek Reservoir	3rd Avenue Reservoir	Pacific View Estates Reservoir
Capacity	1.9 MG	1.0	0.17 MG
Year Constructed	2008	1975	1978
Material	Glass Fused Steel	Concrete	Concrete
Diameter	95 ft	70 ft	38 ft
Overflow Elevation	166 ft	241 ft	420 ft
Base Elevation	129.5 ft	206 ft	400 ft
Feed Source	WTP Clearwell Pumps	3rd Avenue PS	Rock Creek PS

4.3.1 McMillan Creek Reservoir

The McMillan Creek Reservoir is located on an easement west of Highway 101. The reservoir is filled by the water treatment plant clearwell treated water pumps and serves the McMillan Creek Pressure Zone, which provides water to the other pressure zones. The reservoir is in good condition.

4.3.2 3rd Avenue Reservoir

The 3rd Avenue Reservoir is located on 3rd Avenue east of Palisade Street. The reservoir is filled by the 3rd Avenue PS and discharges to the area south of N. 3rd Avenue. Water level in the tank remotely controls the operation of the pump station based on adjusted setpoints. A pump is typical turned on when the reservoir drops 4 ft from full. There is a low level alarm if the water level drops 2 ft below these levels. In addition, there is a second low level alarm if the reservoir reaches a level of 26 ft.

4.3.3 Pacific View Estates Reservoir

The Pacific View Estates Reservoir is located in and serves the Pacific View Estates. Water is delivered to the reservoir by the old Rock Creek PS. The station is remotely controlled by the water level in the reservoir. Typically the pump is activated when the level drops 3 ft from full, although this set point is adjustable. There is a low level alarm if the water level drops 1 ft below this level. The reservoir is in good condition.

4.4 PRESSURE SYSTEM

4.4.1 Pressure Zones

There are 4 different pressure zones within the water distribution system. These are the McMillan Creek Pressure Zone, 3rd Avenue Pressure Zone, Nehalem Ave. and Ocean St. Pressure Zone, and Pacific View Pressure Zone. The pressure zones are shown in Figure 4-3 with detailed information listed in Table 4-13.

Table 4-13 - Summary of System Pressure Zones

Pressure Zone	Supply	Area (acres)	Min. Service Elevation	Max. Service Elevation
McMillan Creek	WTP & McMillan Creek Reservoir	930.9	0 ft	115 ft
3rd Avenue	3rd Ave PS & Reservoir	91.1	5 ft	142 ft
Nehalem Ave. & Ocean St.	3rd Ave Zone PRV	396.0	3 ft	79 ft
Pacific View	Pacific View Estates Reservoir	68.5	182 ft	347 ft

McMillan Creek Pressure Zone

The McMillan Creek Pressure Zone is supplied water by the WTP and McMillan Creek Reservoir. This is the largest pressure zone extending from the WTP to N. 3rd Avenue and contains over 930 acres. Elevations range from approximately 0 ft to 115 ft. The McMillan Creek Pressure Zone contains approximately 51% of the projected 20-year customer demands within the system and provides water to the rest of the system via the 3rd Avenue PS.

The elevation of the McMillan Creek Reservoir is sufficient to maintain working pressures between 50 to 70 psi for the majority of the service area during peak hour conditions; however several services, located near the abandoned Scenic View Reservoir, require additional pumping to maintain pressures.

3rd Avenue Pressure Zone

The 3rd Avenue Pressure Zone is supplied by the 3rd Avenue PS and 3rd Avenue Reservoir. It serves customers along Palisades St., Quadrant St., Ocean Loop, and S. 2nd and 3rd Ave. east of Falcon St as well as the cross streets along S. 2nd and S. 3rd Ave. This zone contains approximately 6% of the customer demands within the system and also provides water to the Nehalem Ave./Ocean St. Pressure Zone through a 6" PRV and the Pacific View Pressure Zone through the Rock Creek PS.

The elevation of the 3rd Avenue Pressure Zone ranges from 5 ft to 142 ft with service pressures within the zone typically varying between 40 psi to 100 psi.

Nehalem Ave./Ocean St. Pressure Zone

The Nehalem Ave./Ocean St. Pressure Zone is supplied by the 3rd Avenue Reservoir through a 6" PRV at the intersection of Nehalem Ave. and N. Ocean St. The pressure zone contains approximately 396 acres extending from N. 3rd Ave. to the south boundary of the system. The pressure zone contains approximately 46% of the customer demands within the system.

The pressure zone serves customers at elevations ranging from 3ft to 79ft resulting in service pressures of 35 psi to 70 psi.

Pacific View Pressure Zone

The Pacific View Pressure Zone contains the Pacific View Estates development and an adjacent area. The area near the Pacific View Estates Reservoir of approximately 10 houses contains a sub-pressure zone that has the pressure boosted by a small pump station and hydropneumatic tank.

Elevations within the Pacific View Pressure Zone range from approximately 182 ft. to 347 ft. Average day demand pressures are estimated at 30 psi to 100 psi. The sub-pressure zone is provided a constant pressure of approximately 60psi.

4.4.2 Pump Stations

The City's water system includes three pump stations. Two of these stations are primarily used to pump water from one pressure zone to a reservoir located in another pressure zone. The remaining pump station is required to increase service pressure to customers in the upper Pacific View Pressure Zone.

A summary of these pump station is provided in the following table.

Table 4-14 - Summary of System Pressure Zones

	3rd Avenue Pump Station	Rock Creek Pump Station	Pacific View Pump Station
No. Pumps	2	2	1
Pump Make/Model	Cornell/ 2STG 7CC		Peerless/610A
Motor Size	15 Hp		7.5 Hp
Pump Capacity (each)	200 gpm	200 gpm	50 gpm
Hydropneumatic Tank	NA	NA	530 gallon
Feed	McMillan Creek PZ	3rd Avenue Zone	Pacific View Estates Reservoir
Discharge	3rd Avenue Reservoir	Pacific View Estates Reservoir	Pacific View Estates Zone

3rd Avenue Pump Station

The 3rd Avenue PS is located approximately 1,200 feet away from the 3rd Avenue Reservoir at the intersection of N. Palisade Street and N. 3rd Avenue. The station has a pump capacity of approximately 200 gpm. Control telemetry at the pump station sequences the operation of the pumps and transmits the reservoir level back to the water treatment plant where the water level is displayed. The pumps are started and stopped by a pressure transducer at the reservoir. The elevation of the pump station is approximately 94 ft.

Rock Creek Pump Station

The Rock Creek PS conveys water to the Pacific View Estates Reservoir and has a pump capacity of the station is 200 gpm. Telemetry between the Rock Creek PS, Pacific View Estates Reservoir, and the WTP controls the operation of the pumps.

Pacific View Estates Pump Station

The Pacific View Estates PS serves approximately 10 of the customers within Pacific View Estates that are near the Pacific View Estates Reservoir. The pump station is fed by the Pacific View Estates Reservoir. The pump station works in conjunction with an air compressor, pressure tank, and pump to provide a constant pressure of approximately 60 psi.

4.4.3 Pressure Reducing Station

There is one pressure reducing valve (PRV) within the distribution system. The 6” PRV is located in a vault at the intersection of Nehalem Ave. and N. Ocean St. The PRV reduces the pressure of the water into the lower elevation areas that are served by the 3rd Avenue Reservoir. The PRV is at an elevation of 76 ft. and is set to a pressure of 37 psi (162 ft. HGL).

4.5 TRANSMISSION AND DISTRIBUTION SYSTEM

The City's transmission and distribution system consists of water pipelines as well as a number of valves, fire hydrants, and customer meters. The system is generally configured in a north-south layout with several sub-sections feeding off the main pipeline that runs parallel with Highway 101. A schematic drawing of the City's transmission and distribution systems is provided on Figure 4-4.

4.5.1 Piping Inventory

The distribution and transmission system consists of approximately 31 miles of pipe 2 inches and larger. Table 4-15 identifies the approximate quantity, size and type of pipe in the system.

Table 4-15 - Pipe Inventory

Pipe Size (inches)	Length					Percentage
	AC	PVC	HDPE	Steel	Total	
2	-	-	-	600	600	0.4%
4	29,400	24,000	300	-	53,700	32.6%
6	7,600	22,700	500	-	30,800	18.7%
8	12,100	43,200	600	-	55,900	33.9%
10	-	12,700	400	-	13,100	7.9%
12	-	10,800	-	-	10,800	6.5%
Totals	49,100	113,400	1,800	600	164,900	100.0%

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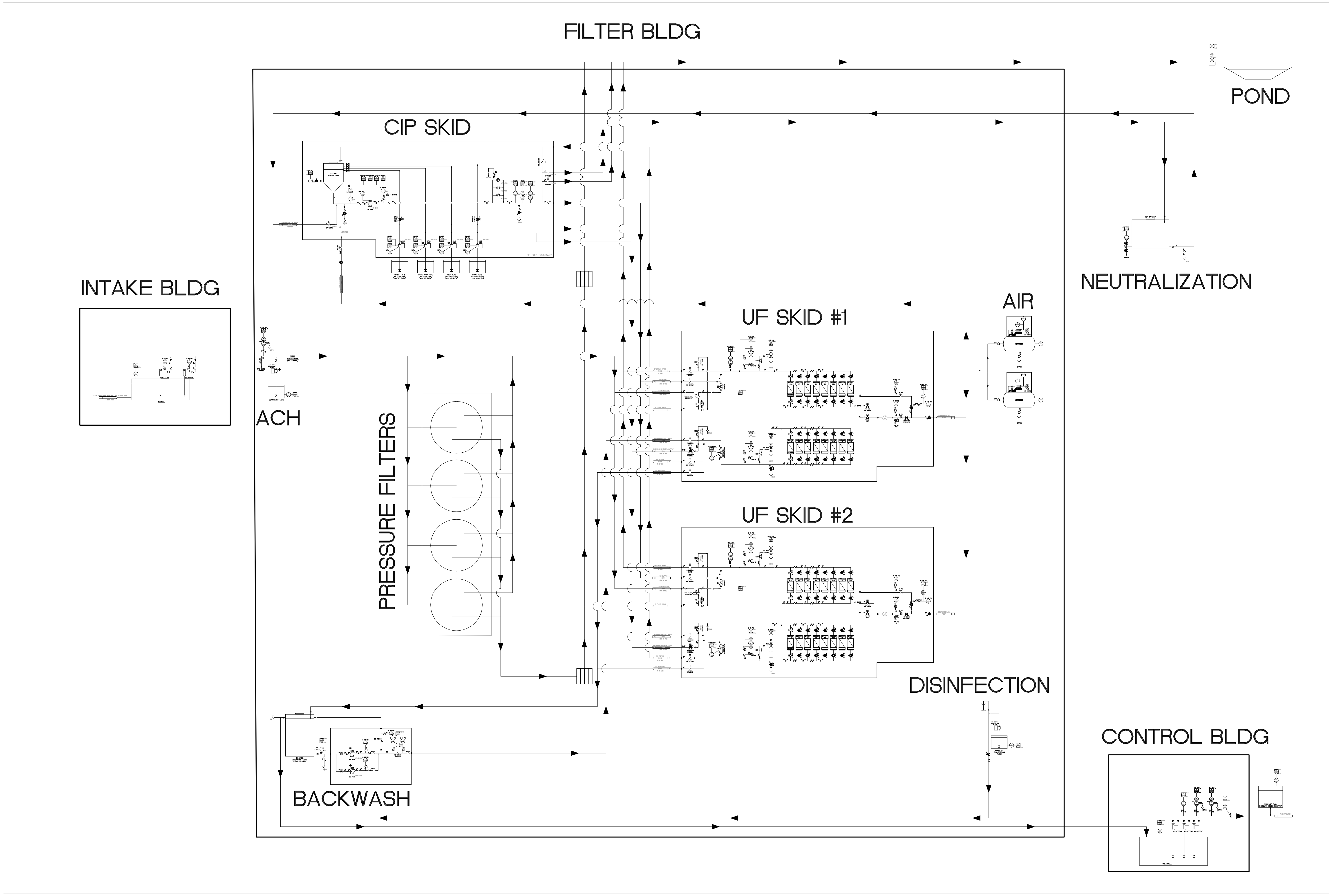


CITY OF ROCKAWAY BEACH
WATER SYSTEM MASTER PLAN

H B H Consulting Engineers

PID DIAGRAM

DRAWN BY: BJC
DATE: September 30, 2011

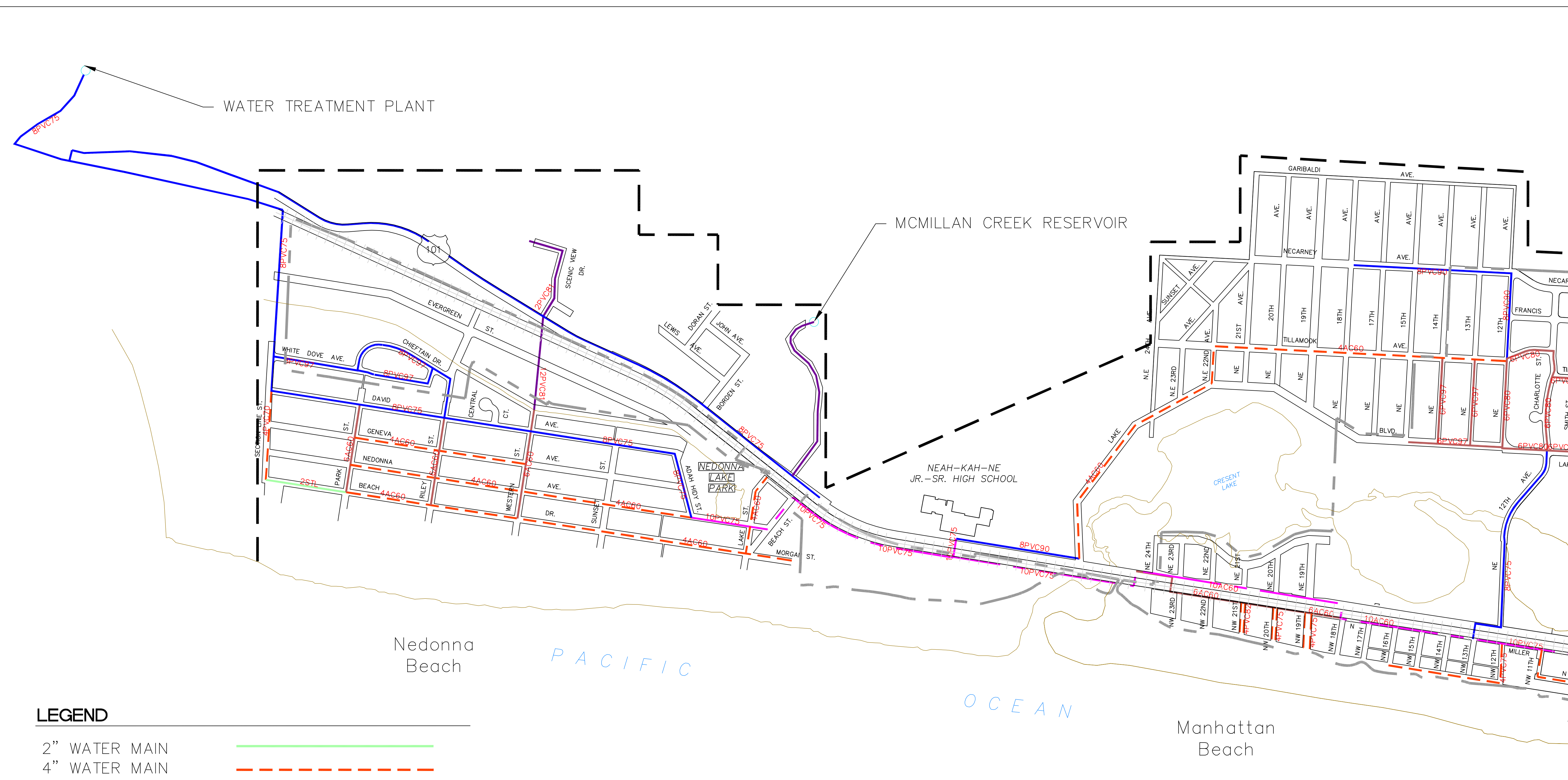
FIG. 4-2

MASTER SYSTEM WATER PLAN UPDATE

SCALE: 1" = 1,600'

