CITY OF OAK HARBOR

ISLAND COUNTY, WASHINGTON

DRAFT WATER SYSTEM PLAN

G&O #13404
DRAFT MARCH 2014

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF OAK HARBOR

ISLAND COUNTY **WASHINGTON**

2013 WATER SYSTEM PLAN UPDATE

G&O #13404
DRAFT – MARCH 2014

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LIST OF ABBREVIATIONS

AAF	average annual flow
ac	acre
ACOE	Army Corps of Engineers
ADWF	average dry weather flow
AKART	all known, available, and reasonable technologies
avg.	average
BOD_5	5-day biochemical oxygen demand
BTU	British thermal units
$CaCO_3$	calcium carbonate
$CBOD_5$	5-day carbonaceous biochemical oxygen demand
CCWF	Centennial Clean Water Fund
cf	cubic feet
cfm	cubic feet per minute
CFR	Code of Federal Regulations
cfs	cubic feet per second
CFU	colony-forming units
CIP	Capital Improvement Projects
CM	construction management
CMU	concrete masonry units
COD	chemical oxygen demand
conc.	concentration
constr.	construction
CWA	Clean Water Act
cy	cubic yards
DMR	discharge monitoring reports
DNS	determination of non-significance
DO	dissolved oxygen
DOH	Department of Health
DT	dry tons
EA	each
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERU	equivalent residential unit
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
F/M	food-to-microorganism ratio
fps	feet per second
ft^2	square feet
FTE	full-time equivalent
gal.	gallons
gfd	gallons per square foot per day
GMA	Growth Management Act

LIST OF ABBREVIATIONS

gpad	gallons per acre per day
gpcd	gallons per capita per day
gpd	gallons per day
gpd/ft^2	gallons per day per square foot
gph	gallons per hour
gpm	gallons per minute
gpm/ft^2	gallons per minute per square foot
HDPE	high density polyethylene
HMI	Human-Machine Interface
hp	horsepower
HPA	Hydraulic Project Approval
HRT	hydraulic residence time
HVAC	heating, ventilation, and air conditioning
I/I	infiltration and inflow
in.	inches
kVA	kilovolt-amps
kW	kilowatt
kWh	kilowatt hour
lb	pounds
lb/cap/d	pounds per capita per day
lb/d	pounds per day
lb/ft^2/d	pounds per square foot per day
lf	linear foot
LS	lump sum
max.	maximum
MBR	membrane bioreactor
MDF	maximum day flow
mg	milligrams
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
misc.	miscellaneous
mJ/cm^2	millijoules per square centimeter (UV dose measurement)
ml	milliliters
MLSS	mixed liquor suspended solids
mm	millimeter
MM	maximum month
MMF	maximum month flow
MSL	mean sea level
N/A	not applicable
NEPA	National Environmental Policy Act
NH_3	ammonia-nitrogen
NMFS	National Marine Fisheries Service
NO_3-N	nitrate - nitrogen
NPDES	National Pollutant Discharge Elimination System

LIST OF ABBREVIATIONS

NR	not reported
NRCS	National Resource Conservation Service
NTU	nephelometric turbidity units
NWI	National Wetlands Inventory
OD	outside diameter
OFM	Office of Financial Management
O&M	operation and maintenance
PDF	peak day flow
PFRP	process to further reduce pathogens
pH	negative log hydronium ion concentration
PHF	peak hour flow
PHS	priority habitat and species
PLC	Programmable Logic Controller
PMAC	plan to maintain adequate capacity
P.S.	pump station
psi	pounds per square inch
PSRP	process to significantly reduce pathogens
PWTF	Public Works Trust Fund
Q	flow rate
RAS	return activated sludge
RCW	Revised Code of Washington
ROW	right-of-way
rpm	revolutions per minute
SBR	sequencing batch reactor
scfm	standard cubic feet per minute
SEPA	State Environmental Policy Act
SERP	State Environment Review Process
sf	square feet
S.F.	safety factor
SR	State Route
SRF	State Revolving Fund
SRT	solids retention time
SWD	side water depth
TBD	to be determined
TDH	total dynamic head
TKN	total Kjehldahl nitrogen
TMDL	total maximum daily load
TSS	total suspended solids
UGA	Urban Growth Area
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
UV	ultraviolet radiation
V	volts
VFD	variable frequency drive
VOC	volatile organic compounds

LIST OF ABBREVIATIONS

VS	volatile solids
VSS	volatile suspended solids
WAC	Washington Administrative Code
WAS	waste activated sludge
WDFW	Washington State Department of Fish and Wildlife
WT	wet tons
WWTP	wastewater treatment plant
µm	micrometer (micron)

EXECUTIVE SUMMARY

The City of Oak Harbor Water System Plan provides a planning strategy for the City's water utility over 6- and 20-year periods. The plan has been prepared consistent with Department of Health requirements as specified in the Washington Administrative Code (WAC) Chapter 246-290. The plan represents a commitment by the City to pursue and implement the Plan's recommendations and capital improvements.

PLAN SUMMARY

This Plan is divided into chapters, each of which discusses different aspects of the City's water system analysis. Individual chapter topics include:

- Chapters 1 and 2

  Background data, including a description of existing facilities, service area, service area policies, and projections of population and water use.

- Chapter 3

  Description of system design and water quality standards, and an analysis of water quality. This chapter also presents a source, storage, and booster station analysis.

- Chapter 4

  Distribution system analysis including hydraulic modeling summary and the basis for identification of distribution system improvements.

- Chapter 5

  Water use efficiency program which details conservation and efficient water use goals and measures.

- Chapter 6

  Discussion and recommendations for the City's Source Protection Plan.

- Chapter 7

  Water system operation and maintenance procedures.

- Chapter 8

  Capital Improvement Program

- Chapter 9

  Financial analysis and financing options for the recommended improvements.

- Appendix

  Supplementary and background documentation both required by DOH and used for the preparation of this Plan.

WATER SERVICE

The City's primary source of water is through the City of Anacortes, which extracts and treats water from the Skagit River. The City receives water through 24-inch and 10-inch transmission mains that extend from Sharpe's Corner down Highway 20 to the City. The City maintains three pump stations (Ault Field, Heller Street, and Redwing) which fill reservoirs and provide appropriate service pressure to its customers. The City maintains three storage reservoirs and construction of a fourth reservoir at Gun Club Road is nearly complete. The City also maintains three groundwater sources (Well No. 8, No. 9, and No. 11) which are used sporadically and do not represent a significant source of water for the City.

The City provides water to customers within the retail service area as well as to wholesale customers at Naval Air Station – Whidbey Island (NASWI), Deception Pass State Park, and the North Whidbey Water District.

The City's current (2013) retail service area population is approximately 18,778 people. The service area, which includes retail and wholesale customers, serves a total of 5,922 connections, which represents approximately 14,771 ERUs. The City anticipates a retail service area population of approximately 24,999 by 2033 and an estimated population of 31,074 at buildout.

HISTORICAL AND PROJECTED WATER PRODUCTION

The City maintains detailed records of water production and consumption and updates these files continuously. Since 2007, the City has reduced the overall water production and consumption. As the City's population continues to grow however, more water will be consumed. Historical and projected required production and consumption is shown in Table E-1.

TABLE E-1

Historical and Projected Water Production & Consumption

Year	Retail Service Area Population	Retail Service Area ERUs	Average Daily Consumption	DSL	Required Production		
					Average Daily (gpd)	Maximum Daily (gpd)(3)	Peak Hour (gpm)(4)
2013	18,778	8,700	1,305,000	80,030	1,385,000	2,493,000	2,839
2014	19,419	8,997	1,350,000	81,710	1,431,000	2,576,000	2,934
2015	19,835	9,190	1,378,000	82,800	1,461,000	2,630,000	2,995
2016	21,326	9,880	1,482,000	86,710	1,569,000	2,824,000	3,216
2017	22,053	10,217	1,533,000	88,610	1,621,000	2,918,000	3,323
2018	22,245	10,306	1,546,000	89,120	1,635,000	2,943,000	3,352
2019	22,440	10,396	1,559,000	89,630	1,649,000	2,968,000	3,380
2020	22,470	10,410	1,562,000	90,390	1,652,000	2,974,000	3,387
2021	22,667	10,502	1,575,000	91,600	1,667,000	3,000,000	3,417
2022	22,867	10,594	1,589,000	92,810	1,682,000	3,027,000	3,447
2023	23,068	10,687	1,603,000	94,020	1,697,000	3,055,000	3,479
2024	23,270	10,781	1,617,000	95,240	1,712,000	3,082,000	3,510
2025	23,475	10,876	1,631,000	96,460	1,728,000	3,110,000	3,542
2030	24,348	11,281	1,692,000	102,200	1,794,000	3,230,000	3,679
2033	24,999	11,582	1,737,000	106,000	1,843,000	3,318,000	3,779
2060	31,074	14,397	2,160,000	121,900	2,281,000	4,107,000	4,677

SYSTEM ANALYSIS

The analysis of the City's water system in this Plan evaluates whether the City's existing water system facilities are adequate to provide the current and projected water demands of the City's customers. Analysis in Chapter 3 – System Analysis concludes that:

- The City's existing groundwater use is significantly below its allowable instantaneous and annual water right;
- With the completion of the new North Reservoir which is projected for early 2014, the City will have adequate storage capacity for the water system;
- All three of the City's booster stations (Ault Field, Heller Street, and Redwing) provide adequate annual average, maximum day, and peak hour demand capacity; and
- The City is in compliance with all water quality and testing requirements and standards.

WATER USE EFFICIENCY

The Plan includes the City's Water Use Efficiency (WUE) program as required by the Water Use Efficiency Rule (WAC 246-290-800), which became active in 2007. The WUE rule requires additional planning, distribution leakage standards, and performance reporting aimed at conserving the State's water resources. The Rule requires that distribution system leakage, which includes loss of water through leaky pipes or unauthorized usage, remain at or below 10 percent based on a 3-year rolling average. Since at least 2007, the City has maintained a rolling 3-year average for distribution system leakage of less than 10 percent.

The City must also provide at least two quantifiable reduction goals in order to comply with the rule. The City's goals are to maintain distribution system leakage below 10 percent and to maintain per-capita water use at or below 64 gallons per day. To achieve these goals, the City actively investigates and monitors leakage, and promotes water conservation through advertising, rate structure, distribution of various flow reducing products (aerators, showerheads), and various other methods.

CAPITAL IMPROVEMENT PROGRAM

This Water System Plan contains a list of projects for the City's capital improvement plan through the 20-year planning period. A recommended schedule for projects within the 6-year planning period and estimated project costs are provided in Table E-2. More detailed project information is listed in Chapter 8 – Capital Improvement Program. These projects will help insure that the City is able to meet the short- and long-term water requirements for its customers.

TABLE E-2

Capital Improvement Project Summary

Construction Year	Project Number	Project Name	Estimated Cost (2013$)	Estimated Construction Cost
2014	S-2	Emergency Supply Study	$100,000	$100,000
	T-1	Cross City Transmission Main	$3,559,000	$3,559,000
	T-2	North-End Trunk Main: Phase I & II	$1,767,000	$1,767,000
	BS-1	Ault Field Booster Station Surge Protection Analysis	$208,000	$208,000
	BS-2	Ault Field Booster Station Pump Replacement	$86,000	$86,000
	PZ-3	East 384 Zone Development	$90,000	$90,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
2014 Subtotal			**$6,310,000**	**$6,310,000**

TABLE E-2 – (continued)

Capital Improvement Project Summary

Construction Year	Project Number	Project Name	Estimated Cost (2013$)	Estimated Construction Cost
2015	S-1	Well No. 9 Replacement	$236,000	$243,000
	S-3	Eastside Reservoir Demolition	$100,000	$103,000
	BS-3	North Booster Pump Station	$2,398,000	$2,470,000
	PZ-1	O'Leary Way Water Main	$599,000	$617,000
	PZ-2	North O'Leary Way Water Main	$511,000	$526,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
2015 Subtotal			**$4,344,000**	**$4,459,000**
2016	DS-1	NE Regatta Drive Pipeline	$116,000	$123,000
	PZ-4	West 384 Zone Development	$326,000	$346,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
2016 Subtotal			**$942,000**	**$969,000**
2017	T-4	24-Inch Transmission Line Investigation	$150,000	$150,000
	S-4	Emergency Supply Well	$301,000	$329,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
2017 Subtotal			**$951,000**	**$979,000**
2018	T-3	West 384 Zone Extension: Phase I	$2,678,000	$3,014,000
	DS-2	Glencoe Street Fire Flow Improvements	$936,000	$1,053,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
2018 Subtotal			**$4,114,000**	**$4,567,000**
>2019(1)	T-5	Westside Water Main Extension	$7,609,000	$9,086,000
	DS-3	SW 10th Court Pipe Replacement	$188,000	$224,000
	DS-4	SW 11th Court Pipe Replacement	$188,000	$224,000
	DS-5	Erin Park Main Road Extension	$578,000	$690,000
	DS-6	Erin Park Road Tie-In	$50,000	$60,000
	DS-7	Industrial Avenue Tie-In	$50,000	$60,000
	DS-8	Westside Reservoir Extension	$696,000	$831,000
	PZ-5	322 Zone Development	$485,000	$579,000
	T-6	Campbell Lake Main Replacement	$1,970,000	$2,352,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
>2019 Subtotal			**$12,314,000**	**$14,606,000**
6-Year Planning Period Total			**$16,661,000**	**$17,284,000**
20-Year Planning Period Total			**$28,975,000**	**$31,890,000**

FINANCIAL PROGRAM

The Plan contains information on the water utility's financial program, which suggest that the City is unable to maintain sufficient cash flow to fund all of the projected and recommended CIP projects. Given the aggressive project schedule and anticipated costs, this Chapter also suggests that the City will operate at an annual deficit for a majority of the 6-year planning period. However, these project estimates are in large part due to NASWI requirements or desires, and as such, it is anticipated that NASWI will assume a

large portion of the project costs, which should bring the City back to financial solvency. Table E-3 below summarizes the historical and projected financial information for the City's water utility fund.

TABLE E-3

Historical and Projected Financial Information

Parameter	2011	2013	2014	2015	2016	2017	2018	2019
Water Rates	$4,344,050	$4,360,000	$4,578,000	$4,682,660	$4,907,810	$5,106,540	$5,319,090	$5,531,980
Total Revenues	**$4,564,807**	**$9,832,700**	**$4,677,700**	**$4,785,360**	**$5,013,580**	**$5,215,480**	**$5,431,290**	**$5,647,550**
Professional Services	$27,243	$40,000	$869,000	$88,000	$10,000	$933,000	$197,000	$197,000
Capital Outlay	$738,965	$5,373,000	$5,087,400	$1,918,000	$--	$--	$2,142,000	$--
System Improvements	$1,138	$30,000	$590,000	$1,657,000	$854,000	$500,000	$1,490,000	$500,000
Total Expenditures	**$3,860,933**	**$9,072,661**	**$10,390,396**	**$7,620,410**	**$4,938,243**	**$5,627,587**	**$8,147,550**	**$5,143,253**
Annual Surplus/(Deficit)	**$703,874**	**$760,039**	**($5,712,696)**	**($2,835,050)**	**$75,337**	**($412,107)**	**($2,716,260)**	**$504,297**
End of Year Balance	**$4,693,094**	**$4,016,055**	**$4,016,055**	**$1,181,005**	**$1,256,342**	**$844,235**	**($1,872,025)**	**($1,367,728)**

CHAPTER 1

DESCRIPTION OF WATER SYSTEM

INTRODUCTION

In accordance with Washington Administrative Code (WAC) 246-290-100 and the Washington State Department of Health (DOH), water system plans need to be updated every 6 years or more frequently, if necessary, to reflect the current conditions of the water system. This Plan has been prepared to update the 2003 City of Oak Harbor *Water System Plan*, using the 2009 DOH Water System Design Manual and the 1997 DOH Water System Planning Handbook. Copies of the City's Water Facilities Inventory form, as well as Washington State DOH Project Approval Application and Submittal Forms are included in Appendix A.

This chapter includes background information and a brief system history, a summary of existing facilities, information on adjacent purveyors, service area agreements, summary of service area policies, and information on related planning documents used in the composition of this plan.

OWNERSHIP AND MANAGEMENT

The City of Oak Harbor (City) is a small, mostly residential community within Island County and located on Whidbey Island (Figure 1-1). The City operates a Group A municipal water system to deliver water to residential and commercial customers, as well as to the U.S. Naval facilities located north and east of the city limits. The City's operating permit color is green (as of June 2013), which indicates that the system is currently in compliance with all requirements.

The City's water system is officially designated by DOH records as the City of Oak Harbor public water system number 62650C.

The City is governed by a mayor and a seven-member city council. The City Administrator has ultimate responsibility for all water utility administration, engineering, operation and maintenance activities, and reports directly to the city council. Day-to-day operations are handled by the Operations Manager and the six-person water staff. Operation and maintenance of the water system is supervised by the Public Works Director, while engineering and administrative staff are supervised by the City Engineer. A more detailed discussion of water system responsibilities is included in Chapter 7 – Operation and Maintenance Program.

The City's current mailing address and contact information is:

City of Oak Harbor
865 SE Barrington Drive
Oak Harbor, Washington 98277

(360) 279-4500 (phone)
(360) 279-4507 (fax)

SYSTEM HISTORY AND BACKGROUND

The City of Oak Harbor was incorporated on May 14, 1915, and remained a small, agricultural community until the beginning of World War II in 1941. At that time, the U.S. Navy established Naval Air Station Whidbey Island (NASWI) adjoining the eastern city limits. The effect of the military installation significantly changed the nature of the community and increased the population of the City and adjacent areas on north Whidbey Island.

The original water system consisted of two wells and a small distribution system. In 1928, a 60,000-gallon elevated reservoir was installed. The 130-foot-high storage tank remained in service until it was dismantled in 1971.

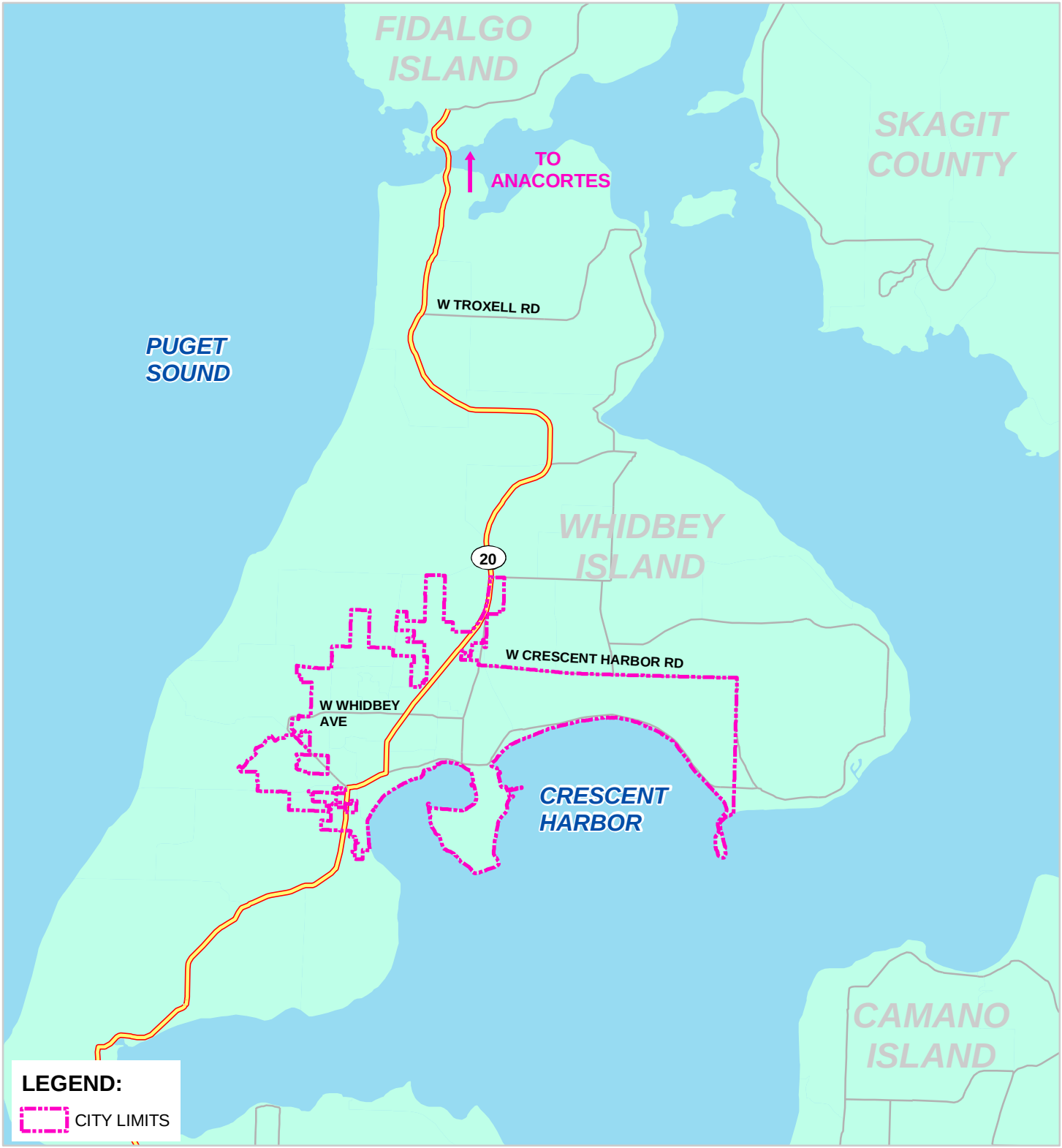
In 1942, the U.S. Navy constructed a 10-inch transmission main from the City of Anacortes (Anacortes) pipeline at Sharpe's Corner, which travels underneath the Deception Pass Bridge to the Ault Field facility to serve the then-growing needs of NASWI.

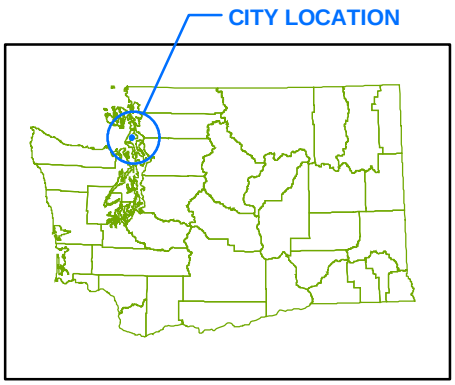
In 1949, Well 4 was drilled and the Eastside Reservoir, with a capacity of 270,000 gallons, was constructed. In 1959, the capacity of this reservoir was increased to 540,000 gallons. During the 1950s, Well 5 was acquired from the Navy, and Wells 6 and 7 were drilled to further increase the City's water supply.

In 1963, Westside Reservoir 1 was constructed near Heller Street with a capacity of 585,000 gallons. Four additional wells (8, 9, 10, and 13) were added to the system during the 1960s.

In 1970, Anacortes completed major improvements to their water supply and transmission system through construction of a new water treatment plant and 36-inch pipeline. Also, by 1970 the City's population had increased to 9,167 as a result of the annexation of the NASWI Seaplane Base and married housing areas.

In 1971, the City, Anacortes, and NASWI executed agreements for supply of water from Anacortes to the City and NASWI facilities. A new 24-inch transmission main was constructed (parallel to the existing 10-inch transmission main) jointly by the City and the U.S. Navy to convey water from Anacortes at Sharpe's Corner. At that point in time, NASWI became a wholesale water customer of the City. At the time of construction of the 24-inch transmission main, the City planned on using groundwater from Wells 8, 9,





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CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-1
LOCATION MAP

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and 11 as the primary source of water for City customers. Over time, however, the City's operational strategy shifted toward using water from Anacortes as a primary supply and water from Wells 8, 9, and 11 as auxiliary supply.

In 1973, the Navy granted a license to Oak Harbor to use the 10-inch transmission main in order to serve City customers as well as customers within the North Whidbey Water District (NWWD) and Deception Pass State Park (DPSP) facilities. The Ault Field Booster Station, which is owned and operated by the City and is located immediately north of the city limits at the termination of the 10-inch and 24-inch transmission mains, was constructed by the City in 1974.

In 1976, the Navy transferred ownership of the 10-inch main to the City, which then permitted service connections to the main on Fidalgo Island.

In 1979, the City renegotiated its contract with Anacortes and as a result transferred ownership of the 10-inch main from Sharpe's Corner to the Deception Pass Bridge to Anacortes.

In 1989, the City constructed the Heller Street Booster Station in order to boost domestic water pressure and provide necessary fire flows.

In 1991, the City modified and expanded the Ault Field Booster Station, which included converting two existing pumps to variable-speed models and installing two 700 gpm constant-speed pumps with solid-state starters.

In 2004, the City constructed the Redwing Booster Station in order to boost domestic water pressure and provide necessary fire flows.

A timeline of important dates regarding the current water system is outlined below.

- 1942 – 10-inch transmission main constructed
- 1949 – Eastside Reservoir constructed
- 1959 – Eastside Reservoir expanded
- 1963 – Westside Reservoir 1 constructed
  Wells 8 and 9 drilled
- 1970 – Anacortes 36-inch transmission main constructed
- 1971 – 24-inch transmission main constructed
- 1974 – Ault Field Booster Station constructed
- 1976 – Westside Reservoir 2 constructed
- 1977 – Well 11 drilled
- 1989 – Heller Street Booster Station constructed
- 1991 – Ault Field Booster Station expanded
- 2004 – Redwing Booster Station constructed
- 2010 – NASWI Crescent Elementary pipeline constructed

- 2012 – Gun Club Road Pipeline constructed
- 2013 – North Reservoir constructed

EXISTING SYSTEM

A schematic profile of the existing system components is shown on Figure 1-2 and a map showing the locations of existing water system features is shown on Figure 1-3. Each of the primary components of the existing water facilities is described in greater detail below.

Political boundaries which include the current city limits and current UGA are shown on Figure 1-4.

SERVICE AREA

In 2003, the Washington State Legislature enacted the Municipal Water Law (MWL) in order to give municipal water suppliers more certainty and flexibility with current and future water rights. The MWL also required municipal suppliers to use water more efficiently and to take steps in goal setting and documenting efforts to reduce water use. Part of the MWL requires the definition of specific service areas. These service areas are shown on Figure 1-5 and are discussed below.

Retail Service Area

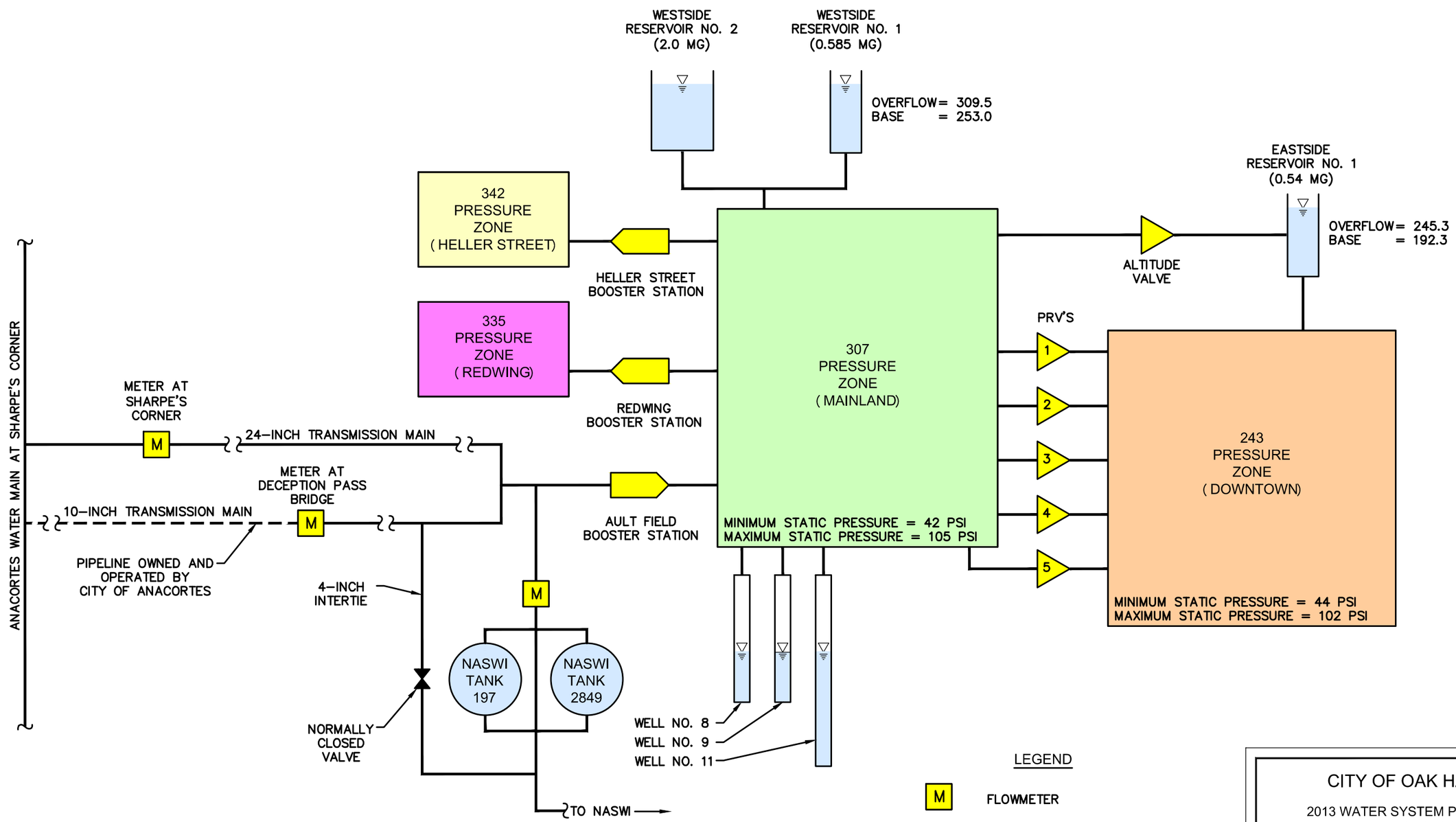
As part of the MWL, municipal water systems must define a retail service area. The retail service area is the specific area defined by the municipal water supplier where the municipal water supplier has a duty to provide service to all new service connections. This area must include the municipal water supplier's existing service area and may also include areas where future water service is planned if the requirements of RCW 43.20.260 are met. For the purposes of this plan, both existing and future retail service areas have been identified.

The existing retail service area includes a majority of the city limits (excluding NASWI property), while the future retail service area is defined as the UGA.

Wholesale Service Area

The City's wholesale service area includes the retail service areas shown on Figure 1-5 as well as its wholesale customers. The City's current wholesale customers include NASWI Ault Field, NASWI Seaplane Base, Deception Pass State Park, and the North Whidbey Water District.