FIG. 4-3	DRAWN BY: CLL DATE: DEC. 2013	EXISTING PRESSURE ZONES	City of Rockaway Beach *WATER SYSTEM MASTER PLAN*

HBH Consulting Engineers



LEGEND

2" WATER MAIN	light green solid line
4" WATER MAIN	orange dashed line
6" WATER MAIN	brown solid line
8" WATER MAIN	blue solid line
10" WATER MAIN	magenta broken line
12" WATER MAIN	purple solid line
FIRE HYDRANT	hydrant symbol
CITY LIMITS	grey broken line
UGB	black dashed line

4AC60

PIPE SIZE — PIPE MATERIAL — YEAR OF INSTALLATION

MASTER SYSTEM WATER PLAN UPDATE

SCALE: 1" = 800'

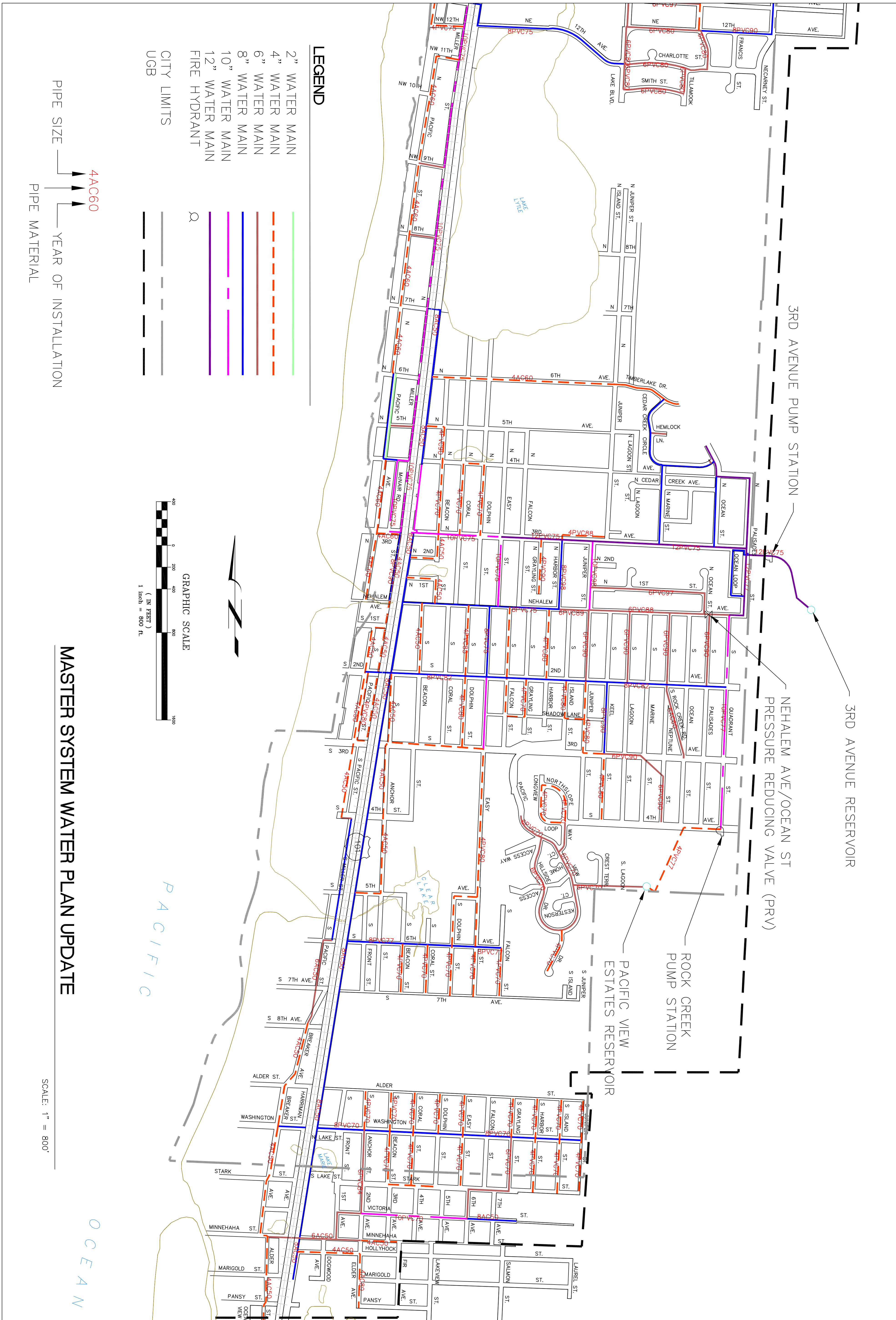
HBH Consulting Engineers

City of Rockaway Beach
WATER SYSTEM MASTER PLAN

EXISTING WATER SYSTEM

DRAWN BY: CLL
DATE: DEC. 2013

FIG. 4-4A



DRAWN BY: CLL

DATE: DEC. 2013

EXISTING WATER SYSTEM

City of Rockaway Beach

WATER SYSTEM MASTER PLAN

H B H Consulting Engineers

FIG. 4-4B

SECTION 5

Water use and

Projected Demands

Water Use & Projected Demand

Section 5

5.1 WATER CUSTOMERS & CONSUMPTION

5.1.1 Water Customers

The City of Rockaway Beach provides water service to residents and businesses located within the city limits and surrounding areas including Nedonna Beach and Oceanlake development. Currently, the City serves 2,501 active accounts. This includes 2,406 residential accounts and 95 non-residential accounts. Non-residential water customers in the City include:

- 22 Motels & other lodging
- Neah-Kah-Nie High School
- 10 City accounts
- RV Park
- Miscellaneous commercial such as restaurants, churches, and other businesses

The following table provides an inventory of customers served for the past two years. Overall, the total number of accounts in 2012 increased by 0.81% compared to the previous year. This was the result of the addition of 31 new city residential accounts. During this same period, rural residential accounts declined by 11 and both city and rural commercial accounts remained unchanged.

Table 5-1 - Summary of Water Customers

Water Customers	2011	2012
Residential Accounts		
Residential, In-City	1,881	1,912
Residential, Rural	505	494
Total Residential	***2,386***	***2,406***
Commercial Accounts		
Commercial, In-City	79	79
Commercial, Rural	5	5
Total Commercial	***84***	***84***
Total	**2,470**	**2,490**

5.1.2 Water Consumption

The City's bills its water customers on a bi-monthly basis. The previous WMP included water sales from 2004 through 2006. Additional records were analyzed for the period of January 2011 through December 2012.

Table 5-2 - Summary of Recent Water Consumption

Year	Annual Water Consumption (gallons)		
	Residential	Non-residential	Total
2004[1]	52,105,851	19,076,821	71,182,672
2005[1]	51,106,373	21,249,163	72,355,536
2006[1]	51,210,382	20,708,322	71,918,704
2011	50,575,132	3,647,160	54,222,292
2012	51,129,638	3,534,824	54,664,462
2004 - 2012 Average	**51,225,475**	**13,643,258**	**64,868,733**
2010 - 2012 Average	**50,852,385**	**3,590,992**	**54,443,377**

[1] Based on data from 2009 WMP

As Table 5-2 shows, overall water sales have decreased over the past decade. The average water sales for the past two years is nearly 25% lower than average sales between 2004-2006. The majority of this decline is related to non-residential consumption, which has decreased by over 82% compared to residential sales that only decreased by 1.2%.

The majority of the City's water consumption is for residential use. Between 2004 to 2006, residential usage accounted for approximately 72% of total water sales. Over the past several years, this percentage has increased to over 93% as the result of the significant decrease in non-residential sales.

5.1.3 Equivalent Dwelling Units (EDU)

A dwelling unit is defined as one typical single-family residential dwelling. Non-residential users (commercial, industrial, public facility, etc.) can be described as a number of equivalent residential units based on their water consumption compared to the consumption of a residential unit. The number of equivalent dwelling units (EDU's) that a commercial or other non-residential user has can be used as a basis for rate structure. Capacity of a system can be defined based on the ability to serve a certain number of EDU's and future checks can be made on system capacity at any time regardless of the growth patterns that have occurred in residential, commercial and industrial users.

Based on water account and sales records, the current average usage by residential accounts equals 58 gpd per account. The City's 2009 Water Master Plan determined this average rate to equal 65 gpd per residential account. Therefore, for the purpose of this report, the average EDU for the City of Rockaway Beach will be defined as the overall average or 60 gpd per account.

Table 5-3 - EDU Calculations

Year	Unit Residential Usage (gal/acct/day) or (gpd/EDU)
2009 WMP	65
2011	58
2012	58
Average	**60**

The City's non-residential water usage was translated to EDUs by dividing total daily commercial consumption by the average residential usage rate listed in Table 5-3. Calculated residential and non-residential EDUs are listed in the following table. Between 2011 and 2012 residential EDUs in the system increased by 0.83% while non-residential EDUs decreased by 2.9%. Overall the system's EDUs increased by only 0.59% between 2011 and 2012. EDU calculations from the City's 2009 Water Master Plan are also presented in Table 5-4 and show the City experienced a significant decrease in its non-residential EDUs resulting in a overall system EDU decrease of over 14.3%.

Table 5-4 - Rockaway Beach Water EDU Summary

Year	Residential EDUs	Non-Residential EDUs	Total System EDUs
2009 WMP	2,154	851	3,005
2011	2,386	172	2,558
2012	2,406	167	2,573

Future EDUs will be projected using a similar growth rate expected for the system's population calculated in Section 2. It is anticipated that as the area's economy improves in the upcoming years, of both permanent and transient user's water demand will increase. Consequently a conservative 1.0% annual increase was used to determine future EDUs in the system. Projected EDUs for the City of Rockaway Beach's water system are presented in Table 5-5

Table 5-5 - Projected Water System EDUs

Year	Total System EDUs
2018	2,731
2023	2,871
2028	3,017
2033	3,171

5.2 HISTORIC WATER DEMAND

5.2.1 Description and Definitions

Water demand is the quantity of water delivered to the system over a period of time to meet the needs of consumers as well as other uses such as fire fighting, system flushing, and other system operations. Additionally, virtually all systems have a small amount of leakage that cannot be economically removed and total demand usually includes some loss. Water demand varies seasonally with the lowest usage typically in winter months and the highest demands occurring in summer months. Variations in usage also occur with respect to time of day (diurnal) with higher usage occurring during the morning breakfast 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 expressed in million gallons (mg). When demand fluctuates up and down over several years, an average is used.

Average Daily Demand (ADD) The total volume of water delivered to the system over a year divided by 365 days. The average use in a single day expressed in million gallons per day (mgd).

Maximum Monthly Demand (MMD) The average daily usage during the month with the highest water demand expressed in million gallons per day (mgd). The highest monthly usage typically occurs during a summer month.

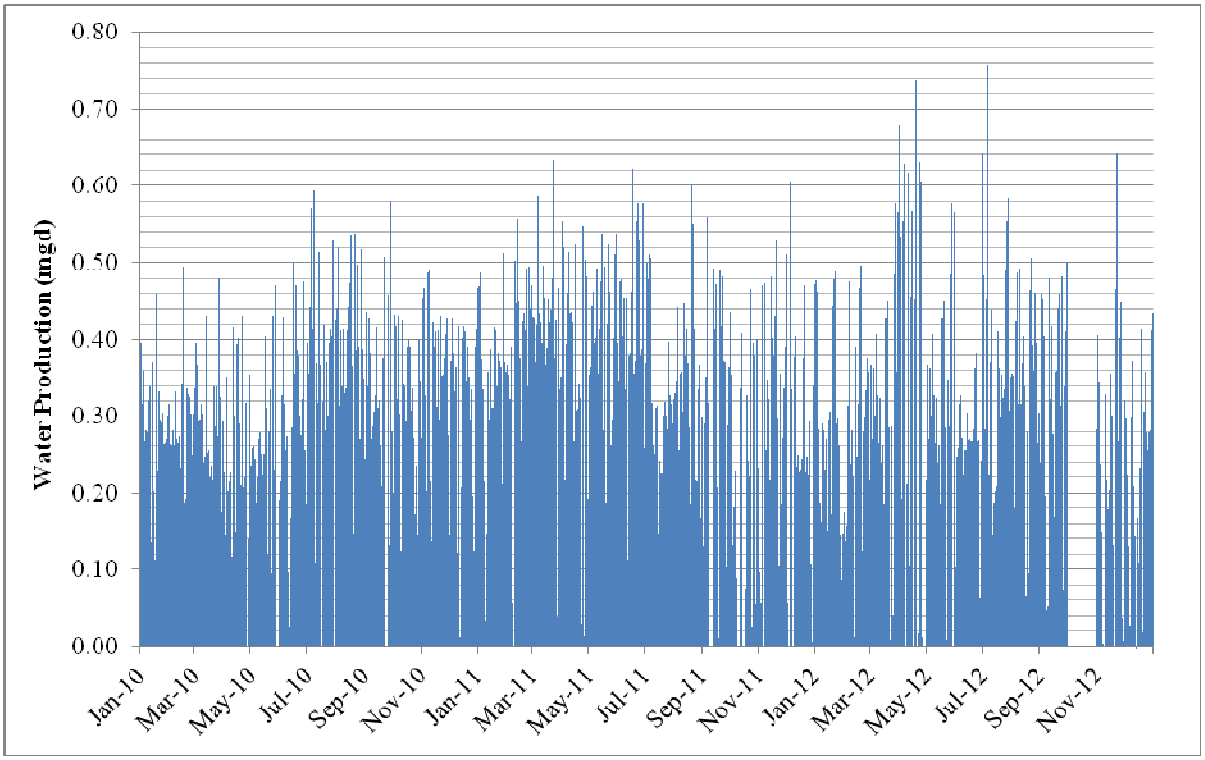
Maximum Day Demand (MDD) The largest volume of water delivered to the system in a single day expressed in million gallons per day (mgd).

5.2.2 Historic Water Demand

Water demand of the system is equal to the total water diversions from the City's sources. Daily Monitor Records (DMRs) were obtained to include data for January 2011 through December 2012.

Daily water production values are graphically displayed in Figure 5-1. As this figure shows, daily production varies considerably with higher demand during summer/late fall and less production occurring during winter. This graph also shows that several days have no water production. This typically occurs when the plant must be shut down due to poor raw water quality or maintenance is required.

Figure 5-1 - Daily Water Production



Key water demand characteristics were determined by analyzing daily water production. Average daily demand (ADD), maximum monthly demand (MMD), and maximum daily demand (MDD) were calculated and are presented in the following table. This table also includes demands determined as part of the previous WMP.

Table 5-6 - Water Production

Year	Average Day Demand (mgd)	Maximum Month Demand (mgd)	Maximum Daily Demand (mgd)
2004	0.456	0.580	0.900
2005	0.415	0.536	0.796
2006	0.344	0.467	0.739
2010	0.289	0.366	0.539
2011	0.320	0.412	0.634
2012	0.278	0.348	0.758
2004 - 2012 Average	0.350	0.452	0.728
2010 - 2012 Average	0.299	0.375	0.644

Table 5-7 compares maximum monthly and daily demands to average daily demands for each of the years analyzed. The average ratio of MMD to ADD is1.27 and is within the normal range for similar-sized systems. The MDD peaking factor has ranged from 1.87 to 2.73 and is also within the normal range for small systems.

Table 5-7 - Water Demand Peaking Factors

Year	MMD:ADD	MDD:ADD
2004	1.27	1.97
2005	1.29	1.92
2006	1.36	2.15
2010	1.27	1.87
2011	1.29	1.98
2012	1.25	2.73
2004 - 2012 Average	1.29	2.10
2010 - 2012 Average	1.27	2.19

Per capita system demand is presented in the following table. In 2012, the average daily per capita water demand was approximately 154 gallons per capita day (gpcd), which was over a 12% decreased compared to the per capita average reported in 2011. Table 5-8 also lists average daily demands based on EDUs. Between 2011 to 2012, the average water demand was nearly 117 gpd per EDU. Unit demand information from the City's 2009 Water Master Plan is also provided for comparison. As Table 5-8 shows, the decrease in EDU unit demands is relatively small compared to the nearly 46% decrease in per capita demand.

Table 5-8 – Average Daily Demand Per Capita & Per EDU

Year	Pop	ADD/capita (gpcd)	EDUs	ADD/EDU (gpd/EDU)
2011	1,786	179	2,558	125
2012	1,801	154	2,573	108
Average	1794	167	2,566	117
2009 WMP	1,360	298	3,005	135

5.2.3 Unaccounted Water

Not all water produced is consumed by a water system's users. A portion of treated water is required for backwashing filters, system flushing, and sampling. Unaccounted water is the difference between total water produced and the total metered usage of system customers and operations. This difference can be attributed to leakage in the distribution system, inaccuracies in water meters, water used fire fighting, and other public non-metered use. The following figure shows the amount of unaccounted water in the system over the past 2 years compared with the unaccounted water determined in the City's 2009 Water Master Plan.

Table 5-9 - Unaccounted Water in System

	2011	2012	2009 WMP
Total Water Production	116.75	101.75	143.18
Water Sales & Other Metered Uses	54.92	54.98	71.82
Unaccounted Water	61.83	46.77	71.36
Unaccounted Water as a Percentage of Total Production	53.0%	46.0%	49.8%

As Table 5-9 shows, unaccounted water in the system has averaged 49.5% over the past two years, which is essentially unchanged from the values determined in the City's previous master plan. The City' has recently performed leak detection and regularly repairs leaks as they are located. Additionally, the City has upgraded many of its customer water meters in recent years. At this point it is unclear if the large volume of unaccounted water in the system is due to real losses through leaks in the system or can be attributed to non-reported uses for system operation.

5.3 FUTURE WATER DEMAND

Water demands are projected into the future using the target design values along with projected EDU estimates. 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 improvements and to size new facilities for reasonable demand rates.

Table 5-10 shows the design unit water demand values used for this study. These values are based on demand and peaking factor data calculated for 2011 and 2012 as well as the2009 Water Master Plan. The unit ADD demand of 121 gpd/EDU is the average of these data. The unit MMD and MDD were determined based on the average peaking factor calculated.

Table 5-10 – Unit Water Demand Design Values

	ADD	MMD	MDD
Peaking Factor	1.0	1.3	3.0
Unit Demand (gpd/EDU)	120	155	360

The selected target design values are multiplied with the projected EDUs of system anticipated over the 20-year study period presented in Table 5-5. The result of this analysis shows that by the year 2033 average daily demand in the system is estimated be 0.33 mgd while maximum daily demand is expected to exceed 0.84 mgd.

Table 5-11 – Future Water Demands

Yea	EDUS	ADD (mgd)	MMD (mgd)	MDD (mgd)
2018	2,731	0.328	0.423	0.983
2023	2,871	0.345	0.445	1.034
2028	3,017	0.362	0.468	1.086
2033	3,171	0.381	0.492	1.142

SECTION 6

Design Criteria and Level of Service

Design Criteria & Level of Service

Section 6

6.1 DESIGN LIFE OF IMPROVEMENTS

The design life of a water system component is sometimes referred to as its useful life or service life. The selection of a design life is a matter of judgment 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.

As discussed in Section 1, the planning period for this Water System Master Plan is 20 years ending in the year 2033. 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 determine 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.

6.1.1 Treatment Plant Equipment

The design life of most motorized equipment and pumps is typically 20 years. Filter media should be replaced after 15 years of service. Buildings and major structures should have a design life of 50 years. Steel components exposed to weather or submerged can deteriorate within 10 to 15 years if not properly maintained. Periodic maintenance and painting will provide a useful life of more than 20 years unless larger facilities are required. Flowmeters typically have a design life of 10 to 15 years. Valves usually need to be replaced after 15 to 20 years of use.

6.1.2 Pumping Equipment and Structures

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 some equipment can be extended, when properly maintained, if additional capacity is not required. Properly maintained pumps can sometimes last 30 years or longer.

6.1.3 Water Transmission and Distribution Piping

Water transmission and distribution piping should easily have a useful life of 40 to 60 years if quality materials and workmanship are incorporated into the construction and the pipes are adequately sized. Steel piping used in the 1950's and 60's that has been buried, commonly exhibits significant corrosion and leakage within 30 years. Cement mortar lined ductile iron piping can last up to 100 years when properly designed and installed.

6.1.4 Water Storage

Distribution storage tanks should have a design life of 60 years (painted steel construction) to 80 years (concrete 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. Ground settlement, earthquakes, and inadequate quantities of reinforcing steel can all lead to a substantially reduced life for concrete structures.

6.2 SIZING AND CAPACITY CRITERIA

Demand projections presented in Section 5.3 are used to size improvements. Various components of the system demand are used for sizing different improvements. Methods and demands used are discussed below.

6.2.1 Intake Pumps

The water source(s) must be capable of meeting the maximum daily demand (MDD) of the system over a period of many years. Typically, the 20-year MDD is used as the design flow. Raw water pumping equipment should be sized to provide the design MDD with 18 hours or less of operation.

6.2.2 Water Treatment Plant Capacity

Treatment plants must be able to successfully treat quantities of raw water equal to the MDD. The 20-year MDD is used as the design flow. A WTP should produce this MDD with 18 hours or less operation time required.

6.2.3 Treated Water Storage

Total storage capacity must include reserve storage for fire suppression, equalization storage, and emergency storage. Equalization storage is typically set at 25% of the MDD to balance out the difference between peak hourly demand and supply capacity so that these variations in demand are not imposed on the water supply source. Emergency storage is required to protect against a total loss of water supply such as would occur with a broken transmission line, an electrical outage, equipment breakdown, or natural disaster. At a minimum, emergency storage should be equal to 75% of the MDD assuming that water use would be restricted during times of emergencies. Some water suppliers prefer to provide a full 100% of the MDD for emergency storage. For Rockaway Beach, an emergency storage of 100% of the MDD will be used. This method gives a storage requirement of 1.25 times the MDD plus fire storage.

Fire storage should be sufficient to provide for the required fire demand and required fire duration. The flows and durations for a building are based upon the fire flow calculation area square feet and the type of construction as listed in Appendix B of the Oregon Fire Code. For one and two-family dwellings that are less than 3,600 ft^2, minimum fire flow requirement is 1,000 gpm for two hours. The fire flow requirements for multi-family and commercial buildings range from 1,500 gpm to 8,000 gpm in the table, and the durations range from 2 to 4 hours. To determine the exact fire requirements for the buildings within the City a survey would need to be done to determine the fire flow calculation area square feet and the types of construction. For this study a fire flow of 1,000 gpm for a duration of 2 hours will be used for single family residential, 2,000 gpm will be used for multi-family residential for a duration of 2 hours, and 3,000 gpm will be used for commercial for a duration of 3 hours.

Another important design parameter for reservoirs is elevation. Efforts should be made to locate all reservoirs at the same elevation when possible. As a consistent water surface is maintained in all reservoirs, the need for altitude valves, check valves, PRV's, booster pumps, and other control devices are eliminated. 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 30 to 80 psi. Pressures below 30 psi cause annoying flow reductions when more than one water-using device is in service. High pressures may cause faucets to leak, valve seats to wear out quickly, and system leakage to increase. The Uniform Plumbing Code requires that water pressures not exceed 80 psi at service connections, unless the service is provided with a pressure-reducing device. Another pressure criterion, related to fire flows, commonly requires a minimum of 20 psi at the hydrant used for fire fighting. OHD also requires that service connection pressures never drop below 20 psi.

6.2.4 Distribution System

Distribution mains are typically sized for fire flow and 20-year population demand, or fire flow and saturation development demand. The mains should be at least six inches in diameter to provide minimum fire flow capacity. All pipelines should be large enough to sustain a minimum line pressure of approximately 30 psi at maximum flow rates. The State of Oregon requires a water distribution system be 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 guidelines are recommended for the design of water distribution systems:

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

- Eight-inch (8") diameter lines - minimum size for permanently dead-ended mains supplying fire hydrants and for minor trunk mains.

- Ten-inch diameter (10") and larger - as required for trunk (feeder) mains based on hydraulic analysis.

The distribution system lateral mains should be looped whenever possible. A lateral main is defined as a main not exceeding eight-inches in 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 six-inches in diameter. However, eight-inch 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 eight inches in diameter. Six-inch diameter mains may be used for a stub-out not 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 six-inches provided six-inch mains are looped.

A computer model of the distribution system will be made. The model will use actual pipe sizes and materials as well as system pipe junction elevations and storage tank elevations. The system will be checked for ability to provide fire flows during times when the system demand is at the 20-year MDD. The system will also be checked at the 20-year PHD. System pressure must remain above 20 psi at all conditions. The model will be developed using a software program called WaterCAD®.

6.3 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 is discussed in this section. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this Study. Construction costs are based on competitive bidding as public works projects. As projects proceed and as site-specific information becomes available, the estimates may require updating. System improvements that are recommended are summarized in Section 8 along with associated costs. Detailed cost estimates and alternatives are presented in Section 7.

6.3.1 Construction Costs

The estimated construction costs in this Plan are based on actual construction bidding results from similar work, published cost guides, and other construction cost experience. Reference was made to 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. Cost estimates prepared in this plan are based on the December 2013 index. Future costs should be compared to a baseline ENR Index value of 9668. If specific ENR index figures are not available, the historical ENR growth pattern has been around 3% per year.

6.3.2 Contingencies

A contingency factor equal to approximately twenty percent (20%) of the estimated project 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.

6.3.3 Engineering

The cost of engineering services for major projects typically include special investigations, a predesign report, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, start-up 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% 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. Engineering costs for design and construction presented in this Plan should average 20% of the estimated construction costs.

6.3.4 Legal and Administrative

An allowance of five percent (5%) of construction cost 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 that the City could incur.

6.3.5 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. Effort was made to include costs for land acquisition, where expected, within the cost estimates included in this Plan.

SECTION 7

System Analysis and Improvement Alternatives

System Analysis and Improvement Alternatives

7.1 ANALYSIS OF EXISTING WATER SYSTEM

7.1.1 Water Supply

Evaluation of Water Source

Although the City of Rockaway Beach has a total of 12.5 cfs of water rights, the water system is currently limited to the combined 2.0 cfs (898 gpm) water right on Jetty Creek. This is because the City does not have the infrastructure in place to utilize its other surface water rights and water quality of its groundwater supply is generally poor.

Based on the water demand analysis completed in Section 5, the total water right on Jetty Creek is sufficient to meet the City's peak day water needs through the 20-year planning period. It should be noted that the junior water right has not yet been certified, however, the City has began the process to obtain partial perfection and has also applied for a time extension for the permit.

Although the City has sufficient water rights allocated, the availability of water from Jetty Creek can at time be limited due to low flows or poor quality. Additionally, the in-stream water right discussed in Section 4 can also impact the quality of water permitted for diversion. A detailed analysis of daily streamflows shows that average flows exceed the City's needs and in-stream water right for fish passage. However, the average flows from July through September are not adequate to allow the City to withdrawal the full capacity of its junior water right. August has the lowest average daily stream flow of 1.95 cfs. Moreover, daily stream flows are routinely less than the in-stream water right for fish passage and in some cases even less than the City's senior water right allocation. Minimum historical stream flow is 0.57 cfs or 255 gpm.

Table 7-1 shows the percentage of days that met specific flow conditions. This analysis determined that the period from October 1 to October 15 is when the source is least reliable. However, this period is after the peak tourist season and therefore water demand from the City is lower. During peak tourist season, there is a 65% probability that the City will have access to its full 2.0 cfs from Jetty Creek.

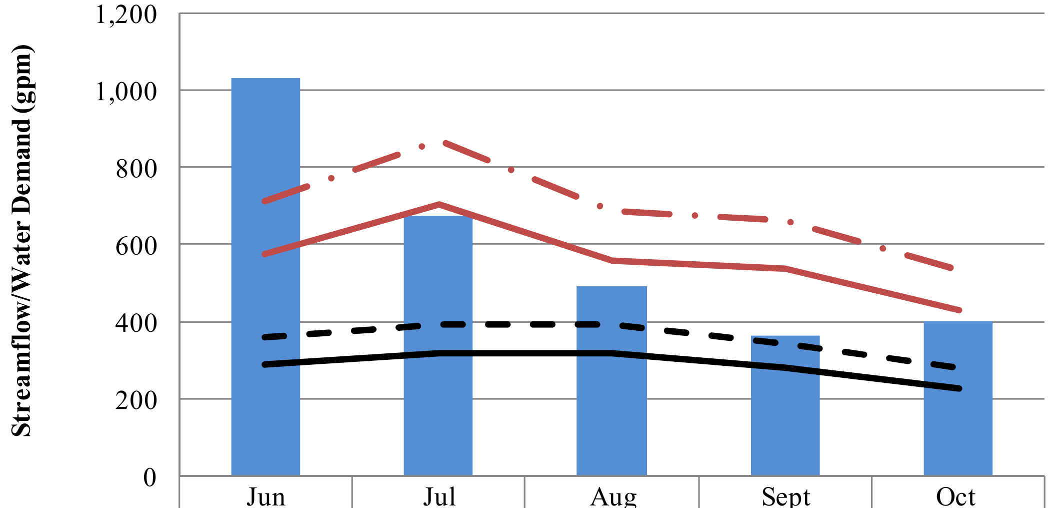
Table 7-1 - Percentage of Daily Flows Meeting Water Right Conditions

	Meet Senior Water Right	Meet Junior Water Right[1]
Oct 1 - Oct 15	26%	20%
October 16 – March 31	81%	76%
April 1 – September 30	84%	65%

[1] Assumes that in-stream water right must first be met

A statistical analysis of Jetty Creek summer streamflows was performed to identify the 95% reliable summer streamflows. The results of this analysis indicate the degree to which the City's water supply is limited by seasonal fluctuations (Figure 7-1).