There are currently no plans to expand the City's wholesale service area, but the City is open to providing water service to communities in need, provided a beneficial agreement can be reached. Possible communities include Penn Cove, isolated water systems north



NOTES:

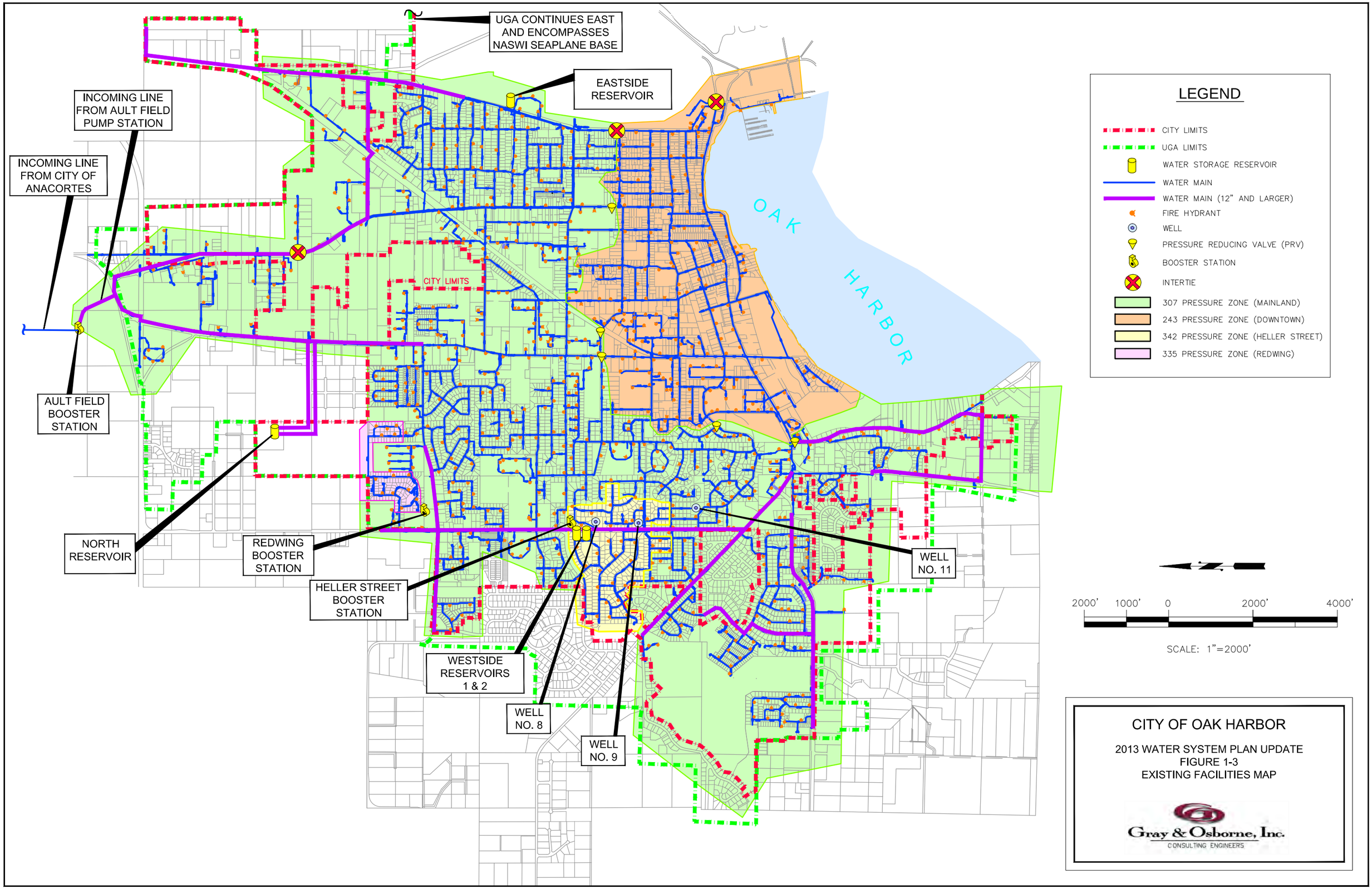
1. OAK HARBOR DATUM – NAVD88
2. MINIMUM SYSTEM PRESSURE AT SHARPE'S CORNER = 120 PSI

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-2
EXISTING FACILITIES SCHEMATIC DIAGRAM

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:\Oak Harbor\13404 - Water System Plan Update\FIGURES\Figure 1-2.dwg 12/12/2013 9:04:57 AM, DWG To PDF.pc3



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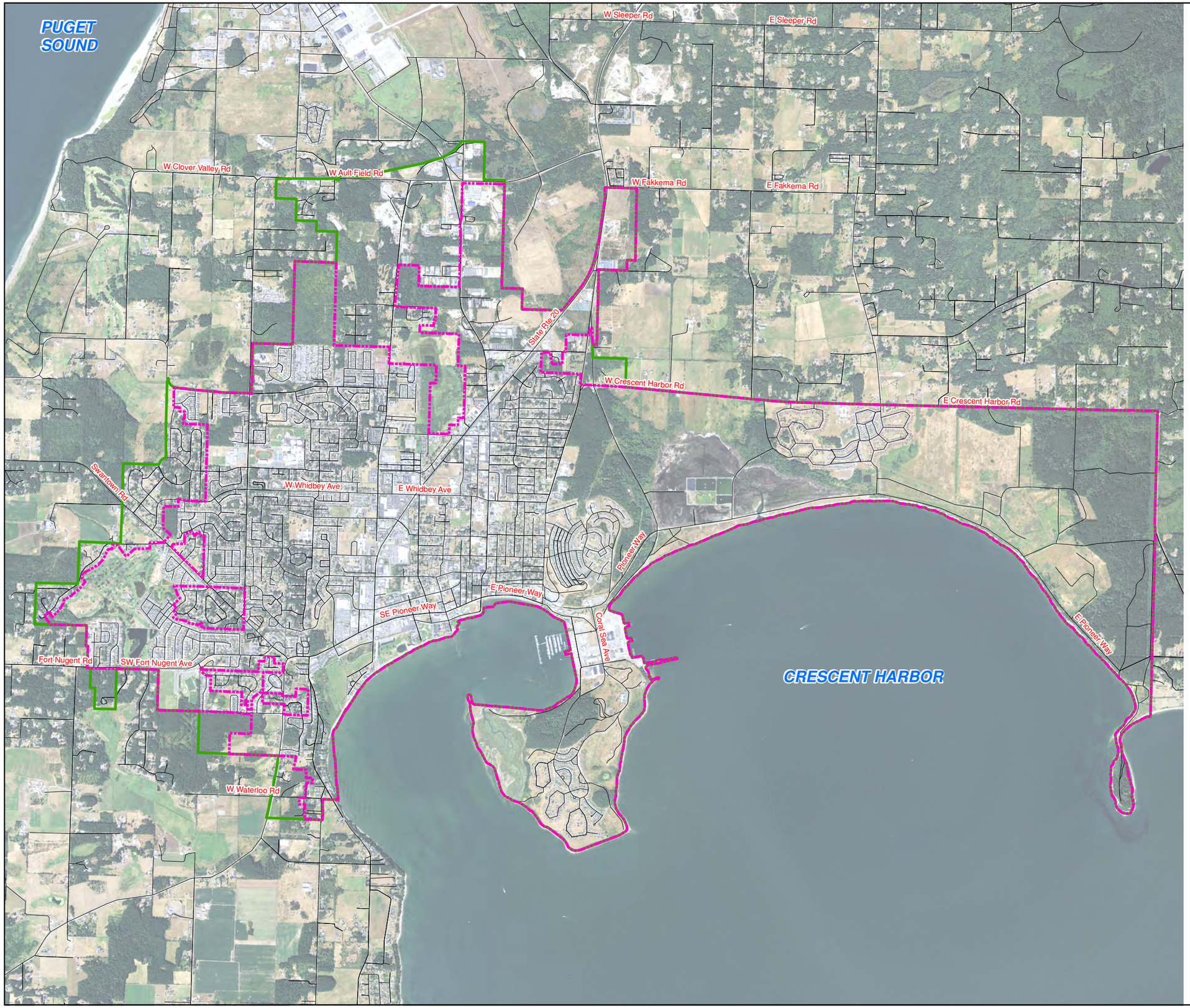

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LEGEND:

- CITY LIMITS
- URBAN GROWTH AREA
- STREETS / ROADS

DATA SOURCE: DEPARTMENT OF AGRICULTURE (USDA)

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-4
BOUNDARIES MAP

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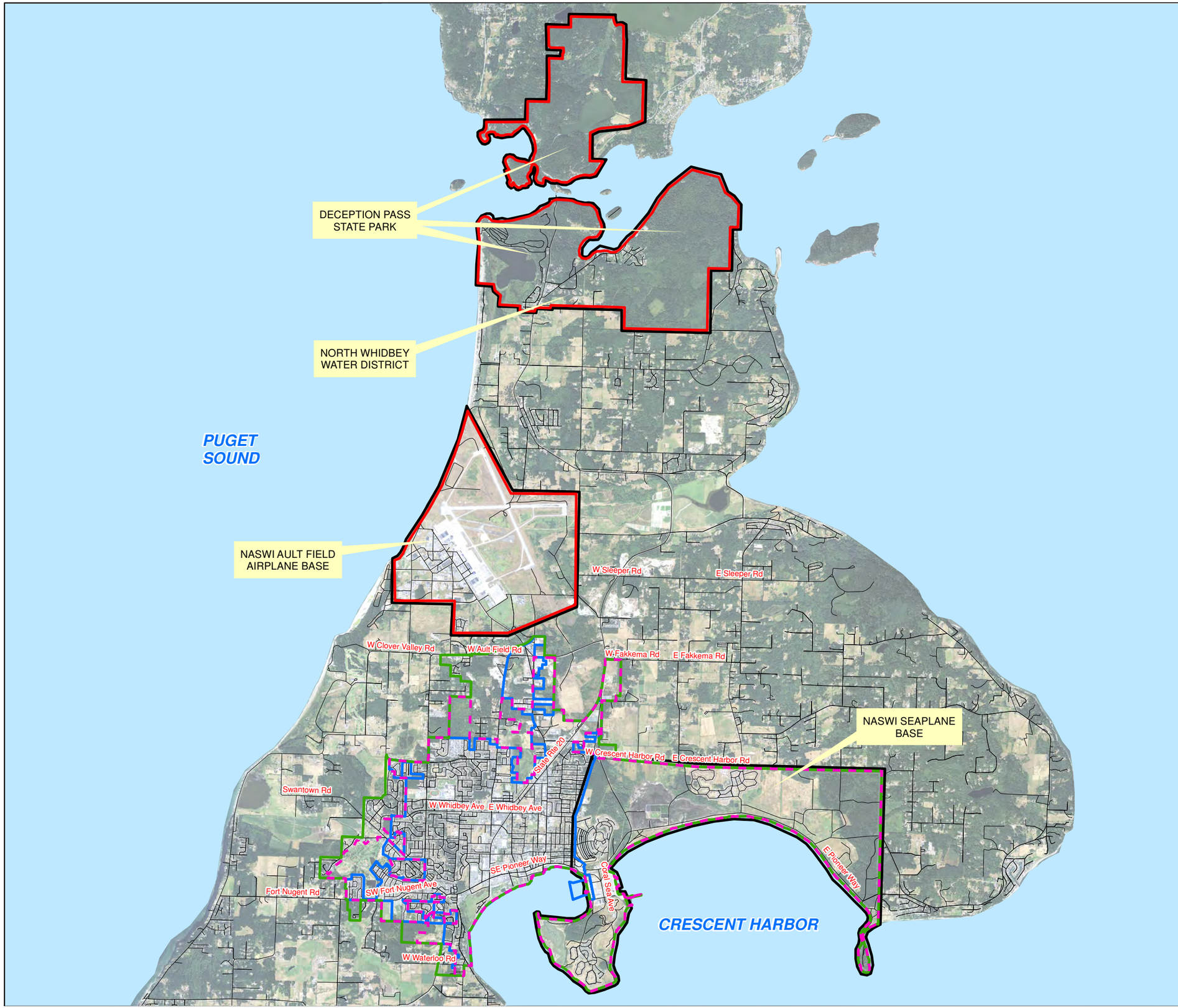

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LEGEND:

- CITY LIMITS
- EXISTING RETAIL SERVICE AREA
- EXISTING WHOLESALE SERVICE AREA
- URBAN GROWTH AREA
- FUTURE WHOLESALE SERVICE AREA

DATA SOURCE: DEPARTMENT OF AGRICULTURE (USDA)

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-5
SERVICE AREAS MAP

Gray & Osborne, Inc.

M:\Oak Harbor\13404 - Water System Plan Update\GIS\AERIAL_FIG1-5.mxd

of the City on Whidbey Island, and smaller water systems outside of the city limits. Some of these systems are described later in this chapter.

Future Service Area

Future service area is defined by DOH as the specific area where a municipal water supplier plans to serve. For the purposes of this planning effort, the future service area shall be defined as the future retail and wholesale service areas.

TRANSMISSION MAINS

The primary supply to the City's water system is from Anacortes. Each of the two transmission mains that deliver water to the City connect to a 36-inch transmission main owned and operated by Anacortes at Sharpe's Corner, which is located on Fidalgo Island. Water leaves the 36-inch transmission main and flows through a 12-inch meter owned and maintained by Anacortes into a 24-inch transmission main. The 24-inch main is ductile iron, generally follows Highway 20, and is owned, operated, and maintained by the City. As part of its water supply agreement with the U.S. Navy, however, the City is only responsible for 50 percent of the cost of major repairs or upgrades, while NASWI is responsible for the remaining half of the costs.

The second transmission main is an older, 10-inch main that parallels the 24-inch transmission main along Highway 20. Both the 10- and 24-inch mains are approximately 12 miles in length. The City owns, operates, and maintains the entire 10-inch transmission main south of the meter located immediately north of the Deception Pass Bridge and up to the Ault Field Booster Station.

Water from the 10-inch main is combined with the 24-inch main prior to entering the Ault Field Booster Station. The 10-inch transmission main is the primary service line for NWWD and DPSP, and also provides an alternative supply to the City as well as NASWI facilities. In recent years, because of its age as well as to address issues with water system service pressure, various sections of the 10-inch transmission main have been replaced with 16-inch transmission main piping. In total, approximately 7,000 linear feet of pipe have been upsized since 2006.

WATER SOURCE SUPPLY

Primary Supply – City of Anacortes

The City obtains approximately 99.7 percent of its potable water from Anacortes. The City is classified as a wholesale customer of the Anacortes water system and has a committed water volume (CWV) of 1 billion gallons (3,070 acre-feet) per year. Water is provided via the 24-inch and 10-inch transmission mains described above. Per the current water service agreement between the City and Anacortes, the water supply from Anacortes must be delivered to Sharpe's Corner (24-inch transmission main) and the

Deception Pass Bridge meter (10-inch transmission main). The current water service agreement also states the water from Anacortes must be delivered to the Sharpe's Corner connection point at a minimum of 120 pounds per square inch (psi).

Auxiliary Supply – Wells 8, 9, and 11

The City operates three wells, Wells 8, 9, and 11, which are controlled manually. The wells are operated as needed but are exercised monthly to ensure functionality and reliability. The City also has six other existing wells, Wells 4, 5, 6, 10, 12, and 13, which are no longer active.

Water quality testing is performed on Wells 8, 9, and 11 according to DOH requirements. The active wells draw water from the same aquifer, but are not designated as a wellfield by DOH due to the lack of a common withdrawal point.

The aquifer supplying the wells consists primarily of sand and gravel, interspersed with several thin lenses of clay. A single clay layer (confining layer) exceeding 30 feet thick is located immediately above the water-bearing strata.

Active groundwater source information is summarized in Table 1-1.

TABLE 1-1

Groundwater Source Summary

Parameter	Well 8	Well 9	Well 11
DOH ID	S11	S12	S14
Drilling Date	April 1961; Rebuilt in 2004	October 1961; Rebuilt in 2005	March, 1977; Modified in 2007
Overall Depth (ft)	250	258	255
Pump Depth (ft)	209	207	207
Pump Type	Byron Jackson turbine pump; 25 hp; 12-stage	U.S. Electric submersible pump motor; 25 hp; 13-stage	Grundfos submersible pump; 25 hp; 7-stage
Casing Diameter	8-inch	10-inch	8-inch
Average Flow (gpm)	160 gpm	50 gpm	160 gpm
Pumps To	307 Zone	307 Zone	307 Zone

Well 8

Well 8 (DOH ID S11) was drilled in 1961 and was rebuilt in January 2004. The base of the well is at a depth of 250 feet below grade, while water is drawn from the aquifer at a depth of approximately 209 feet below grade. The well pump consists of a 25-horsepower Byron Jackson Model 7 (12-stage) turbine pump capable of delivering

190 gpm at 300 feet of total head. The pump is enclosed within an 8-inch diameter casing. The current production of Well 8 is 160 gpm. Overall, the City believes that Well 8 is in fair condition. In the event of an emergency, auxiliary power to Well 8 is provided by an 80-kilowatt diesel generator. This generator provides auxiliary power for Wells 8 and 9 as well as the Heller Street Booster Station.

Well 9

Well 9 (DOH ID S12) was drilled in 1961 and was upgraded in October 2005. The base of the well is at a depth of 243 feet below grade and water is drawn from a depth of approximately 207 feet below grade. The well pump consists of a 25-horsepower U.S. Electric (13-stage) submersible pump capable of delivering 220 gpm at 300 feet of head. The pump is enclosed within a 10-inch diameter casing. The current production of Well 9 is 50 gpm. According to the City, this well is in poor condition and is scheduled for replacement in 2014. Auxiliary power for this well is provided by an 80-kilowatt diesel generator.

Well 11

Well 11 (DOH ID S14) was drilled in 1977 and was upgraded in March 2007. The base of the well is at a depth of 255 feet below grade and water is drawn from a depth of approximately 207 feet below grade. The well pump consists of a 25-horsepower Grundfos A15B70007 (7-stage) submersible pump capable of delivering 230 gpm at 294 feet of total dynamic head. The pump is encased within an 8-inch casing. The current production of Well 11 is 160 gpm. According to the City, this well is in good condition.

Auxiliary power for this well is provided by a 200 Wacker 70-kilowatt trailer-mounted diesel generator. In the event of a power outage, the trailer is mobilized to the site and connected to provide power to the well pumping equipment.

Inactive Groundwater Sources

As mentioned previously, the City has six additional wells (4, 5, 6, 10, 12, and 13) which are no longer active. Inactive wells have been capped with a concrete slab. In order to reactivate these wells, new casings, screens, pumping equipment, and treatment systems would be required for each well brought back into service.

WATER RIGHTS

The City holds water rights for 11 wells under its control, although only Wells 8, 9, and 11 are regularly exercised. These wells serve as an auxiliary supply only. Water right information for the City is summarized in Table 1-2 and is also included in Appendix B. Information about the City of Anacortes water rights is also summarized in Appendix B.

TABLE 1-2

Water Rights Summary

Certificate Number	Source Name	Priority Date	Instantaneous Withdrawal (gpm)	Annual Withdrawal (acre-feet/year)
Active				
G1-05901CWRIS-04114	Well 8 (S11)	04/10/1961	200	320
G1-08370CWRIS-06201	Well 9 (S12)	10/27/1966	450	720
G1-05858CWRIS-03967	Well 11 (S14)	03/06/1961	200	320
Total	**—**	**—**	**850**	**1,360**
Inactive				
20916PWRIS	Well 4	07/16/1973	160	256
G1-22778CWRIS (1)	Well 5	12/27/1976	180	290
00101PWRIS	Well 6	09/27/1971	400	640
20915PWRIS	Well 10	07/16/1973	100	160
20913PWRIS	Well 12	07/16/1973	500	800
20914PWRIS	Well 13	07/16/1973	300	480
Total	**—**	**—**	**1,640**	**2,626**
Claims				
G1-039420CL	—	01/01/1942	—	—

(1) This source is classified as "active," but is not regularly used so it is not included in the active withdrawal total.

Water Service Agreement

The City's primary source of supply is from Anacortes. The City's most recent Water Supply Agreement with Anacortes took effect on January 1, 2008. The agreement states that it will remain viable until December 31, 2027, and that once annually either party can request an amendment to or a negotiation of the agreement. The two cities typically negotiate the agreement every 3 years and update the committed annual water volume during that renegotiation. The current water supply agreement includes delivering a CWV of 1 billion gallons per year to the connection points at Sharpe's Corner (24-inch main) and Deception Pass (10-inch main). The agreement limits expansion of water service to 10 percent above the CWV without prior approval from Anacortes. Anacortes maintains water rights for the Skagit River, which is the original source for all water delivered to the City. Additional information regarding Anacortes water rights is available in the *City of Anacortes Water System Plan* (HDR, 2011).

The City also has agreements to provide water to NASWI, DPSP, and to the NWWD. Copies of these agreements are included in Appendix B.

RESERVOIRS

The City currently owns and operates three reservoirs that serve to distribute water to customers within the service area. The City recently completed construction of a fourth reservoir, which will be called the North Reservoir.

Eastside Reservoir

Eastside Reservoir is a steel standpipe with a height of 53 feet, a diameter of 41.5 feet, and a nominal storage volume of 540,000 gallons. Eastside Reservoir is in fair condition, but was constructed in 1949 without a foundation structure and sits directly on the soil beneath the tank. This design is unstable and does not meet current seismic design requirements. Retrofitting this tank to adhere to current seismic standards would be extremely expensive, and would reduce the maximum operating level to a point that would significantly reduce the functionality of the reservoir. Plans to address Eastside Reservoir are further discussed in Chapter 3 – System Analysis, and in Chapter 8 – Capital Improvement Program.

After construction of the North Reservoir, the City plans to abandon the Eastside Reservoir. Abandonment of the Eastside Reservoir was recommended in the *New Reservoir Project Predesign Report* (Gray & Osborne, 2009) due to the extremely high cost of seismic retrofits that would be required to fortify it.

Westside Reservoirs 1 and 2

Both Westside reservoirs are located along Heller Street just south of West Whidbey Avenue. Westside Reservoir 1 is in fair condition and is the smaller of the two steel design reservoirs with a storage volume of approximately 585,000 gallons. It has a height of 56.5 feet, a diameter of 42 feet, and was originally constructed in 1963.

Westside Reservoir 2 is the larger of the two storage facilities and is also a steel reservoir design. The reservoir is in fair condition and is 56 feet high and with a diameter of 78 feet. The reservoir was constructed in 1976 and has a nominal storage volume of 2 million gallons.

North Reservoir

The City developed plans and specifications for the construction of a new reservoir to be located near the end of Gun Club Road. The reservoir has a height of 39 feet, a diameter of 150 feet, a capacity of 4 million gallons, and is a welded steel design. The new reservoir has been constructed to address existing supply and water pressure issues, and to accommodate future growth and/or expansion by the City. The reservoir is fully constructed, but awaiting painting, and will be fully completed in 2014.

Existing reservoirs are summarized in Table 1-3.

TABLE 1-3

Reservoir Summary

Parameter	Westside Reservoir 1	Westside Reservoir 2	Eastside Reservoir	North Reservoir
Material of Construction	Steel	Steel	Steel	Welded Steel
Year of Construction	1963	1976	1949 (1)	2014
Height (ft)	56.5	56.5	53	39
Diameter (ft)	42	78	41.5	150
Total Storage Volume (MG)	0.585	2	0.54	4
Gallons per Foot	10,354	35,398	10,189	102,564
Overflow Elevation	307.6	307.6	247.1	327
Base Elevation	251.1	251.1	194.1	295

(1) This reservoir was expanded to its current size in 1959.

BOOSTER STATIONS

Information regarding the City's three existing pump stations is described fully below and is summarized in Table 1-4.

Ault Field Booster Station

The Ault Field Booster Station was originally constructed in 1974 but was expanded in 1991. The booster station is located within the Ault Field naval facility with restricted access. The booster station is in fair condition and has two 125-horsepower Aurora 6 x 8 x 18 Series 410 pumps equipped with variable-frequency drives (VFDs). The pumps are designed to deliver 1,380 gpm at 228 feet of head. The booster station also utilizes two 75-horsepower Worthington 5LR-15 constant-speed pumps which are designed to deliver 700 gpm at 228 feet of head.

The pumps are currently controlled by the water level in Westside Reservoirs 1 and 2. As the water level in these reservoirs drops, one variable-speed pump is started. Additional pumps are called to run if the water level continues to drop.

Presently, the two Worthington constant-speed pumps are not used to move water to the Westside reservoirs. City staff curtailed the use of these pumps shortly after construction because of high amperage. In 2011, tests conducted on these pumps demonstrated that at normal head conditions, the pumps were operating at 1,500 gpm and approximately 105 amps, which is well above the full-load amperage rating of 89 amps. In order to achieve the desired amperage, the pumps must be throttled to a flow of approximately 785 gpm. These inefficiencies led the City to cease operation of these two pumps and to investigate options for their replacement or modification. Replacement and modification alternatives, along with pump test results and other information, are discussed in the *Ault*

Field Booster Station Technical Memorandum (Gray & Osborne, 2011). This memorandum is available in Appendix C.

The booster station uses Motorola MoScad RTU telemetry software to relay information about the booster station operation status. This software and telemetry package was installed in 2000.

The booster station contains a dedicated 350-kilowatt diesel generator for auxiliary power. The generator is in good condition and is tested monthly for functionality.

Heller Street Booster Station

The Heller Street Booster Station was constructed in 1989 and is in fair condition. The station serves the 342 Zone (discussed later) and serves approximately 250 single-family equivalent residential units (ERUs) along the western edge of the city limits.

The booster station has two 7.5-horsepower U.S. Electric motors connected to two Weinman 2.5 x 3 x 12B constant-speed pumps. These pumps are designed to deliver 215 gpm at 90 feet of head. One of the two pumps runs continuously and a second pump is called to run when discharge pressure falls below 50 psi. The booster station provides domestic pressure only. Fire flows are met by gravity flow from the 307 Zone. A check valve opens and provides flow from the 307 Zone if pressure in the 342 Zone falls below that of the 307 Zone.

In 2000, a Motorola MoScad RTU telemetry system was installed.

The current auxiliary power source comes from an 80-kilowatt diesel generator, which is also shared with Wells 8 and 9. The generator is in good condition and is tested monthly for functionality.

Redwing Booster Station

The Redwing Booster Station was constructed in 2004 and remains in good condition. The station serves approximately 215 single-family and multifamily ERUs along the northern edge of the City. The booster station pumps water from the 307 Zone up to the 335 Zone.

The booster station has three 7.5-horsepower Aurora 341A Series domestic booster pumps, one 60-horsepower Aurora 360 Series pump used for fire flow, and one 2,200 gallon hydropneumatic pressure tank. The design flow for the domestic and fire flow pumps are 100 gpm at 112 feet of head and 1,800 gpm at 100 feet of head, respectively.

The booster station also includes a 100-kilowatt diesel generator for auxiliary power capable of powering all three pumps and the entire facility. The generator comes online

automatically when power from the grid is interrupted. The generator is in good condition and is tested monthly for functionality.

The station also uses Motorola MoScad RTU telemetry software to relay information about the booster station operation status.

TABLE 1-4

Booster Station Summary

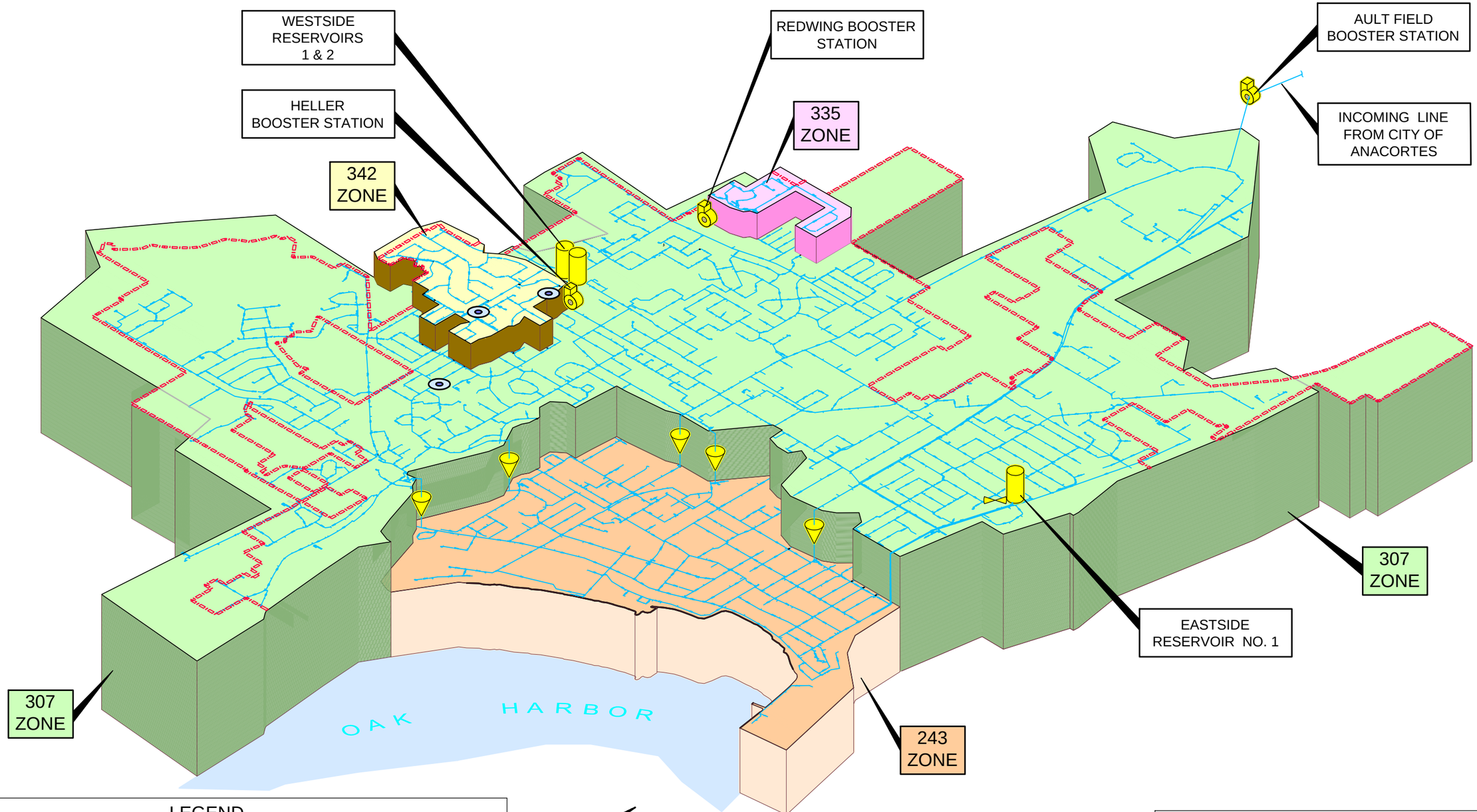
Parameter	Ault Field Booster Station	Heller Street Booster Station	Redwing Booster Station
Location	Forrestal Avenue (NASWI)	SW Heller Street Near SW 2nd Way	1137 Kathleen Drive
Year Built	1974; Modified 1991 and 2000	1989	2004
Overall Condition	Fair	Fair	Good
Number of Pumps	2 constant-speed; 2 with VFD	2 constant-speed	3 domestic; 1 fire flow
Pump Brand	Aurora 6 x 8 x 18 (VFD); Worthington 5LR-15 (constant)	Weinman 2.5 x 3 x 12B (U.S. Electric motors)	Aurora 341A (domestic); Aurora 360 (fire flow) (1)
Design Flow	1,380 gpm (VFD); 700 gpm (constant)	215 gpm	100 gpm (domestic); 1,800 gpm (fire flow)
Pumps To	307 Zone (2)	342 Zone	335 Zone
Telemetry	Motorola MoScad RTUs w/Wonderware	Motorola MoScad RTUs w/Wonderware	Motorola MoScad RTUs w/Wonderware
Auxiliary Power	350 kW Diesel Generator Set	80 kW Diesel Generator Set	100 kW Diesel Generator Set

(1) Redwing Booster Station also includes a 2,200-gallon hydropneumatic pressure tank.
(2) When reservoir construction is completed in 2014, the Ault Field Booster Station will then pump water to the North Reservoir.

PRESSURE ZONES

All the elevations listed throughout this plan are based on the NAVD 88 datum. Previous water system plans and water system construction documents prepared for the City are based on the NVGD 1929 datum plus 100 feet. Elevations based on the old datum can be converted to the current NAVD 88 datum by subtracting 96.24 feet.

The existing distribution system includes four pressure zones which are shown schematically on Figure 1-6. The Mainland Zone (HGL 307) is supplied by the Ault Field Booster Station and Wells 8, 9, and 11. The hydraulic gradient in the 307 Zone is determined by Westside Reservoirs 1 and 2 with an overflow elevation of



LEGEND

- 307 PRESSURE ZONE (MAINLAND)
- 243 PRESSURE ZONE (DOWNTOWN)
- 342 PRESSURE ZONE (HELLER STREET)
- 335 PRESSURE ZONE (REDWING)
- CITY LIMITS
- EXISTING WATER MAIN
- RESERVOIR
- BOOSTER STATION
- PRESSURE REDUCING VALVE
- ALTITUDE VALVE
- GROUNDWATER WELL

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-6
EXISTING PRESSURE ZONE SCHEMATIC

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CONSULTING ENGINEERS

M:\Oak Harbor\13404 - Water System Plan Update\FIGURES\Figure 1-6.dwg 12/12/2013 9:06:55 AM, DWG To PDF.pc3

307.6 feet above sea level. The 307 Zone serves elevations between 122 feet and 204 feet.

The Downtown Zone (HGL 243) is supplied by five pressure reducing valve stations from the 307 Zone and the Eastside Reservoir. The Eastside Reservoir is refilled via an altitude valve from the 307 Zone. The 243 Zone serves elevations between 0 feet and 145 feet.

The Heller High-Pressure Zone (HGL 342) is supplied by the Heller Street Booster Station. The hydraulic grade line for the zone is boosted to approximately 342 feet by the domestic supply booster pumps. The 342 Zone serves elevations between 180 feet and 250 feet.

The Redwing Pressure Zone (HGL 335) is supplied by the Redwing Booster Station. The hydraulic grade line for the zone is determined by the booster station and is approximately 335 feet. The 335 Zone serves elevations between 194 and 244 feet.

As part of the *New Reservoir Project Predesign Report* (Gray & Osborne, 2009), new pressure zone alignments were recommended in order to provide additional water system storage capacity and to address various reliability, pressure, and fire flow issues. The City is currently committed to the design and construction of projects identified in the predesign report that would create a new pressure zone scheme. Additional evidence and support for the creation of new pressure zone scheme is available in the predesign report.

New zones will include a 384 Zone and a 328 Zone. The 384 Zone will be divided into East and West components. The City is currently constructing a transmission main to create the East 384 Zone and has plans to construct a transmission main to create the West 384 Zone within the 6-year planning period.

The 328 Zone will be created as a result of construction of the North Reservoir and the future construction of a North Booster Station at the site of the new North Reservoir. The future pressure zone schematic is shown on Figure 1-7.

Projects regarding the creation of new pressure zones are described further in Chapter 3 – System Analysis, Chapter 4 – Hydraulic Analysis, and Chapter 8 – Capital Improvement Program.

PRESSURE REDUCING VALVES

The City has seven pressure reducing valve (PRV) stations which are summarized in Table 1-5. These stations provide the necessary decrease in system pressure between the 307 Zone and the 243 Zone.

TABLE 1-5

Pressure Reducing Valve Summary

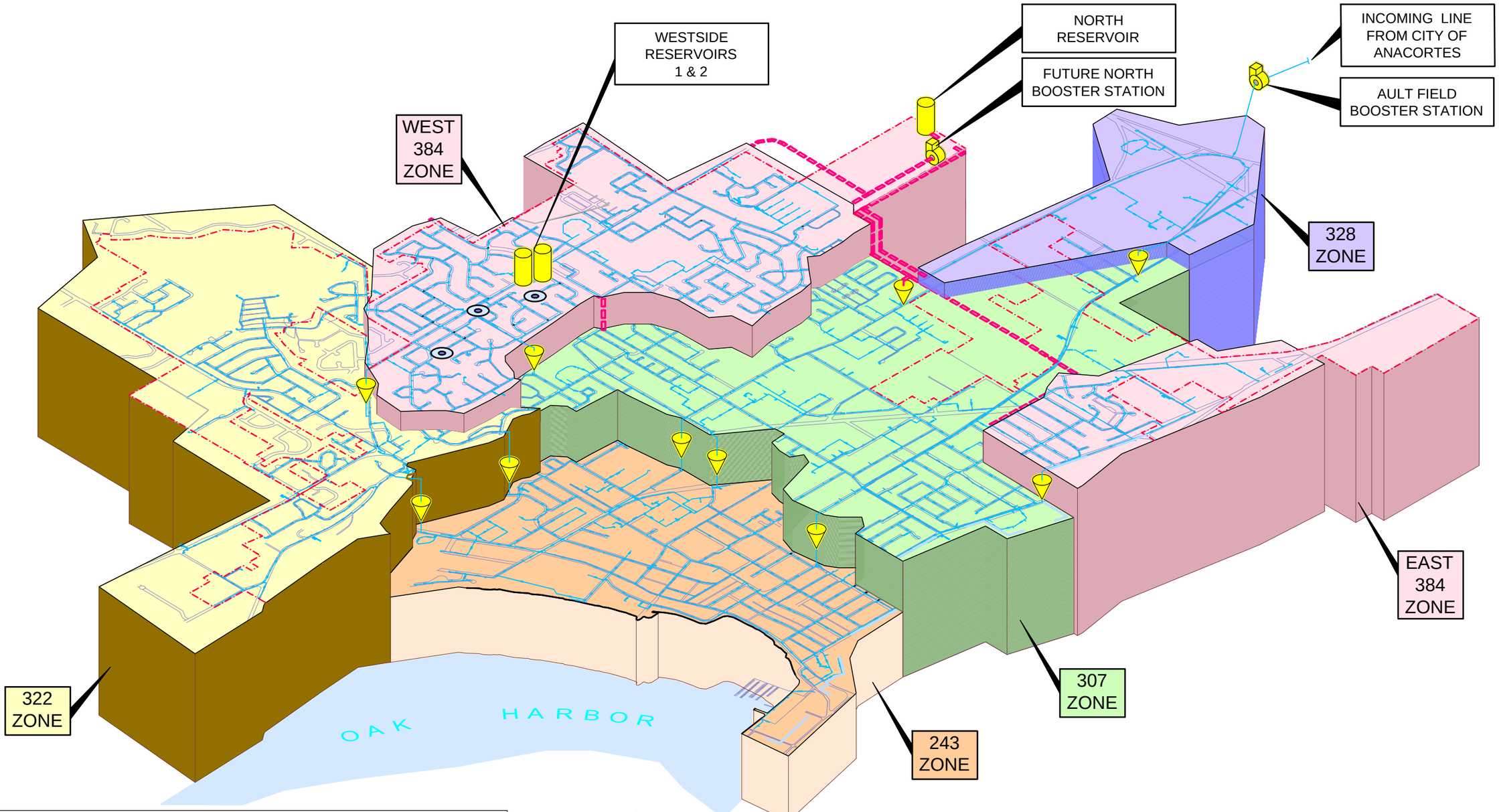
PRV Station Location	PRV Elevation (ft)	PRV Valve Size (in)	PRV Setting (psi)	Resulting Downstream HGL (ft)
Divides 307 Zone and 243 Zone				
SW 3rd Avenue and Oak Harbor Street	71.2	8-inch	71	236
		3-inch	76	247
SR 20 and SW Scenic Heights Street	84.3	8-inch	65	236
		3-inch	70	247
SR 20 and SE Cabot	61	8-inch	76	236
		4-inch	81	247
Midway and SE 4th Avenue	107.1	8-inch	56	236
		3-inch	61	247
SW Barrington Drive and Fleet Street	94.9	6-inch	61	236
		2-inch	66	247
Divides 384 Zone and 307 Zone				
Goldie Road	133.8	10-inch	69	293
		4-inch	74	305
Gun Club Road	132.8	10-inch	69	292
		4-inch	74	304

ALTITUDE VALVES

There is one 6-inch altitude valve at the Eastside Reservoir. The altitude valve is set at 240.4 feet (3 feet below the overflow). As the water level drops below this set point, the valve opens and fills the Eastside Reservoir from the 307 Zone.

DISTRIBUTION SYSTEM

The City currently maintains approximately 103 miles of distribution system piping. Pipe sizes range from 4 inches to 24 inches and are typically ductile iron, but some Class 900 PVC, Class 200 PVC, steel, and asbestos-cement pipes do exist. Water system distribution piping is summarized in Table 1-6.



LEGEND

- 307 PRESSURE ZONE
- 243 PRESSURE ZONE
- 384 PRESSURE ZONE
- 328 PRESSURE ZONE
- 322 PRESSURE ZONE
- CITY LIMITS
- RESERVOIR
- BOOSTER STATION
- PRESSURE REDUCING VALVE
- GROUNDWATER WELL
- EXISTING WATER MAIN
- PROPOSED WATER MAIN

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-7
FUTURE PRESSURE ZONE SCHEMATIC

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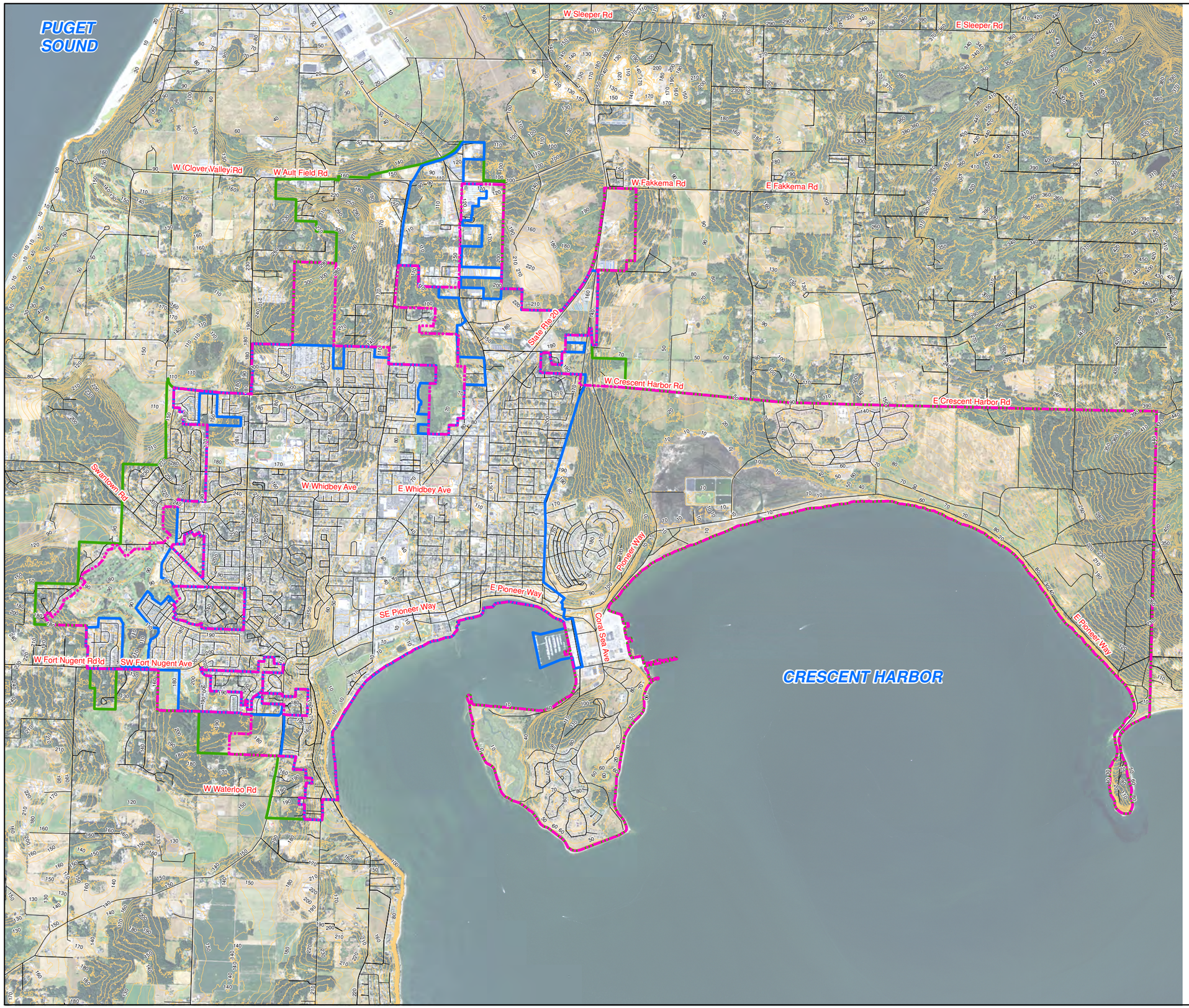

N

0 1,500 3,000 6,000 Feet

LEGEND:

- CITY LIMITS
- EXISTING RETAIL SERVICE AREA
- URBAN GROWTH AREA

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-8
TOPOGRAPHY MAP

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TABLE 1-6

Distribution System Piping Summary

Parameter	PVC	C 900	Asbestos Cement	Steel	Ductile Iron	Cast Iron	Total (feet)	Total (miles)	Percent of Total
4-inch	1,364	767	8,171	4,223	0	0	**14,525**	**2.8**	**3.1**
6-inch	32,488	1,477	41,331	5,863	324	46	**81,529**	**15.4**	**17.6**
8-inch	50,896	136,067	24,749	1,535	35,559	291	**249,097**	**47.2**	**53.9**
10-inch (1)	6,371	17,319	8,298	850	3,687	2,299	**38,824**	**7.4**	**8.4**
12-inch	9,100	25,987	2,480	150	19,967	68	**57,752**	**10.9**	**12.5**
16-inch	0	1,450	0	0	10,788	0	**12,238**	**2.3**	**2.6**
18-inch	0	0	0	0	7,042	0	**7,042**	**1.3**	**1.5**
24-inch (2)	0	0	0	0	1,067	0	**1,067**	**0.2**	**0.2**
Total (feet)	**100,219**	**183,067**	**85,029**	**12,621**	**78,434**	**2,704**	**462,074**	**87.5**	**—**
Total (miles)	**19.0**	**34.7**	**16.1**	**2.4**	**14.9**	**0.5**	**87.5**	**—**	**—**
Percent of Total	**21.7**	**39.6**	**18.4**	**2.7**	**17.0**	**0.6**	**—**	**—**	**—**

(1) The City also owns the 10-inch asbestos-cement transmission main south of Deception Pass Bridge. Total length under the City's ownership is 32,208 feet (6.1 miles).

(2) The City also owns the 24-inch ductile iron transmission main south of Deception Pass Bridge. Total length under the City's ownership is 32,208 feet (6.1 miles).

(3) The total length of each of the mains in (1) and (2) is 61,852 feet (11.7 miles).

GENERAL INFORMATION

The following section outlines general information regarding the City's water system and characteristics that can impact water use or water system facilities.

GEOGRAPHICAL INFORMATION

An aerial map of the City showing the city limits and associated UGAs is shown on Figure 1-4. The U.S. Navy owns and operates several large land areas near the City as part of NASWI. NASWI facilities include air strips, flight support operations, military housing, and various training and operations buildings.

Topography

Figure 1-8 shows topographical relief for the central Whidbey Island region. In general, the area is slightly higher in the western parts of the City, with a maximum elevation of 260 feet. There are regions of the city limits with elevations as high as 440 feet, but these are located at the far eastern boundary and are located on land used by NASWI. The landscape generally slopes gently down to sea level along the shores of Puget Sound. Areas with significant local slopes and grades include the southern shoreline as well as regions on the Oak Harbor peninsula.

Climate

The City experiences relatively mild weather due to its proximity to the Pacific Ocean and its location within the rain shadow of the Olympic Mountains. Because of these moderate conditions, the City does not experience significant temperature extremes or high precipitation. This is important primarily because extreme temperatures, especially high temperatures in the summer, can lead to high water demand by residential and irrigation customers. Monthly average temperature and precipitation values are shown graphically on Figure 1-9.

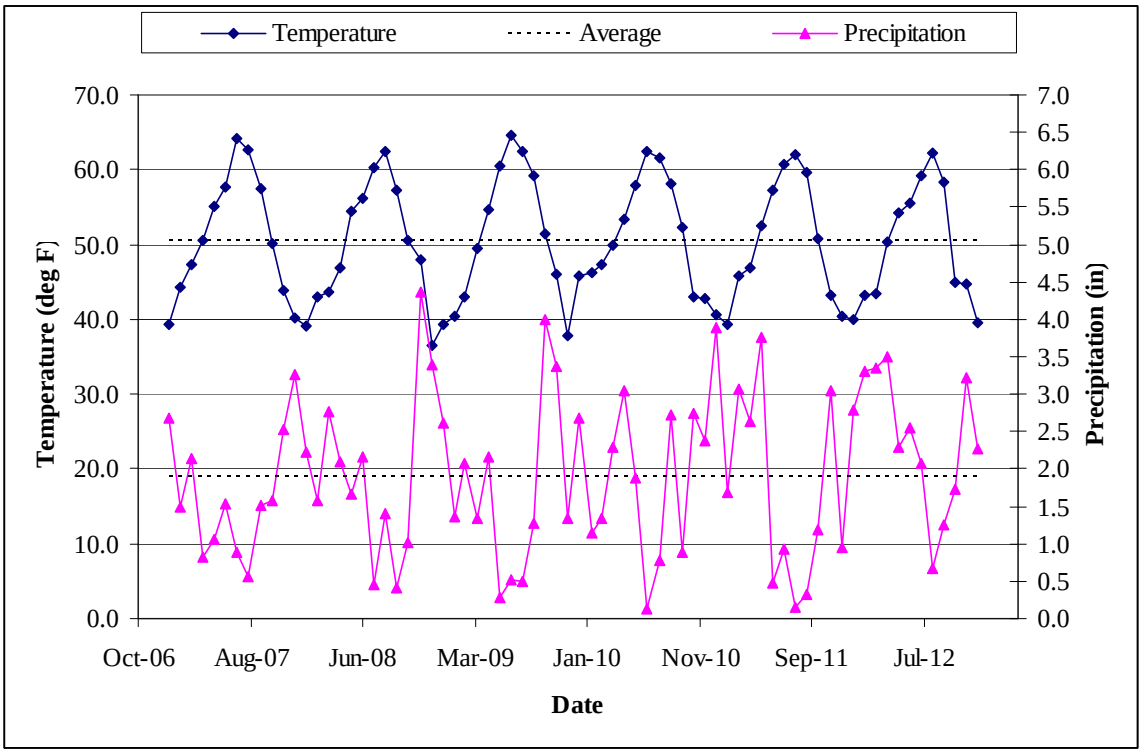
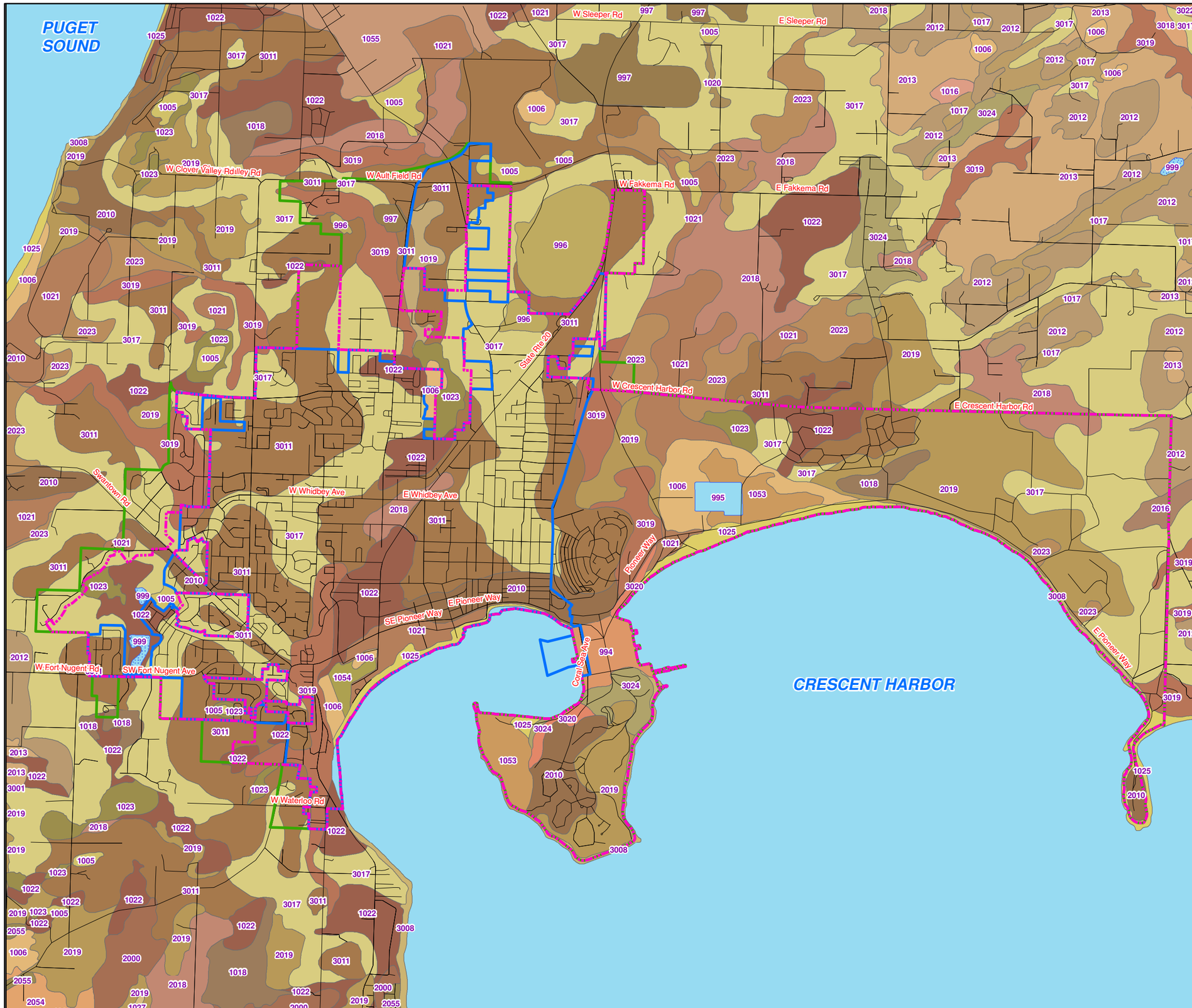


FIGURE 1-9

Historical Monthly Precipitation and Average Temperature

Soil

Figure 1-10 shows the approximate locations of various soil types within the City's UGA and surrounding areas. The majority of the City's service area is composed of loamy soils of the Coveland or Everett-Alderwood Complex, with slopes of less than 15 percent.



N

0 1,500 3,000 6,000 Feet

LEGEND:

- CITY LIMITS
- EXISTING RETAIL SERVICE AREA
- URBAN GROWTH AREA

SOILS DESCRIPTION:

- 3022 - Aquic Dystroxerepts-Oxyaquic Xerorthents complex, 15 to 70 percent slopes
- 1025 - Beaches-Endoaquents, tidal-Xerorthents association, 0 to 5 percent slopes
- 1023 - Coupeville loam, 0 to 3 percent slopes
- 1027 - Coupeville loam, prairie, 0 to 3 percent slopes
- 1018 - Coupeville-Mitchellbay, cool, complex, 0 to 5 percent slopes
- 1022 - Coveland loam, cool, 0 to 5 percent slopes
- 1026 - Coveland loam, prairie, 0 to 5 percent slopes
- 1053 - Dugualla muck, 0 to 2 percent slopes
- 996 - Dumps
- 2012 - Elwha-Zylstra-Morancreek, cool, complex, 2 to 12 percent slopes
- 3018 - Everett sandy loam, 15 to 40 percent slopes
- 3011 - Everett-Alderwood complex, 0 to 5 percent slopes
- 3019 - Everett-Alderwood complex, 15 to 40 percent slopes
- 3017 - Everett-Alderwood complex, 3 to 15 percent slopes
- 3001 - Hoypus sandy loam, 3 to 25 percent slopes
- 3024 - Indianola loamy sand, 3 to 15 percent slopes
- 3020 - Indianola loamy sand, 8 to 25 percent slopes
- 2019 - Mitchellbay gravelly sandy loam, cool, 2 to 10 percent slopes
- 1019 - Morancreek, cool-Limepoint complex, 0 to 5 percent slopes
- 1016 - Orcas peat, 0 to 2 percent slopes
- 997 - Pits, gravel
- 1054 - Puget silty clay loam, 0 to 2 percent slopes
- 1006 - Semiahmoo muck, 0 to 2 percent slopes
- 1005 - Shalcar muck, 0 to 2 percent slopes
- 1020 - Sholander, cool-Limepoint complex, 0 to 8 percent slopes
- 1021 - Sholander, cool-Spieden complex, 0 to 5 percent slopes
- 2018 - Sucia loamy sand, cool, 2 to 10 percent slopes
- 2023 - Sucia-Sholander complex, cool, 2 to 15 percent slopes
- 994 - Urban Land
- 1055 - Urban Land-Coupeville-Coveland, cool, complex, 0 to 5 percent slopes
- 995 - Water
- 999 - Water, fresh
- 2000 - Whidbey gravelly loam, 3 to 15 percent slopes
- 2010 - Whidbey-Hoypus complex, 2 to 15 percent slope
- 3008 - Xerorthents-Endoaquents, tidal association, 0 to 100 percent slopes
- 2016 - Zylstra-Alderwood complex, 3 to 30 percent slopes
- 1017 - Zylstra-Frostad complex, 0 to 3 percent slopes
- 2013 - Zylstra-Frostad complex, 0 to 8 percent slopes
- 2054 - Zylstra-Mitchellbay, cool, complex, 0 to 5 percent slopes
- 2055 - Zylstra-Mitchellbay, cool, complex, 2 to 10 percent slopes

DATA SOURCE: DEPARTMENT OF AGRICULTURE (USDA)

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-10
SOIL CLASSIFICATION MAP

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Sensitive Areas

There are various types of sensitive areas within the City's UGA. These are areas that would require special consideration in the case of new development for water system infrastructure. The sensitive areas most applicable to the City are described below.

Erosion Hazard Areas

Erosion hazard areas are areas which are highly susceptible to erosion when disturbed. As such, these are also areas that may not be suited for development or the installation of infrastructure components such as booster stations or water piping. Erosion hazard areas are combined with other similar sensitive areas as a group of geologically sensitive areas addressed in Chapter 20.28 of the Oak Harbor Municipal Code (OHMC). Within the City, these areas include shorelines and areas along the southern edges of the city limits.

Landslide Hazard Areas

Landslide hazard areas are areas prone to unstable behavior due to steep slopes, lack of vegetation, or unconsolidated soils, and include areas potentially subject to risk of land movement due to a combination of geologic, topographic, and hydrologic factors. Specific buffer regions and building setbacks apply to any development that abuts or contains these areas; however, setbacks may be reduced as the result of special studies. As with erosion hazard areas, landslide hazard areas are one of the geologically sensitive areas addressed in Chapter 20.28 of the OHMC. With regard to water systems, these development regulations can affect the amount of buildable area and/or reduce the potential risk for landslides and mass wasting that could impact water infrastructure and natural resources. Landslide areas for the City also include shorelines and areas along the southern edges of the city limits.

Seismic Hazard Areas

Seismic hazard areas are those with low-density soils that are more likely to experience greater damage due to seismic-induced subsidence, liquefaction, ground shaking, or landslides. Seismic hazard areas are regulated with regard to public safety and the potential mass wasting that might occur during an earthquake. Any water source, storage, or distribution facility within these areas must be designed to minimize risk of harm from earthquakes or other seismic activity. These areas are of particular concern for the City due to the presence of the Strawberry Point and Utsalady Faults that run from east to west across the north side of the City, and areas with a high potential for liquefaction such as the Oak Harbor peninsula. Seismic hazard areas are shown on Figure 1-11.

Flood Hazard Areas

Flood hazard areas are regions adjacent to lakes, rivers, streams, or other water bodies prone to flooding during high rainfall and runoff periods. These areas require special attention due to the sensitive ecosystems associated with them and the potential damage to any buildings or other facilities built within the floodplain. Flooding information and flood hazard areas are addressed in Chapter 17 of the OHMC. Figure 1-11 shows the areas within Oak Harbor that are particularly susceptible to flooding.

Wetlands

Wetlands are defined in WAC 173-22-030(10) as areas that are inundated or saturated by surface or ground water for sufficient time to support vegetation typically adapted for life in saturated soils. The OHMC addresses wetlands in Chapter 20.24. These areas support valuable and complex ecosystems and consequently, development in these areas is highly restricted. The National Wetlands Inventory maps, as well as those on file with Island County identify several wetlands within and near the city limits. These areas are shown on Figure 1-11.

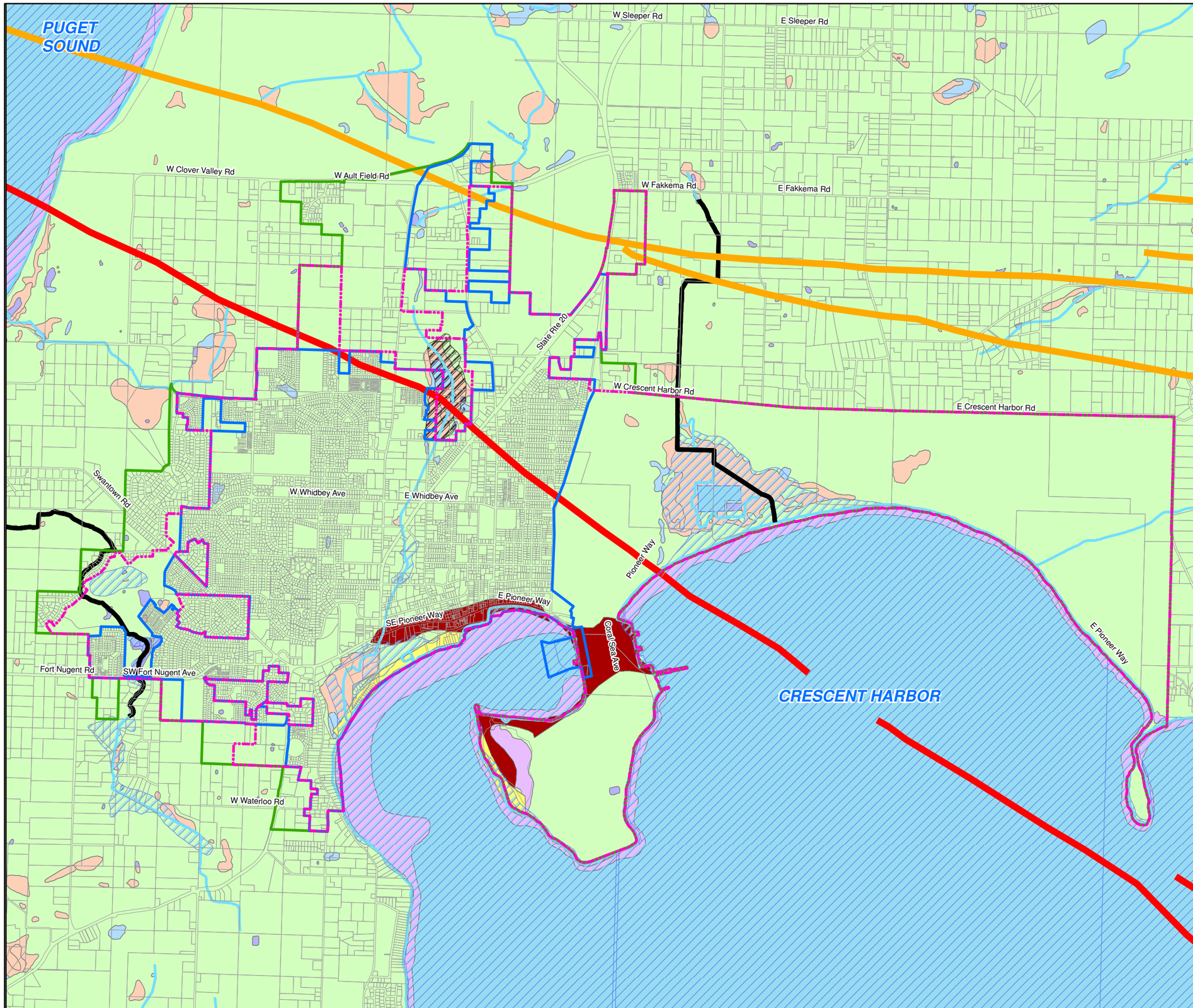
There are specific buffers and allowable alterations for development within a designated wetland area. There are also requirements for special studies and determinations to be performed to identify and classify wetlands. In general, Island County does not allow development in regulated wetlands; however, if development and/or its impacts are unavoidable, then mitigation measures are required.

Water Bodies

Lakes, streams, and other water bodies are classified as sensitive areas due to the variety of plants and animals they support. These plants and animals can often be a source of income or livelihood for local economies, and protecting them is a high priority to both DOH as well as the Washington State Department of Ecology (Ecology). The City has designated corridor zones which are planning areas with variable width setbacks from the ordinary high-water mark elevation of the stream or water course, from the top of the bank or dike, if applicable. Figure 1-11 shows the sensitive water bodies surrounding the City.

Fish and Wildlife Habitat

Fish and wildlife habitat is defined as areas which meet the definition of a “Fish and Wildlife Habitat Critical Area” pursuant to WAC 365-190-080(5) as well as Chapter 20.25 of the OHMC. A proposed activity within 300 feet of these areas requires that a habitat assessment be prepared. This assessment is circulated to all appropriate agencies for review. After review, a Habitat Management Plan may be required to address the project’s potential impacts, provide background information on the affected species, and recommend protection and mitigation measures. After project



N

0 1,500 3,000 6,000 Feet

LEGEND:

- CITY LIMITS
- EXISTING RETAIL SERVICE AREA
- URBAN GROWTH AREA

SEISMIC FAULTS:

- STRAWBERRY POINT
- UTSALADY POINT
- PARCELS

FISH & WILDLIFE HABITAT:

- FISH DISTRIBUTION
- STREAMS

POTENTIAL LIQUEFACTION AREAS:

- MODERATE
- HIGH

WETLANDS:

- ESTUARINE AND MARINE WETLAND
- FRESHWATER EMERGENT WETLAND
- FRESHWATER FORESTED/SHRUB WETLAND
- FRESHWATER POND
- WATER
- OTHER
- RIVERINE

FEMA FLOOD ZONES:

- AREA INUNDATED BY 100 YEAR FLOODING, FOR WHICH NO BFE'S HAVE BEEN ESTABLISHED
- AREA INUNDATED BY 500 YEAR FLOODING; AN AREA INUNDATED BY 100-YEAR FLOODING WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; OR AN AREA PROTECTED BY LEVEES FROM 100 YEAR FLOODING

DATA SOURCE: DEPARTMENT OF NATURAL RESOURCES (DNR)

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-11
SENSITIVE AREAS MAP

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implementation, an assessment of the project's success with regard to sustaining critical fish and wildlife species habitat is required. The City is home to a variety of protected and at-risk species, including bald eagle, harlequin duck, heron species, geoduck and other shellfish areas, as well as eelgrass beds. Some of these fish and wildlife habitat conservation areas are shown on Figure 1-11.

Critical Aquifer Recharge Areas

These areas are discussed in Chapter 20.32 of the OHMC. They are defined as areas which have a critical recharging effect on local aquifers used to supply potable water. These areas are regulated by the City and have limitations on the development and activities on land directly above the critical aquifer. Restricted activities typically involve hazardous chemical storage or other industrial use which may introduce harmful chemicals into the environment. Critical aquifer recharge areas (CARA) are shown on Figure 1-12.

Archaeological Areas

Whidbey Island and the area incorporated by the City are known to have been populated by southern Northwest Coast Salish people prior to arrival of European settlers. The City was an important site to these people and evidence of their lives and culture are continually present Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of their undertakings on historic properties that are included in or meet the criteria for listing on the National Register of Historic Places. Historic properties may include archaeological sites, buildings, structures, districts, or other objects. Regulations implementing Section 106 encourage maximum coordination with the environmental review process required by the National Environmental Protection Act and with other statutes. Under the auspices of the National Historic Preservation Act, the City is required to consult with the Department of Archaeology and Historic Preservation, the Swinomish Indian Tribal Community, the Stillaguamish Tribes of Indians, Samish Indian Nation, the Tulalip Tribes, local governments, and members of the public to resolve potentially adverse effects from development activities.

The City is also subject to relevant state laws addressing archaeological sites and Native American burials. The Archaeological Sites and Resources Act prohibits knowingly excavating or disturbing prehistoric and historic archaeological sites on public or private land. The Indian Graves and Records Act prohibits knowingly destroying American Indian graves and provides that inadvertent disturbance through construction or other activity requires re-interment under the supervision of the appropriate Indian Tribe. The Archaeological Site Public Disclosure Exemption ensures that records, maps, and other information identifying the location of archaeological sites are exempt from disclosure in order to prevent looting or depredation of cultural resources.

As most water system infrastructure is buried underground, disturbing archaeological resources is possible any time excavation is done to maintain, repair or extend the City's water facilities. The City has implemented several policies intended to prevent adverse effects on cultural resources by underground utility installation and maintenance. The first step is a staff review of development and utility permit applications. Applications for work that includes ground-disturbing activities in the public right-of-way are assessed by staff for risk of disturbance of resources. Some applicants are required to conduct archaeological surveys prior to excavating and may be required to employ an archaeologist to monitor excavation while it is occurring. All applicants are provided with a copy of the City's Inadvertent Discovery Protocol ("Protocol"). The Protocol includes descriptions and photographs of common artifacts and instructions for contacting appropriate authorities and City staff should artifacts be found. A copy of the Protocol is included in Appendix D.

SYSTEM INFORMATION

INTERTIES

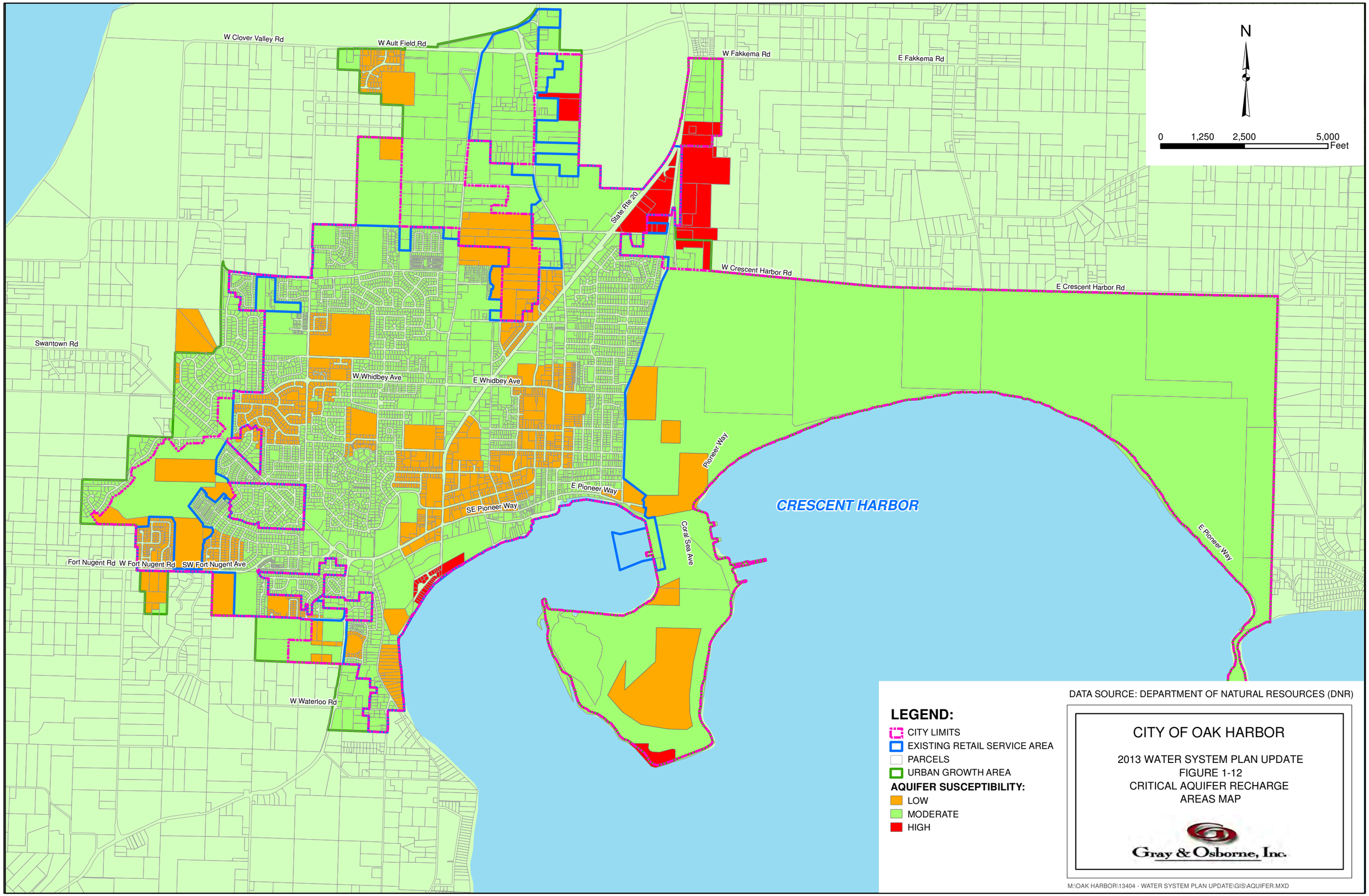
The City currently has four interties with the NASWI water system. These interties provide added reliability for both water systems and are for emergency use only and there is no exchange of water during normal system operation. None of the interties contain check valves and flow may go to or from either the City or NASWI. The direction of flow would depend on the current hydraulic grade line, reservoir levels, and Ault Field Booster Station pump status. All interties are controlled by valves normally kept closed. Interties are located as follows:

- A 12-inch intertie along Goldie Street north of NE 16th Street,
- A 10-inch intertie on Regatta Drive south of East Whidbey Street,
- A 6-inch intertie at the Skagit Valley College campus, and
- A 4-inch intertie near NASWI Building 197.