Figure 7-1 - Jetty Creek Reliable Summer Streamflows & City Water Demands[1]



	Jun	Jul	Aug	Sept	Oct
95% Probability	1032	673	494	364	399
Current Average Day	291	316	316	279	228
Current Peak Day	576	702	556	537	431
20-Yr Average Day	359	391	391	344	281
20-Yr Peak Day	712	868	688	664	533

[1] Water demands are calculated based on 18-hour operation

As Figure 7-1 shows, low streamflows routinely restrict the available water from Jetty Creek. Although the 95% reliable streamflow is sufficient to meet average daily demands (ADD) for each month, current peak day demands exceed reliable streamflows in Jetty Creek for all summer months except June. . By the end of the 20-year planning period July maximum demand is also expected to exceed available source capacity.

Historically, the City has used water from its well sources to supplement low flows in Jetty Creek. Due to the poor water quality from these wells, the City should avoid any use of its wells expect in extreme emergency.

Evaluation of Water Intake Facility

The existing raw water intake is located on Jetty Creek just north of the City. The raw water intake consists of a low concrete dam with a fish ladder and a direct raw water intake line to a duplex pump station. The raw water pump station delivers the raw water to the City's water treatment facility located adjacent to the pumping station.

The existing raw water impoundment is located on the main channel of Jetty Creek. The creek's seasonal turbidity coupled with the concrete dam causes sediment to build up within the impoundment. The City typically has to remove accumulated sediment on an annual basis. Although the existing dam does have a fish ladder, passage of most fish is not possible at the site. Consequently, the intake acts as a fish barrier to over a mile of upstream habitat.

The intake screen and piping that conveys water to the raw water pump station are in poor condition. The existing screen does not sufficiently prevent pine needles and other debris from enter the intake piping, which increases the wear of the raw water pumps and impairs treatment capacity. Also, the condition of the existing piping is questionable and should also be replaced.

7.1.2 Water Treatment

Construction of the City's existing water treatment plant was completed in 2011 and upgraded with pressure filters in 2013. Past operational difficulties have been resolved and the plant is in good working condition. Improvements to the existing intake screen will also have a positive impact of plant operations.

The plant has a nominal design capacity of 900 gpm. As noted in Section 6, the water treatment plant should be sized to meet maximum daily demand in 18 hours or less of operation. The WTP is capable of meeting current peak demands with 14 hours of operations. This correlates to a treatment surplus equivalent to 200 gpm. The following table compares the WTP's ability to meet current and projected water demands. As this table shows, the WTP's will not have adequate capacity to meet the required demand by the end of the 20-year period. In order to meet the anticipated increase in water demand, the WTP would need to operate over 21 hours.

Table 7-2 – Water Treatment Plant Capacity Assessment

	Required Capacity (gpm)	Treatment Surplus (gpm)
Current Demands	700	200
20-Year Demands	1,060	**-160**

[1] Water demands are calculated based on 18-hour operation

7.1.3 Finished Water Storage

Evaluation of Storage Requirements

Water storage is needed to provide the difference between peak demands and supply capacity; provide water during power failures and equipment or line failures; and to provide water for fire protection. As discussed in Section 6.2, the minimum recommended storage volume equals 1.25 times MDD plus fire demand storage. Fire demand storage varies based on the type of land use. For residential areas, fire flow requirements are typically 1,000 gpm for 2 hours which equates to 120,000 gallons of fire storage. In commercial areas fire protection is increased to 3,000 gpm fire flow for 3 hours requiring 540,000 gallons of storage

In addition to having sufficient water storage for the overall system, adequate storage should be available in the pressure zones that are served by each reservoir. It is assumed that the overall demand characteristics within each pressure zone have remained relatively unchanged since detailed system demand analysis was performed as part of the City's 2009 Water Master Plan.

Based on this analysis the 20-year peak demand has been allocated to each pressure zone as follows:

- McMillan Creek Reservoir - Approximately 51% of MDD
- 3rd Avenue Reservoir - Approximately 48% of MDD
- Pacific View Estates Reservoir - Approximately 1% of MDD

The following table below shows the total needed storage for the overall system as well as for each pressure zone.

Table 7-3 - Storage Requirements for Rockaway Beach Water System

	MDD (mgd)	Storage Requirements			Existing Storage (MG.)	Excess Storage Available (MG.)
		Equalization and Emergency 1.25 x MDD (MG.)	Fire Storage (MG.)	Total Storage (MG.)		
Overall System						
Existing	0.76	0.95	0.54	1.49	3.17	1.68
20-year	1.14	1.43	0.54	1.97	3.17	1.20
McMillan Creek Pressure Zone						
Existing	0.39	0.48	0.54	1.02	1.90	0.88
20-year	0.58	0.73	0.54	1.27	1.90	0.63
3rd Ave. Pressure Zone						
Existing	0.36	0.45	0.54	0.99	1.00	0.01
20-year	0.55	0.68	0.54	1.22	1.00	**-0.22**
Pacific Pressure Zone						
Existing	0.01	0.01	0.12	0.13	0.17	0.04
20-year	0.01	0.01	0.12	0.13	0.17	0.04

As reported in the 2009 Water Master Plan, not all the volume of the McMillan Creek Reservoir is usable storage. This is due to the fact that several areas have pressures near or below 20 psi when the water level in the tank drops below 17.5 ft. As a result the usable volume of McMillan Creek Reservoir is 930,000 gallons. As the following table indicates, this reduced usable storage volume does not generate a storage deficiency within the overall system, however available storage in the McMillan Creek Pressure Zone is not sufficient to meet the area's current or future storage requirements.

Table 7-4 - Impact of Reduced Available Storage in McMillan Creek Reservoir

	Storage Requirement	Usable Storage	Storage Surplus
Overall System			
Existing	1.49	2.1	0.61
20-year	1.97	2.1	0.13
McMillan Creek Pressure Zone			
Existing	1.02	0.93	**-0.09**
20-year	1.27	0.93	**-0.34**

Evaluation of Existing Storage Facilities

As discussed in Section 4, the City's water system includes three reservoirs: the McMillan Creek Reservoir, 3rd Avenue Reservoir, and Pacific View Estates Reservoir. The City typically inspects and cleans the interior of reservoirs on an approximate 6 year schedule. Both the McMillan Creek Reservoir and Pacific View Estates Reservoir are in good condition, however a number of deficiencies have been noted regarding the condition of the 3rd Avenue Reservoir.

The 3rd Avenue Reservoir is in poor condition and in need of repair. The exterior of the tank needs an overall coating, the roof overhang needs gunnite repair, the roof seams need sealed, and the reservoir roof needs a reflective coating. The fencing around the reservoir needs upgrades and a new gate. The reservoir also needs a new staff gauge and float system.

In addition to the work needed at the 3rd Avenue Reservoir, the City also needs to complete the process of abandoning the Scenic View Reservoir, which no longer is in service.

7.1.4 Pump Stations

3rd Avenue Pump Station

This pump station serves the combined service areas of 3rd Avenue, Nehalem Ave./Ocean St., and Pacific View Pressure Zones. These pressure zones combine for approximately 49% of the current and projected MDD. This equates to approximately 250 gpm and 380 gpm, respectively. With an existing firm pumping capacity of 200 gpm, the 3rd Avenue PS is undersized, which results in the pumps having high daily run times and increased wear. Consequently, the City has had to regularly rebuild these pumps. Additionally, the configuration of the station is such that it is defined as a confined space making it more difficult to perform operation and maintenance of the station.

The location of this station also leads to operation issues. The 3rd Avenue PS is at an elevation of 94 ft. This is near the service limits of where the McMillan Creek Reservoir can maintain adequate pressure. As a results, operation of the pumps act to reduce the pressure in the McMillan Creek Pressure Zone limiting the ability to use the entire volume of storage within the McMillan Creek Reservoir.

Rock Creek Pump Station

The Rock Creek PS pumps water to the Pacific View Estates Reservoir. The City has recently completed a significant upgrade to this pump station including new pumps, building as well as a manual transfer switch. The station has a firm capacity of 200 gpm, which is sufficient for the existing and projected 20-year demand.

With the recent improvements, the Rock Creek PS is in good condition. However, there have been breaks in the 4" CL150 PVC main from the PS to the Pacific View Reservoir at the creek crossing.

Pacific View Estates Pump Station and Hydropneumatic Tank

The Pacific View Estates PS serves approximately 10 of the customers within Pacific View Estates. A number of the pump station's components need to be upgraded including the control panel and electrical system as well as improvements to the interior of the building. Although, the station is capable of meeting existing and future municipal water use demands, but cannot provide fire flows to its service area.

7.1.5 Distribution System

The Rockaway Beach water system includes approximately 31 miles of 2-inch to 12-inch piping. Existing pipe material consists of AC, PVC, HDPE, and Steel water mains. Approximately 33% of the system is composed of pipes having diameters of 4 inches or smaller.

Water loss in the system is nearly 50%, some of which is likely caused by leakage in the distribution system. Leakage occurs in different components of the distribution system: transmission pipes, distribution pipes, service connection pipes, joints, valves, and fire hydrants. In most cases the largest portion of unaccounted water is lost through leaks in supply lines. Causes of leaks include corrosion, materials defects, faulty installation, excessive water pressure, water hammer, and excessive loads and vibration from road traffic. Older AC pipelines are most at risk of breaks and cracks. Nearly 30% of the City's piping system is composed of AC material.

Hydraulic Model of Water System

The City's water system was modeled and analyzed using the WaterCAD software as part of the 2009 Water Master Plan. The purpose of the model is to evaluate the system's distribution performance under various scenarios. This analysis will assist in identifying distribution system shortcomings and will form the basis in developing improvement recommendations.

The WaterCAD model was used to investigate a number of conditions to determine the adequacy of the existing distribution system. Only steady state simulations were performed. The evaluation of the distribution system's performance is based on its ability to meet the following service performance criteria:

Average Daily Demand Performance Criteria

- Pressure should be maintained between a maximum of 100 psi and a minimum of 40 psi
- Maximum velocity within the distribution system pipelines should be 3 to 5 fps

Peak Hour Demand Service Criteria

- Minimum allowable service pressure should be 40 psi
- Maximum velocity within the distribution system pipelines should be 7 fps
- Maximum headloss within the distribution system should be 10 feet per 1000 feet of pipeline

Maximum Daily Demand plus Fire Flow Service Criteria

- Minimum allowable residual pressure should be 20 psi
- Calculated available fire flow should meet or exceed specified fire flow requirements of 1,000 gpm in residential areas and 1,500 gpm in high density or commercial areas
- Maximum velocity within the distribution system pipelines should be 10 fps
- Maximum headloss within the distribution system should be 10 feet per 1000 feet of pipeline

Detailed discussion of the model results of the City's system performance was provided in the 2009 Water Master Plan. Key findings of the analysis are provided in the following table. The most significant is the fact that a large portion of the McMillan Creek Reservoir that is not useable because higher elevation services drop below 20 psi as the water level in reservoir falls below a depth of 18ft. Additionally, there are areas within each pressure zone that do not meet the minimum or maximum pressure performance criteria or have needed fire flow capability.

Table 7-5 - Summary of Hydraulic Model Result of System Performance

Pressure Zone	*Performance Criteria Met?*		Noted Deficiencies
	ADD/PHD	MDD + Fire Flow Demand	
McMillan Creek	Only if McMillan Creek Reservoir is half full	No	• High points reduce useable storage volume in McMillan Creek Reservoir • The velocities of many 4" and smaller mains exceed 10 ft/s during fire events. • Available fire flows limited by undersized pipelines and high points within zone.
3rd Avenue & Nehalem Dr./Ocean St	$40 \geq P \leq 100$ psi	Mixed	• Pressures exceed 80 psi in some areas • Available fire flows limited by undersized pipelines and high points within zone.
Pacific View	$40 \geq P \leq 100$ psi	No	• Pressures exceed 80 psi in some areas • Available fire flows limited by undersized pipelines.

The deficiencies listed in Table 7-5 are primarily related to high points in the pressure zones and undersized pipelines. Note that detailed results of the hydraulic modeling of the system are provided in Appendix H of the City's 2009 Water Master Plan.

7.2 DEVELOPMENT OF SYSTEM IMPROVEMENT & ALTERNATIVES

7.2.1 Water Supply

Summary of Deficiencies

Based on the analysis of the existing water source and intake facilities, the following system deficiencies have been noted:

- Limited source capacity during summer months is insufficient to meet current and future peak water demand.
- Seasonal spikes in turbidity, particularly following rain events, impair treatment capabilities.
- Existing intake screen and piping in poor condition.
- Large screen opening of existing intake does not prevent pine needles and other debris from entering into system which increases wear of pumps and impair treatment.
- Sedimentation within raw water impoundment requires annual maintenance for removal
- Existing dam causes fish barrier

The following improvement alternatives have been developed to resolve these noted deficiencies.

Water Supply Improvement Alternatives

Water Source Alternative 1 - Raw Water Storage

The summer streamflows on Jetty Creek may be supplemented by expanding the existing raw water impoundment. HBH completed a detailed feasibility study of this option that included re-routing a portion of Jetty Creek to a relic channel located in order to increase the size of the impoundment. An additional benefit of off-channel storage is the City will be able to have flows bypass the impoundment during periods of poor water quality. Based on the 2010 *Jetty Creek Feasibility Study*, re-routing the creek would allow the impoundment holding capacity to increase from 50,000 gallons to 300,000 gallons.

Assuming that 75% of this expanded impoundment capacity or 225,000 gallons could be used to supplement Jetty Creek flows, this equates to approximately 200 gpm. As shown in Table 7-6, this increased supply would sufficiently supplement flows to meet current peak day demands. By the end of the 20-year planning period, July through September peak demands would be near or exceed the expanded source capacity.

Table 7-6 - Comparison of Supplemented Streamflow & Water Demands

Month	Supplemented Capacity (gpm)	Existing		20-Year	
		MDD (gpm)	Surplus Capacity (gpm)	MDD (gpm)	Surplus Capacity (gpm)
June	1,232	576	656	712	520
July	873	702	171	868	**5**
August	694	556	138	688	**6**
Sept	564	537	**27**	664	**-100**
October	617	431	186	533	84

In 2010, the City received a series of grants to fund the design phase of this project, which included detailed site plan as well as cost estimates for permitting and construction. Adjusting cost to reflect inflation shows the cost for this project is estimated at $573,000.