NASWI water use is recorded directly by meter readings at a facility adjacent to the Ault Field Booster Station (Figure 1-2). The City owns all piping, valves, and meters through the meter directly upstream of NASWI Tank 197 and Tank 2849, and NASWI owns and operates all piping and appurtenances on the downstream side of this meter.

WHOLESALE CUSTOMERS

The City provides wholesale water service to NASWI, which is a Group A community water system located both within and outside the city limits. According to DOH records, this water system currently has 1,900 connections. The water system operates two wells at depths of approximately 190 feet with capacities of 64 gpm and 100 gpm, but receives a majority of its potable water from the City as part of a wholesale customer agreement. Additional information on the NASWI water system is available in the 2008 *NASWI Water System Plan* (KPFF, 2008).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E Crescent Harbor Rd
Swantown Rd
W Whidbey Ave
E Whidbey Ave
Pioneer Way
E Pioneer Way
SE Pioneer Way
CRESCENT HARBOR
Coral Sea Ave
E Pioneer Way
Fort Nugent Rd
W Fort Nugent Rd
SW Fort Nugent Ave
W Waterloo Rd
DATA SOURCE: DEPARTMENT OF NATURAL RESOURCES (DNR)
LEGEND:
CITY LIMITS
EXISTING RETAIL SERVICE AREA
PARCELS
URBAN GROWTH AREA
AQUIFER SUSCEPTIBILITY:
LOW
MODERATE
HIGH
CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-12
CRITICAL AQUIFER RECHARGE
AREAS MAP
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The City also provides water to the North Whidbey Water District (NWWD) via a direct connection to the 10-inch transmission main. The NWWD is a small Group A water system immediately south of Deception Pass along Highway 20 (Figure 1-1). The system maintains 22 of an approved 26 allowable connections. It is estimated that the District serves a population of 568 people, which is approximately 97 percent non-residential.

The City provides water to the Washington State Parks Commission – Deception Pass State Park from a direct connection off the 10-inch transmission main immediately south of the Deception Pass Bridge (Figure 1-1). This park serves a small number of permanent residents who maintain the facilities, as well as a large number of seasonal State Park users. Facilities include showers, restrooms, drinking water faucets, and a visitor center for day- or overnight-use visitors.

ADJACENT AND NEIGHBORING PURVEYORS

The City is in close proximity to a number of small and medium Group A water systems that serve communities around the City. These water systems are briefly described below, are summarized in Table 1-7, and their approximate locations are shown on Figure 1-13. In general, the systems listed below are in adequate condition and do not exhibit any significant water quality issues. Although the City is not interested in proactively seeking system consolidation at this time, they are amenable to system consolidation, depending on financial and scheduling considerations. System consolidation based on a water quality need is often subject to extremely favorable financial terms for capital projects required to bring the system up to City design standards and the City may wish to work with DOH in the event that a system is in need of consolidation.

Bayview Estates Water Company

The Bayview Estates Water Company water system is a Group A community water system located on the eastern side of the City outside of the city limits and outside the UGA. This water system currently serves 81 of a possible 96 connections to an estimated population of 227 people. The water system operates two wells at a depth of approximately 380 feet, with capacities of 55 gpm and 58 gpm. The distribution capacity of this water system is 44,000 gallons and the system is treated with sodium hypochlorite. The Bayview Estates Water Company water system has no recent significant water quality issues; however, it has had issues with the presence of coliforms as recently as October 2008.

Bets Water System

The Bets water system is a Group A community water system located on the north side of the City outside of the city limits but within the UGA. This water system currently serves 29 connections to an estimated population of 50 people, but appears from land use

and aerial maps to be commercially based. The water system operates a single well at a depth of approximately 78 feet with a capacity of 30 gpm. The distribution capacity of this water system is unknown and the system does not treat its water. The Bets water system has no recent significant water quality issues.

Crosswoods Water Company

The Crosswoods Water Company is a Group A community water system located on the southwestern side of the City along Swantown Road outside the city limits but within the UGA. This water system currently serves 127 of a possible 130 connections to an estimated population of 420 people. The water system operates two wells with depths of 174 feet and capacities of 55 gpm and 65 gpm. The distribution capacity of this water system is 40,000 gallons and the system is disinfected with sodium hypochlorite. The Crosswoods Water Company water system has no recent significant water quality issues; however, it has had issues with the presence of coliforms as recently as October 2009.

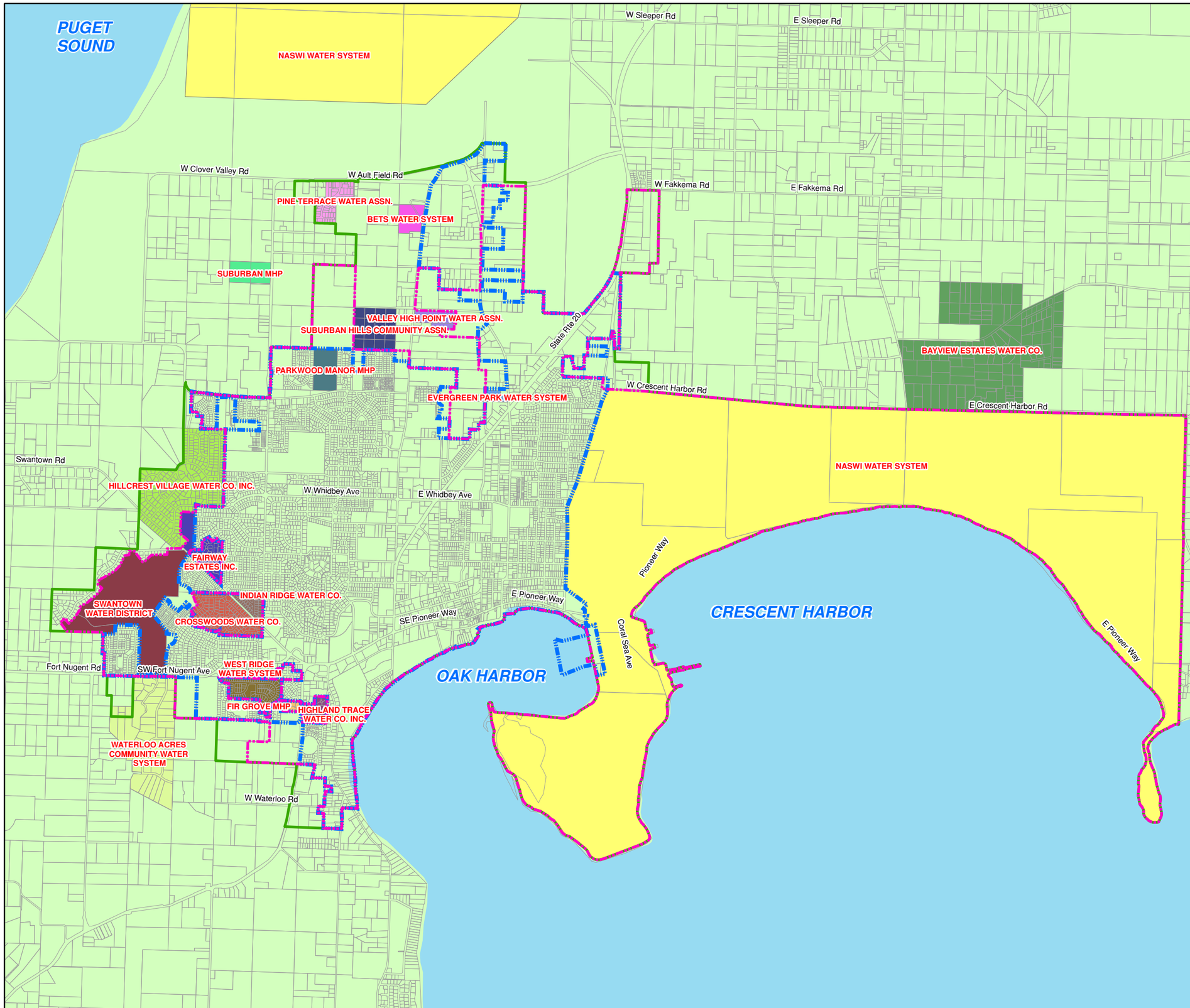
Evergreen Park

The Evergreen Park water system is a Group A community water system located on the eastern side of the City within the city limits. This water system currently serves 18 connections to an estimated population of 32 people. The water system operates a single well at a depth of approximately 66 feet with a capacity of 50 gpm. The distribution capacity of this water system is unknown and the system does not treat its water. The Evergreen Park water system has no recent significant water quality issues; however, it has had serious issues with the presence of coliforms as recently as 2008.

The Evergreen Park water system has historically had mechanical issues with their water system equipment. The water system has communicated with the City about connecting to the municipal system in the event of another significant mechanical problem. The system serves 18 connections, and has space for only two additional mobile home connections.

Fairway Estates, Inc.

The Fairway Estates, Inc. water system is a Group A community water system located on the western side of the City outside of the city limits but within the UGA. This water system currently serves 29 of a possible 25 connections to an estimated population of 100 people. The water system operates a single well with a depth of 206 feet and a capacity of 25 gpm. The distribution capacity of this water system is 21,000 gallons and the system is disinfected with sodium hypochlorite. The Fairway Estates, Inc. water system has no recent significant water quality issues.



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0 1,500 3,000 6,000 Feet

LEGEND:

- CITY LIMITS
- EXISTING SERVICE AREA
- URBAN GROWTH AREA
- PARCELS

WATER PURVEYORS:

- BAYVIEW ESTATES WATER CO.
- BETS WATER SYSTEM
- CROSSWOODS WATER CO.
- EVERGREEN PARK WATER SYSTEM
- FAIRWAY ESTATES INC.
- FIR GROVE MHP
- HIGHLAND TRACE WATER CO. INC.
- HILLCREST VILLAGE WATER CO. INC.
- INDIAN RIDGE WATER CO.
- NASWI WATER SYSTEM
- PARKWOOD MANOR MHP
- PINE TERRACE WATER ASSN.
- SUBURBAN HILLS COMMUNITY ASSN.
- SUBURBAN MHP
- SWANTOWN WATER DISTRICT
- VALLEY HIGH POINT WATER ASSN.
- WATERLOO ACRES COMMUNITY WATER SYSTEM
- WEST RIDGE WATER SYSTEM

DATA SOURCE: ISLAND COUNTY

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-13
ADJACENT WATER PURVEYOR MAP

Gray & Osborne, Inc.

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Fir Grove Mobile Park

The Fir Grove Mobile Home Park is a Group A community water system located on the southwestern side of the City outside of the city limits but within the UGA. This water system currently serves 19 connections to an estimated population of 65 people. The water system operates a single well at a depth of approximately 250 feet with a capacity of 18 gpm. The distribution capacity of this water system unknown and the system is disinfected with sodium hypochlorite. The Fir Grove water system has no recent significant water quality issues.

Forest Hills Park Community

The Forest Hills Park Community water system is a Group A community water system located on the west side of the City outside of the city limits and outside the UGA. This water system currently serves 23 of a possible 25 connections to an estimated population of 54 people. The water system operates a single well at a depth of 249 feet with a capacity of 25 gpm. The distribution capacity of this water system is 20,000 gallons and the system does not treat its water. The Forest Hills Park Community water system has had significant recent water quality issues, with the presence of coliforms as recently as June 2012.

Highland Trace Water Company, Inc.

The Highland Trace Water Company, Inc. water system is a Group A community water system located on the southwestern side of the City outside of the city limits but within the UGA. This water system currently serves 24 of a possible 25 connections to an estimated population of 62 people. The water system operates a single well at a depth of approximately 164 feet with a capacity of 25 gpm. A second, older well is no longer active. The distribution capacity of this water system is 22,000 gallons and the system does not treat its water. The Highland Trace Water Company, Inc. water system has no recent significant water quality issues; however, it has had serious issues with the presence of coliforms as recently as October 2011.

Hillcrest Village Water Company, Inc.

The Hillcrest Village Water Company, Inc. is a Group A community water system located on the western side of the City outside of the city limits but within the UGA. This water system currently serves 276 of a possible 300 connections to an estimated population of 770 people. The water system operates four wells with depths of 232, 217, 243, and 213 feet. The capacities for these wells are 40, 80, 110, and 80 gpm, respectively. A fifth well has been inactive since February 1998. The distribution capacity of this water system, which is a measure of the approximate total storage volume for the system, is 300,000 gallons and the system is disinfected with sodium hypochlorite. The Hillcrest Village Water Company, Inc. system has no recent significant water quality issues.

Indian Ridge Water Company

The Indian Ridge Water Company is a Group A community water system located on the southwestern side of the City near Swantown Road outside of the city limits but within the UGA. This water system currently serves 40 of a possible 42 connections to an estimated population of 119 people. The water system operates a single well at a depth of approximately 203 feet with a capacity of 95 gpm. The distribution capacity of this water system is 13,500 gallons and the system does not currently treat its water. The Indian Ridge Water Company system has no recent significant water quality issues.

Naval Air Station Whidbey Island

The Naval Air Station Whidbey Island water system is a Group A community water system. This water system currently serves 1,900 connections to an estimated population of 5,100 people. The water system operates two wells at depths of approximately 190 feet with capacities of 64 gpm and 100 gpm. This water system also receives water from the City of Oak Harbor as part of a wholesale customer agreement which was discussed previously. That source is estimated at 2,000 gpm and is treated with sodium hypochlorite as well as sodium fluoride. NASWI owns a total of five storage tanks, but only four of these tanks are used. The distributed capacity of this water system is 6,900,000 gallons. The NASWI water system has no recent significant water quality issues; however, it did have one sample that exceeded the allowable limit for coliforms in September 2011.

Parkwood Manor

The Parkwood Manor Mobile Home Park is a Group A community water system located on the north side of the City within the city limits. This water system currently serves 198 of a possible 198 connections to an estimated population of 301 people. The water system operates two wells at a depth of approximately 195 feet, each with a capacity of 60 gpm. The distribution capacity of this water system is 73,000 gallons and the system is disinfected with sodium hypochlorite. The Parkwood Manor system has no recent significant water quality issues.

Pine Terrace Water Association

The Pine Terrace Water Association is a Group A community water system located on the north side of the City outside of the city limits but within the UGA. This water system currently serves 66 of a possible 74 connections to an estimated population of 180 people. The water system operates two wells at depths of 159 and 178 feet with capacities of 20 gpm and 200 gpm, respectively. The distribution capacity of this water system is 55,000 gallons and the system is disinfected with sodium hypochlorite. The Pine Terrace Water Association has had recent water quality issues with conductivity,

total trihalomethanes, and haloacetic acids in 2011 and 2012, as well as the presence of coliforms as recently as 2009.

Suburban Hills Community Association

The Suburban Hills Community Association is a Group A community water system located on the north side of the City outside of the city limits but within the UGA. This water system currently serves 15 of a possible 17 connections to an estimated population of 46 people. The water system operates a single well at a depth of approximately 208 feet with a capacity of 35 gpm. The distribution capacity of this water system is 20,000 gallons and the system does not currently treat its water. The Suburban Hills Community Association system has no recent significant water quality issues; however, has had serious issues with the presence of coliforms as recently as 2005.

Suburban Mobile Park

The Suburban Mobile Park is a Group A community water system located north of the City outside of the city limits and outside the UGA. This water system currently serves 26 of a possible 26 connections to an estimated population of 60 people. The water system operates two wells at depths of approximately 240 and 270 feet with capacities of 10 gpm each. The distribution capacity of this water system is 4,800 gallons and the system is treated with sodium hypochlorite. The Suburban Mobile Park system has no recent significant water quality issues; however, has had issues with excessive conductivity, which is related to solids concentration, as recently as 2012.

Swantown Water District

The Swantown Water District is a Group A community water system located on the western side of the City within the city limits. This water system currently serves 96 of a possible 130 connections to an estimated population of 318 people, which includes some non-residential population. The water system operates two wells at a depth of approximately 130 feet with capacities of 55 gpm and 75 gpm. The distribution capacity of this water system is 40,000 gallons and the system does not currently treat its water. The Swantown Water District system has no recent significant water quality issues.

Valley High Park

The Valley High Park community water system is a Group A community water system located on the north side of the City outside of the city limits but within the UGA. This water system currently serves 47 of a possible 47 connections to an estimated population of 141 people. The water system operates a single well at a depth of 199 feet with a capacity of 35 gpm. The distribution capacity of this water system is 40,000 gallons and the system is treated with sodium hypochlorite. The Valley High Park community water system has had no significant recent water quality issues.

Waterloo Acres

The Waterloo Acres community water system is a Group A community water system located on the south end of the City outside of the city limits and outside the UGA. This water system currently serves 46 of a possible 48 connections to an estimated population of 125 people. The water system operates a single well at a depth of 185 feet with a capacity of 35 gpm. The distribution capacity of this water system is 40,000 gallons and the system is treated through aeration, catalytic media filtration, and permanganate addition. The Waterloo Acres community water system has had significant recent water quality issues with lead and copper rule compliance as well as the presence of coliforms as recently as 2012.

West Ridge Water System

The West Ridge Water System is a Group A community water system located on the southwestern side of the City outside of the city limits but within the UGA. This water system currently serves 90 of a possible 90 connections to an estimated population of 275 people. The water system operates two wells at a depth of approximately 264 feet with capacities of 58 gpm and 26 gpm. The distribution capacity of this water system is 43,500 gallons and the system is treated with sodium hypochlorite. The West Ridge Water System has no recent significant water quality issues.

TABLE 1-7

Adjacent Purveyor Summary(1)

System Name	Group ID	Number of Connections(2)	Population Served
Bayview Estate Water Company	4956	81/96	227
Bets Water System	39991	29 (3)	50
Crosswoods Water Company	16274	127/130	420
Evergreen Park	24153	19 (3)	32
Fairway Estates, Inc.	24524	29/25	100
Fir Grove Mobile Park	25137	19 (3)	65
Forest Hills Park Community	9871	23/25	54
Highland Trace Water Company, Inc.	32840	24/25	62
Hillcrest Village Water Company, Inc.	33150	276/300	770
Indian Ridge Water Company	35640	40/42	119
Parkwood Manor	66218	198/198	301
Pine Terrace Water Association	67600	66/74	180
Suburban Hills Community Association	37911	15/17	46
Suburban Mobile Park	84730	26/26	60
Swantown Water District	96042	96/130	318
Valley High Park	90976	47/47	141

TABLE 1-7 – (continued)

Adjacent Purveyor Summary(1)

System Name	Group ID	Number of Connections(2)	Population Served
Waterloo Acres	93580	46/48	125
West Ridge Water System	94942	90/90	275
Total	**—**	**1,251/1,340**	**3,345**

(1) Data source: DOH Sentry Web site. Does not include NASWI water system.
(2) Number of connections includes current connections/possible approved connections.
(3) DOH lists these connections as unapproved. Assumed to be connected to the maximum extent possible.

ZONING AND LAND USE

Development of accurate and realistic growth projections is essential in establishing future water demand requirements. Accurate projections allow the community to plan financially for needed infrastructure improvements and to establish appropriate facility capacities, locations, and implementation scheduling for water system improvements.

The current and official zoning map for the City was adopted by the Mayor on May 1, 2012. A brief description of the map and other zoning-related data are listed below, but are also available in the City's *Comprehensive Plan* (City of Oak Harbor, 2010). Figure 1-14 shows the City's existing zoning designations.

The zoning categories used for City purposes include:

- **R-1 – Single Family**

  Intended for low-density, urban, single-family uses with sufficient urban services. Densities range between 3 and 6 units per gross acre.

- **R-2 – Limited Multifamily**

  Intended for medium-density, residential housing. Densities range between 3 and 12 units per gross acre and should have safe, convenient access to improved collector or arterial streets.

- **R-3 – Multifamily**

  Intended to provide and protect areas for medium- to high-density multifamily residential development. Densities range from 6 to 16 units per gross acre.

- **R-4 – Multifamily**

  Intended to provide and protect areas for those who wish to live in an apartment environment. These areas must be adjacent to arterials and/or collector streets and range between 12 and 22 units per gross acre.

- **R-O – Residential/Office**

  Intended for professional and administrative offices, to provide a buffer between urban and residential neighborhoods, and to include development standards that would be consistent with residential districts.

- **C-1 – Neighborhood Commercial**

  Intended for limited commercial and residential/commercial uses to serve residents of a surrounding district. Scale of development should be consistent with residential district standards.

- **C-3 – Community Commercial**

  Intended for services that heavily depend on location to serve patrons. Uses could include retail, wholesale, transportation, or other services.

- **C-4 – Highway Service (Auto/Industrial) Commercial**

  Intended for services that rely on highway access or visibility, primarily for vehicle sales centers. Uses within this category must also be compatible with NASWI Air Installation Compatible Use Zones (AICUZ) recommendations.

- **C-5 – Highway Corridor Commercial**

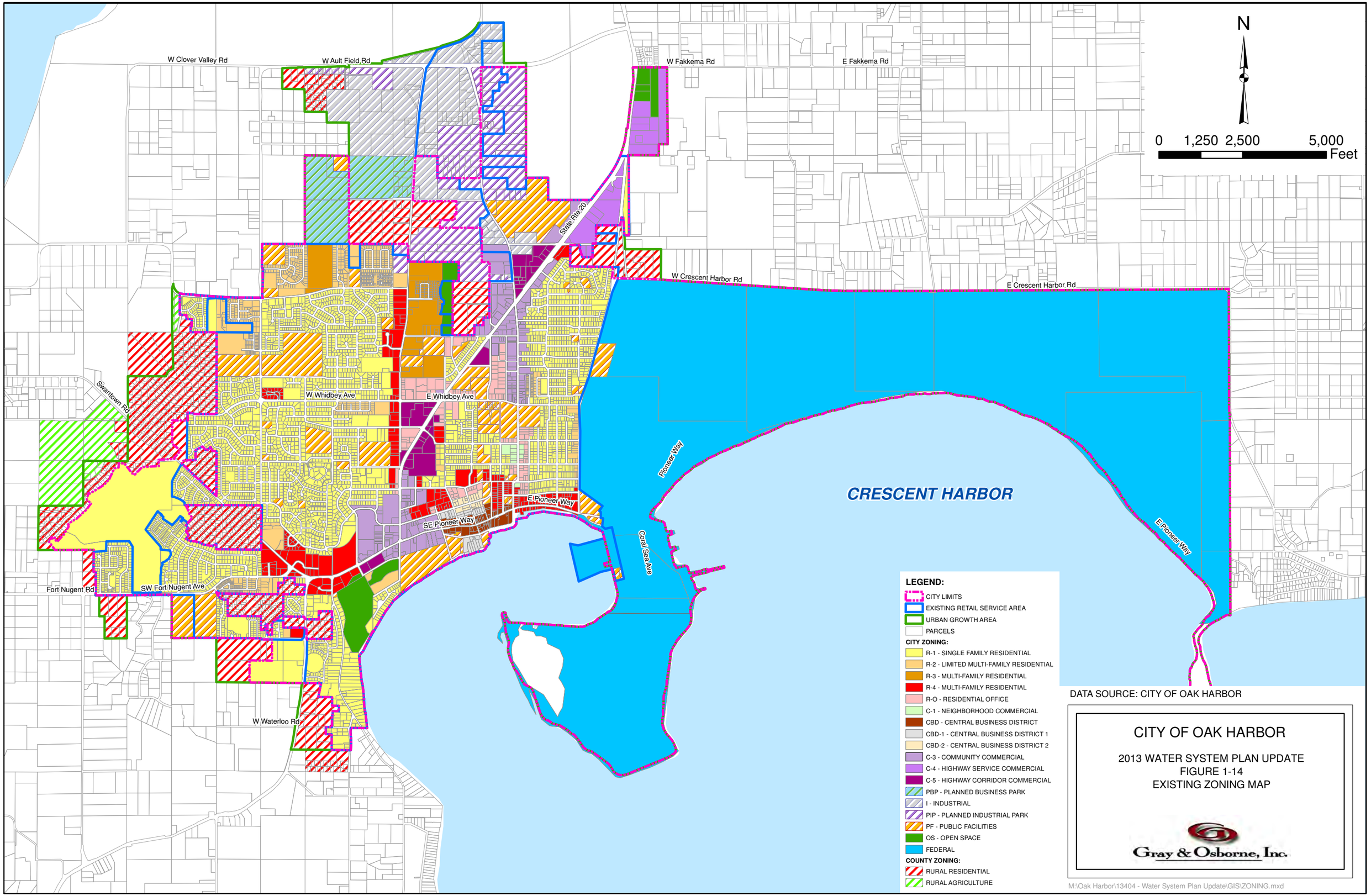
  Intended for uses that are regional in impact and should be located along the highway corridor.

- **CBD – Central Business District**

  Intended for uses which preserve and enhance the harbor location, encourage pedestrian-friendly access, and encourage mixed-use development. Residential development is allowed on an individual case basis.

- **PBP – Planned Business Park**

  Intended for large-scale master planned facilities related to office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State Rte 20
W Crescent Harbor Rd
E Crescent Harbor Rd
Swantown Rd
W Whidbey Ave
E Whidbey Ave
Pioneer Way
E Pioneer Way
SE Pioneer Way
Coral Sea Ave
CRESCENT HARBOR
Fort Nugent Rd
SW Fort Nugent Ave
W Waterloo Rd
LEGEND:
CITY LIMITS
EXISTING RETAIL SERVICE AREA
URBAN GROWTH AREA
PARCELS
CITY ZONING:
R-1 - SINGLE FAMILY RESIDENTIAL
R-2 - LIMITED MULTI-FAMILY RESIDENTIAL
R-3 - MULTI-FAMILY RESIDENTIAL
R-4 - MULTI-FAMILY RESIDENTIAL
R-O - RESIDENTIAL OFFICE
C-1 - NEIGHBORHOOD COMMERCIAL
CBD - CENTRAL BUSINESS DISTRICT
CBD-1 - CENTRAL BUSINESS DISTRICT 1
CBD-2 - CENTRAL BUSINESS DISTRICT 2
C-3 - COMMUNITY COMMERCIAL
C-4 - HIGHWAY SERVICE COMMERCIAL
C-5 - HIGHWAY CORRIDOR COMMERCIAL
PBP - PLANNED BUSINESS PARK
I - INDUSTRIAL
PIP - PLANNED INDUSTRIAL PARK
PF - PUBLIC FACILITIES
OS - OPEN SPACE
FEDERAL
COUNTY ZONING:
RURAL RESIDENTIAL
RURAL AGRICULTURE
DATA SOURCE: CITY OF OAK HARBOR
CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-14
EXISTING ZONING MAP
Gray & Osborne, Inc.
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complexes or manufacturing facilities. Environmental amenities and responsibility would be promoted and uses should encourage a campus or park-like environment.

- **PIP – Planned Industrial Park**

  Same as PBP above.

- **I – Industrial**

  Intended for facilities of an industrial nature that may have adverse impacts on adjoining residential or commercial uses. User requirements for clean, safe, and quiet operation are in place.

- **Federal/Military**

  The NASWI facilities are located within the City limits and operations, land use, and development are governed by the U.S. Navy. Historically, the City and the U.S. Navy have worked cooperatively to ensure that development meets the needs for all parties involved.

- **PF – Public Facilities**

  Intended for public facilities such as schools, parks, churches, government facilities, utilities, and hospitals. This category aids the City and the public in planning while minimizing conflicts between incompatible land uses.

- **OS – Open Space, Recreation, and Agriculture**

  Intended to preserve special community resources such as golf courses, protected forest land, and to delay the timeframe for development of annexed areas.

Zoning designations for areas outside the city-adopted UGA, but inside the county-adopted UGA include:

- **RR – Rural Residential**

  Lands located within defined boundaries of residential areas or more intensive rural development that are intended for infill development and limited subdivision at the prevailing residential density in the defined area.

- **RA – Rural Agricultural**

  Lands where agricultural activities have been an important and valued use in the past and will continue to be in the future, but do not meet the criteria for inclusion as lands of long-term commercial significance.

Table 1-8 summarizes the current zoning within the city-adopted UGA. As with most similarly sized communities, residential and commercial land constitutes the bulk of the City's acreage.

TABLE 1-8

Existing Zoning Characterization

Category	2013 Land Area (acres)	2013 Percentage of City Land Total
C-1 – Neighborhood Commercial	6.3	0.2%
C-3 – Community Commercial	174.6	4.9%
C-4 – Highway Service Commercial	80.0	2.3%
C-5 – Highway Corridor Commercial	69.0	2.0%
CBD – Central Business District	21.6	0.6%
CBD-1 – Central Business District 1	11.4	0.3%
CBD-2 – Central Business District 2	7.1	0.2%
I – Industrial	50.2	1.4%
OS – Open Space	82.2	2.3%
PBP – Planned Business Park	74.9	2.1%
PF – Public Facilities	368.3	10.4%
PIP – Planned Industrial Park	157.1	4.5%
R-1 – Single-Family Residential	1,272.2	36.1%
R-2 – Limited Multifamily	188.6	5.3%
R-3 – Multifamily Residential	94.4	2.7%
R-4 – Multifamily Residential	167.7	4.8%
R-O – Residential Office	78.0	2.2%
ROW – Right-of-Way	623.4	17.7%
Seaplane Base	2,705.0	—
Total Land Area	6,232.0	—
Total City Land Area (1)	**3,527.0**	**100.0%**
Total City Land Area w/o ROW	2,903.6	—

(1) Does not include NASWI facilities (Seaplane Base).

Land use differs from zoning in that land use broadly defines the type of occupancy or use that will be allowed for a particular area. Land use is more commonly used for comprehensive and regional planning to ensure that UGAs are used appropriately. The

City has addressed projected land use in its most recent Comprehensive Plan, which used information from a 2002 land use inventory examination to define regions within the UGA.

Areas outside of the city limits but within the UGA also contain land-use and zoning designations for their future development. Designations for these areas were obtained through Island County records and are included in Table 1-9 as well as on Figure 1-15.

TABLE 1-9

County Defined Zoning Inventory Summary

Land Use	Land Area (acres)	Percentage of City Land Total
Auto/Industrial Commercial	113.1	2.3%
Central Business District	40.5	0.8%
Community Commercial	210.9	4.4%
High Density Residential	151.5	3.1%
Highway Corridor Commercial	75.4	1.6%
Industrial	174.7	3.6%
Low Density Residential	1,552.5	32.1%
Maritime	2.1	0.0%
Medium-High Density Residential	87.3	1.8%
Medium Density Residential	208.1	4.3%
Neighborhood Commercial	6.6	0.1%
Open Space	288.1	6.0%
Planned Business Park	129.4	2.7%
Planned Industrial Park	345.0	7.1%
Public Facilities	381.7	7.9%
Residential Estate	72.4	1.5%
Residential Office	91.5	1.9%
ROW, Right-of-Way	728.2	15.0%
Seaplane Base	2,705.0	—
City Adopted UGA Area (1)	179.7	—
Total Land Area (2)	7,543.7	—
Total City Adopted UGA Land Area (3)	**4,838.7**	**100.0%**
Total City Adopted UGA Land Area w/o ROW	3,930.8	—

(1) Includes areas within the City's adopted UGA but outside the UGA recognized by Island County. Consists of 67.4 acres low-density residential and 112.3 acres special planning area.
(2) Includes areas within the city limits and city-adopted UGA.
(3) Does not include NASWI facilities (Seaplane Base).

RELATED PLANS AND DOCUMENTS

ANACORTES 2011 WATER SYSTEM PLAN

The City obtains more than 99 percent of its water from Anacortes, which completed its most recent Water System Plan (WSP) in 2011. This City of Anacortes WSP is referenced frequently in this document and can be used to find additional information regarding water sources, water treatment, source capacity, and water quality.

OAK HARBOR 2003 WATER SYSTEM PLAN

The previous water system plan was completed in 2003 by Earth Tech Engineers. The plan describes the City's water system and water service agreements, hydraulic model calibration and results, water use efficiency, operation and maintenance, and capital improvement recommendations. Where applicable, information from this plan was used as a starting point for the information presented in this plan update.