Water Source Alternative 2 - Develop New Water Source

As mentioned previously, the City of Rockaway Beach has water rights on Jetty Creek, McMillan Creek, Heitmiller Creek, Spring Creek and Steinhilber Creek, Rock Creek, and the three wells. The City has investigated the possibility of constructing a new WTP that utilizes water from Spring Lake, which historically was fed by Heitmiller Creek until the creek was re-routed. However, at this time it does not appear that City will be able to transfer the 3.0 cfs on Heitmiller Creek to Spring Lake. Without this water right, development of a Spring Lake is not an option. There is not sufficient data available on the other five surface water sources to determine if redevelopment is feasible. Groundwater in the area is generally poor and developing new wells are not advisable.

Water Source Alternative 3 - Interconnection with Other Supplier

The City has previously investigated potential opportunities to form an interconnection with other water systems. The following explores the options of connecting to either the Wheeler/Manzanita or Watseco-Barview/Garibaldi water systems.

The City of Wheeler currently has a water right for of 3.6 cfs on ground water for 4 wells within the Nehalem River Basin. In order to connect to the system, Rockaway Beach would need to install over 50,000 feet of transmission main as well as a new pump station and disinfection system. The total project cost for the Wheeler well supply option is estimated at nearly $7.5 million, which does not include the cost to purchase the water from Wheeler.

Another option previously considered is the formation of a Regional Water District including Rockaway Beach, Watseco-Barview, and Garibaldi. This option would require approximately 20,000 feet of transmission pipeline installed along US Highway 101 and new pump station. This option is expected to cost over $6 million, also not including purchase of water.

Intake Facility Improvements

As noted above, the City's existing intake screen and pipe are in poor condition and need to be replaced. The new screen should include a fine mesh that prevents leaves and other debris from entering the raw water piping. The estimated cost for these improvements is $51,000.

7.2.2 Water Treatment

The City's water treatment facility is in good working condition. Based on the analysis performed in Section 7.1.2, the capacity of the existing plant may not be sufficient to meet peak day demands in an 18-hour operation limit. The treatment system can be expanded by adding additional membrane modules to the skid. The City should monitor water demands and make recommendations for potential upgrades to the treatment facility as needed in updates to this Master Plan.

7.2.3 McMillan Creek Pressure Zone

Summary of Deficiencies

Based on the evaluation of facilities' conditions, capacity, and hydraulic performance, the following deficiencies have been noted:

- The calculated pressure of several areas located at higher elevations drop below 20 psi as the water level in McMillan Creek Reservoir drops. These areas of low pressure are located near the old Scenic Reservoir site, the 3rd Avenue PS, and Necarney St. and NE 12th Avenue intersection.
- An estimated 54% of the storage in McMillan Creek Reservoir is not available for use due to low pressures that results when the tank is less than half full. As a result of the reduced capacity, the McMillan Creek Pressure Zone does not have sufficient storage available to meet current and future water storage needs.
- Work to abandon the Scenic View Reservoir has not been completed

Improvement Alternatives

<u>McMillan Creek Improvement Alternative 1 - New Storage Facility</u>

The first option analyzed to address the existing and future storage deficiency of the area was to construct a second reservoir in the area. The new reservoir would supplement storage in the McMillan Creek Reservoir and limit the drawdown of the water level in order to maintain system pressures above 20 psi. The estimated cost of a new 0.5 million gallon reservoir is over $1.1 million.

In addition to the large capital cost for this alternative, there are also a number of operational drawbacks, including increased age of water within tank can result in the formation of disinfection by-products (DBPs) and significant oversight of reservoirs is require to ensure minimum system pressure is maintained.

McMillan Creek Improvement Alternative 2 - Provide Additional Pumping

An alternative to constructing a new storage tank is to eliminate existing high points in the system by added additional pumping facilities. New hydropneumatic pump stations would need to be installed near the old Scenic View Reservoir as well as near the intersection of Necarney and 12th Avenue. These improvements are expected to cost an estimated \$126,000 and \$217,000, respectively. In addition the 3rd Avenue PS would be relocated west near the intersection of Marine Street.

Installing new pump stations to eliminate low pressure in the system is significantly more cost effective than constructing new storage. These improvements will allow full utilization of the McMillan Creek Reservoir which will not only eliminate the area's storage deficiency but also have a positive impact on water quality. The disadvantage of this option is increased electrical costs due to operation of the new pump station. This can be mitigated somewhat by utilizing high-efficiency motors on all pumps.

7.2.4 3rd Avenue Pressure Zone

Summary of Deficiencies

Based on the analysis of the existing capacity and condition of the facilities in the area, the following deficiencies were noted for the 3rd Avenue Pressure Zone:

- The pumps at the 3rd Avenue PS are undersized for current demands resulting in high daily run times and have to be rebuilt regularly. When the pumps are in operation they reduce the pressure in the McMillan Creek Pressure Zone. The pump station is currently a confined space and the City would like a building with a rail system for pulling the pumps.
- The 3rd Avenue Reservoir is in poor conditions and needs rehabilitation. Additionally, the facility may not have sufficient storage capacity to meet the storage needs of the system through the 20-year planning period.
- High points and undersized piping limit the capacity and impair hydraulics of the distribution system so that performance criteria are not met during many existing and future conditions. The high points of concern are in areas surrounding the Neptune St. and S. 4th Avenue.

Improvement Alternatives

3rd Avenue Improvement Alternative 1S (Storage) - Replace 3rd Avenue Reservoir

Tank replacement is the first option developed to address the conditional, operational, and capacity deficiencies of the 3rd Avenue Reservoir. The new tank would be a minimum 1.5 million gallons to ensure that areas served by the tank will have sufficient storage throughout the planning period. The new tank is estimated to cost nearly $1.4 million.

The significant capital cost of a new tank is the primary disadvantage of this alternative. However, other drawbacks include the need to locate and acquire land for a tank site and possible permitting and environmental requirements.

3rd Avenue Improvement Alternative 2S (Storage) - Rehabilitate Existing Reservoir

The existing tank is in poor condition and needs various improvements to ensure proper operation and reduce maintenance costs. Necessary improvements include sealing and roof repairs, installing new staff gauge and float system as well as new site fencing. The estimated cost for this work is nearly $123,000.

In addition, it is recommended that an 8-inch pipeline be installed along S. 4th Avenue and connected to piping on Longview Loop in the Pacific View Pressure Zone. This would eliminate the low pressures currently experienced in the southern portion of the zone. A PRV would be included to provide an interconnection between to two pressure zones. This would enable to storage from the Pacific View Reservoir to supplement the 3rd Avenue Reservoir as needed. The anticipated cost for this improvement is $84,000.

Although this is the most economical alternative, it does not address the existing storage deficiency of the system thus additional improvements may be needed.

3rd Avenue Improvement Alternative 1P (Pump Station) - Rehabilitate Existing Pump Station

This alternative would rehabilitate the existing 3rd Avenue PS with new pumps; upgrade controls, building modifications, and a number of other improvements. The estimated cost for this alternative is nearly $200,000.

Although this alternative is the more cost effective option, it does not address the operational problems primarily due to the elevation of the existing station. As a result, this alternative would not eliminate the risk of low pressures occurring in the McMillan Creek Pressure Zone during pump operations.

3rd Avenue Improvement Alternative 2P (Pump Station) - Relocate Pump Station

The second alternative is to relocate the 3rd Avenue PS to a site at a lower elevation. This would require land acquisition or an easement. The estimated cost for this alternative is $315,000 and includes new pump station equipment, building, controls, telemetry, site work, piping and electrical as well as cost for land acquisition/easement and environmental review.

Relocating the pump station would improve system performance and eliminate the risk of system pressures dropping below 20 psi. This improvement is also a necessary part of McMillan Creek Improvement Alternative 2. Consequently the increased cost of relocating the pump station is offset by eliminating the need of constructing a new reservoir.

7.2.5 Nehalem Ave/Ocean St Pressure Zone

Summary of Deficiencies

Based on the analysis completed as part of this study, the following deficiencies have been noted:

- Existing PRV needs to be replaced
- Deteriorating water quality due to long pipeline runs
- Low pressure near southeastern boundary of system

Improvement Alternatives

<u>Oceanlake Reservoir & Pump Station</u>

The Oceanlake PS and Reservoir are needed to provide water service to the Oceanlake development as well as increase system pressures in the southern portion of the Nehalem Ave/Ocean St Pressure Zone. These improvements will also help alleviate issues related to stagnant water in the far end of the distribution system helping improve water quality and decrease the likelihood of DBP formation.

The new reservoir will be sized to meet the storage demands of the Oceanlake development as well as providing supplemental storage for the Nehalem Ave/Ocean St. Pressure Zone. Previous studies have determined that a 350,000 reservoir is necessary. In order to construct the new reservoir, an access road will need to be constructed and new transmission piping installed. The estimated cost for the Oceanlake Reservoir and related items (road, transmission line, etc.) is approximately $1.0 million.

A new pump station will be required to deliver water to the new Oceanlake Reservoir. The pump station will be sized to meet the projected demands of the Oceanlake development. Based on previous studies the projected 20-year MDD for the area is 35,500 gpd; therefore the new pump station should have a firm capacity of 150 gpm. It is also recommended that a PRV be included to will allow water to flow back into the Nehalem Ave/Ocean St. Pressure Zone. The estimated cost for the new pump station is $243,000.

7.2.6 Pacific View Estates Pressure Zone

Summary of Deficiencies

The following deficiencies have been noted in the Pacific View Pressure Zone:

- The Pacific View PS needs a new control panel and upgrades to the power supply. In addition, the pump station building needs interior improvements.
- The 4” CL150 PVC main that conveys water from the Rock Creek PS to the Pacific View Reservoir at the creek crossing is in poor condition and needs replacement.

- The Pacific View PS does not have capacity to provide fire protection to areas at higher elevations.

Improvement Alternatives

Pacific View PS System Improvement Alternative 1 - Upgrade Existing PS & Construct New Fire Demand PS

Improvements for the Pacific View PS are needed to ensure proper operations and decrease maintenance. Additionally, the station is not capable of providing fire flows to high elevation service areas. Improvement alternative #1 would rehabilitate the existing pump station and install a separate pump station for fire demands. Improvements to the existing pump station would include replacement of the control panel, upgrades to its power supply, and make other improvements to the interior of the station's building. The estimated cost for these improvements is $37,500. As part of this alternative a new fire demand pump station would also be constructed to serve the upper elevations of the Pacific View Pressure Zone. The estimated cost for the fire demand pump station is $220,500.

The advantage of this alternative is that it would allow the City to make the needed improvements to the existing Pacific View PS and then construct the fire demand PS sometime in the future when funding is available. The drawback of this option is an overall higher capital cost as well as the possibility that the fire demand PS may not be budgeted in the foreseeable future. Additionally, this alternative would require land acquisition, additional permitting and/or environmental review, and increased O&M to maintain two facilities.

Pacific View PS System Improvement Alternative 2 - New Service PS w/ Fire Pump

A second alternative is to completely replace the existing deteriorated pump station with a new station that includes a fire demand pump. The project would include a new packaged pump station with hydropneumatic tank and a 1,000 gpm fire pump. A new building would be requires as well. The total cost for the new pump station is estimated at nearly $202,500. This is significantly less than the combined alternative but significantly more than simply upgrading the existing station.

The advantage of this alternative is that is requires significantly less capital than the combined alternative discussed above as well as less O&M. The disadvantage of this alternative is that it is more expensive than simply upgrading the existing station.

7.2.7 Additional Distribution System Improvements

The many areas with the water system are served by pipelines that are undersized or in poor condition. As a result, portions of the distribution system do not have the hydraulic capacity to satisfy performance criteria under existing or future conditions. In addition, the piping network \ includes pipelines that are composed of AC material that are at or near the end of their useful life and should be replaced.

A map of the proposed distribution improvements is shown in Figure 7-2. These improvements primarily focus on replacing undersized piping, providing additional looping, and replacing AC pipelines. In general, pipelines with a 4-inch and small diameter cannot meet the system's performance criteria and should be replaced with minimum 6-inch diameter pipes. The most significant improvement is increasing the capacity of the City's main distribution pipeline that runs along Highway 101.

7.2.8 Comparison of Improvement Alternatives

The following tables has been provided to present a comparison of the various improvement alternatives developed to address a number of deficiencies identified in the City's water system. This table includes information on anticipated capital cost as well as the advantages and disadvantages of each alternative.

Table 7-7 - Comparison of Improvement Alternatives

Atl.	Description	Est. Cost (millions)	Advantages	Disadvantages
Water Supply				
1	Raw Water Storage	$0.573	• Lowest Capital Cost • Design 90% Complete • City maintains control of operations • Benefits operations at WTP	• May not be sufficient to alleviate long-term supply deficiency • Does not provide secondary source
2	Development of New Sources	Unknown	• Increase available water sources to City • Provides redundancy	• Issues related to existing WR sources prevent development • High capital costs
3	Interconnection	$6-7.5	• Provides secondary water supply source • Eliminates source capacity deficiency	• Very high capital costs • City would not control operations and could be cut off
McMillan Creek Pressure Zone				
1	New Storage Facility	$1.120	• Eliminates storage deficiencies • Limited increase in O&M	• Does not adequately address low pressures in the system • High capital cost • May increase water quality problems due to increased water age in distribution system • Does not require changes to other facilities
2	Provide Additional Pumping	$0.343	• Improves system hydraulics by eliminates low pressures in pressure zone • Improves water quality • Allows full capacity of McMillan Creek Reservoir to be used • Lower capital cost which can be phased	• Increase in O&M costs • Requires 3rd Ave. PS to be relocated

Atl.	Description	Est. Cost (millions)	Advantages	Disadvantages
3rd Avenue Pressure Zone				
S1	Replace 3rd Avenue Reservoir	$1.338	• Eliminates storage deficiency	• High capital cost • May require new site with additional permitting and environmental review
S2	Rehabilitate 3rd Avenue Reservoir	$0.123	• Significantly lower capital cost	• Requires modification to pressure zone to eliminate low pressures • Additional Storage may be needed by the end of the planning period
P1	Rehabilitate 3rd Avenue PS	$0.200	• Lower capital cost • No land acquisition/easement required	• Does not aid in reducing low pressures in McMillan Creek Pressure Zone preventing full use of storage.
P2	Relocate 3rd Avenue PS	$0.315	• Assists in eliminating low pressures in McMillan Creek Pressure Zone allowing full utilization of existing tank	• Higher capital costs • Requires land acquisition/easement • Additional permitting/environmental may be required.
Pacific View Pressure Zone				
1	Rehabilitate Existing PS & Construct Separate Fire Demand PS	$0.258	• Allows phasing of improvements so that necessary upgrades to existing station can be done in near term and fire demand pumps added in future	• Requires two facilities • Land acquisition/easement • Additional permitting/environmental require • Higher total capital cost
2	Replace PS with New Combined Service + Fire PS	$0.202	• Keeps all pump equipment in one location • Lower total capital cost • Does not require addition land acquisition/easement	• Does not allow phasing of improvements

7.3 RECOMMENDATIONS

A summary of recommended improvements are provided below. Detailed cost estimates can be found in Appendix D.

7.3.1 Water Supply Improvement Recommendations

As previously noted, the City needs to upgrade its intake facility and secure adequate water supply. Improvements to the existing intake screen and piping are projected to cost$51,000. These improvements should be completed in the next 1-2 years.