OAK HARBOR COMPREHENSIVE PLAN

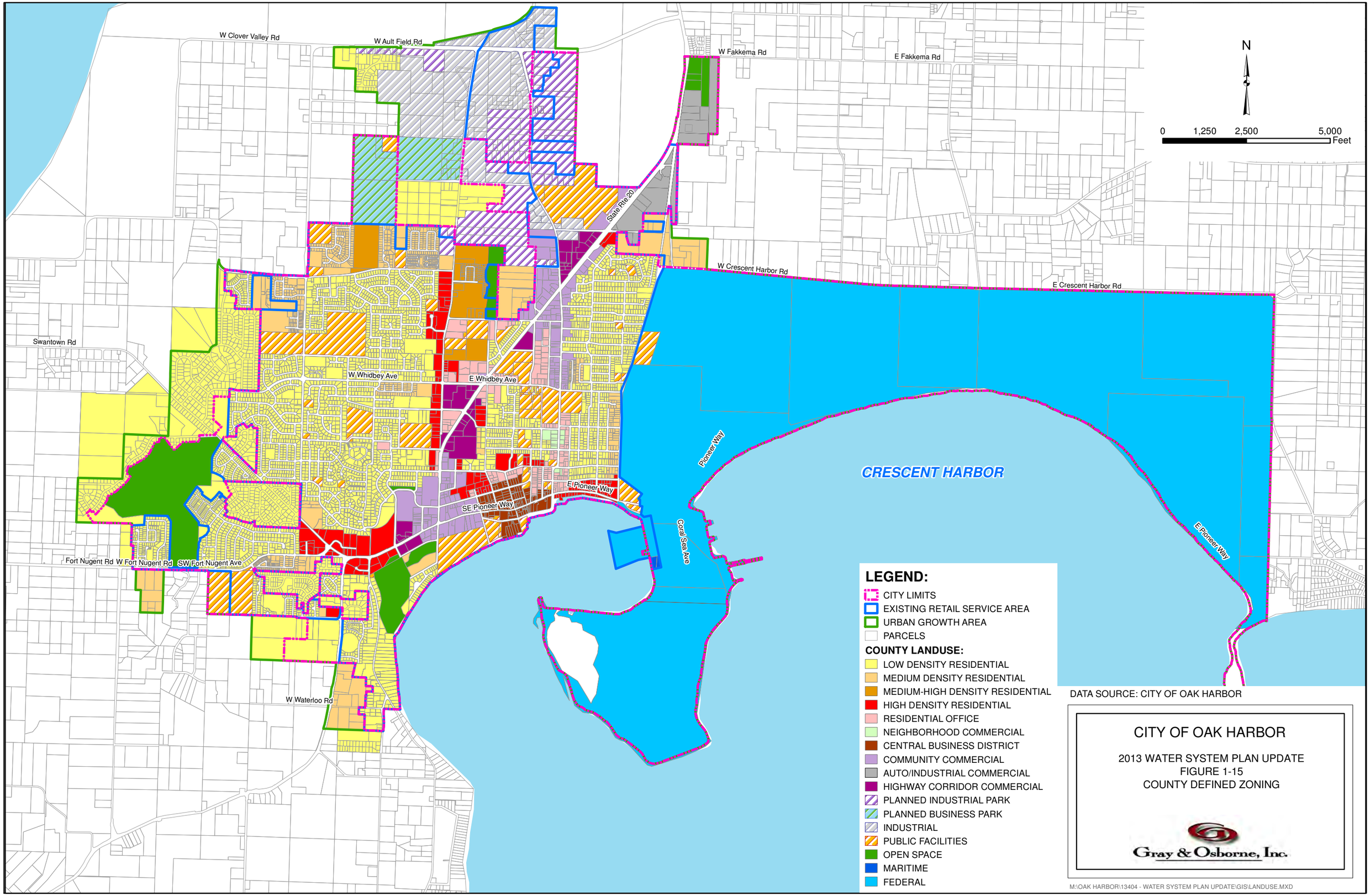
The current Oak Harbor Comprehensive Plan was adopted in 1995 and revised in 1997, 1998, 2000, and in each of the years from 2002 through 2012. The plan identifies goals and policies to be used in shaping growth of the community within the UGA. The plan is divided into elements that cover such topics as land use, housing, development, and utilities. The plan briefly described the water system transmission line components and concludes that the current facilities have sufficient capacity to meet projected peak day demands for 2013.

OAK HARBOR MUNICIPAL CODE

The City has water service regulations which are established by City ordinances in the OHMC. Title 13 (Water), Title 18 (Planning), Title 19 (Zoning), and Title 21 (Subdivisions) all deal with water service issues. A copy of Title 13 is available in Appendix E, while the full OHMC is available through the City's Web site at www.oakharbor.org.

ISLAND COUNTY COORDINATED WATER SUPPLY PLAN

The Island County Coordinated Water Supply Plan (CWSP) was completed in 1990. This plan is consistent with the CWSP contents. The CWSP guides water utilities throughout Island County so that water supply management and development can be accomplished through coordinated, rather than individual efforts. The CWSP assessed water demand forecasts and supply alternatives. Redistribution of groundwater was its highest priority recommendation.


W Clover Valley Rd
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W Fakkema Rd
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0
1,250
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Feet
State Rte 20
W Crescent Harbor Rd
E Crescent Harbor Rd
Swantown Rd
W Whidbey Ave
E Whidbey Ave
Pioneer Way
CRESCENT HARBOR
E Pioneer Way
SE Pioneer Way
Coral Sea Ave
Fort Nugent Rd
W Fort Nugent Rd
SW Fort Nugent Ave
W Waterloo Rd
LEGEND:
CITY LIMITS
EXISTING RETAIL SERVICE AREA
URBAN GROWTH AREA
PARCELS
COUNTY LANDUSE:
LOW DENSITY RESIDENTIAL
MEDIUM DENSITY RESIDENTIAL
MEDIUM-HIGH DENSITY RESIDENTIAL
HIGH DENSITY RESIDENTIAL
RESIDENTIAL OFFICE
NEIGHBORHOOD COMMERCIAL
CENTRAL BUSINESS DISTRICT
COMMUNITY COMMERCIAL
AUTO/INDUSTRIAL COMMERCIAL
HIGHWAY CORRIDOR COMMERCIAL
PLANNED INDUSTRIAL PARK
PLANNED BUSINESS PARK
INDUSTRIAL
PUBLIC FACILITIES
OPEN SPACE
MARITIME
FEDERAL
DATA SOURCE: CITY OF OAK HARBOR
CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-15
COUNTY DEFINED ZONING
Gray & Osborne, Inc.
M:\OAK HARBOR\13404 - WATER SYSTEM PLAN UPDATE\GIS\LANDUSE.MXD

ISLAND COUNTY WATER RESOURCE MANAGEMENT PLAN

The 1998 legislature passed Chapter 90.82 RCW to set a framework for developing local solutions to watershed issues. Chapter 90.82 RCW states that "The legislature finds that the local development of watershed plans for managing water resources and for protecting existing water rights is vital to both state and local interests." Through Ecology funds, Island County developed a Water Resource Management Plan (WRMP).

The current WRMP, which was adopted by the Board of Island County Commissioners in June 2005, is a series of topic papers drafted by the Island County Water Resource Advisory Committee (WRAC). These topic papers were the basis of the WRMP and cover such topics as seawater intrusion, water supply alternatives, rainwater catchments, and water conservation, among others. The WRMP also discusses groundwater recharge, groundwater levels, population forecasts, drought conditions, water rights, water system coordination, alternative water supply sources, water conservation, and education and outreach.

After completion of the WRMP, Ecology funded Island County to develop the Water Resource Detailed Implementation Plan. This working document was approved by the WRAC in December of 2006, and outlines specific watershed-related projects. Additional information on the County's WRMP and related documents can be found through the County and on their Web site, www.islandcountyeh.org.

NAVAL AIR STATION WHIDBEY ISLAND WATER SYSTEM PLAN

The *NASWI Water System Plan* (KPFF, 2008) was used as a reference for information regarding water use and facilities and personnel data during the composition of this plan. Planning information, such as population and water demand projections, from the NASWI plan are corroborated with this document.

CITY OF OAK HARBOR 2011 TO 2016 CAPITAL IMPROVEMENT PLAN

The City's Capital Improvement Plan was produced in December 2011 and outlines proposed projects and funding for City resources and infrastructure. Wastewater facilities, water system facilities, public facilities, and infrastructure projects such as roads and signage are summarized and discussed. The plan pulls information from the most recent individual service plans (water, wastewater, transportation, etc.) so that the City may efficiently and successfully prioritize required projects and ensure that they are funded appropriately.

NEW RESERVOIR PROJECT PREDESIGN REPORT

The *New Reservoir Predesign Report* (Gray & Osborne, 2009) investigated the status of the City's water system and addresses water delivery zones, water pressure, system redundancy, and system resiliency. The report provides a site analysis for the new North

Reservoir and recommends twelve capital improvement projects meant to address water system issues listed above. The new North Reservoir is currently constructed and is awaiting painting (scheduled for 2014), with additional projects from the report slated for construction within the 6-year planning period. A copy of this report is available in Appendix F.

Several projects recommended in this report have been developed to various stages. A pipeline along Gun Club Road has been constructed, and will serve the North Reservoir. Lastly, the City recently advertised design qualifications for the east-west pipeline from Gun Club Road across Highway 20. Each of these projects is meant to reorganize the water system operations and pressure zone scheme as recommended in the *New Reservoir Predesign Report*.

AULT FIELD BOOSTER STATION TECHNICAL MEMORANDUM

The *Ault Field Booster Station Technical Memorandum* (Gray & Osborne, 2011) addresses the existing constant-speed pumps at the Ault Field Booster Station. Currently, the constant-speed pumps are not utilized to move water to the 307 Zone; however, the City would like to use these two pumps as the primary pumps for the booster station. The technical memorandum examines alternative solutions for replacement/modification of the existing constant-speed pumps, and recommends a course of action based on capital cost, recurring maintenance costs, cost of power, and desires by the City staff. A copy of this technical memorandum is presented in Appendix C.

SERVICE AREA POLICIES

DOH has established a list of policies that should be addressed in a water system plan. Table 1-10 lists these policies, the required actions, and the City's status regarding them. As part of the 2003 WSP, some changes were recommended to the OHMC to add clarity and to reflect more current conditions and practices. These changes included language changes for peak day demand, alterations to the standard designs and specifications, and service beyond city limits policy recommendations.

TABLE 1-10

Service Area Policy Summary

DOH Policy	Policy Description	Current City Policy	Source
Annexation Policy	How City annexation relates to the provision of water service.	The City, at its discretion, may choose not to allow water service unless the applicant is first annexed to the City.	Water System Plan
Connection Fee Policy	Fees relating to the installation of water service.	Fees for water service are determined by meter size, service location, and customer class designation.	OHMC Chapters 3.64.525 and 13.32.010
Cross-Connection Control Program	Policy on regulations of cross connections, including steps taken if a cross connection is discovered.	Water service shall be contingent on provision of cross-connection control deemed suitable by City officials. See Appendix G.	OHMC Chapter 13.13
Design and Performance Standards	Minimum design and performance standards for water infrastructure.	City of Oak Harbor Design Standards. See Appendix H.	Design and Performance Standards
Direct Connection and Remote System Policy	New developments directly connect to existing water system, or if satellite systems are allowable.	All proposed developments to be served by the City shall require direct connection to the City's water system. The City does not provide Satellite System Management.	Water System Plan
Extension Policy	Policy regarding extension of the system, including identification of the responsible party. Design standards and payment included in conditions of service.	Design standards are established in the City's Developer Standards. See Appendix H.	Design and Performance Standards
Latecomer Agreements	Policy on allowing latecomer agreements for those who propose to extend the water system, and provisions of payback.	A property owner wishing to extend water service to their area may be required to extend of improve the municipal water supply system as a condition thereof, and to execute a developer's agreement regarding the appointment of the costs thereof. These developer's agreements may include provisions for recovery of a pro-rated share of the initial construction costs of the water service extensions from additional customers desiring to connect to such extensions.	OHMC Chapters 13.28 and 13.32

TABLE 1-10 – (continued)

Service Area Policy Summary

DOH Policy	Policy Description	Current City Policy	Source
New Account Servicing Fees	Fees relating to the creation of a new water service account.	The City has a utility account initiation fee of $25 to begin the connection process. Connection fees are the actual costs of construction and payable prior to initiation of connection of water services.	OHMC Chapter 3.95.040 or 3.64.525
Surcharge for Outside Customers	City's surcharge for customers outside of city limits.	Services outside of city limits are subject to a 1.5 rate differential. Deception Pass State Park is charged as if within city limits.	Ordinance 1587 and OHMC Chapter 13.24
Water Rates	Rates charged to the City's water service customers.	The City's water rates are established by ordinance in the City's taxes, rates, and fees schedule. Rates are based on meter size, usage, and customer class.	Ordinance 1587 and OHMC Chapter 13.32.025(2)
Water Rights	Relinquishment/transfer of water rights within the water service area.	The City does not currently have an established water rights policy.	—
Wheeling of Water	Conditions to be met for water wheeled to another system.	The City does not currently have an established wheeling of water policy.	—
Wholesaling of Water	Conditions that must be met to obtain a wholesale agreement.	The City does not currently have an established water system wholesaling policy. The City provides water to NASWI, NWWD, and DPSP through a water supply agreement.	—

DUTY TO SERVE

Regarding a municipal water service providers requirement to provide water to residents within the retail service area, WAC 246-290-106 requires that the City provide retail water service to all new service connections within the retail service area if:

- It can be available in a timely and reasonable manner,
- There are sufficient water rights to provide water service,
- There is sufficient capacity to serve the water in a safe and reliable manner as determined by DOH, and

- It is consistent with the requirements of local plans and regulations, and for water service by the water utility of a city or town, with the utility service extension ordinances of the city or town.

Additional requirements are that the supplier must provide a retail service area map and must meet the requirements of WAC 246-290-108 which state that:

> Municipal water suppliers must provide documentation within a WSP describing how it has considered consistency with other local plans and regulations with regard to:
>
> - Land use and zoning within the applicable service area,
> - Six-year growth projections used for demand forecasting,
> - Utility service extension ordinances,
> - Provisions of water service for new service connections, and
> - Other relevant elements related to water planning.

Should an inconsistency be found within the review period, DOH must be notified and appropriate steps shall be taken to remedy the inconsistency.

Furthermore, the municipal water supplier may provide temporary water service to another water system if a written agreement with the water system is in place, and lastly, the municipal supplier may allow water service to be extended prior to meeting the requirements set forth in the WAC in order to resolve a significant public health and saftey concern.

The City actively plans to provide retail water service in conformance with all state and local regulations and land use plans to all customers and customer classes throughout the existing retail service area. New customers may apply for water service through the permitting process established within OHMC Title 13. OHMC Chapter 13.24 details the conditions for providing water service beyond city limits and within the UGA.

Water service connection permits are reviewed by the City engineering staff according to workload and maximum allowable review periods. Conformance to these time lines creates a predictable process for provision of retail water service.

SATELLITE MANAGEMENT

The Growth Management Act restricts the City's ability to provide domestic water service outside the UGA. This plan does not include consideration of water use outside the UGA, with the exception of the existing service to NWWD, NASWI, and DPSP. Adjacent water purveyors are summarized in Table 1-7 and are shown graphically on Figure 1-12. Requests to connect to the City's municipal water system will be addressed on an individual basis and will be evaluated based on existing infrastructure, distance from mainline connection, water availability, economic considerations, as well as

direction by DOH. If an adjacent purveyor wishes to connect to the City's municipal water system, they are required to upgrade the water system facilities to meet City standards. If the area requesting service is adjacent to the city limits, annexation may be required. Furthermore, requests to the City for water service will be considered only if the City establishes the legality of service, secures a water allocation from Anacortes, and the party requesting service agrees to pay all costs of the following:

- Studies necessary to evaluate impacts of service,
- Legal fees,
- System development charges,
- Improvements or expansion of the City's water system necessary for service,
- Improvement or expansion of the requesting entity water system to comply with City's design standards,
- Pumping costs,
- Annual maintenance and operation costs,
- Pro-rated share of Anacortes charges, and
- Pro-rated share of general system improvements.

CONSUMER AND AGENCY INPUT

REGIONAL PLANNING CONSISTENCY

Consistency with local plans and regulations applies to planning and engineering documents under WAC 246-290-106, 246-290-107, and 246-290-110(4)(b)(ii). These policies state that municipal water suppliers must include a consistency review and supporting documentation in its planning or engineering document describing how it has addressed consistency with local plans and regulations. This review must include specific elements of local plans and regulations, as they reasonably relate to water service as determined by DOH.

This Plan was reviewed for its consistency with other regional planning documents and a signed checklist is included as Appendix I.

LOCAL AGENCIES

The draft WSP was made available to local government agencies to ensure consistency in watershed planning efforts. A complete copy of the plan was submitted to the Washington State Department of Health as well as the Island County Public Works Department.

The Plan was also made available electronically to all adjacent water systems, each of the City's wholesale customers (NASWI, NWWD and DPSP), and the Island County Water Resources Advisory Committee (WRAC). The WRAC is a special County committee of both appointed citizen members and designated staff representatives from both Island County Public Works and Island County Health. WRAC members have been assigned responsibility by the county commissioners to coordinate local water planning issues, including the watershed plan for WRIA 6. A copy of these notification letters, as well as any comments or correspondence received from them regarding the Plan is available in Appendix J.

PUBLIC PARTICIPATION

Per WAC 246-290, the City's Water System Plan must be made available for public comment prior to acceptance. To fulfill these requirements, the City plans to make an electronic version of the WSP available through its website, and will also maintain at least one hard copy at the City's Public Works Department Office. The City will then place discussion of the WSP on the agenda at both the Community Planning Department regularly scheduled meeting as well as the City Council workshop meeting, both of which are open to the public. Advertisements for these meetings will be on the City's website, posted at the Public Works Building, and advertised in the Whidbey Times in accordance with State Law. A proposed newspaper announcement is available in Appendix J.

CHAPTER 2

BASIC PLANNING DATA

INTRODUCTION

This chapter includes basic planning data that is essential for the assessment of the City's water demands. Information is included regarding historical and existing population data, historical and existing water production and consumption, and projected water production and demand. Projected population, service area connections, ERUs, water consumption, and required water production are also discussed. Information presented below is used to evaluate the condition of the existing water system and to determine future needs based on foreseeable demographic trends for the next 20 years.

HISTORICAL AND EXISTING SYSTEM INFORMATION

Information on connections, monthly water production and purchasing, and monthly water consumption was provided by the City. Data was extracted from water profile reports, metered data, and billing information records.

For the tables, data, and analysis that follow, it is assumed that data are for the City's service area only and do not include NASWI facilities unless otherwise noted.

POPULATION

Historical population within the City is summarized in Table 2-1. Historical population data was provided for the City's service area by the Washington State Office of Financial Management (OFM) and the most recent U.S. Census.

TABLE 2-1

Historical Population Summary

Year	City Population	UGA Population(1)	City and UGA Population(2)	Seaplane Base Population(3)	Service Area Population(4)	Retail Service Area Population(5)
1940	376	—	—	—	—	—
1950	1,193	—	—	—	—	—
1960	3,942	—	—	—	—	—
1970	9,167	—	—	—	—	—
1980	12,271	—	—	—	—	—
1990	17,176	—	—	—	—	—
2000	19,795	2,235	22,030	3,230	18,800	16,583
2001	19,914	2,234	22,148	3,230	18,918	16,989
2002	20,201	2,250	22,451	3,230	19,221	17,020
2003	20,232	2,248	22,480	3,230	19,250	17,250
2004	20,462	2,259	22,721	3,230	19,491	17,856
2005	21,068	2,285	23,353	3,230	20,123	18,243
2006	21,455	2,306	23,761	3,230	20,531	18,507
2007	21,719	2,320	24,039	3,230	20,809	18,664
2008	21,876	2,313	24,189	3,230	20,959	18,936
2009	22,148	2,302	24,450	3,230	21,220	18,773
2010(6)	22,075	2,280	24,355	3,320	21,035	18,898
2011	22,200	2,281	24,481	3,320	21,161	18,898
2012(7)	22,200	2,280	24,480	3,320	21,160	18,778

(1) Estimated from OFM and City records.
(2) Calculated as the sum of City and UGA populations.
(3) Estimated from City population data.
(4) Calculated as difference between total population and Seaplane Base population.
(5) Calculated as sum of City population, connections outside the City limits but inside the UGA, minus the Seaplane Base population.
(6) Data collected from the 2010 U.S. Census.
(7) Data from Washington OFM and City records.

The data show that from 2009 to 2010, the City population *decreased* from 23,360 to 22,075. This is fairly common in municipalities for years prior to an official U.S. Census. The population from 2009 is most likely an estimate based on locally available surveys or other information, and as such, differs from federal census data.

SERVICE CONNECTIONS

Data for the number of service connections were provided by the City's annual water profiles. These annual water profiles include data on production, consumption, per capita use, system infrastructure, and other data. The City's historical and existing water connections are summarized in Table 2-2.

TABLE 2-2

Historical Water System Connection Summary

Category	2007	2008	2009	2010	2011	2012
Residential	4,204	4,111	4,232	4,302	4,338	4,350
Multi-Residential	734	695	763	763	770	767
Commercial	407	312	339	327	310	320
Multi-Commercial	97	115	106	106	118	113
School	24	27	23	23	23	22
Hotel/Motel	10	10	9	9	9	9
Church	24	23	24	25	25	25
Sprinklers	103	109	111	112	113	114
Commercial/Residential	13	14	14	14	15	16
Irrigation	102	107	107	115	118	118
Hydrant Meters(1)	—	—	—	—	—	—
NASWI(2)	1	1	1	1	1	9
Total	**5,719**	**5,524**	**5,729**	**5,797**	**5,840**	**5,863**

(1) Portable meter checked out by the City and used for construction or other flushing-type activity.

(2) NASWI connections are from the existing Old Goldie Road NASWI water main and represent residential connections to the City's distribution system. Two additional connections are planned for 2016.

WATER PRODUCTION

The City purchases approximately 99.7 percent of its water from the City of Anacortes. This water is conveyed to the City by a 24-inch-diameter and a 10-inch-diameter transmission mains. The small remaining percentage of water is pumped from Wells 8, 9 and 11. These wells serve as an auxiliary water source and are only exercised monthly in order to keep the pumps and wells and other equipment in good order. Table 2-3 summarizes the historical purchase and production of water for the City's sources, while Table 2-4 lists the monthly production for the City sources. Monthly values from 2012 are representative of monthly totals since 2007.

TABLE 2-3

Historical Water Purchase and Production

Source	2007	2008	2009	2010	2011	2012	Percent of 2012 Total
Anacortes	877.028	806.231	862.262	753.064	772.883	744.607	99.73
Well 8	0.968	0.956	1.122	0.920	0.760	0.901	0.12
Well 9	1.076	0.885	1.026	0.201	0.243	0.268	0.04
Well 11	0.970	1.410	1.142	0.931	0.704	0.882	0.12
Total Well Production	**3.014**	**3.251**	**3.290**	**2.052**	**1.707**	**2.051**	**0.27**
Total Production and Purchase	**880.042**	**809.483**	**865.552**	**755.116**	**774.590**	**746.658**	**—**

TABLE 2-4

Monthly Historical Source Production for 2012

Month	MG Anacortes	Gallons Well 8	Gallons Well 9	Gallons Well 11	MG Total
January	55.326	53,731	17,019	55,054	**55.451**
February	50.794	76,187	24,561	75,031	**50.969**
March	52.689	90,321	28,080	89,936	**52.897**
April	57.622	61,858	17,739	53,517	**57.755**
May	59.733	159,876	49,140	154,322	**60.096**
June	62.600	94,771	22,612	88,045	**62.806**
July	75.443	37,042	10,887	36,183	**75.527**
August	75.450	42,626	12,934	43,534	**75.549**
September	83.446	168,076	47,774	152,950	**83.815**
October	66.338	45,996	16,610	57,254	**66.458**
November	50.802	26,616	6,900	25,868	**50.861**
December	54.365	43,833	13,404	50,676	**54.473**
Total	**744.607**	**900,933**	**267,660**	**882,370**	**746.658**
Average Daily Production	**2.034**	**2,462**	**731**	**2,411**	**—**

Overall, the total purchase and production of water has decreased since 2007. This is likely due to repair of previously leaky pipes/joints, replacement of old and aging pipelines, an increased focus on preventive maintenance by water operations staff, a sluggish local economy, and an increased focus on water conservation by water users.

The data show several months with abnormally high production from the groundwater sources. One example of this is Well 11 in October of 2007. Production for this month was 423,926 gallons, which is significantly higher than the annual average of 121,261 gallons per month for Well 11.

These higher periods of well pumping typically occurred as a result of a temporary shutdown of the Anacortes water supply. Occasionally, the City will operate groundwater source pumps to ensure that they are still capable of handling the required pumping capacity for long periods in the event that the Anacortes water supply becomes unavailable. Higher groundwater source production also may occur as the result of planned maintenance or drawdown testing.

AVERAGE DAY/MAXIMUM DAY DEMAND

The average day demand (ADD) is defined as the total volume of water produced in one year divided by the number of days in the year. The maximum day demand (MDD) is determined by meter readings and is the largest single-day usage of water. Using water production data rather than consumption data gives an indication of the actual water required by the City, which includes distribution system leakage. Peak hour demand (PHD) is an estimate of the highest demand a water system experiences in a year and is based on the number of ERUs in the water system.

Historical ADD and MDD for the City as well as NASWI are presented in Table 2-5. Average day demand values for NASWI were supplied by the City's metering data.

TABLE 2-5

Historical Average Day Demand and Maximum Day Demand

Parameter	2007	2008	2009	2010	2011	2012	Average
City of Oak Harbor(1)							
ADD (gpd)	1,535,166	1,426,790	1,455,223	1,370,034	1,381,016	1,476,198	**1,440,738**
MDD (gpd)	2,753,858	2,400,056	2,842,091	2,456,206	2,379,364	2,523,003	**2,559,096**
Date	July 12	August 16	July 16	July 14	September 3	August 18	**—**
MDD/ADD	1.79	1.68	1.95	1.79	1.72	1.71	**1.8**
NASWI							
ADD (gpd)	780,548	752,471	877,161	771,895	777,617	709,616	**778,218**
MDD (gpd)	—	—	—	1,750,000	1,790,000	1,580,000	**1,706,667**
Date	—	—	—	August 2	March 13	August 8	**—**
MDD/ADD	—	—	—	2.27	2.30	2.23	**2.3**
Combined System							
ADD (gpd)	2,315,714	2,179,261	2,332,384	2,141,929	2,158,633	2,185,814	**2,218,956**
MDD (gpd) (2)	—	—	—	4,169,034	3,580,000	4,103,003	**3,950,679**
MDD/ADD	—	—	—	1.95	1.66	1.88	**1.8**

(1) Data also includes NWWD and DPSP.
(2) Data does not include MDD values for NASWI.

In general, both ADD and MDD have decreased slightly from 2007 though 2012. In each of the past 6 years, the MDD-to-ADD peaking factor remained below 2.00, which suggests that water conservation efforts by both City water customers as well as NASWI personnel have been successful. The MDD-to-ADD ratio for the retail service area decreased slightly from 2007 through 2012 and results in an average value of 1.78. This value is typically

referred to as the MDD peaking factor. For water use projections, a conservative peaking factor of 1.80 will be used for demand projections for the retail service area.

NASWI data was obtained from daily City water meter readings for 2010 through 2012 in order to more accurately assess the MDD. The average MDD-to-ADD ratio for NASWI was 2.3, which is significantly higher than that for the City. This higher MDD-to-ADD ratio will be used for demand projections for NASWI facilities.

PEAK HOUR DEMAND

PHD is calculated according to the following formula, which is listed as Equation 5-1 in the DOH Water System Design Manual.

$$PHD = \frac{MDD}{1{,}440}\left[(C)(N) + F\right] + 18$$

Where:

PHD	= peak hour demand (gallons per minute)
C	= coefficient associated with ranges of ERUs
N	= number of ERUs
F	= coefficient associated with ranges of ERUs
MDD	= maximum day demand (gpd/ERU)

Table 2-6 summarizes historical and existing values for PHD for the City as well as NASWI. PHD for the City was calculated using the formula above. PHD for NASWI was calculated using the average PHD-to-MDD factor of 1.64 which was calculated from historical City data.

TABLE 2-6

Historical Maximum Data and Calculated Peak Hour Demand

Parameter	2007	2008	2009	2010	2011	2012	Average
City of Oak Harbor							
MDD (gpd)	2,753,858	2,400,056	2,842,091	2,456,206	2,379,364	2,523,003	**2,559,096**
MDD (gpm)	1,912	1,667	1,974	1,706	1,652	1,752	**1,777**
PHD (gpm)(1)	3,124	2,728	3,226	2,790	2,703	2,865	**2,906**
PHD/MDD	1.63	1.64	1.63	1.64	1.64	1.64	**1.64**
NASWI							
MDD (gpd)	—	—	—	1,750,000	1,790,000	1,580,000	**1,706,667**
MDD (gpm)	—	—	—	1,215	1,243	1,097	**1,185**
PHD (gpm)(2)	—	—	—	1,988	2,033	1,794	**1,938**
PHD/MDD	—	—	—	1.64	1.64	1.64	**1.64**
Combined System							
MDD (gpm)	—	—	—	2,895	2,486	2,849	**2,744**
PHD (gpm)	—	—	—	4,735	4,066	4,659	**4,487**
PHD/MDD	—	—	—	1.64	1.64	1.64	**1.64**

(1) From the DOH Water System Design Manual (Table 5-1) for systems with ERUs greater than 500.
(2) Based off of the average PHD-to-MDD ratio of 1.64.

Although annual fluctuations in water use are typical, overall, water consumption within the system has remained relatively consistent from 2007 through 2012. Fluctuations from year-to-year occur due to variations in weather patterns, summer temperatures, conservation efforts, and the local economy.

WATER USE

WATER CONSUMPTION

Historical and existing water consumption by consumer class is presented in Table 2-7.

TABLE 2-7

Historical Annual Water Consumption by Customer Class

Category	Million Gallons						Average % of Service Area Total[1]	Average % of City Total
	2007	2008	2009	2010	2011	2012		
Residential	232.1	228.0	245.3	222.6	225.7	219.2	30.2%	48.5%
Multi-Residential[2]	121.2	118.2	118.2	114.9	116.9	116.0	15.8%	25.4%
Commercial	60.4	48.4	51.2	48.7	46.9	44.9	6.2%	10.0%
Multi-Commercial[3]	18.8	18.2	18.2	18.4	18.8	17.6	2.5%	4.0%
School	19.6	12.8	8.7	11.2	18.4	11.4	2.0%	3.3%
Hotel/Motel	10.6	10.4	10.2	9.9	9.9	11.2	1.4%	2.3%
Church	2.7	2.4	2.8	2.3	2.7	2.3	0.3%	0.5%
Sprinklers[4]	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	0.0%
Commercial/Residential	4.8	4.8	4.9	4.9	1.3	1.6	0.2%	0.3%
Irrigation	36.5	27.7	41.4	23.5	25.9	24.9	3.4%	5.5%
Hydrant Meters	1.0	1.6	0.1	2.8	0.6	0.7	0.1%	0.1%
Total Retail Service Area Consumption	**507.8**	**472.5**	**501.0**	**459.2**	**467.1**	**449.9**	**62.2%**	N/A
NASWI	284.9	275.4	320.2	281.7	283.8	259.7	36.9%	
Wholesale Users [5]	7.8	7.8	8.0	8.6	6.3	6.6	0.9%	
TOTAL Service Area Consumption	**800.5**	**755.6**	**829.2**	**749.5**	**757.2**	**716.2**	**100.0%**	

(1) Average values are for 2011 and 2012 data only to more accurately reflect the current focus on conservation. Does not include NWWD or DPSP.
(2) Includes multifamily residential units of medium or high density.
(3) Includes small commercial businesses located within larger commercial buildings (e.g., strip malls).
(4) For fire suppression, does not include irrigation.
(5) Includes DPSP and NWWD.

From the data, it is clear that NASWI facilities and residential connections constitute the majority of the water consumption within the City's wholesale water system (83 percent). Commercial and irrigation are the next largest users (12 percent), while the remaining classes (which include DPSP and NWWD) make up a small portion of overall water consumption (5 percent).

NASWI water consumption has remained relatively consistent from 2007 through 2012. Additional information on NASWI water consumption is available in the *NAS Whidbey Island Water System Plan* (KPFF, 2008). One of the main findings from this plan is that the Seaplane Base, which contains almost all of the residential and housing units for NASWI personnel, averaged approximately 45 percent of the total NASWI water consumption from 2007 through 2011.

Water consumption for all customer classes other than NASWI is shown graphically on Figure 2-1.

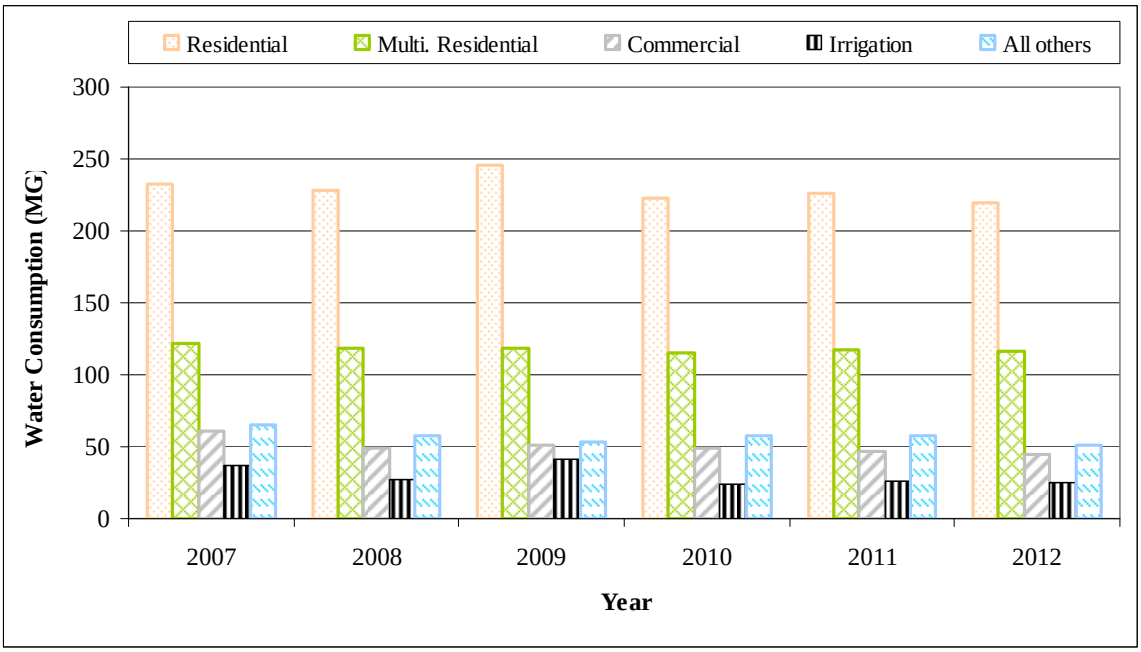


FIGURE 2-1

Historical Annual Water Consumption by Customer Class

Table 2-7 and Figure 2-1 show that water consumption has decreased slightly since 2007. This is likely due to a focus on conservation, continual preventive maintenance measures by the water system operations staff, and a relatively stable retail service area population.

EQUIVALENT RESIDENTIAL UNITS

An equivalent residential unit (ERU) represents the water consumption of a standard single-family residence and is calculated by dividing the average daily single-family residential (SFR) demand by the number of SFR connections. It is typically measured in gallons per day per ERU (gpd/ERU).

Table 2-8 outlines the data and calculations used to estimate the consumption per ERU for the City. The average water demand for 2007 through 2012 is approximately 150 gpd/ERU. This value is within the typical range for a municipal water system of comparable size to Oak Harbor. By dividing this average consumption per ERU into the demand by other customer classes, estimates for the number of non-residential ERUs within the City's service area are derived. This data is presented in Table 2-9.

TABLE 2-8

Historical ERU Calculation Summary

Parameter	2007	2008	2009	2010	2011	2012	Average
SFR Consumption (MG/year)	232.09	228.04	245.27	222.63	225.71	219.24	**228.83**
SFR Consumption (gpd)	635,860	624,762	671,960	609,933	618,379	600,665	**626,927**
SFR Water Connections	4,204	4,111	4,232	4,302	4,338	4,350	**4,256**
SFR Water Use (gpd/ERU)	151	152	159	142	143	138	**150**

TABLE 2-9

Historical ERU Summary

Category	ERUs(1)						Average % of Total(2)	ERUs per Connection(3)
	2007	2008	2009	2010	2011	2012		
Residential	4,204	4,111	4,232	4,302	4,338	4,350	30.3	1.0
Multi-Residential	2,196	2,125	2,039	2,220	2,247	2,296	15.8	3.0
Commercial	1,095	871	883	941	900	889	6.2	2.8
Multi-Commercial	340	327	314	356	361	348	2.5	3.1
School	355	230	151	217	354	226	2.0	10.3
Hotel/Motel	193	186	177	192	190	222	1.4	24.7
Church	49	42	48	44	52	46	0.3	1.8
Sprinklers	0	0	0	0	0	0	0.0	0.0
Commercial/Residential	88	86	85	94	25	31	0.2	1.9
Irrigation	661	498	714	454	498	492	3.4	4.2
Hydrant Meters	—	—	—	—	—	—	0.0	—
Total Retail Service Area Consumption ERUs	**9,180**	**8,476**	**8,643**	**8,819**	**8,966**	**8,899**	**62.2**	—
NASWI	5,161	4,951	5,848	5,444	5,455	5,139	36.9	—
Wholesale Users(4)	142	139	147	166	121	131	0.9	—
DSL	1,440	968	627	108	333	602	3.3	—
Total Service Area Consumption ERUs	**14,483**	**13,567**	**14,637**	**14,430**	**14,542**	**14,169**	**100.0**	—

(1) Based on annual ERU values found in Table 2-8.
(2) Average values are for 2011 and 2012 only.
(3) Data are for 2012 only.
(4) Includes DPSP and NWWD.

PER CAPITA DEMAND

Per capita demand is an estimate of the daily amount of water used per service area customer. It is typically measured in gallons per capita per day (gpcd). A summary of per capita consumption for the City's service area customers is presented in Table 2-10.

TABLE 2-10

Historical Per Capita Water Use Summary

Year	Retail Service Area Consumption (gallons/year)	Retail Service Area Population(1)	Per Capita Water Consumption (gpcd)
2007	507,808,260	18,507	75
2008	472,479,194	18,664	69
2009	501,020,368	18,936	72
2010	459,184,100	18,773	67
2011	467,098,909	18,898	68
2012	449,898,221	18,898	65
Average	**476,248,175**	**18,779**	**69**

(1) The decrease in population seen between 2009 and 2010 is due to the availability of 2010 U.S. Census data.

The City's average per capita consumption is 69 gpcd. As the demographic structure of the City is not projected to change significantly within the 6- and 20-year planning periods, this value will be used for water demand projections. The City's historical average per capita water use rate of 69 gpcd is significantly lower than that of Washington State (102 gpcd, 2005) as well as the United States (101 gpcd, 2010).

This is likely due to a focus on conservation, City demographics, and low water use for agriculture, among other factors.

DISTRIBUTION SYSTEM LEAKAGE

Distribution system leakage (DSL) is defined by DOH as the difference between total water produced and total authorized consumption and typically includes losses due to leaks, illegal service connections, accounting errors, inaccurate meter readings, and various other unmetered uses. Other authorized consumption that may not be included in consumption records might include water used for park irrigation, reservoir overflow, or City-sponsored construction projects. The City does account for all of these potential sources; however, so their contribution to DSL is estimated to be minimal. It is also occasionally referred to as unaccounted-for water; however, since this term has no standard definition, DOH recommends using only DSL in professional documents.

The City monitors DSL on an annual basis, and typically has low DSL. DSL is defined according to the equation below from the DOH Water System Design Manual:

$$DSL\ (gallons) = TP - AC$$

$$DSL\ (percent) = \left[\frac{(TP - AC)}{TP}\right] * 100\%$$

Where:

DSL = distribution system leakage (gallons or percent)
TP = total water produced and/or purchased (gallons/year)
AC = authorized consumption (gallons/year)

Table 2-11 summarizes DSL for the City's water system. DSL is related to the City's Water Use Efficiency Program, which is discussed in Chapter 5 – Water Use Efficiency Program. State regulations have established a standard maximum allowable DSL of 10 percent based on a rolling 3-year average. The City's DSL is well below this threshold, and as such, is in compliance with the Water Use Efficiency Rule and requires no further action other than continued monitoring and reporting. Should the 3-year rolling average percent DSL ever increase above 10, the City would be required to develop a water loss control action plan.

TABLE 2-11

Historical Distribution System Leakage Summary

Parameter	2007	2008	2009	2010	2011	2012	Average
Total Source Production (MG)(1)	880.04	809.48	865.55	755.12	774.59	746.66	805.24
Authorized Consumption (MG)(2)	800.54	755.64	829.22	749.53	757.25	716.24	768.07
DSL (MG)	79.50	53.84	36.33	5.59	17.34	30.42	37.17
DSL (percent)	9.0%	6.7%	4.2%	0.7%	2.2%	4.1%	4.5%
3-year Rolling Average	—	—	6.6%	3.9%	2.4%	2.4%	—

(1) Combined production from Anacortes and Wells 8, 9 and 11 from Table 2-3.
(2) Total Service Area Consumption from Table 2-10.

DSL is below the required 10 percent in each year from 2007 through 2012. In 2007, Anacortes recalibrated all source meters that measure the City's water use. In addition, the City verified that all its meters were calibrated properly and replaced all inaccurate meters. The City completes regularly scheduled inspection and calibration of their source meters.

Between 2008 and 2012, the annual average DSL was 3.9 percent. Leakage from 2007 was excluded because of inaccurate metering data. For source demand projections, a conservative annual DSL of 4.0 percent will be assumed.

SEASONAL VARIATIONS

Seasonal average day consumption by customer class for 2012 was analyzed and is shown on Figure 2-2. For simplicity, customer classes with low consumption were combined into a single data category. These classes included multi-commercial, school, hotel/motel, industrial/church, sprinklers, commercial/residential, and hydrant meters.

Analysis of seasonal demand by class can help to identify trends or important differences between indoor and outdoor residential and commercial demands and/or potential peaking factors. These data also help to visualize significant increases in water demand for a particular customer class during only part of the year. Knowledge of seasonal variations in water demand can help planning personnel better serve customers and maintain the water system.

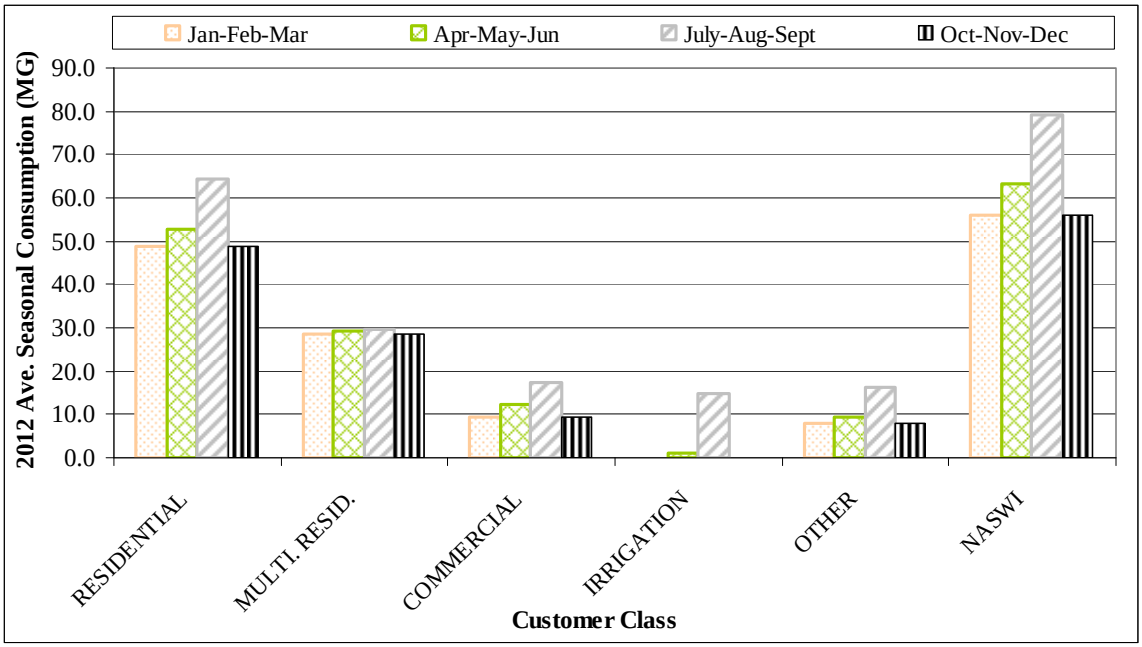


FIGURE 2-2

Annual Water Use Seasonal Variations by Customer Class

Data from Figure 2-2 show that the highest seasonal use for all customer classes considered is during the summer months of July, August, and September. The multi-residential customer class shows very consistent water consumption throughout the entire year. Summer water use constitutes approximately 31 percent of the overall annual water use, while fall water use is the next largest seasonal use period at approximately 24 percent. This is typical for most municipalities, as irrigation requirements significantly increase due to warmer temperatures.

The seasonal variation of water consumption within a particular customer class is not expected to change within the timeframe of this planning effort.

LARGE WATER USERS

Information regarding the ten largest consumers of City water is listed in Table 2-12.

TABLE 2-12

Top City Water Users for 2012

User Name	2012 Consumption (gallons)	Average Consumption (gpd)	Customer Class	ERUs(1)
NASWI (2)	259,719,414	709,616	Wholesale	4,731
Western Village/Vito Ent, Ltd.	4,499,968	12,295	Commercial	89
State of Washington (DPSP) (2) (3)	3,993,572	10,911	Commercial	79
OHMP, LLC	3,934,480	10,750	Multi-Residential	78
Oak Bay Station Apartments	3,590,400	9,810	Multi-Residential	71
Woodside North	3,161,796	8,639	Multi-Residential	63
City Beach West Park Irrigation	3,012,944	8,232	Irrigation	60
Coachman Inn	2,933,656	8,015	Commercial	58
North Whidbey Water District (2)	2,628,472	7,182	Commercial	52
City RBC Sewer Treatment	2,569,380	7,020	Commercial	51
Summer Hill Assisted Living, LLC	2,496,824	6,822	Multi-Residential	49
Total	**292,540,906**	**799,292**	**—**	**5,792**
Retail Service Area Values	**449,898,221**	**1,470,594**	**—**	**8,899**

(1) Based on the 2012 value of 138 gpd/ERU.
(2) Wholesale user.
(3) DPSP = Deception Pass State Park facilities.

Only one of the top ten users within the City's service area are in the irrigation customer class, while the remaining users are considered commercial or multi-residential. ERUs were calculated by dividing the 2012 consumption by the 2012 ERU value of 138 gpd/ERU developed earlier in this chapter. Overall, the top ten users within the City represent approximately 7.2 percent of the overall City water consumption.

Targeting these top ten water-consuming customers for conservation and efficient water use programs presents an opportunity for water use savings, which are discussed further in Chapter 5 – Water Use Efficiency Program.

PROJECTED SYSTEM INFORMATION

POPULATION

Future water demands for the City's retail service area were developed using population projections provided by the City and Island County planning departments, the Washington State OFM, and NASWI staff. The projected service area population is summarized in Table 2-13.

TABLE 2-13

Projected Population of Oak Harbor and Retail Service Area

Year	City Population(1)	RSA in UGA Population(2)	Seaplane Base Population(3)	Retail Service Area Population(4)
2013	22,080	18	3,320	18,778
2014	22,266	18	3,320	18,964
2015	22,454	18	3,320	19,952
2016	22,644	18	3,320	20,942
2017	22,835	18	3,320	21,933
2018	23,027	18	3,320	22,925
2019	23,222	18	3,320	23,920
2020	23,418	18	3,320	24,116
2021	23,615	18	3,320	24,313
2022	23,815	18	3,320	24,513
2023	24,016	18	3,320	24,714
2024	24,218	18	3,320	24,916
2025	24,423	18	3,320	25,121
2030	25,471	18	3,320	26,169
2033	26,121	18	3,320	26,819
2060	32,774	18	3,320	33,472

(1) Population within the city limits – which includes the Seaplane Base.
(2) Population outside of the city limits, but within the City's urban growth area and retail service area.
(3) Remains constant. Current NASWI plans for expansion of personnel do not include additional housing on the Seaplane Base.
(4) City population plus population in UGA and retail service area minus NASWI Seaplane Base personnel.

Growth rates used for projecting future populations are based on previous plan projections, current populations, current growth indicators, economic indicators, and an appropriate level of contingency. City population growth rates were assumed to be constant at 1.26 percent annually. The UGA population was assumed to decrease at an annual rate of 0.47 percent due to City annexation of lands within the UGA, but outside the city limits. The combined population thus grows at rates that vary with time. Growth rates for the combined population start at 1.03 percent in 2013 and steadily increase to 1.07 percent by 2033, and to 1.11 percent by 2060. The service area population includes the combined City and UGA populations, but does not include NASWI Seaplane Base residents as they are considered separately. NASWI personnel is anticipated to grow by up to 25 percent within the 6-year planning period, but NASWI has no plans to expand housing at either Ault Field or the Seaplane Base. Consequently, these populations are projected to remain constant, and additional military personnel and their dependents are included in projections for the RSA and entire service area.

SERVICE CONNECTIONS

The number of service connections in each customer class was estimated to increase at an annual rate of 1 percent. By doing this, the total estimated number of connections in 2019, 2033 and 2060 is 7,059, 8,111 and 10,609, respectively.

The City is currently designing a project that will provide two metered interties between the City and the NASWI Seaplane Base. When this project is completed, water for the Seaplane Base facilities will be provided by the City's distribution system through two connections located at the intersections of NE Regatta Drive and West Crescent Harbor Road, and also at NE Regatta Drive and East Whidbey Avenue. The U.S. Navy has requested 775 gpm for peak hour flow plus 2,500 gpm fire flow at the Crescent Harbor Road intertie, and 1,000 gpm peak hour flow at the Whidbey Avenue intertie. These projects are further described in Chapter 8 – Capital Improvement Program.

WATER USE

Water demand through the end of the planning period must be estimated to determine water system deficiencies. Distribution facilities are typically sized to supply the peak hour demands or maximum day plus fire flow demands. Major transmission, pumping, and storage facilities are typically sized using maximum day demand and a diurnal demand curve. The diurnal demand curve describes the demand variations throughout the day as a function of the total demand.

WATER CONSUMPTION

In general, water consumption by the City as well as by NASWI has decreased since 2007. As the population continues to increase, however, it is likely that the water demand by the water system customers will also increase.

Table 2-14 summarizes the system wide projected consumption (in MG) through the 20-year planning period.

TABLE 2-14

Projected Water Consumption

Year	Million Gallons								
	Residential(1)	Multi. Residential(1)	Commercial(1)	Irrigation(1)	All Others(1)	Total Retail Service Area Consumption	NASWI(2)	Wholesale Users(3)	Total Service Area Consumption
2013	231.1	121.0	47.7	26.4	50.1	**476.3**	290.0	8.6	**774.9**
2014	233.4	122.2	48.2	26.6	50.6	**481.0**	290.0	8.6	**779.7**
2015	245.6	128.6	50.7	28.0	53.3	**506.1**	290.0	8.6	**804.7**
2016	258.5	135.3	53.3	29.5	56.1	**532.7**	290.8	8.6	**832.1**
2017	270.0	141.3	55.7	30.8	58.6	**556.3**	290.0	8.6	**855.0**
2018	282.2	147.7	58.2	32.2	61.2	**581.5**	290.0	8.6	**880.1**
2019	294.4	154.1	60.7	33.6	63.9	**606.7**	290.0	8.6	**905.4**
2020	297.6	155.8	61.4	34.0	64.6	**613.4**	297.5	8.6	**919.5**
2021	299.3	156.7	61.7	34.2	64.9	**616.7**	303.3	8.6	**928.7**
2022	301.7	158.0	62.2	34.4	65.4	**621.8**	310.0	8.6	**940.4**
2023	304.2	159.3	62.8	34.7	66.0	**626.9**	316.7	8.6	**952.1**
2024	307.5	161.0	63.4	35.1	66.7	**633.8**	324.2	8.6	**966.6**
2025	309.2	161.9	63.8	35.3	67.1	**637.2**	330.0	8.6	**975.8**
2030	322.1	168.6	66.4	36.8	69.9	**663.8**	363.3	8.6	**1,035.7**
2033	330.1	172.8	68.1	37.7	71.6	**680.3**	383.3	8.6	**1,072.1**
2060	413.1	216.3	85.2	47.2	89.6	**851.4**	384.3	8.6	**1,244.3**

(1) Based on projected population and 69 gpcd and system demand by class from Table 2-7.
(2) Assumes constant NASWI population until 2020, then an average of 0.4 percent growth per year through 2060.
(3) Assumed to remain constant.

Total water demand projections are ultimately based on the projected ADD. The ADD value was calculated by multiplying the assumed per capita water usage (69 gpd) by the projected service area population.

Table 2-14 shows a steady increase in water demand until 2016, when an increase in demand is evident. Figure 2-3 shows the historical and projected water demands for the City, NASWI, as well as the total projected water demands. These projections do not include water use efficiency program savings, which are discussed further in Chapter 5 – Water Use Efficiency Program.

FIGURE 2-3

Historical and Projected Service Area Annual Water Consumption

EQUIVALENT RESIDENTIAL UNITS

Projections for the number of ERUs within the retail and wholesale service areas were also estimated. To project the number of service area ERUs, the total projected water consumption was divided by the ERU value of 150 gpd per ERU (Table 2-8). Results of this calculation are shown in Table 2-15. Although not shown below, ERUs by customer class can also be estimated using the percentage totals listed in Table 2-7.

TABLE 2-15

Projected Service Area ERUs

Year	Retail Service Area ERUs(1)	Total NASWI ERUs(2)	Seaplane Base ERUs(3)	Wholesale ERUs(4)	Service Area ERUs(5)
2013	9,233	5,297	2,384	5,454	14,821
2014	9,323	5,297	2,384	5,454	14,911
2015	9,798	5,297	2,384	5,454	15,391
2016(6)	10,274	5,297	2,384	5,454	15,871
2017	10,750	5,297	2,384	5,454	16,352
2018	11,227	5,297	2,384	5,454	16,833
2019	11,706	5,297	2,384	5,454	17,316
2020	11,804	5,419	2,438	5,576	17,538
2021	11,904	5,540	2,493	5,697	17,761
2022	12,004	5,662	2,548	5,819	17,985
2023	12,106	5,784	2,603	5,941	18,210
2024	12,208	5,905	2,657	6,062	18,436
2025	12,310	6,027	2,712	6,184	18,662
2030	12,837	6,635	2,986	6,792	19,808
2033	13,164	7,000	3,150	7,157	20,505
2060	16,362	7,000	3,150	7,157	23,733

(1) Includes City ERUs and ERUs inside the UGA within the retail service area.
(2) Based on projected water consumption and ERU value of 150 gpd. Also includes Seaplane Base ERUs.
(3) Based on historical use of 45 percent of total NASWI consumption, projected NASWI consumption, and ERU value of 150 gpd.
(4) Includes NASWI, DPSP, and NWWD.
(5) Includes retail and wholesale ERUs.
(6) In 2016, Seaplane Base customers are expected to start being served by the City distribution system.

AVERAGE DAY/MAXIMUM DAY/PEAK HOUR DEMAND

Projected ADD, MDD, and PHD were also estimated for planning purposes and are shown in Table 2-16. ADD was estimated by multiplying the projected service area population by the daily per capita water use value of 69 gpcd. Both the MDD and the PHD were estimated based on the historical MDD-to-ADD and PHD-to-MDD peaking factors, which are 1.80 (2.27 for NASWI), and 1.64, respectively.

TABLE 2-16

Projected Service Area ADD, MDD, and PHD Consumption

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2033	2060
Retail Service Area																
ADD (mgd)	1.305	1.318	1.387	1.455	1.524	1.593	1.662	1.676	1.690	1.704	1.717	1.732	1.746	1.819	1.864	2.326
MDD (mgd)	2.349	2.372	2.496	2.620	2.744	2.868	2.992	3.017	3.041	3.066	3.091	3.117	3.142	3.274	3.355	4.187
PHD (gpm)	2,675	2,702	2,843	2,983	3,125	3,266	3,408	3,436	3,464	3,492	3,521	3,550	3,579	3,728	3,821	4,769
NASWI																
ADD (mgd)	0.795	0.795	0.795	0.795	0.795	0.795	0.795	0.813	0.831	0.849	0.868	0.886	0.904	0.995	1.050	1.050
MDD (mgd)	1.827	1.827	1.827	1.827	1.827	1.827	1.827	1.869	1.911	1.953	1.995	2.037	2.079	2.289	2.415	2.415
PHD (gpm)	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,129	2,177	2,225	2,272	2,320	2,368	2,607	2,750	2,750
Combined System																
ADD (mgd)	2.100	2.112	2.181	2.250	2.319	2.388	2.457	2.489	2.521	2.553	2.585	2.617	2.650	2.814	2.914	3.376
MDD (mgd)	4.176	4.200	4.323	4.447	4.571	4.695	4.820	4.886	4.953	5.020	5.087	5.154	5.222	5.563	5.770	6.602
PHD (gpm)	4,757	4,783	4,924	5,065	5,206	5,347	5,489	5,565	5,641	5,717	5,793	5,870	5,947	6,335	6,571	7,519

WATER PURCHASE AND WELL PRODUCTION

SOURCE INFORMATION

As described previously, the City maintains a water purchase agreement with the City of Anacortes. The City of Anacortes water treatment plant, which treats water from the Skagit River, completed an expansion to 42 million gallons per day (rated capacity) in 2013. Table 2-17 summarizes the projected required source production for the 20-year planning period.

TABLE 2-17

Retail Service Area Projected Source Production

Year	Retail Service Area Population	Retail Service Area ERUs	Average Daily Consumption(1)	DSL(2)	Required Production		
					Average Daily (gpd)	Maximum Daily (gpd)(3)	Peak Hour (gpm)(4)
2013	18,778	8,700	1,305,000	80,030	1,385,000	2,493,000	2,839
2014	18,964	8,786	1,318,000	80,520	1,398,000	2,517,000	2,867
2015	19,952	9,244	1,387,000	83,110	1,470,000	2,645,000	3,012
2016	20,942	9,702	1,455,000	85,700	1,541,000	2,774,000	3,159
2017	21,933	10,162	1,524,000	88,300	1,613,000	2,903,000	3,306
2018	22,925	10,621	1,593,000	90,900	1,684,000	3,031,000	3,452
2019	23,920	11,082	1,662,000	93,500	1,756,000	3,160,000	3,599
2020	24,116	11,173	1,676,000	94,700	1,771,000	3,187,000	3,630
2021	24,313	11,265	1,690,000	95,910	1,786,000	3,214,000	3,660
2022	24,513	11,357	1,704,000	97,120	1,801,000	3,241,000	3,691
2023	24,714	11,450	1,717,000	98,330	1,816,000	3,268,000	3,722
2024	24,916	11,544	1,732,000	99,550	1,831,000	3,296,000	3,754
2025	25,121	11,639	1,746,000	100,800	1,847,000	3,324,000	3,786
2030	26,169	12,124	1,819,000	107,000	1,926,000	3,466,000	3,947
2033	26,819	12,425	1,864,000	110,700	1,975,000	3,554,000	4,048
2060	33,472	15,508	2,326,000	128,200	2,454,000	4,418,000	5,032

(1) Based on population projections and 69 gpcd.
(2) Assumed to be 80 percent of the estimated DSL for the entire service area.
(3) Estimated as 1.8 * ADD + DSL.
(4) Estimated as 1.64 * required maximum daily production.

CHAPTER 3

SYSTEM ANALYSIS

INTRODUCTION

Water system planning is based on a careful analysis of a water utility's ability to meet minimum level of service standards for existing and future customers. The City has adopted design standards, which identify criteria and standards for the water system. These standards can be used to evaluate and analyze the existing water system facilities and water quality. Based on these analyses, a summary of deficiencies and options to improve compliance with required standards can be identified.

SYSTEM DESIGN STANDARDS

Performance and design criteria typically address the sizing and reliability requirements for source, storage, distribution, and fire flow components of a water system. WAC 246-290 contains general criteria and standards that must be followed in development of public water systems. In addition, DOH has published its Water System Design Manual ("Design Manual") that provides more specific guidance for water system design. The design recommendations for general facility standards and City policies and standards are compared below.

GENERAL FACILITY STANDARDS

Table 3-1 lists the suggested DOH Design Manual guidance as well as the City's policies with regard to each standard for general facility requirements.

TABLE 3-1

General Facility Standards Summary

Standard	DOH Design Manual	City Standard
Average Day and Maximum Day Demand	Average day demand should be determined from previous actual water use data. Maximum day demand (MDD) is estimated at approximately 2 times the average day demand if metered data is not available.	Average day demand is determined from historic production data. Maximum day demand is determined by examining maximum day production for the last 7 years.

TABLE 3-1 – (continued)

General Facility Standards Summary

Standard	DOH Design Manual	City Standard
Peak Hour Demand	Peak hour demand is determined using DOH Design Manual PHD = (MDD/1440)[(C) (N)+F] +18 C = Coefficient from DOH Table 5-1 N = Number of ERUs F = Factor of range from Table 5-1	Peak hour demand is determined by applying a peaking factor of 1.64 based upon the Design Manual.
Source	Capacity must be sufficient to meet MDD and replenish fire suppression storage in 72 hours.	Same as the Design Manual.
Storage	The sum of: Operational Storage Equalizing Storage Standby Storage Fire Suppression Storage	Same as the Design Manual.
Fire Flow Requirements	N/A	Maximum required fire flow within the City is 3,500 gpm for 2 hours. All other requirements are as stated in the International Fire Code (2009). Minimum fire flow is 1,000 gpm for 2 hours.
Minimum System Pressure	The system should be designed to maintain a minimum of 30 psi in the distribution system during peak hour demand and 20 psi under fire flow conditions during MDD.	Same as the Design Manual.
Minimum Pipe Sizes	The minimum size for a transmission line shall be determined by hydraulic analysis and in accordance with Design Manual Section 8.1.2.	All pipe is designed to withstand a minimum internal pressure of 150 psi. (OHMC 13.28.040)

TABLE 3-1 – (continued)

General Facility Standards Summary

Standard	DOH Design Manual	City Standard
Reliability Recommendations	Two or more sources capable of replenishing fire suppression storage within a 72-hour period. Sources must meet ADD with largest source out of service. Back-up power equipment for booster stations unless there are two independent public power sources. Provision of multiple storage tanks. Standby storage equivalent to 2 times ADD, with a minimum of 200 gpd/ERU. Low and high level storage alarms. Looping of distribution mains when feasible. Pipeline velocities not >8 fps at PHD and not >10 fps during fire flow. Flushing velocities of a minimum of 2.5 fps for all pipelines.	Same as the Design Manual Chapter 5.
Valve and Hydrant Spacing	Sufficient valving should be placed to keep a minimum of customers out of service when water is turned off for maintenance or repair. Fire hydrants on laterals should be provided with their own auxiliary gate valve.	Valve and hydrant standards follow 2009 IFC.

FIRE FLOW

During fires, a combination of supply, storage, and distribution capacity must be available to meet firefighting requirements. The primary purpose of the system is to provide water to a fire at the rate and duration required to extinguish it. To achieve this purpose, the following standards and criteria have been adopted:

- It is assumed that fire flow demand will occur during maximum day demand for modeling purposes.

- The pressure at any point within the system during a fire must remain above 20 psi.

System fire flows were established by the Oak Harbor Fire Department for the 1988 Water System Plan based on the grading schedule published in 1974 by the Insurance Services Office. These requirements have been updated and follow Section 507 and Appendix B of the International Fire Code published in 2009. Current minimum fire flow rates are shown in Table 3-2. Fire flows are also discussed with regard to the hydraulic model in Chapter 4 – Hydraulic Analysis.

TABLE 3-2

Minimum Fire Flow Requirements

Land Use Category	Minimum Fire Flow (gpm)
Low-Density Residential	1,000
Medium-Density Multifamily	2,000
Small Business	2,000
High-Density Multifamily	3,000
Large Office	3,000
Industrial/Commercial	3,500
Large Assembly Occupancies	3,500

WATER QUALITY STANDARDS AND ANALYSIS

WATER QUALITY STANDARDS

Table 3-3 lists existing and future drinking water regulations and the status of each regulation. Existing state law contains regulations for bacteriological contaminants, inorganic chemicals and inorganic physical parameters (IOCs), volatile organic chemicals (VOCs), synthetic organic chemicals (SOCs), radionuclides, and trihalomethanes (THMs). Six drinking water regulations will become effective in the next 10 years that will define new regulatory requirements for sulfate, radionuclides, additional IOCs and SOCs, arsenic, additional disinfection byproducts, and bacteriological contaminants.

Many of the regulations listed in Table 3-3 define treated source water quality standards and establish monitoring schedules. The implementation schedules for the proposed new regulations are subject to revision and the City will continue to stay informed regarding regulatory deadlines. It is also important to note that some of the required standards fall under the responsibility of the Anacortes water treatment system.

Minimum standards for water quality are specified in terms of maximum contaminant levels (MCLs). Primary MCLs are based on chronic and/or acute human health effects while secondary MCLs are based on factors other than health effects, including aesthetics. MCLs are specified in WAC 246-290-310 and described further in the following pages and tables. The following sections discuss the applicable water quality regulations, analysis of the City's compliance with these regulations, and a summary of

future regulations for each category. A water quality monitoring schedule is presented later in this chapter.

TABLE 3-3

Drinking Water Regulations and Required Action Summary

Regulation	Affected Contaminants	City Action
Bacteriological	Coliform	Monitoring
Residual Disinfectant	Total free chlorine	Monitoring
Consumer Confidence Report	Reporting	Reporting
IOC and Physical Parameters	IOCs	Monitoring
VOC/SOC	VOCs, SOCs	Monitoring
Asbestos	Asbestos	Monitoring
Lead and Copper Rule	Lead, Copper	Monitoring
Radionuclide Rule	Radionuclides	Monitoring
Stage 2 DBP Rule	TTHM, HAA5, Chlorite, Bromate	Monitoring
Unregulated Contaminant Rule	IOCs, VOCs, SOCs	Planning and Monitoring
Groundwater Rule	Bacteriological	N/A (1)
Surface Water Treatment Rule	Microbial	N/A
Information Collection Rule	Bacteriological	Reporting
Filter/Backwash Rule	Bacteriological	N/A
Interim Enhanced Surface Water Treatment Rule	Bacteriological	N/A
Long Term 1 Enhanced Surface Water Treatment Rule	Bacteriological	N/A
Long Term 2 Enhanced Surface Water Treatment Rule	Bacteriological	N/A

(1) N/A indicates that planning and monitoring requirements are the responsibility of the City of Anacortes.

TESTING REQUIREMENTS

The City is required to comply with the DOH requirements for a Group A Public Water System. DOH defines the constituents required and their MCLs for water systems in WAC 246-290-300 and 246-290-310.

Water from Wells 8, 9, and 11 is brought to the surface, tested according to DOH requirements prior to treatment, then finally treated with sodium hypochlorite prior to entering the distribution system. Water from Wells 8, 9, and 11 as well as the Anacortes Water Treatment Plant supply is also treated with sodium fluoride prior to entering the distribution system. A brief description of the testing required and the City's current status with each test is described below.

Water quality data for water purchased from Anacortes is presented in the *City of Anacortes Water System Plan* (HDR, 2011); however, Anacortes source water samples did not exceed the primary MCL for any of the contaminants discussed below.

BACTERIOLOGICAL

Coliform bacteria describe a broad category of organisms routinely monitored in potable water supplies. Though not all coliform bacteria are pathogenic in nature, they are relatively easy to identify in laboratory analysis. If coliform bacteria are detected, then pathogenic organisms may also be present. Bacterial contamination in a water supply can cause a number of waterborne diseases, so these tests are strictly monitored and regulated by DOH.

The Coliform Monitoring Rule specifies two types of violations, "non-acute MCLs" and "acute MCLs." A purveyor is required to notify both the DOH and system consumers if either type of MCL violation occurs. Non-acute violations of bacteriological MCLs are as follows:

- Coliform is detected in two or more routine or repeat samples for systems collecting fewer than 40 samples per month

- Coliform detected in greater than 5 percent of samples during routine sampling for systems that collect greater than 40 samples per month

Acute violations of bacteriological MCLs are as follows:

- E. coli and/or fecal coliform presence in a repeat sample.

- Coliform presence in a set of repeat samples collected as a follow-up to a routine sample with fecal coliform or E. coli presence.

Public notification requirements for violations are included in Chapter 6 – Operation and Maintenance Program. Sample letters and notifications are included in Appendix K.

The City is required to collect 20 monthly samples for bacteriological analysis. Within the 6-year planning period, it is projected that the service area population will increase to a value that will require additional sampling. When the City's service area population rises to 21,501 customers, a total of 25 bacteriological samples will be required. A copy of the sampling locations and repeat sample locations is included as part of the City's Coliform Monitoring Plan, which is included in Appendix L. The City has not detected the presence of coliforms in source water samples since 2002.

INORGANIC PHYSICAL AND CHEMICAL CHARACTERISTICS

WAC 246-290 specifies primary and secondary MCLs for inorganic physical and chemical characteristics. Primary MCLs are based on potential impact to human health, while secondary MCLs are based on aesthetic factors such as taste, color, and odor which do not directly impact human health. Primary and secondary MCLs for inorganic chemical and physical characteristics are summarized in Table 3-4.

TABLE 3-4

Water Quality Standards for Inorganic Chemical Constituents

Chemical	Primary MCL (mg/L)
Antimony (Sb)	0.006
Arsenic (As)	0.01
Asbestos	7 million fibers/liter
Barium (Ba)	2.0
Beryllium (Be)	0.004
Cadmium (Cd)	0.005
Chromium (Cr)	0.1
Cyanide (HCN)	0.2
Fluoride (F)	4.0
Mercury (Hg)	0.002
Nickel (Ni)	0.1
Nitrate (as N)	10.0
Nitrite (as N)	1.0
Selenium (Se)	0.05
Sodium (Na)	None(1)
Thallium (Tl)	0.002
Chemical	**Secondary MCL (mg/L)**
Chloride (Cl)	250
Fluoride (F)	2.0
Iron (Fe)	0.3
Manganese (Mn)	0.05
Silver (Ag)	0.1
Sulfate (SO4)	250
Zinc (Zn)	5.0
Color	15 color units
Specific Conductivity	700 µmhos/cm
Total Dissolved Solids (TDS)	500 mg/L

(1) Although an MCL has not been established for sodium, there is enough public health significance connected with sodium levels to require inclusion in inorganic chemical and physical monitoring.

Groundwater sources must be sampled for inorganics as well as nitrite once every 3 years, while nitrate samples are required annually.