Of the various improvements analyzed to increase the availability of water, expanding the holding volume in the raw water impoundment is recommended. This alternative was significantly more cost effective than connecting to a secondary system and also has the benefit of improving system operations and fish habitat in Jetty Creek. As part of this project the existing impoundment would be excavated to provided 225,000 gallons of raw water storage and restore nearly 300 linear feet of relic creek channel. It is further recommended that the City continue to evaluate additional options for increasing its water supply.

7.3.2 McMillan Creek Pressure Zone Improvement Recommendations

Based on the analysis of improvement alternatives, it is recommended that the City construct two new booster pump stations in the McMillan Creek Pressure Zone. New pump station will include a new 80 gpm booster station with fire demand pumps near Necarney Street and a new 20 gpm hydropneumatic booster station near the old Scenic View Reservoir site. The Necarney booster pump is estimated to cost $217,000 and should be completed in the next 5 years. Construction of the small Scenic View booster pump station should be done in the next 10 years at an estimated (current) cost of $126,000.

In addition to construction new pump stations, the City should complete the decommissioning of the old Scenic View Reservoir within the next one to two years. The estimated cost for this work is $10,000.

7.3.3 3rd Avenue Pressure Zone Improvement Recommendations

The recommended improvements for the 3rd Avenue Pressure Zone include rehabilitation of the existing 1.0 million gallon reservoir, relocating the 3rd Avenue PS, and connection to the Pacific View Pressure Zone through a PRV. These are the most cost effective alternatives to address existing deficiencies and improve system performance. Tank rehabilitation is expected to cost $123,000 and should be completed as soon as possible. Relocating the existing pump station should also be done in the next few years and has an estimated cost of $315,000. The interconnection with the Pacific View zone has an estimated cost of $84,000 and should be completed in the next 5 to 10 years.

7.3.4 Nehalem Ave/Ocean St Pressure Zone Improvement Recommendations

The new Oceanlake Reservoir and pump station should be completed in the next five years. These improvements will help reduce the formation of DBP in the distribution system. The new 350,000 gallon reservoir and 150 gpm pump station are estimated to cost $1.0 million and $243,000, respectively.

7.3.5 Pacific View Estates Pressure Zone Improvement Recommendations

Recommended improvements to the Pacific View Pressure Zone include rehabilitation of the existing booster pump station and new fire demand pump station. Although separating these projects is not as cost effective as constructing a new system, it provides the flexibility to make the necessary pumping improvements now and make fire demand improvements once funds are available. The improvements to the existing pump station should be completed as soon as possible and are estimated to cost $37,500. Constructing a fire demand pumps station is estimated to cost $220,500 and can be completed later in the planning period.

In addition to the pump station rehabilitation, the City also needs to replace the section of piping that crosses Rock Creek within the next two years. The estimated cost of this project is $45,000.

7.3.6 Distribution Piping Improvement Recommendations

A significant amount of distribution water main improvements are recommended to in order to improve system capacity and hydraulic performance as well as replace deteriorated pipelines. Pipeline improvements are shown in Figure 7-2 and summarized in Table 7-8. As the following table shows, these improvements involve 91,500 lineal feet pipeline.

Table 7-8 - Distribution Piping Improvements for Each Pressure Zone

Pipe Size (in)	McMillan Creek	3rd Ave	Nehalem Ave/ Ocean St	Pacific View Estates
6"	16,000	2,100	22,000	1,000
8"	14,000	2,400	10,500	2,000
10"	1,600	---	13,100	---
12"	5,500	---	1,300	---
Total	37,100	4,500	46,900	3,000

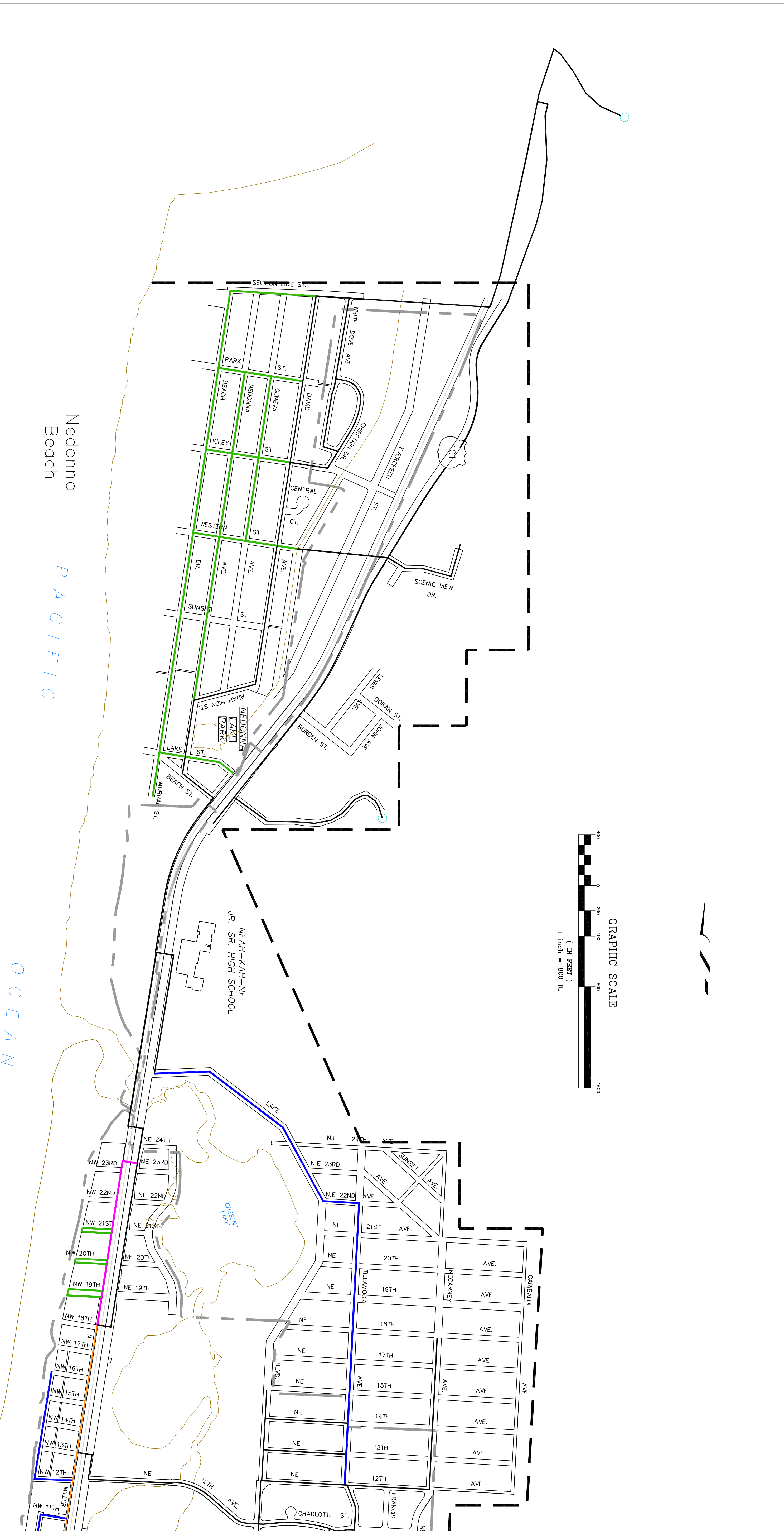
Due to the scope of these improvements, it is recommended that the City priority pipeline replacements into multiple phases. Figure 7-3 presents pipeline improvements divided into three phases. Phase 1 improvements should be completed in the next five years. With Phase 2 and 3 implemented within 10 and 15 years, respectively. Estimated cost for each phase of improvements is provided in Table 7-9.

Table 7-9 - Estimated Cost for Each Phase of Distribution System Improvements

Distribution Improvements	Lineal Feet	Est. Cost (millions)
Phase 1	15,200	$2.934
Phase 2	33,900	$2.493
Phase 3	29,600	$2.221
Total	91,500	$7.648

WATER LINE LEGEND

- EXISTING WATER LINE
- NEW 6-IN PVC WATER LINE
- NEW 8-IN PVC WATER LINE
- NEW 10-IN PVC WATER LINE
- NEW 12-IN PVC WATER LINE



MASTER SYSTEM WATER PLAN UPDATE

SCALE: 1" = 800'

FIG. 7-2A	DRAWN BY: CLL DATE: Dec. 2013	DISTRIBUTION SYSTEM IMPROVEMENTS	City of Rockaway Beach *WATER SYSTEM MASTER PLAN*

H B H Consulting Engineers

DRAWN BY: CLL

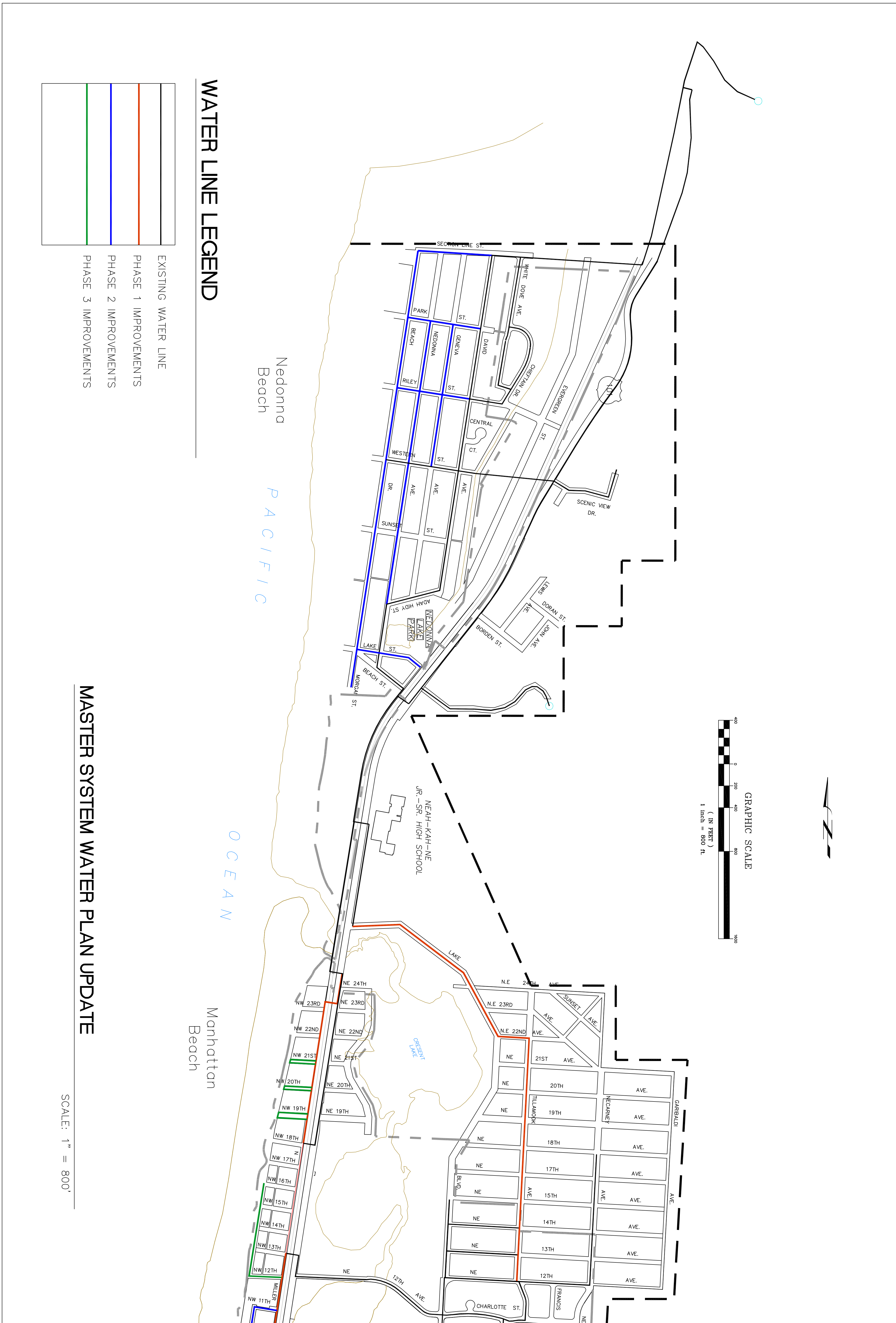
DATE: Dec. 2013

DISTRIBUTION SYSTEM IMPROVEMENTS

City of Rockaway Beach
WATER SYSTEM MASTER PLAN

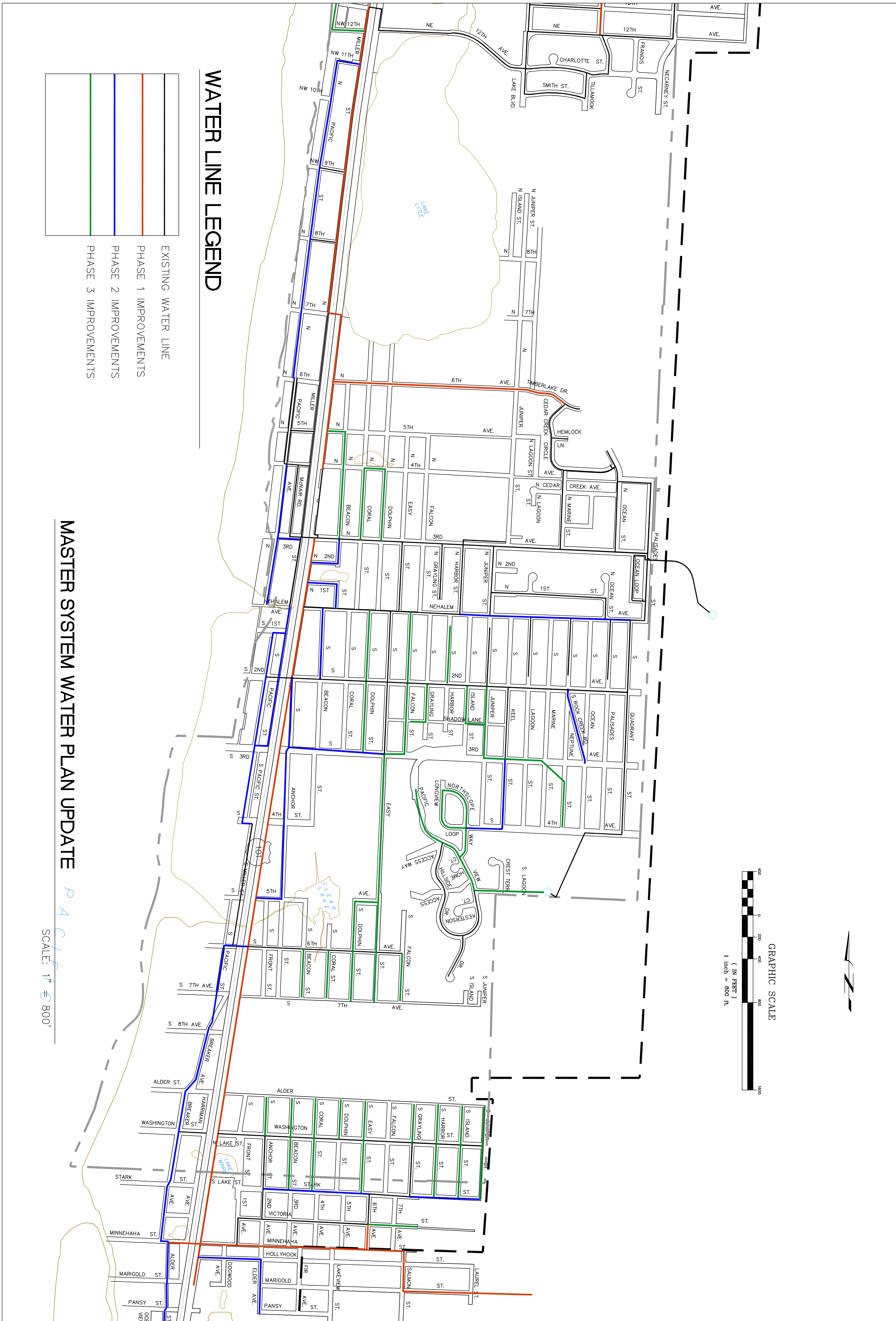
HBH Consulting Engineers

FIG. 7-2B



DRAWN BY: CLL	DISTRIBUTION SYSTEM PHASING	City of Rockaway Beach	HBH Consulting Engineers
DATE: Dec. 2013		*WATER SYSTEM MASTER PLAN*	

FIG. 7-3A



DRAWN BY: CLL DATE: Dec. 2013	DISTRIBUTION SYSTEM PHASING	City of Rockaway Beach *WATER SYSTEM MASTER PLAN*	H B H Consulting Engineers

FIG. 7-3B

SECTION 8

Recommended Capital Improvement Plan

Recommended Capital Improvement Plan

Section 8

Below is a summary of all the recommendations for the City's water supply, storage, and distribution systems. This includes clear and concise information on project selection, capacity needs, project prioritization, and project costs. These recommendations were developed through analyses and studies that were completed in previous sections of the Plan.

As the projects vary in their criticality, the projects have been divided into three separate and distinct priority groups. The priority groups are further described below:

Priority 1 Projects: Priority 1 projects are the most critical and must be undertaken as soon as possible in order to satisfy the current operational and regulatory requirements. Priority 1 projects should be considered as the most immediate needs of the water system and completed within the next few of years, or as soon as funding for these projects can be obtained.

Priority 2 Projects: Priority 2 projects are projects that should be undertaken within the first half of the planning period to restore aging facilities to new operating conditions and to increase system capacity as needed. While they do not have to be undertaken immediately, they should be included in the capital improvement plan (CIP) and undertaken as funding is obtained.

Priority 3 Projects: Priority 3 projects are projects that are least critical and primarily dependent on future development, fire protection, or increasing service performance. Implementation of Priority 3 projects can be delayed until the latter half of the planning period, unless changes occur in development patterns.

8.1 SUMMARY OF RECOMMENDED IMPROVEMENTS

Improvements to the City's water system are needed to:

- Rehabilitate a number of deteriorating facilities including intake, reservoir, pump stations and pipelines;
- Supplement existing raw water source;
- Increase water pressures near the high elevation boundaries of pressure zones;
- Improve water quality in south end of distribution system; and
- Increase capacity and improve hydraulic performance of distribution system.

Each of the recommended improvements is discussed in detail in Section 7.

8.1.1 Priority 1 Projects

Highest priority improvements, indicated as Priority 1projects, include improvements to the City's water supply, rehabilitation of deteriorated facilities, and most significant improvements to the distribution system. Priority 1 projects should be completed within the next five years or as soon as funding is available.

Priority 1 projects are listed below:

Water Supply Improvements
- Intake screen and piping improvements

McMillan Creek Pressure System Improvements
- Abandon Scenic View Reservoir

3rd Avenue Pressure System Improvements
- Rehabilitate 3rd Avenue Reservoir
- Relocated 3rd Avenue Pump Station

Pacific View Estates Pressure System Improvements
- Rehabilitate existing pump station
- Replace section of Rock Creek transmission line

Distribution System Improvements
- Distribution System Improvements - Phase 1

8.1.2 Priority 2 Projects

Moderate priority projects include projects related to improving system performance (such as pressures or water quality). Priority 2 projects are listed below:

Water Supply Improvements
- Expansion of raw water impoundment

McMillan Creek Pressure System Improvements
- Construct new 80 gpm pump station near Necarney Street

3rd Avenue Pressure System Improvements
- Interconnection with Pacific View Estates Pressure Zone

Nehalem Ave/Ocean St Pressure System Improvements
- Construct new 350,000 gallon Oceanlake Reservoir
- Construct new 150 gpm Oceanlake Pump Station

Distribution System Improvements
- Distribution System Improvements - Phase 2

8.1.3 Priority 3 Projects

Priority 3 projects are viewed as the least critical and can be completed in the latter half of the planning period or as additional funding becomes available. Priority 3 improvements are listed below:

McMillan Creek Pressure System Improvements

- Construct new 20 gpm pump station near old Scenic View Reservoir site

Pacific View Estates Pressure System Improvements

- Fire demand pump station

Distribution System Improvements

- Distribution System Improvements - Phase 3

8.2 RECOMMENDED IMPROVEMENTS COST SUMMARY

A summary of the recommended capital improvement projects costs is provided in the Table 8-1. Detail cost estimates for each improvement is provided in the Appendix D. As the table shows, the total for all recommended improvements exceeds $10.72 million. Nearly $7.65 million (71.3%) of this total is related to piping improvements. The following graph illustrates distribution of estimated project costs between the water supply, storage, pumping, and distribution systems.

Figure 8-1 - Distribution of Project Costs

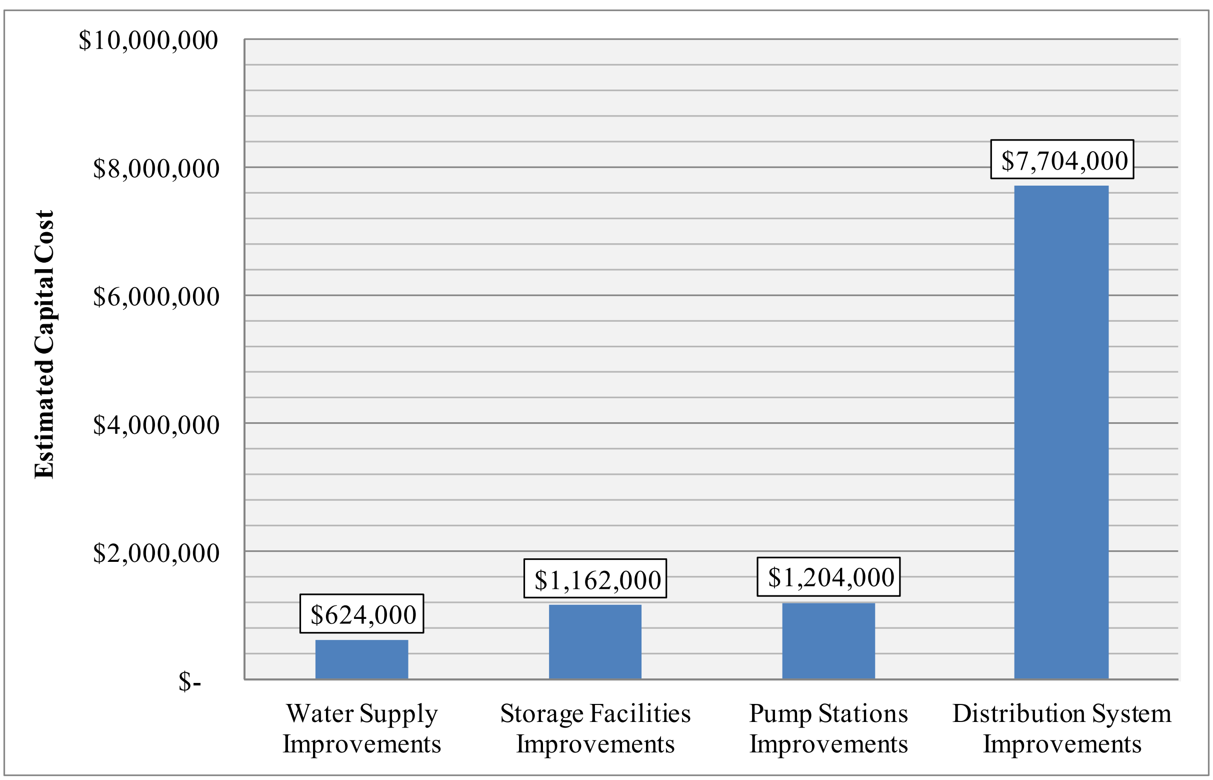


Table 8-1 - Recommended Capital Improvement Costs Summary

Capital Improvement Project	Preliminary Estimated Cost	
Priority 1		
Intake Screen	$	51,000
Abandon Scenic View Reservoir	$	10,000
Rehabilitate 3rd Ave Reservoir	$	123,000
3rd Avenue PS Relocation	$	315,000
Rehabilitation Pacific View Estates BPS	$	37,500
Rock Creek Transmission Line	$	45,000
Distribution System Improvements Ph 1	$	2,934,000
Total Priority 1	*$*	*3,515,500*
Priority 2		
Raw Water Impoundment Improvements	$	573,000
Necarney BPS	$	217,000
3rd Ave-Pacific View Connection	$	84,000
Oceanlake Reservoir	$	1,029,000
Oceanlake Pump Station	$	243,000
Distribution System Improvements Ph 2	$	2,493,000
Total Priority 2	*$*	*4,639,000*
Priority 3		
Scenic View BPS	$	126,000
Pacific View Fire Demand PS	$	220,500
Distribution System Improvements Ph 3	$	2,221,500
Total Priority 3	*$*	*2,568,000*
Total Improvements	**$**	**10,722,500**

As previously noted, the estimated cost for all system improvements is over $10.72 million. Funding options for proposed improvement projects are discussed in greater detail in Section 9.

SECTION 9

Financing Options

Financing Options

Section 9

Most communities are unable to finance major infrastructure improvements without some form of governmental funding assistance, such as low interest loans or grants. Below, a number of major Federal/State funding programs and local funding mechanisms that are appropriate for the recommended improvements are discussed. Projects are usually funding by a combination of grant, loan and local funds.

9.1 GRANT AND LOAN PROGRAMS

A brief description of the major Federal and State funding programs that are typically utilized to assist qualifying communities in the financing of infrastructure improvement programs is given below. Each of the government assistance programs has its own particular prerequisites and requirements. These assistance programs promote such goals as aiding economic development, benefiting areas of low to moderate-income families, and providing for specific community improvement projects. With each program having its specific requirements, not all communities or projects may qualify for each of these programs. *Oregon Water & Wastewater Funding and Resource Guide*¸ prepared by Rural Community Assistance Corporation (RCAC) is provided in Appendix E.

9.1.1 Oregon Community Development Block Grant (OCDBG) Program

The Oregon Business Development Department Infrastructure Finance Authority (OBDD-IFA) administers the State's annual federal allocation of CDBG funds. Funds for the program come from the U.S. Department of Housing and Urban Development. OCDBG funds under the Public Works category are targeted to water and wastewater systems.

Only non-metropolitan cities and counties in rural Oregon can apply for and receive grants. Cities and counties may undertake projects to improve existing facilities owned by other public bodies, such as water or sanitary districts. A city or county can only have one CDBG application under consideration by the State at any one time. Applications are not accepted when a jurisdiction has three or more administratively open CDGB projects. Applications may be submitted year around.

OCDBG grants are available for each of three phases necessary to complete water and/or wastewater system improvements; preliminary engineering and planning, final engineering, and construction. Engineering costs are limited to 20% of the total budget. No matching fund is required. The maximum grant available for a single project is $2,000,000 or $20,000 per permanent residential connection, whichever is less. This maximum grant allocation covers all aspects of the single project for a five year period. Projects may not be separated into phased in order to apply for more that the maximum grant funding during the five year period.

Grants awarded may be used for the following public works projects:

- Projects necessary to bring municipal water systems into compliance with the requirements of the Safe Drinking Water Act by the Oregon Department of Human Services – Drinking Water Program.

- Projects where the municipal system has not been issued a notice of noncompliance from the Oregon Health Services, Safe Drinking Water Program, but the department determines that a project is eligible for assistance upon finding that; a recent letter, within the previous twelvemonths, from the appropriate regulatory authority (DHS-DWP) or their contracted agent, indicating a high probability that within two years the system will be notified of non-compliance, and department staff deems it reasonable and prudent that program funding will assist in bringing the water system into compliance with current regulations or requirements proposed to take effect within the next two years.

- Water system planning, design and construction projects necessary to eliminate water rationing. The applicant must demonstrate past (within last 2 years) and/or consistent water rationing events due to insufficient drinking water quality or supply.

- Planning, design and construction projects necessary for the provision of dependable and efficient water storage, treatment and/or transmission to meet domestic drinking water needs

Projects eligible for funding must be to solve problems faced by current residents, not projects intended to provide capacity for population and economic growth. CDBG funds may be used in projects that are needed to benefit current residents but which will be built with capacity for future development. In these cases, the CDBG participation is limited to that portion of the project cost that is necessary to serve the current population.

In order to be eligible for CDBG, a system must at least 51% of permanent residents must characterized as low or moderate incomes based on the most recent OBDD Method of Distribution and the monthly user rate at construction completion of proposed projects meets the threshold rate criteria. The Threshold rat criteria states that by completion of the proposed project, the average system annual water rate is equal to or exceeds 1.25% of the current MHI as defined by the most recent *American Community Survey 5-Year Estimate*.

For additional information on the CDBG programs, call (503)-986-0123 or visit the OBDD-IFA website at http://www.orinfrastructure.org/Learn-About-Infrastructure-Programs/Interested-in-a-Community-Development-Project/Community-Development-Block-Grant/

9.1.2 Water/Wastewater Financing Program

The 1993 Legislature created the Water/Wastewater Financing Program for communities that must meet Federal and State mandates to provide safe drinking water and adequate treatment and disposal of wastewater. The legislation was intended to assist local governments in meeting the Safe Drinking Water Act and the Clean Water Act. The fund is capitalized with lottery funds appropriated each biennium and with the sale of state revenue bonds. The Oregon Business Development Department Infrastructure Financing Authority (OBDD-IFA) administers the program.

Program eligibility is limited to projects necessary to ensure compliance with the Safe Drinking Water Act or the Clean Water Act where a Notice of Non-Compliance has been issued. Cities, counties, districts and other public entities may apply to the program.

Eligible activities include the following:

- Water source, treatment, storage, and distribution improvements.
- Wastewater collection and capacity.
- Storm system.
- Purchase of rights of way and easements necessary for infrastructure development.
- Design and construction engineering.

The grant/loan amounts are determined by a financial analysis based on demonstrated need and the applicant's ability or inability to afford additional loans (dept capacity, repayment sources and other factors). The programs guidelines, project administration, loan terms, and interest rates are similar to the Special Public Works Fund program. The maximum loan term is 25 years, however, loans are generally made for 20-year terms. Loans are generally repaid with utility revenues, general funds, or voter approved bond issues. Borrowers that are "credit worthy" may be funded through sale of state revenue bonds.

Interested applicants should contact OBDD-IFA prior to submitting an application. Applications are accepted year-round. For additional information on this and other OBDD-IFA programs, call (503)-986-0123 or visit the OBDD-IFA website at http://www.orinfrastructure.org

9.1.3 Oregon Special Public Works Fund

The Special Public Works Fund (SPWF) program provides financing to municipalities (cities, districts, tribal councils, etc.) to construct, improve, and repair infrastructure in order to support local economic development and create new jobs locally, especially family wage jobs. In order to be eligible, the following conditions must be satisfied.