The City's most recent IOC samples were taken from all sources in June 2011 and nitrate samples were taken in June 2012 and 2013. Results for these most recent IOC samples are presented in Appendix M. The City's only exceedance was for manganese at 0.0520 mg/L (MCL 0.05 mg/L) from Well 11.

VOLATILE ORGANIC COMPOUNDS AND SYNTHETIC ORGANIC COMPOUNDS

Volatile organic chemicals (VOCs) are manufactured, carbon-based chemicals that vaporize quickly at normal temperatures and pressures. VOCs include many hydrocarbons associated with fuels, paint thinners, and solvents. This group does not include organic pesticides, which are regulated separately as synthetic organic chemicals (SOCs).

There are currently 21 regulated VOCs and 30 regulated SOCs. A list of these compounds and their MCLs is included in Table 3-5. Per DOH requirements, VOCs must be sampled for once every 3 years unless a waiver is in place.

Water samples from all the sources were most recently tested for VOCs in April 2013. VOCs were not detected in any of these tests. Sample results on file with DOH are presented in Appendix M.

TABLE 3-5

Water Quality Standards for Volatile Organic and Synthetic Organic Chemical Constituents

Volatile Organic Chemical	Primary MCL (mg/L)(1)	Synthetic Organic Chemical	Primary MCL (mg/L)(1)
Vinyl Chloride	0.002	Arochlor	0.002
Benzene	0.005	Aldicarb	0.003
Carbon Tetrachloride	0.005	Aldicarb sulfone	0.003
1,2-Dichloroethane	0.005	Aldicarb sulfoxide	0.004
Trichloroethylene	0.005	Atrazine	0.003
Para-Dichlorobenzene	0.075	Carbofuran	0.04
1,1-dichloroethylene	0.007	Chlordane	0.002
1,1,1-Trichloroethane	0.2	Dibromochloro-propane	0.0002
cis-1,2-Dichloroethylene	0.07	2,4-D	0.07
1,2-Dichloropropane	0.005	Ethylene dibromide	0.00005
Ethylbenzene	0.7	Heptachlor	0.0004
Monochlorobenzene	0.1	Heptachlor epoxide	0.0002

TABLE 3-5 – (continued)

Water Quality Standards for Volatile Organic and Synthetic Organic Chemical Constituents

Volatile Organic Chemical	Primary MCL (mg/L)(1)	Synthetic Organic Chemical	Primary MCL (mg/L)(1)
Ortho-Dichlorobenzene	0.6	Lindane	0.0002
Styrene	0.1	Methoxychlor	0.04
Tetrachloroethylene	0.005	Polychlorinated biphenyls (PCBs)	0.0005
Toluene	1	Pentachlorophenol	0.001
Trans-1,2-Dichloroethylene	0.1	Toxaphene	0.003
Xylenes (total)	10	2,4,5-TP	0.05
Dichloromethane	0.005	Benzo(a)pyrene	0.0002
1,2,4-Trichloro-benzene	0.07	Dalapon	0.2
1,1,2-Thrichloro-ethane	0.005	Di(2-ethylhexyl) adipate	0.4
—	—	Di(2-ethylhexyl) phthalate	0.006
—	—	Dinoseb	0.007
—	—	Diquat	0.02
—	—	Endothal	0.1
—	—	Endrin	0.002
—	—	Glyphosate	0.7
—	—	Hexachlorobenzene	0.001
—	—	Hexachlorocyclopentadiene	0.05
—	—	Oxamyl (vydate)	0.2
—	—	Picloram	0.5
—	—	Simazine	0.004
—	—	2,3,7,8-TCDD (dioxin)	0.00000003

(1) Reflects most recent DOH guidelines.

ASBESTOS

Asbestos is the name for a group of naturally occurring, hydrated silicate minerals with fibrous morphology. Included in this group are chrysotile, corcidolite, amosite, and the fibrous varieties of anthophyllite, tremolite, and actinolite. Most commercially mined asbestos is chrysotile. Asbestos' flexibility, strength, and chemical and heat resistance properties have adapted it to many uses including building insulation, brake linings, and water pipe.

In recent years, there has been much concern with the health risks associated with asbestos. Several studies and case histories have documented the hazards to internal organs as a result of inhalation of asbestos fibers. Data is limited on the effects of ingestion of asbestos fibers or on the effects of inhalation exposure from drinking water.

Ingestion studies have not caused cancer in laboratory animals, although studies of asbestos workers have shown increased rates of gastrointestinal cancer.

Asbestos is listed a primary inorganic contaminant; however, it is not routinely included in IOC samples for public water systems. Since the City's water distribution system has greater than 10 percent asbestos-cement pipe installed, an asbestos sample must be collected from the distribution system at least once every 9 years. The most recent asbestos sample was collected in May 2013. Sample results on file with DOH are presented in Appendix M.

LEAD AND COPPER

In 1991, the EPA promulgated the federal Lead and Copper Rule. The State of Washington adopted this rule in 1995 with minimal changes. The Lead and Copper Rule (LCR) is intended to reduce the tap water concentrations of lead and copper that can occur when corrosive source water causes lead and copper to leach from water meters, piping, and other plumbing fixtures. Possible treatment techniques to reduce lead and copper leaching include aeration or the addition of caustic soda or soda ash to the source water prior to distribution. Both of these tactics effectively increase the pH of the water, which decreases the solubility of lead and copper found within pipes and fixtures.

For compliance with the LCR, 90 percent of the distribution system lead samples collected according to the procedures outlined in WAC 246-290 must have concentrations below the "action level" of 0.015 mg/L. Similarly, 90 percent of the copper samples must have concentrations less than 1.3 mg/L. Systems with samples that exceed these action levels are required to provide public notification and implement a program for reducing lead and copper levels.

In August 2010 and again in August 2013, the City performed routine lead and copper testing as required by DOH. The City took samples from specific sample locations throughout the City's distribution system. Data from these samples is summarized in Table 3-6. Sample results on file with DOH are presented in Appendix M.

TABLE 3-6

LCR Sample Results Summary

Parameter	2010 Lead	2013 Lead	2010 Copper	2013 Copper
Maximum Value	0.020	0.005	0.135	0.289
Minimum Value	0.001	0.001	0.011	0.025
90th Percentile Value	0.009	0.003	0.000	0.193
Average (mg/L)	0.004	0.002	0.041	0.103
Samples Collected	30	27	30	27
Action Level (mg/L)	0.015	0.015	1.3	1.3
Samples Exceeding Action Level	3	0	0	0

RADIONUCLIDES AND RADON

Radionuclides include radioactive substances occurring naturally in subsurface waters. Regulated substances include radium-226, radium-228, uranium, and gross alpha and beta particles. Table 3-7 summarizes radionuclide MCLs as defined by EPA's Radionuclide Rule and Washington State Department of Health's WAC 246-290.

TABLE 3-7

Water Quality Standards for Radionuclides

Parameter	MCL
Radium-226	3 pCi/L
Radium-228	20 pCi/L
Combined Radium-226 and Radium-228	5 pCi/L
Uranium	30 µg/L
Gross Alpha Particle Activity, excluding Uranium	15 pCi/L
Gross Beta Particle Activity	4 millirem/year

Though a radon MCL was included in the originally proposed Radionuclide Rule, it was determined that a radon MCL will now be issued as a separate rule. In November of 1999, EPA proposed a preliminary radon MCL of 300 pCi/L. EPA is considering an alternative MCL of 4,000 pCi/L if states or water purveyors implement a multimedia mitigation program aimed at reducing household indoor-air health risks from radon gas from soil as well as tap water. The final Radon Rule publication date is unknown.

The City's most recent radon/radionuclide samples were collected in July 2009. No radionuclides or radon were detected at significant levels for these samples. New samples should be collected by water system staff and submitted to DOH within the 2013 calendar year. Sample results on file with DOH are presented in Appendix M.

DISINFECTANTS/DISINFECTION BYPRODUCTS (D/DBP)

WAC 246-290-300(6) requires purveyors of public water systems that provide water treated with chemical disinfectants to monitor for disinfectants and disinfection byproducts (DBPs). The Disinfection/Disinfectants Byproduct Rule (D/DBP Rule) establishes minimum residual disinfectant concentrations and MCLs for DBPs.

Trihalomethanes (THMs) and five haloacetic acids (HAA5) are a group of organic compounds that can be formed as a result of drinking water disinfection by chlorine and are, therefore, often referred to as disinfection byproducts. Total trihalomethanes (TTHMs) include the sum of the concentrations of four specific disinfection byproducts: chloroform, bromoform, bromodichloromethane, and dibromochloromethane.

The Stage 1 D/DBP rule became effective in February 1999 and the City's compliance deadline was December 2003. Under Stage 1 of the D/DBP Rule, the MCLs for TTHM and HAA5 are 80 μg/L and 60 μg/L, respectively, and are based on the running annual average of four quarterly samples. Systems are required to prepare and implement a DBP monitoring plan. For the City, the Stage 1 D/DBP Rule will remain in effect for compliance until October 1, 2013.

Stage 2 of the D/DBP Rule was published in January 2006 and compliance with the new regulation began on October 1, 2013. Under Stage 2 of the D/DBP Rule, the MCLs for TTHM and HAA5 remain 80 μg/L and 60 μg/L, respectively. However, compliance with the MCL is based on the running annual average of each individual sample location (called a locational running annual average, or LRAA) instead of the running annual average of all samples combined. Since the City's population is between 10,000 and 49,999 people, the City will be required to collect four samples each quarter. Sampling locations are based on results of the Initial Distribution System Evaluation (IDSE), which was completed by the City in July 2010. It is also possible to qualify for a reduced monitoring schedule depending on results from submitted samples. If results from City samples are below 40 μg/L for TTHM and 30 μg/L for HAA5, respectively, the City may reduce their sampling schedule.

The City did not exceed the TTHM, HAA, or bromate MCL in its most recent DBP sampling event in August 2013. Although they did not exceed the MCL for TTHM or HAA5, they did not qualify for a reduced monitoring schedule as part of the Stage 2 D/DBP Rule. Sample results as well as the City's Stage 2 Monitoring Plan are presented in Appendix M.

EPA UNREGULATED CONTAMINANTS

Starting in 2013, any public water system serving more than 10,000 customers is required to monitor the List 1 Contaminants for a period of 12 months between 2013 and 2015. This list includes analytes that the U.S. EPA is considering regulating in future years, and information collected on these analytes will be used to guide potential regulatory levels.

The City has provided the Safe Drinking Water Accession and Review System (SDWARS) with contact information, a proposed monitoring schedule, and proposed sampling locations. After October 1, 2012, any modifications to contact information, sampling location, or sampling schedule must be updated with SDWARS.

The 21 unregulated contaminants that are required to be monitored are listed in Table 3-8. Once collected, samples must be submitted to an EPA-approved laboratory for analysis and the data should be submitted to SDWARS within 120 days of sample collection.

TABLE 3-8

Unregulated Contaminant Monitoring and Analysis Information

Contaminant Name	Minimum Reporting Level (µg/L)	Analytical Method
1,2,3-trichloropropane	0.03	EPA 524.3
1,3-butadiene	0.1	
chloromethane	0.2	
1,1-dichloroethane	0.03	
bromomethane	0.2	
chlorodifluoromethane (HCFC-22)	0.08	
bromochloromethane (Halon 1011)	0.06	
1,4-dioxane	0.07	EPA 522
vanadium	0.2	EPA 200.8 Rev 5.4 ASTM D5673-10 SM 3125
molybdenum	1	
cobalt	1	
strontium	0.3	
chromium-3	0.2	
chromium-6	0.03	
chlorate	20	EPA 300.1 ASTM D6581-08 SM 4110D
perfluorooctanesulfonic acid (PFOS)	0.04	EPA 537 Rev. 1.1
perfluorooctanoic acid (PFOA)	0.02	
perfluorononanoic acid (PFNA)	0.02	
perfluorohexanesulfonic acid (PFHxS)	0.03	
perfluoroheptanoic acid (PFHpA)	0.01	
perfluorobutanesulfonic acid (PFBS)	0.09	

GROUNDWATER RULE

The Groundwater Rule (GWR) is one of the requirements of the 1994 Amendments to the Safe Drinking Water Act. The final rule was published on November 8, 2006, revised on October 1, 2010, and applies to all water systems that use groundwater as a source of supply. However, because the City receives the majority of its water from the City of Anacortes, and the water from Wells 8, 9, and 11 are disinfected with sodium hypochlorite, the City is not required to monitor the system according to Groundwater Rule requirements.

FLUORIDATION

The City has adopted a policy of fluoridating water using sodium fluoride at Wells 8, 9, and 11, and at the Ault Field Booster Station. Fluoride has been shown to have significant health benefits on oral health, and many water systems within the State of Washington add fluoride to their drinking water. Per WAC 246-290-460 the City determines fluoride concentration daily and has historically maintained the concentration between 0.8 mg/L and 1.3 mg/L. In January 2011, DOH requested that the fluoride levels be reduced to a goal of 0.7 mg/L. The City complied immediately with this request. In the future, the City will be evaluating the use of fluoride in the water supply.

As part of the project to create a new pressure scheme for the City and its customers, it is assumed that residents of the NASWI Seaplane Base will soon receive water directly from the City and not from NASWI facilities. At that point in time, both City and NASWI customers will receive fluorinated water.

CHLORINATION

Water from Anacortes is chlorinated at the Anacortes Water Treatment Plant prior to the 24-inch transmission piping. More information regarding Anacortes disinfection techniques is available in the Anacortes *Water System Plan* (HDR, 2011).

Water extracted from Wells 8, 9, and 11 is disinfected using sodium hypochlorite. Disinfectant is added to groundwater through a solution tank and chemical metering pump that are linked to the submersible well pumps. When these well pumps are activated, the chemical meter pump adds disinfectant solution at a rate pre-adjusted by water system operation staff. Chlorine dosage, levels, and residuals are monitored daily at each well location and the Ault Field Booster Station to ensure sufficient residual exists within the distribution system, and as a result, rechlorination of water from the Anacortes is not required.

WATER QUALITY MONITORING SCHEDULE

Water quality monitoring is required for regulatory compliance and to monitor water system conditions. The DOH prepares a Water Quality Monitoring Report each year that is distributed to each water purveyor. A copy of the water quality monitoring report is included in Appendix N. This report defines a monitoring schedule and provides sample locations. Table 3-9 provides a summary of source monitoring activity for the City.

TABLE 3-9

Water Quality Monitoring Requirements

Parameter	Sample Location(1)	Sampling Frequency	Notes
Asbestos	DS	Once every 9 years	Sampled in 1995 and 2013.
Bacteriological	DS	20 per month	Sampled in 2012. Continued sampling in 2013.
D/DBP	DS	3 per year until Oct. 2014, then 4 per quarter	Sampled in 2009 and 2013.
General Pesticides	SO	Two samples every 3 years at each source	No sampling required thru December 2013.
Herbicides	SO	Two samples every 3 years at each source	No sampling required thru December 2013.
IOC	SO	One sample every 3 years at each source	Sampled in 2011. No additional sampling required thru 2019.(2)
Insecticides	SO	Two samples every 3 years at each source	No sampling required through December 2013.
Lead and Copper	DS	30 samples every three years	Sampled in 2010 and 2013.
Nitrates	SO	One sample every year at each source	Sampled in June 2012 and 2013.
Radionuclides	SO	One sample every 6 years at each source	Sampled in 2009.
SOCs	SO	One sample every 3 years at each source	Sampled in 2004 and 2009.(3)
VOCs	SO	One sample every 3 years at each source	Well 9 sampled in 2013 Well 8 and 11 sampled in 2009(4)

(1) Sample location code, DS = distribution system, SO = Wells 8, 9, and 11.
(2) IOC waiver also requires that some analytes be sampled more frequently.
(3) Sample will be collected from each source in 2014.
(4) Wells 8 and 11 received waivers through 2013 for VOC analysis. The City will collect and submit VOC samples for Wells 8 and 11 in 2014.

SYSTEM COMPONENT ANALYSIS

SOURCE OF SUPPLY ANALYSIS

A description of the City's water sources was presented in Chapter 1 – System Description. According to the DOH Design Manual, source production capacity must be sufficient to supply the water supplier's projected MDD. In addition, MDD and ADD must also comply with the maximum instantaneous and annual withdrawal limitations of the associated water rights.

WATER RIGHTS ANALYSIS

The City's water rights are discussed in Chapter 1 – System Description and are summarized in Table 1-2. The City's production for each groundwater source in 2012 is compared to the maximum annual and instantaneous withdrawal designated by its existing water rights in Table 3-10.

TABLE 3-10

2012 Source Production and Water Rights Summary

	Water Right		2012 Withdrawal		2012 Surplus/(Deficit)	
Developed Sources	**Qi (gpm)**	**Annual (ac-ft/yr)**	**Qi (gpm)**	**Annual (ac-ft/yr)**	**Qi (gpm)**	**Annual (ac-ft/yr)**
Well 8	200	320	160	0.28	40	320
Well 9	450	720	160	0.08	290	720
Well 11	200	320	160	0.27	40	320
System Wide	**850**	**1,360**	**480**	**0.63**	**370**	**1,359**
Percentage of Annual Water Right Used	0.05%					

The data show that the City pumps water from Wells 8, 9, and 11 at a level significantly below both the allowable instantaneous and annual water rights. These wells are exercised monthly for preventive maintenance, to supplement times of extremely high demand, and to provide an auxiliary source of water should the Anacortes water supply be interrupted.

SOURCE CAPACITY ANALYSIS

Average Day Demand

In order to determine if total source capacity is able to meet projected ADD for the City and its wholesale customers, capacities for all existing sources were analyzed. This

includes water from Anacortes as well as the City's three groundwater sources. The analysis includes three scenarios:

- **Existing Source Scenario:**
  - Anacortes annual CWV of 1,000 million gallons, and
  - Groundwater sources exercised monthly at current rate.
- **Maximum Potential Source Scenario:**
  - Anacortes CWV of 1,000 million gallons, and
  - Groundwater sources operated at water right capacity.
- **DOH-Recommended Potential Source Scenario:**
  - Anacortes CWV of 1,000 million gallons, and
  - Groundwater sources operated at water right capacity a total of 18 hours per day as recommended by the DOH Design Manual.

Results for this analysis are summarized in Table 3-11.

TABLE 3-11

Source ADD Capacity Analysis Summary

Year	ADD (MG/year)(1)	Anacortes Source Scenario (MG/year)(2)	DOH Recommended Source Scenario (MG/year)(3)	Surplus/ (Deficit)	Maximum Source Scenario (MG/year)(4)	Surplus/ (Deficit)
2012	798	1,000	-	-	-	-
2013	811	1,000	1,335	189	1,447	635
2014	816			184		630
2015	843			157		604
2016	871			129		575
2017	895			105		552
2018	922			78		525
2019	948			52		499
2020	963			37		484
2021	975			25		472
2022	987			13		459
2023	1,000			0		447
2024	1,012			-12		435
2025	1,022			-22		425
2030	1,084			-84		362
2033	1,123			-123		324
2060	1,299			-299		147

(1) Includes both retail service area and wholesale users.
(2) Includes only the CWV from Anacortes.
(3) Calculated using a well pumping time of 18 hours per day and maximum allowable instantaneous water right of 850 gpm.
(4) Calculated using a well pumping time of 24 hours per day and maximum allowable instantaneous water right of 850 gpm.

Results of the source capacity analysis suggest that the City's current arrangement will meet projected MDD until approximately 2027. If the City were to maintain a CWV of 1,000 million gallons with Anacortes, as well as pump water from Wells 8, 9, and 11 at the maximum allowable instantaneous rate of withdrawal for the DOH-recommended 18 hours per day, the City will have sufficient source capacity to meet projected MDD through the long-term planning period.

The City maintains adequate source capacity to meet the required average day demands of its retail service area and its wholesale customers. This analysis assumes, however, that the source from Anacortes is maintained. Table 3-11 above shows that the City does not maintain adequate capacity with its groundwater sources (water right of 850 gpm) to meet the ADD for its RSA and wholesale customers if supply from Anacortes is unavailable, and as such, should investigate the possibility of developing additional water sources.

Maximum Day Demand

The City must also be able to meet the MDD for its RSA and wholesale customers with its developed sources. Table 3-12 compares the required MDD with the capacity of the 24-inch transmission line while Table 3-13 compares the required MDD for the RSA and the Seaplane Base with the capacity of the Ault Field Booster Station. As mentioned in Chapter 1 – Description of Water System, and Chapter 2 – Basic Planning Data, the Seaplane Base is slated to be served through the City's distribution system within the next 3 years.

TABLE 3-12

Service Area MDD Capacity Analysis Summary

Year	Service Area MDD (gpm)(1)	Pipeline Capacity (gpm)(2)	Surplus/ (Deficit)	Sufficient Capacity?
2012	2,849	14,099	11,250	Yes
2013	2,828	14,099	11,271	Yes
2014	2,845	14,099	11,254	Yes
2015	2,937	14,099	11,163	Yes
2016	3,028	14,099	11,071	Yes
2017	3,120	14,099	10,979	Yes
2018	3,212	14,099	10,887	Yes
2019	3,304	14,099	10,795	Yes
2020	3,347	14,099	10,753	Yes
2021	3,389	14,099	10,710	Yes
2022	3,432	14,099	10,668	Yes
2023	3,475	14,099	10,625	Yes
2024	3,518	14,099	10,582	Yes

TABLE 3-12 – (continued)

Service Area MDD Capacity Analysis Summary

Year	Service Area MDD (gpm)(1)	Pipeline Capacity (gpm)(2)	Surplus/ (Deficit)	Sufficient Capacity?
2025	3,561	14,099	10,538	Yes
2030	3,780	14,099	10,320	Yes
2033	3,913	14,099	10,187	Yes
2060	4,529	14,099	9,571	Yes

(1) Includes City, NASWI, NWWD, and DPSP facilities.
(2) Assumes a nominal pipe velocity of 10 fps.

TABLE 3-13

Retail Service Area and Seaplane Base MDD Capacity Analysis Summary

Year	Retail Service Area & Seaplane Base MDD (gpm)	AFBS Capacity (gpm)(1)	Surplus/ (Deficit)	Sufficient Capacity?
2012	2,302	2,760	458	Yes
2013	2,319	2,760	441	Yes
2014	2,408	4,380(2)	1,972	Yes
2015	2,497	4,380	1,883	Yes
2016	2,587	4,380	1,793	Yes
2017	2,676	4,380	1,704	Yes
2018	2,766	4,380	1,614	Yes
2019	2,798	4,380	1,582	Yes
2020	2,829	4,380	1,551	Yes
2021	2,861	4,380	1,519	Yes
2022	2,893	4,380	1,487	Yes
2023	2,926	4,380	1,454	Yes
2024	2,958	4,380	1,422	Yes
2025	2,991	4,380	1,389	Yes
2030	3,122	4,380	1,258	Yes
2033	3,223	4,380	1,157	Yes
2060	3,823	4,380	557	Yes

(1) Includes both 1,380 gpm VFD-operated pumps, but does not include either 700 gpm pump.
(2) Includes two new 1,500 gpm constant-speed pumps and single 1,380 gpm VFD-controlled pump.

Table 3-12 shows that the 24-inch transmission main contains adequate capacity to serve the service area MDD which includes the City and its wholesale customers.

Table 3-13 shows that Ault Field Booster Station contains adequate capacity to serve the required MDD for the RSA as well as the Seaplane Base. The increase in capacity seen in 2014 is the result of replacing two of the existing pumps with more efficient, appropriately sized models. This project is described further in Chapter 8 – Capital Improvement Program.

STORAGE ANALYSIS

Storage requirements for the City will be determined by applying recommendations from the DOH Design Manual. The storage recommended according to this manual is based on the sum of the following:

- Operational Storage (OS)
- Equalizing Storage (ES)
- Standby Storage (SB)
- Fire Suppression Storage (FSS)
- Dead Storage (DS), if any

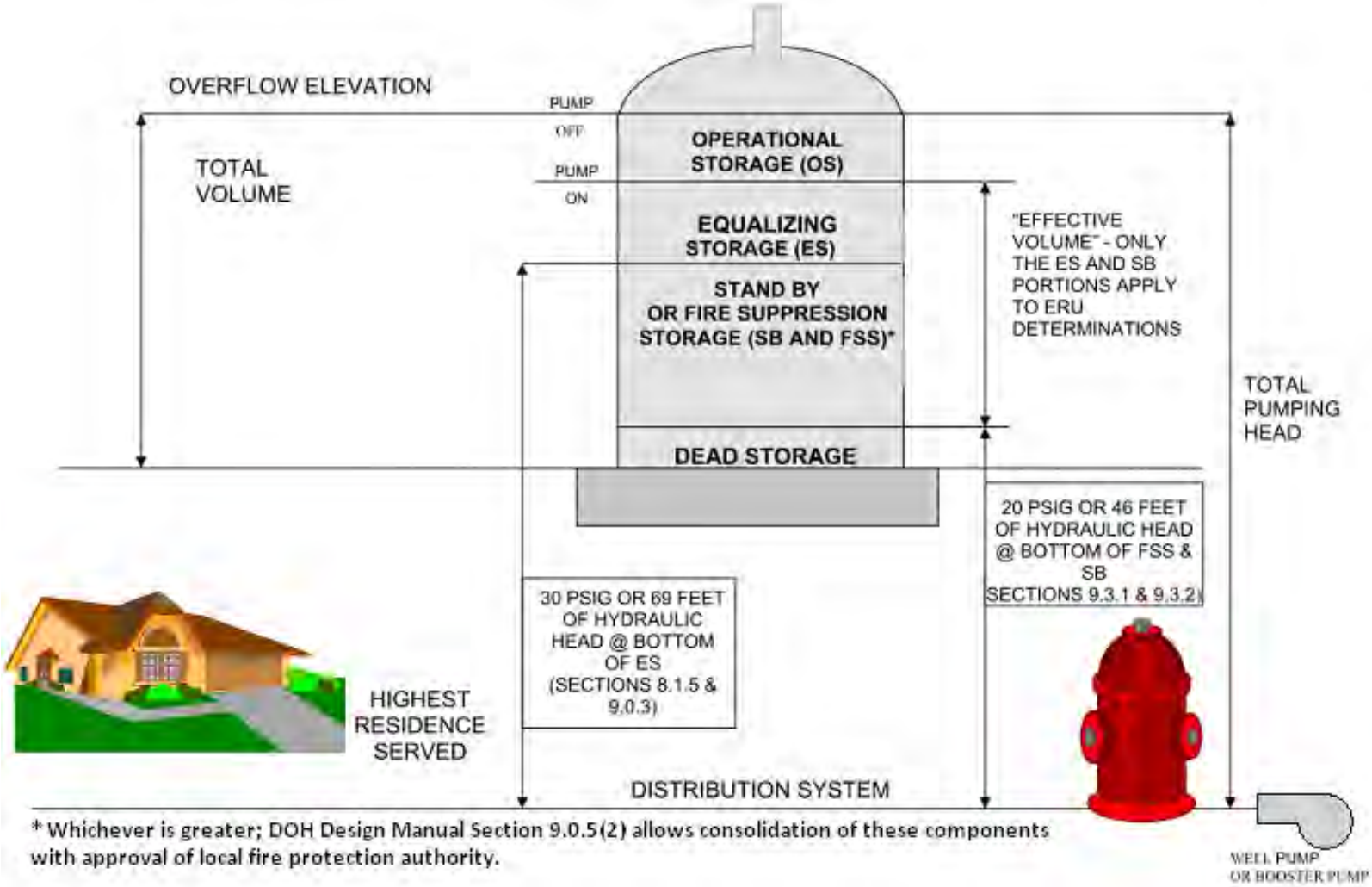
The City currently has three storage tanks in its system including Westside Reservoirs 1 and 2, and the Eastside Reservoir. The City began constructing a new, 4 million gallon North Reservoir in 2013. North Reservoir was considered to be existing for the water system model. When construction of the new reservoir is complete, the Eastside Reservoir will be abandoned and the City will continue to operate a total of three reservoirs. Therefore, the Eastside Reservoir was considered for 2012 to 2013 analysis only.

Figure 3-1 shows a schematic drawing of the various storage components and system pressure requirements.

Operational Storage

Operational storage is the volume of the reservoir devoted to supplying the water system while under normal operating conditions the source(s) of supply are in “off” status. This volume is dependent upon the sensitivity of the reservoir water level sensors and the tank configuration necessary to prevent excessive cycling of source pump motors.

Operational storage is in addition to other storage components, thus providing a factor of safety for equalizing, standby, and fire suppression components. Operating storage for the City’s water system is summarized in Table 3-14. For the City, the operational storage varies since the supply from Anacortes is continuous, but the City closes the valves at night in order to drawdown reservoir levels and promote water circulation. For this exercise, operational storage was assumed to be 10 percent or reservoir volume.



* Whichever is greater; DOH Design Manual Section 9.0.5(2) allows consolidation of these components with approval of local fire protection authority.

Source: DOH Design Manual, 2009

CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE

FIGURE 3-1
WATER SYSTEM STORAGE COMPONENTS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

Equalizing Storage

Equalizing storage is typically used to meet diurnal demands that exceed the average day and maximum day demands. The volume of equalizing storage required depends on peak system demands, the magnitude of diurnal water system demand variations, the source production rate, and the mode of system operation. Sufficient equalizing storage must be provided in combination with available water sources and pumping facilities such that peak system demands can be satisfied.

Equalizing storage is calculated using the following equation:

$$V_{ES} = (PHD - Q_S)(150 \text{ minutes})$$

Where:

V_{ES} = equalizing storage component (gallons)
PHD = peak hourly demand (gpm)
Q_S = total source of supply capacity, excluding emergency sources (gpm)

Equalizing storage was calculated using the City's projected PHD and the CWV from Anacortes. Although there is not instantaneous withdrawal limitation for the Anacortes supply, the CWV is equivalent to approximately 1,900 gpm. This value was used for the total source of supply capacity in the equation above. Equalizing storage volumes are summarized in Table 3-14.

Standby Storage

Standby storage is provided in order to meet demands in the event of a system failure such as a power outage, an interruption of supply, or break in a major transmission line. The amount of emergency storage should be based on the reliability of supply and pumping equipment, standby power sources, and the anticipated length of time the system could be out of service.

Standby storage is calculated using the following equation:

$$SB_{TMS} = (2\ days)(ADD)(N) - t_m(Q_S - Q_L)$$

Where:

SB_{TMS} = standby storage component for a multiple source system (gallons)
ADD = average day demand for the system (gpd/ERU)
N = number of ERUs
t_m = time the remaining sources are pumped on the day when the largest source is not available (minutes)

Q_S = sum of all installed and continuously available supply source capacities, excluding emergency sources (gpm)
Q_L = the largest capacity source available to the water system (gpm)

DOH Note: Although standby storage volumes are intended to satisfy the requirements imposed by system customers for unusual situations and are addressed by WAC 246-290-420, it is recommended that a standby storage volume not be less than 200 gallons/ERU.

The estimated number of total ERUs within the retail service area in 2012 was 8,899. Using the DOH note above, which recommends a minimum of 200 gallons/ERU, standby storage for 2012 is estimated to be approximately 1.73 million gallons. Using the equation above with the values listed below results in a standby storage requirement of 1.37 million gallons. Since this value is less than the DOH recommendation, a value of 200 gallons/ERU will be assumed for standby storage.

ADD = 150 gpd/ERU (Table 2-8)
N = ERUs (Table 2-9 and Table 2-15)
t_m = 1,440 minutes (maximum possible)
Q_S = 2,750 gpm (water agreement plus well water rights)
Q_L = 1,900 gpm (water agreement of 1,000 million gallons annually)

The standby storage volume for the City may be reduced since it is served by multiple sources (WAC 246-290-235). It is assumed that when the largest source is unavailable (Anacortes), the remaining sources will continue to operate (Wells 8, 9, and 11). Standby storage volumes are summarized in Table 3-14.

Fire Suppression Storage

Fire suppression storage (FSS) is provided to ensure that the volume of water required for fighting fires is available when necessary. Fire suppression storage also reduces the impact of firefighting on distribution system water pressure. The amount of water required for firefighting purposes is specified in terms of rate of flow in gallons per minute (gpm) and an associated duration. Fire flow must be provided at a residual water system pressure of at least 20 pounds per square inch (psi).

Fire suppression storage is calculated using the following equation:

$$FSS = (FF)(t_m)$$

Where:

FSS = required fire suppression storage component (gallons)
FF = required fire flow rate, as specified by fire protection authority (gpm)
t_m = duration of FF rate, as specified by fire protection authority (minutes)

DOH Note: The standby storage component or the fire suppression storage component, whichever volume is smaller, can be excluded from a water system's total storage requirement provided that such practice is

not prohibited by: (1) a locally developed and adopted Coordinated Water System Plan, (2) local ordinance, or (3) the local fire protection authority or County Fire Marshal (reference WAC 246-290-235(4)).

The largest fire flow required in the City is at the High School and has a requirement of 3,500 gpm for a duration of 2 hours. This results in a required fire suppression storage of 420,000 gallons. The City and the local fire authority have decided to allow nesting of fire suppression and standby storage. These values are listed in Table 3-14.

Dead Storage

Dead storage is the volume of stored water not available to all customers at the minimum design pressure in accordance with WAC 246-290-230(5) and (6). Dead storage is excluded from the volumes provided to meet the other storage requirements. WAC 246-290-230(5) and (6) require that a minimum of 30 psi be maintained system wide under peak hour demand conditions (equalization storage depleted) and that 20 psi be maintained system wide under maximum day demand plus fire flow conditions (equalization and fire suppression storage depleted).

Using the definitions in the DOH Design Manual, Westside Reservoir 1 maintains a dead storage volume of approximately 321,000 gallons, while Westside Reservoir 2 maintains a dead storage volume of approximately 1,097,000 gallons.

Eastside Reservoir 1 has no dead storage since it maintains a base elevation of 190.4 feet and a minimum static pressure of 101.6 feet and only serves customers in the Downtown Zone. Dead storage volumes as well as a summary of other storage components are shown in Table 3-14.

TABLE 3-14

Storage Capacity Analysis

Parameter	2013(1)	2019(2)	2033	2060
Gross Storage	3,125,000	6,585,000	6,585,000	6,585,000
Dead Storage	1,418,312	0(6)	0	0
Available Storage	**1,706,688**	**6,585,000**	**6,585,000**	**6,585,000**
Operational Storage(3)	278,877	658,500	1,145,521	1,145,521
Equalizing Storage	140,895	362,585	467,455	602,190
Fire Suppression Storage(4)	420,000	420,000	420,000	420,000
Standby Storage	1,739,988	2,079,295	2,316,400	2,879,391
Required Storage(5)	**2,159,760**	**3,100,380**	**3,929,377**	**4,627,101**
Storage Surplus/(Deficit)	**(453,072)**	**3,484,620**	**2,655,623**	**1,957,899**

(1) Includes Eastside Reservoir and Westside Reservoirs 1 and 2.
(2) Includes Westside Reservoirs 1 and 2, and North Reservoir.
(3) North Reservoir OS assumed to be equal to 10 percent of total storage volume.
(4) FSS is based on a maximum fire flow requirement of 3,500 gpm for 2 hours at Oak Harbor High School.
(5) The total required storage volume assumes nesting of fire suppression and standby storage.
(6) Assumes that new West 384 Zone will be completed.