- The existing infrastructure must be insufficient to support current or future industrial or eligible commercial development; and

- There must be a high probability that family wage jobs will be created or retained within: 1) the boundary to be served by the proposed infrastructure project or 2) industrial or eligible commercial development of the properties served by the proposed infrastructure project.

The SPWF program is capitalized through biennial appropriations from the Oregon Lottery Economic Development Fund by the Oregon State Legislature, through bond sales for dedicated project funds, through loan repayments and other interest earnings. The Oregon Business Development Department Infrastructure Authority (OBDD-IFA) administers the fund. The following criteria are used to determine project eligibility.

The SPWF is primarily a loan program. Grant funds are available based upon economic need of the municipality. The maximum loan term is 25 years, though loans are generally made for 20-year terms. The grant/loan amounts are determined by a financial analysis based on a demonstrated need and the applicant's ability or inability to afford additional loans (debt capacity, repayment sources and other factors). Borrowers that are "credit worthy" may be funded through the sale of state revenue bonds. Loans are generally repaid with utility revenues, local improvement districts (LID's), general funds, or voter approved bond issues.

Determination of the final amount of financing and the loan/grant/bond mix will be based on the financial feasibility of the project, the individual credit strength of an applicant, the ability to assess specially benefited property owners, the ability of the applicant to afford annual payments on loans from enterprise funds or other sources, future beneficiaries of the project, and six other applicable issues.

The maximum SPWF loan per project is $10 million, if funded from SPWF revenue bond proceeds. Projects financed directly from the SPWF may receive up to $1 million. The maximum SPWF grant is $500,000 for a construction project and cannot exceed 85% of the total project cost. Grants are made only when loans are not feasible.

Technical Assistance grants and loans may finance preliminary planning and engineering studies and economic investigations to determine infrastructure feasibility. Up to $10,000 in grant funds and $20,000 in additional loan funds may be awarded to eligible applicants with fewer than 5,000 persons living within the City.

For additional information on this and other OBDD-IFA programs, call (503)-986-0123 or visit the OBDD-IFA website at http://www.orinfrastructure.org

9.1.4 Safe Drinking Water Revolving Loan Fund

The purpose of this loan fund is to provide funding to drinking water systems to comply with the Safe Drinking Water Act (SDWA), i.e., to protect the public health. It is intended to assist community and nonprofit, non-community water systems plan, design and construct drinking water facilities needed to correct non-compliance issues and to further the public health protection goals of the SDWA. Funds may be used for the following types of activities:

- All drinking water facilities necessary for source of supply, filtration, treatment, storage, transmission and metering.
- The acquisition of real property necessary for the project
- Preliminary and final engineering, surveying, legal review and other support activities necessary for the construction of the project
- Construction contingencies in approved change orders.
- Cost necessary for recipients to contract environmental review services
- A reasonable amount of community growth may be accommodated in the project. Growth may not be the primary purpose for constructing the facilities; public health improvement must be the main goal.

The Oregon Health Division and the Oregon Business Development Department (OBDD) rate proposed projects. The applicant must submit a "Letter of Interest" which is used to rank projects in a Project Priority List. Projects must be on the Priority List to receive funding. Highest ratings are given to projects that present the following:

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

Special consideration is given to projects at small water systems that serve 10,000 or fewer people, consolidating or merging with another system as a solution to a compliance problem, and which have an innovative solution to the stated problem.

Additional consideration will be given to disadvantaged communities. A disadvantaged community is defined as one whose average water cost for a residential customer in the service area of the water system is at least the state average for like systems (which have recently undergone a construction project) after the proposed project improvements are completed and currently meets at least two of the three criteria listed below:

- Community water system debt is at least $250 per capita (for sewer and water systems combined $500 per capita).
- The water system includes at least 51% low and moderate-income persons.
- The residents of the community water system have documented financial burden due to a recent (within the past two years) national or state declared disaster with documented not reimbursable expenses (minimum of $25 per capita).

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 twenty-year period and includes the major elements outlined in 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.

For additional information on this and other OBDD-IFA programs, call (503)-986-0123 or visit the OBDD-IFA website at http://www.orinfrastructure.org

9.1.5 State Water Resources Department: Water Development Loan Fund

The Water Development Loan Fund (WDLF) may grant loans to individuals, cities, local governments, and other public and private entities. The goal of the fund is to provide low-cost, long-term, fixed-rate financing incentives that promote projects that achieve the state's long-term water management goals.

Eligible projects include:

- **Drainage projects:** facilities installed to provide for the removal of excess water to increase soil versatility and productivity.
- **Irrigation projects:** facilities designed to provide water to land for the purpose of irrigation.

- **Community water supply project:** an undertaking, in whole or in part, in Oregon for the purpose of providing water for municipal use. A community is an incorporated or unincorporated town or locality with more than three service connections and a population of less than 30,000 people.

- **Fish protection project:** an undertaking, in whole or in part, in Oregon for the purpose of watershed protecting fish or fish habitat.

- **Watershed project:** a water development project in Oregon that provides more than one use. The primary use of the project must be one of the uses listed above. Secondary uses may include other water uses that are compatible with the primary use.

Funds to finance a water development project are obtained through the issuance and sale of self-liquidating bonds. The bonds are repaid by participants in the program and at no cost to the state or the Oregon taxpayer. The amount and type of loan security required depends on the borrower and the type of project. A first lien on real estate is required security for all loans. Other security may also be required.

Interested parties should contact the Water Resources Department for details. For additional information on the WDLF programs, call 1-800-624-3199 or visit the WRD website at http://www.wrd.state.or.us.

9.1.6 Water and Waste Disposal Loans and Grants (RUS)

The Rural Utilities Service (RUS) is one of three entities that comprise the USDA's Rural Development mission area. Administered by the USDA Rural Development office, the RUS supports various programs that provide financial and technical assistance for development and operation of safe and affordable water supply systems and sewer and other forms of waste disposal facilities.

RDA has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities. Grants are also available to applicants who meet the median household income (MHI) requirements. 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 a deteriorating water supply, or to improve, enlarge, or modify a water facility and/or inadequate waste facility. Preference is given to requests that involve the merging of small 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.

- Have legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities.

- Be financially sound and able to manage the facility effectively.

- Have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including operation and maintenance, and to retire the indebtedness and maintain a reserve.

- Water and waste disposal systems must be consistent with any development plans of State, multi-jurisdictional area, counties, or municipalities 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 improve water supply and distribution facilities including reservoirs, pipelines, wells, pumping stations, water supplies, or water rights.

- Construct, repair, improve, expand, or otherwise improve waste collection, pumping, treatment, or other disposal facilities. Facilities to be financed may include such items as sewer lines, treatment plants, including stabilization ponds, storm sewer facilities, sanitary landfills, incinerators, and necessary equipment.

- Acquire needed land, water supply or water rights.

- Legal and engineering costs connected with the development of facilities.

- Other costs related to the development of the facility including the acquisition of right-of-way and easements, and the relocation of roads and utilities.

- Finance facilities in conjunction with funds from other agencies or those provided by the applicant.

- Interim commercial financing will normally be used during construction and Rural Development funds will be available when 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 or the useful life of the improvement 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.

There are other restrictions and requirements associated with these loans and grants. If the City becomes eligible for grant assistance, the grant will apply only to eligible project costs. Additionally, grant funds are only available after the City has incurred long-term debt resulting in an annual debt service obligation equal to ½% of the MHI. In addition, an annual funding allocation limits the RDA funds. To receive a RDA loan, the City must secure bonding authority, usually in the form of general obligation or revenue bonds.

RDA will advise the applicant as to how to assemble information to determine engineering feasibility, economic soundness, cost estimates, organization, financing, and management matters in connection with the proposed improvements. If financing is provided, the RDA will also make periodic inspections to monitor project construction.

Applications for financial assistance are made at area offices of the RDA. For additional information on RDA loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water.

9.1.7 Emergency Community Water Assistance Grants (ECWAC)

Available through the USDA Rural Utilities Service (RUS) as part of the Water and Waste Disposal programs, ECWAC is available to communities when disaster strikes. Congress may appropriate funds for the program after a flood, earthquake, or other disaster if Federal assistance is warranted.

In order to receive assistance through an ECWAC grant, applicant must fulfill the following requirements:

- Demonstrate that a significant decline in quantity or quality of water occurred within two years of the date the application was filed with RUS,

- Public bodies and nonprofit corporations serving rural areas, including cities or towns whose population does not exceed 10,000 people may be eligible.

Projects that are eligible for assistance include the following:

- Extend, repair or perform significant maintenance on existing water systems.

- Construct new water lines, wells, or other sources of water, reservoirs, and treatment plants.

- Replace equipment and pay costs associated with connection or tap fees.

- Pay related expenses such as legal and engineering fees and environmental impact analyses, or acquire rights associated with developing sources of treating, storing, or distributing water.

- Achieve compliance with the requirements of the Federal Water Pollution Control Act (33 U.S.C et seq.) or with the Safe Drinking Water Act when noncompliance is directly related to a recent decline in potable water quality.

The maximum grant available through ECWAC is $500,000. Grants for repairs, partial replacement, or significant maintenance on an established system cannot exceed $75,000. Otherwise, grants may be made for 100% of eligible project costs.

Applications are filed with any USDA Rural Development office. For additional information on RDA loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/.

9.1.8 Rural Community Assistance Corporation (RCAC) Financial Services

The mission of RCAC's Financial Services is to manage resources, develop programs and participate in collaborative efforts, enabling RCAC to provide suitable and innovative solutions to the financial needs of rural communities and disadvantaged populations. In 1996, RCAC was designated a Community Development Financial Institution by the US Treasury to help address the capital needs of rural communities and has since added other loan programs. These programs include community facilities (housing, educational centers, public buildings, etc.) as well as lending for water and wastewater improvements.

Long-term loans are made in communities with a population of 20,000 or fewer. The Community Facility Loan Guarantee Program from USDA Rural Development enables RCAC to make low-interest loans with amortization periods of up to 25 years. The primary goal of Financial Services is to serve low- and very-low income rural residents. The primary borrowers are nonprofit organizations and municipalities.

Additional information can be found at http://www.rcac.org.

9.2 LOCAL FUNDING SOURCES

The amount and type of local funding obligations for infrastructure 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 ad valorem taxes, various types of bonds, service charges, connection fees, and system development charges. The following sections identify those local funding sources and financing mechanisms that are most common and appropriate for the improvements identified in this study.

9.2.1 General Obligation Bonds

A general obligation (G.O.) bond is backed 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) is sufficient to cover debt service.

Oregon Revised Statutes limit the maximum term to 40 years for cities. Except in the event that Rural Development Administration 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, their tax-exempt status, and their 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. Because the users of the water system pay their share of the debt load based on their water usage rates, the share of that debt is distributed in a fare and equitable manner.

Advantages of general obligation bonds over other types of bonds include:

- 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 and 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.

9.2.2 Ad Valorem Taxes

Ad valorem property taxes are often used as revenue source for utility improvements. Property taxes may be levied on real estate, personal property or both. Historically, ad valorem taxes were the traditional means of obtaining revenue to support all local governmental functions.

A marked advantage of these taxes is the simplicity of the system; it requires no monitoring program for developing charges, additional accounting and billing work is minimal, and default on payments is rare. In addition, ad valorem taxation provides a means of financing that reaches all property owners that benefit from a water system, whether a property is developed or not. The construction costs for the project are shared proportionally among all property owners based on the assessed value of each property.

Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits. In addition, the ability of communities to levy property taxes has been limited with the passage of Ballot Measure 5 and other subsequent legislation. While the impacts of the various legislative efforts are still unclear, capital improvement projects are exempt from property tax limitations if new public hearing requirements are met and an election is held.

9.2.3 Revenue Bonds

The general shift away from ad valorem property taxes and toward a greater reliance on user fees makes revenue bonds a frequently used option of 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 issue.

Many communities prefer revenue bonding, as opposed to general obligation bonding because it insures that no tax will be levied. In addition, 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 outside 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, track record in obtaining rate increases historically, 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 5% of the municipality's registered voters may cause the issue to be referred to an election.

9.2.4 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, but is 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 20 years in 40 semi-annual installments with interest. Cities and special districts are limited to improvement bonds not exceeding 3% 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 50% of the total assessments to be levied. As a result, a substantial cash payment is usually required by owners of undeveloped property. 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.

9.2.5 Capital Construction (sinking) Fund

Sinking funds are often established by budgeting 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 system development charges or serial levies.

A City may wish to develop sinking funds for each sector of the public services. The 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 a municipal budgeting process.

9.2.6 User Fees

User fees can be used to retire general obligation bonds, and are commonly the sole 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 applicable system. These fees are established by resolution and can be modified, as needed, to account for increased or decreased operating and maintenance costs.

User fees should be based on a metered volume of water consumption. Through metered charges, an equitable and fair system of recovering water system costs is used. Flat fees and unmetered connections should be avoided. Large water users should pay a larger portion of the water system costs. Through higher rates and metered billing, this can be accomplished.

9.2.7 Connection Fees

Most municipalities charge connection fees to cover the cost of connecting new development to water and wastewater systems. Based on recent legislation, connection fees can no longer be programmed to cover a portion of capital improvement costs.

9.2.8 System Development Charges

A system development charge (SDC) is essentially a fee collected as each piece of property is developed, and which 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 system development charges.

The Oregon Systems Development Charges Act was passed by the 1989 Legislature (HB 3224) and governs the requirements for systems development charges effective July 1, 1991. Two types of charges are permitted under this act: 1) improvement fees, and 2) reimbursement fees. 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 Systems Development Charges Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A capital improvement plan 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. However, revenue from the collection of SDCs can only be used to finance specific items listed in a capital improvement plan. The projects and costs developed in this Water System Master Plan may be used for this purpose. In addition, SDCs cannot be assessed on portions of the project paid for with grant funding.

9.2.9 Local Improvement District (LID)

A local improvement district (LID) or multiple LIDs can be formed by the City to be responsible for securing and repaying the debt. A LID incorporates property owners within a defined boundary who agree to fund all or a portion of an improvement project. LID projects are best suited for improvements that benefit a limited number of users rather than the entire system.

The City may be required to assist in the LID process through facilitation and administration of the project. Agreements should be prepared detailing who will pay for engineering and planning costs, administration costs, interim financing, and other costs related to a public works project.

The LID formation process requires public hearings, at which, a remonstrance (no vote) of two thirds of the influenced area can halt the process. A successful LID area would result in liens against the LID properties at the end of the project or a full payment from all or some of the property owners.

Disadvantages to a LID include the requirement of a significant amount of time and interest from the City if they choose to administer the LID. It is not uncommon to have some or many within the LID boundary that are opposed to the project. Those in opposition to the project must either rally enough support to derail the project or work for some other compromise. The political and administrative fall out is often borne by the City.

9.2.10 Assessments

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, the City may provide some improvements or services that directly benefit a particular development. The City may choose to assess the industrial or commercial developer to provide up-front capital to pay for the administered improvements.