Data in Table 3-14 show that the City has adequate storage capacity through both the 6- and 20-year planning periods.

BOOSTER STATION ANALYSIS

An open system is a pressure zone which is governed by an atmospheric storage tank, such as Westside Reservoirs 1 and 2, as well as the Eastside Reservoir 1 and the North Reservoir. These reservoirs serve both the 307 Zone as well as the 243 Zone. A closed system is a zone that is closed to the atmosphere in which pressures are controlled by a booster station. Both the 335 Zone and the 342 Zone are examples of closed systems.

For open systems, WAC 246-290-230 requires that the booster station be designed to meet the MDD for the zone with all pumps in service and meet the ADD with the largest pump out of service.

For closed systems, WAC 246-290-230 requires that the booster station be designed to meet the MDD and fire flow for the zone with the largest routinely used pump out of service. It is also recommended that peak hour demands can be met with a minimum pressure of 30 psi with the largest capacity pump out of service.

Ault Field Booster Station

The Ault Field Booster Station is an open system and was described in Chapter 1 – System Description. The existing and projected population, ERUs, ADD, MDD, and PHD for the area served by this booster station are summarized in Table 3-15.

TABLE 3-15

Ault Field Booster Station Capacity Analysis

Parameter	2012	2013	2019	2033	2060
Population (1)	21,160	27,166	30,828	34,067	41,297
ERUs (2)	8,899	8,700	10,396	11,582	14,397
Total Capacity (gpm) (3)	2,760	2,760	4,160	4,160	4,160
Capacity with Largest Routinely Used Pump Out of Service (gpm) (3)	1,380	1,380	2,780	2,780	2,780
ADD (gpm) (4)	1,021	906	1,083	1,206	1,500
MDD (gpm) (5)	1,752	1,631	1,949	2,172	2,699
Sufficient MDD Capacity?	Yes	Yes	Yes	Yes	Yes
Sufficient ADD Capacity?	Yes	Yes	Yes	Yes	Yes

(1) Assumed to be equal to the existing service area.
(2) ERUs assumed to be the total number of ERUs within the City service area. Does not include NWWD or DPSP. Growth as described in Chapter 2 – Basic Planning Data.
(3) For 2012 and 2013 assumes only two VFD pumps are operational. Beyond 2013 assumes that two new constant-speed pumps and two VFD pumps are operational.
(4) Calculated using 69 gpcd.
(5) Calculated using the MDD-to-ADD ratio of 1.95.

Data suggest that the Ault Field Booster Station has sufficient capacity to meet the service area MDD. The station also has sufficient capacity to meet the region's ADD with the largest pump out of service.

Heller Street Booster Station

The Heller Street Booster Station is a closed system and was described in Chapter 1 – System Description. The existing and projected population, ERUs, ADD, MDD, and PHD for the area served by this booster station are summarized in Table 3-16.

TABLE 3-16

Heller Street Booster Station Capacity Analysis

Parameter	2012	2013	2019	2033	2060
Population(1)	613	613	613	613	613
Estimated ERUs(2)	245	245	245	245	245
Total Capacity (gpm)	430	430	430	430	430
Capacity with Largest Routinely Used Pump Out of Service (gpm)	215	215	215	215	215
ADD (gpm)(3)	26	26	26	26	26
MDD (gpm)(4)	46	46	46	46	46
PHD (gpm)(5)	124	124	124	124	124
Fire Flow (gpm)(6)	1,000	1,000	1,000	1,000	1,000
Sufficient MDD and FF Capacity?	No	No	No	No	No
Sufficient PHD Capacity?	Yes	Yes	Yes	Yes	Yes

(1) Calculated based on 2.5 persons per household, 2010 U.S. Census.
(2) ERUs were estimated from aerial photographs of region. Region included only single-family residential properties. Area served by this booster station is fully developed and no additional services are anticipated/available at this time.
(3) Calculated using an average of 150 gpd per ERU.
(4) Calculated using the MDD-to-ADD ratio of 1.95.
(5) PHD was calculated using Equation 5-1 of DOH Design Manual.
(6) For a duration of 2 hours, per City standards. Fire flow is not pumped to this zone, but instead flows by gravity through a check valve downstream of the westside Reservoir No. 2.

Data show that the Heller Street Booster Station does not have sufficient capacity to meet the projected MDD and fire flow requirements for the 342 Zone. As mentioned in Chapter 1 – System Description, the Heller Street Booster Station provides water service while fire flow is provided by Westside Reservoirs 1 and 2. Since fire flow is provided by the Westside Reservoirs, the Heller Street Booster Station does have sufficient capacity to meet both MDD and PHD with the largest pump out of service.

Redwing Booster Station

The Redwing Booster Station is a closed system and was described in Chapter 1 – System Description. The existing and projected population, ERUs, ADD, MDD, and PHD for the area served by this booster station are summarized in Table 3-17.

TABLE 3-17

Redwing Booster Station Capacity Analysis

Parameter	2012	2013	2019	2033	2060
Population(1)	568	573	608	700	915
Estimated ERUs(2)	227	229	243	280	366
Total Capacity (gpm)	2,100	2,100	2,100	2,100	2,100
Capacity with Largest Routinely Used Pump Out of Service (gpm)	2,000	2,000	2,000	2,000	2,000
ADD (gpm)(3)	24	24	25	29	38
MDD (gpm)(4)	43	43	46	53	69
PHD (gpm)(5)	117	118	123	136	165
Fire Flow (gpm)(6)	2,000	2,000	2,000	2,000	2,000
Sufficient MDD and FF Capacity?	No	No	No	No	No
Sufficient PHD Capacity?	Yes	Yes	Yes	Yes	Yes

(1) Calculated based on 2.5 persons per household, 2010 U.S. Census.
(2) ERUs were estimated from aerial photographs or region. Region included 112 SFR ERUs and 115 ERUs as part of multifamily units. Units were assumed to have one, two, or four separate residences. Projected ERUs were assumed to increase at an annual rate of 1 percent.
(3) Calculated using an average of 150 gpd per ERU.
(4) Calculated using the MDD-to-ADD ratio of 1.95.
(5) PHD was calculated using Equation 5-1 of DOH Design Manual.
(6) For a duration of 2 hours, per City standards.

Data show that while very close, the Redwing Booster Station does not have has sufficient capacity to meet the projected MDD and fire flows for the 335 Zone. The booster station does, however, have sufficient capacity to meet existing and projected PHD with the largest routinely used pump out of service.

TRANSMISSION MAIN AND DISTRIBUTION SYSTEM ANALYSIS

A description of the distribution system facilities was provided in Chapter 1 – System Description. Overall, the distribution system is in functional condition, but as with every domestic water system, there are areas that should be upgraded. Distribution system deficiencies that were identified as a part of this hydraulic analysis are discussed in both Chapter 4 – Hydraulic Analysis, as well as Chapter 8 – Capital Improvement Program.

An analysis of the transmission mains is provided in Chapter 4 – Hydraulic Analysis. System. Overall, the transmission mains are in functional condition. The City has expressed an interest in proactively investigating the integrity of both the 10- and 24-inch transmission mains, and projects that address these interests are described in Chapter 8 – Capital Improvement Program.

The 2009 Predesign Report (Appendix F) recommended a reconfiguration of the existing pressure zones for the City in order to address storage capacity shortcomings identified in

the report. Developing new pressure zones will include additional transmission mains, pressure-reducing valve stations, a booster station, and a reservoir. Some of these projects have been completed while others are in the design or planning stage. It is the City's intention to reconfigure its existing pressure zone scheme in line with the recommendations from the Predesign Report and they have already taken steps to accomplish this transition. Projects associated with this reconfiguration are described throughout this report as well as in Chapter 8 – Capital Improvement Program.

SYSTEM DEFICIENCIES

Existing and future system deficiencies of the City's water system are summarized below.

WATER RIGHTS AND SOURCE OF SUPPLY

The total volume of City sources, including the CWV from Anacortes and the annual water right for its three groundwater sources is able to meet the projected MDD through 2022. The City may extend this time period to 2030 by operating its groundwater sources continuously, but this operation method is not recommended by DOH. Additional discussion on specific projects to address issues with source supply is included in Chapter 8 – Capital Improvement Program.

STORAGE

The City does have adequate storage capacity for the 6- and 20-year planning periods. Completion of the North Reservoir will increase the available storage capacity to levels sufficient to provide reliable water service until beyond 2033. Construction of this reservoir began in 2013, and should be completed by early 2014. Additional storage capacity can be retained by keeping the Eastside Reservoir 1 in service, but design shortcomings and costs to refurbish or stabilized the foundation of the reservoir may pose an unnecessary safety risk and the City may instead wish to remove the reservoir from service.

BOOSTER STATIONS

The Ault Field Booster Station currently does not currently have sufficient capacity to meet projected MDD for the City through the 20-year planning period. The City plans to replace the existing constant-speed pumps in 2014 with larger, constant-speed models to address this deficiency. The Ault Field Booster Station will have sufficient capacity to meet the service area's projected ADD with the largest routinely used pump out of service throughout the 20-year planning period.

The Heller Street Booster Station does not exhibit any deficiencies at this time, and is able to meet the required ADD and MDD for the 342 Zone as long as sufficient fire flows are provided by Westside Reservoirs 1 and 2.

The Redwing Booster Station is not able to meet projected MDD and fire flows through the 20-year planning period. Immediate required capacity is 2,046 gpm, while the available capacity with the largest routinely used pump out of service is 2,000 gpm. The booster station is, however, able to meet projected PHD for the 335 Zone.

The City maintains plans to restructure the booster station and pressure zone structure of its water system through completion of several different projects. These projects and proposed changes to the water system pressure scheme and booster station status are discussed further in Chapter 4 – Hydraulic Analysis and Chapter 8 – Capital Improvement Program.

DISTRIBUTION SYSTEM

Improvements to the City's distribution system are discussed in Chapter 4 – Hydraulic Analysis, and Chapter 8 – Capital Improvement Program.

TREATMENT

Water treatment facilities are not required at this time. Future changes in the regulations and the water quality within the City's system may require new facilities. As new regulations are promulgated, the City's water supply should be evaluated and if treatment facilities are required, they should be implemented by the City.

CHAPTER 4

HYDRAULIC ANALYSIS

INTRODUCTION

This chapter presents information on the computer hydraulic model of the City's water system and the results of hydraulic analyses. The purpose of the hydraulic analysis is to evaluate the existing and future capabilities of the water system.

The operation of a municipal water system involves dynamic interactions between various water system components including source, storage, transmission, and distribution system facilities. These interactions and their effect on the level of service provided to the City's customers are dependent on the distribution and magnitude of water demands within the system and the performance characteristics of the water system facilities. In addition, infrequent high water demand events, such as firefighting and other emergencies, can significantly alter the normal flow patterns and pressures in the municipal water system. These factors must be considered in analyzing the ability of a water system to provide for future demands, while maintaining an adequate level of water service to customers.

The development of a computer hydraulic model, which can accurately and realistically simulate the response of a water system under a variety of conditions and scenarios, has become an increasingly important element in the planning, design, and analysis of municipal water systems. The Washington State Department of Health's WAC 246-290 requires hydraulic modeling as a component of water system comprehensive plans.

HYDRAULIC MODELING PROGRAM

The City's system was analyzed using MWHSoft's H_2ONet hydraulic modeling software which operates in a computer-aided design and drafting (AutoCAD) environment. The H_2ONet model is configured with a graphical user interface. Each model element, including pipes, valves, pumps, and reservoirs, is assigned a unique graphical representation within the program. Each element is also assigned a number of attributes specific to its function. Element attributes include spatial coordinates, elevation, water demand, pipe length, diameter, and pipe status (open/closed), as well as pump, valve and reservoir characteristics. Model input is accomplished through the creation and manipulation of these objects and their attributes. The H_2ONet software produces the model output in the form of flows and pressures throughout the simulated water system.

MODEL LAYOUT AND CONSTRUCTION

In order to create a realistic representation of the City's water system, the model was created using the water system base map and information obtained through conversations with the city. A map detailing existing pipes and nodes is included in Appendix O.

SOURCE

The only source included in the City's model is the intertie with the City of Anacortes, which has been modeled as a fixed head reservoir and is controlled by the Ault Field Booster Station.

SERVICE DOMAIN

The model includes all City distribution mains, but does not include NASWI water mains. Model demands are assigned to nodes in all areas where services or facility demands actually exist. All demand nodes are modeled to maintain pressures of 20 psi under maximum day demands and fire flow conditions, and 30 psi under peak hour conditions as described in Chapter 3 – System Analysis.

STORAGE

In H_2ONet, reservoirs are modeled as "tanks" with finite size using actual reservoir dimensions and elevations. The model includes Westside Reservoirs 1 and 2 as well as the new North Reservoir. Dimensions and critical elevations of the storage facilities are provided in Table 1-4.

Per WAC 246-290-230(6), fire flows must be provided when equalizing storage (ES) and fire suppression storage (FSS) have been depleted from the reservoirs and while maintaining a system-wide minimum pressure of 20 psi. Similarly, peak hour demands must be met while maintaining a system-wide minimum pressure of 30 psi with equalizing storage depleted. To provide a more conservative analysis, operational storage has also been depleted from all reservoirs for all model scenarios. Table 4-1 summarizes reservoir levels used in the model and storage volumes depleted.

TABLE 4-1

Model Storage Tank Information

Storage Component	Westside 1		Westside 2		North		Total (gallons)
	Volume (gallons)	Drawdown (ft)	Volume (gallons)	Drawdown (ft)	Volume (gallons)	Drawdown (ft)	
2013 OS	58,500	5.7	200,000	5.7	400,000	3.2	658,500
2013 FSS	7,995	0.8	27,335	0.8	420,000	3.4	455,330
2013 ES	10,331	1.0	35,318	1.0	70,636	0.6	116,285
2013 Total	**76,826**	**7.4**	**262,653**	**7.4**	**890,636**	**7.1**	**1,230,115**
2019 OS	58,500	5.7	200,000	5.7	400,000	3.2	658,500
2019 FSS	7,995	0.8	27,335	0.8	420,000	3.4	455,330
2019 ES	17,282	1.7	59,085	1.7	118,170	0.9	194,537
2019 Total	**83,778**	**8.1**	**286,420**	**8.1**	**938,170**	**7.5**	**1,308,368**
2033 OS	58,500	5.7	200,000	5.7	400,000	3.2	658,500
2033 FSS	7,995	0.8	27,335	0.8	420,000	3.4	455,330
2033 ES	22,140	2.1	75,693	2.1	151,386	1.2	249,220
2033 Total	**88,636**	**8.6**	**303,028**	**8.6**	**971,386**	**7.8**	**1,363,050**

MODEL DEMANDS

Existing system demands were determined for the City's service area from existing production data. Future demands are based on growth assumptions as described in Chapter 2 – Basic Planning Data.

SCENARIOS

The H_2ONet modeling software allows the user to input a variety of demands and scenarios. For the purpose of this plan, the following sets of demands were developed in the hydraulic model:

- 2013, 2019, and 2033 Maximum Day Demand: These demands were used to evaluate the system's ability to meet the required fire flows for the DOH minimum requirement of 20 psi.

- 2013, 2019, and 2033 Peak Hour Demand: These demands were used to verify that the system is capable of meeting DOH standards to supply domestic water at a minimum system-wide pressure of 30 psi.

These six scenarios were used to determine the improvements required to meet the current and projected expansion of the City's water system.

MODEL CALIBRATION

Model calibration was not performed as part of the water system plan modeling. Calibration information was taken from the *New Reservoir Predesign Report*

(Gray & Osborne, 2009) and incorporated into the current water system model. The results from previous model calibration tests are all within the acceptable limits set forth within the DOH planning guidelines. Table 4-2 summarizes calibration data.

TABLE 4-2

Model Calibration Data

Zone	Location	Flow Node	Pressure Node	Static (psi)		Residual (psi)		Flow (gpm)
				Field	Model	Field	Model	
247	SE City Beach Street and SE Bayshore Drive	116	456	98	100	76	76	2,253
247	SW Erie Street north of SR 20	758	92	86	89	58	57	2,094
307	SW Cooper Way	50	52	72	73	46	43	1,797
307	SW Waterloo Avenue and SW Balda Street	848	219	93	96	61	60	1,891
307	NW Cherry Hill Loop and NW Almond Loop	666	665	76	75	51	51	1,921
307	NE Regatta Dr north of NE 16th Avenue	600	588	52	53	33	33	1,580

MODEL SIMULATION AND RESULTS

Full model results and data output tables are presented in Appendix O.

PEAK HOUR DEMAND

According to DOH waterworks standards and WAC 246-290-230, a water system must maintain a minimum pressure of 30 psi in the distribution system under peak hour demand conditions. The City's existing distribution system was modeled under current 2013 and projected 2019 and 2033 peak hour demand conditions.

All services are above 30 psi during 2013, 2019, and 2033 peak hour demand conditions with the exception of those in Parkwood Manor Mobile Home Park. This community is located along NW Crobsy Road between Kathleen Drive and NW Elwha Street. While the surrounding neighborhoods are part of the Redwing Zone (HGL 335), the mobile home park is served by a private water system not associated with the City's distribution system. The City does, however, provide fire flow to the mobile home park at the required 20 psi pressures. There are four dead-end mains extending through the park.

AVAILABLE FIRE FLOW

WAC 246-290-230 states, "If fire flow is to be provided, the distribution system shall also provide MDD plus the required fire flow at a pressure of at least 20 psi at all points throughout the distribution system, and under the condition where the designed volume

of fire suppression and equalizing storage has been depleted." Specific fire flow requirements for the City were summarized in Table 3-1. The highest requirement for an institution within the City's water system is 3,500 gpm for a duration of 2 hours.

The hydraulic model was used to simulate the required fire flows throughout the system. As a basis for recommending improvements, fire flows were run for the existing system conditions, which includes the North Reservoir, but not the new booster station or transmission mains. Table 4-3 summarizes deficient areas and lists available fire flows in 2013, and the improved flow with a capital improvement project (CIP, as described in Chapter 8 – Capital Improvement Program). Figure 4-1 shows available fire flows throughout the system under 2013 maximum day demands. Figures 4-2 and 4-3 show available fire flow under 2033 maximum day demands with the existing system and with CIPs, respectively.

Fire flows were assigned in the model based on zoning and the required flows shown in Table 3-1. The actual required flow for each individual structure will vary based on building size, material, and occupancy. This is important to note when determining if any deficiency exists in the northern part of the system, which is zoned for industrial and commercial use, and has been assigned a fire flow requirement of 3,500 gpm. However, many of the structures in this area are not actually large enough to require 3,500 gpm and thus the existing water system was not designed to provide that flow. These locations are included in Table 4-3; however, no specific improvement project is currently proposed to address these areas. It is assumed that the existing piping is adequate for the current structures.

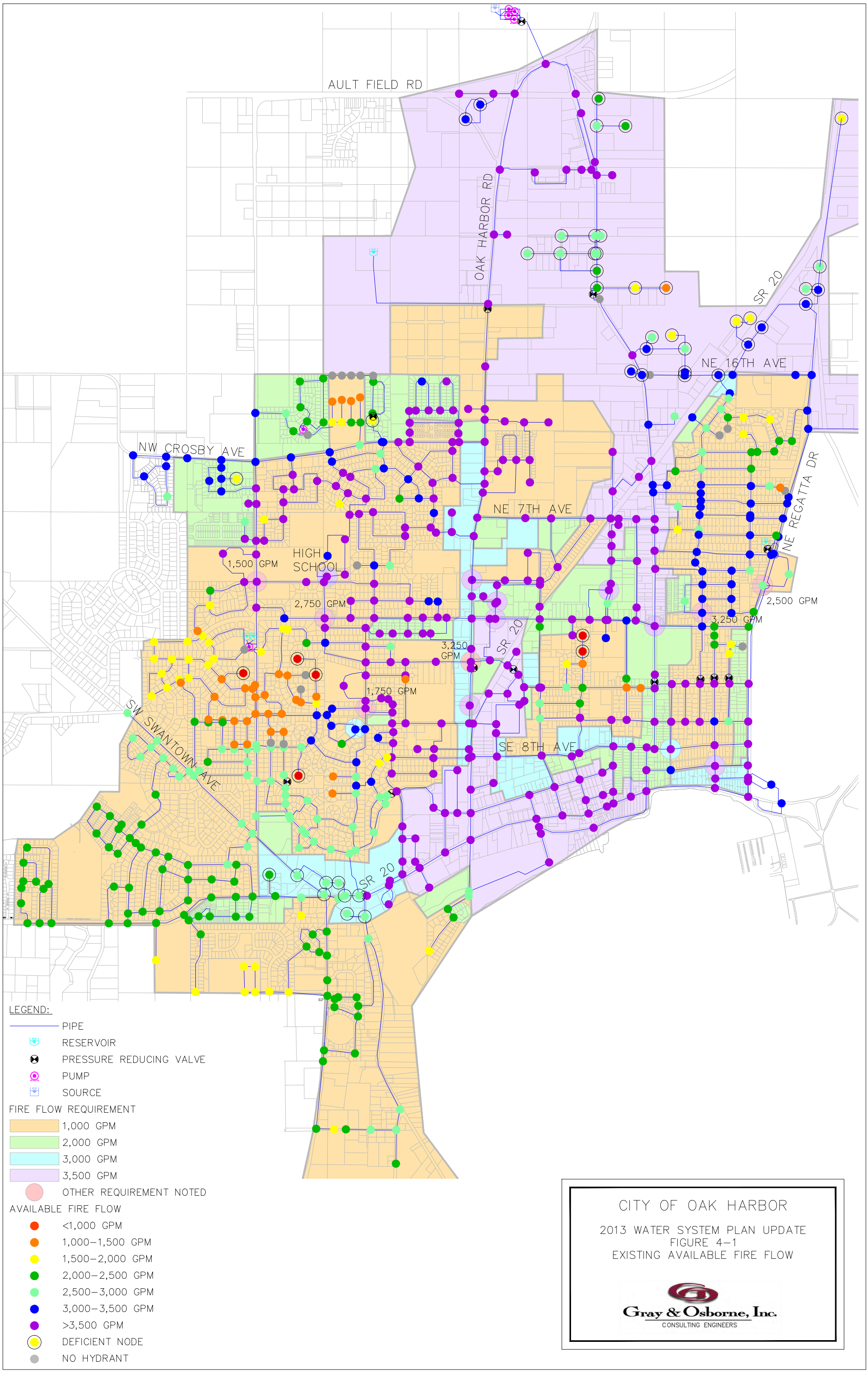
TABLE 4-3

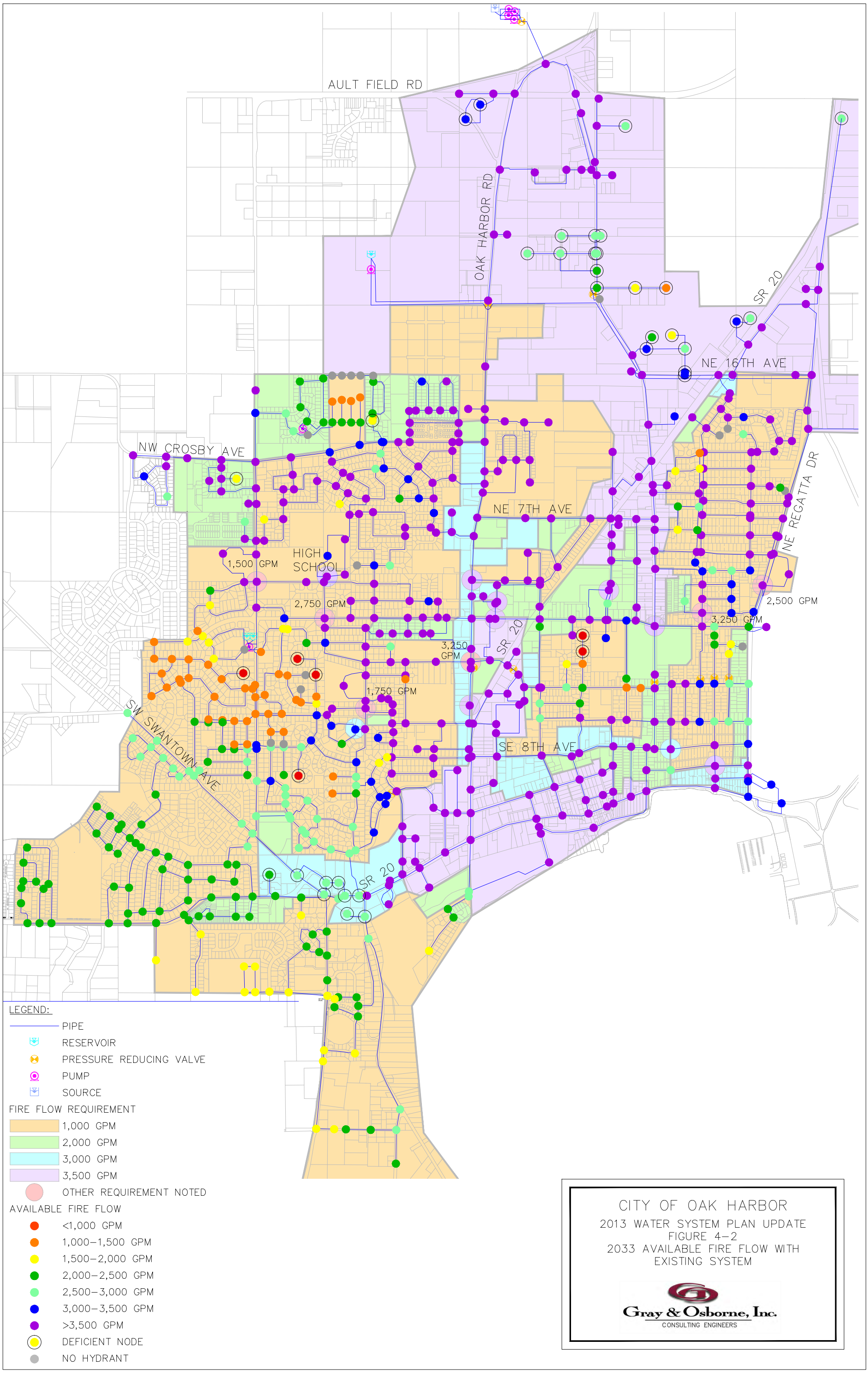
Areas of Existing Fire Flow Deficiencies

ID	Location	Min. Required Fire Flow (gpm)	Existing/ Future Zone	2013 Available Flow (gpm)(1)	2033 Available Flow with CIPs (gpm)	CIP Project(s)
614, 810	SE Glencoe Street from SE 2nd Place to 90° bend	1,000	245	560-740	2,410-2,690	DS-5
315, 316	SW Judson Drive from SW 4th Avenue to dead end	1,000	307/370 W	680-940	1,260-2,330	370 W Zone
919	SW Periwinkle Lane	1,000	342/370 W	820	1,270	370 W Zone
728	SW Kingma Court	1,000	307/370 W	980	1,450	370 W Zone
838	SE 4th Avenue between SE Midway Boulevard and SE Jerome Street	2,000	245	1,375	>5,000	DS-2
576, 577, 102	Technical Drive from Goldie Road to dead end	3,500	328	1,420-2,240	1,580-3,510	None (2)
602, 862	8-inch water main serving 33575 SR 20 (west of SR 20, north of NE 16th Avenue)	3,500	307/370 E	1,580-1,830	>4,000	370 E Zone
575	Goldie Road between Technical Drive and Oak Street	3,500	328	2,370	4,090	DS-13
693	NW 9th Place east of NW Prow Street	2,000	307/370 W	1,750	2,580	370 W Zone
570, 571, 573	Erin Park Road	3,500	328	2,280-2,470	>4,000	DS-11
555	Ault Field Road and Colin Lane	3,500	328	2,400	>4,000	T-2
568, 569, 572, 574	Oak Street from Goldie Road to dead end	3,500	328	2,440-2,470	>4,000	DS-5, DS-6
599-601, 841	NE Regatta Drive north of NE 16th Avenue	3,500	307/370 E	2,440-2,660	3,660	370 E Zone
840, 598	SR 20 north of NE 16th Avenue	3,500	307/370 E	2,660-2,850	>4,000	370 E Zone
579-583, 551, 839	Loop northeast of 16th and Goldie Way	3,500	307	2,660-3,445	1,940-4,000	None (2)
340, 407, 768-771	Area of SW Swantown Avenue, SW Kimball Drive, and SR 20/w Pioneer Way	3,000	307/322	2,725-2,790	>3,400	322 Zone
931	SW 19th Court west of SW Scenic Heights Street	3,000	307/322	2,745	3,490	322 Zone
251, 926	8-inch water main west of NE Goldie Street, north of NE Easy Street	3,500	307	2,945-3,480	3,060-4,920	T-2, DS-5
927, 928	Colin Road south of Ault Field Road	3,500	328	2,980	3,120	T-2, DS-7
564, 565	8-inch looped water main serving property at Ault Field Road and N Oak Harbor Road	3,500	328	3,030-3,410	3,010-3,540	None (2)
538, 539	NE Midway Boulevard and NE 8th Avenue	3,500	307	3,470	>4,000	T-2

(1) Available flow as limited by system pressure of 20 psi.

(2) No specific project planned, existing system assumed sufficient to meet actual fire flow requirements and development will drive any improvements to the area.


AULT FIELD RD
OAK HARBOR RD
SR 20
NE 16TH AVE
NW CROSBY AVE
NE 7TH AVE
NE REGATTA DR
HIGH SCHOOL
1,500 GPM
2,750 GPM
3,250 GPM
1,750 GPM
2,500 GPM
3,250 GPM
SR 20
SW SWANTOWN AVE
SE 8TH AVE
SR 20
LEGEND:
PIPE
RESERVOIR
PRESSURE REDUCING VALVE
PUMP
SOURCE
FIRE FLOW REQUIREMENT
1,000 GPM
2,000 GPM
3,000 GPM
3,500 GPM
OTHER REQUIREMENT NOTED
AVAILABLE FIRE FLOW
<1,000 GPM
1,000–1,500 GPM
1,500–2,000 GPM
2,000–2,500 GPM
2,500–3,000 GPM
3,000–3,500 GPM
>3,500 GPM
DEFICIENT NODE
NO HYDRANT
CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE
FIGURE 4–1
EXISTING AVAILABLE FIRE FLOW
Gray & Osborne, Inc.
CONSULTING ENGINEERS


AULT FIELD RD
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SR 20
NE 16TH AVE
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NE 7TH AVE
NE REGATTA DR
HIGH SCHOOL
1,500 GPM
2,750 GPM
3,250 GPM
1,750 GPM
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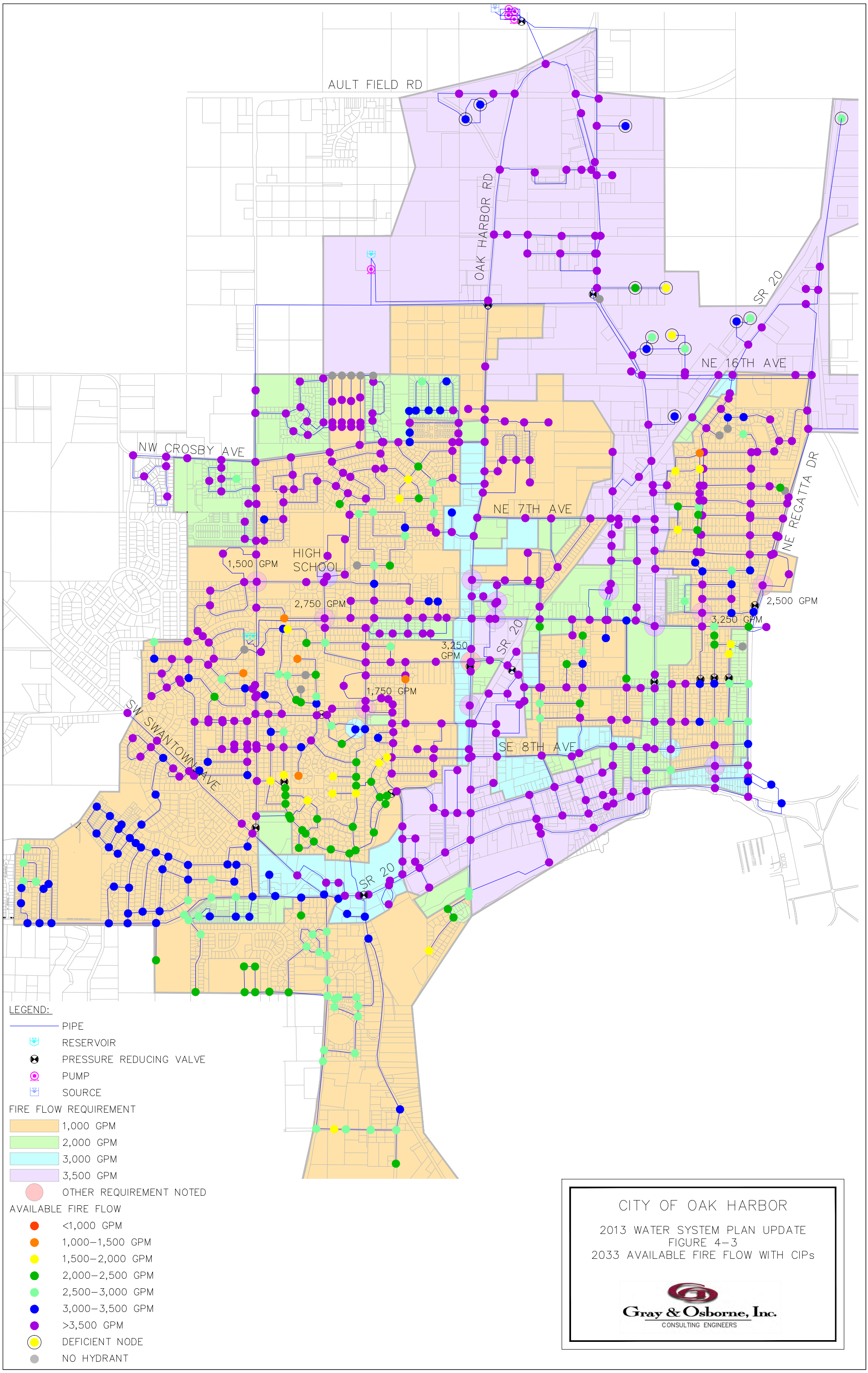
3,250 GPM
SR 20
SW SWANTOWN AVE
SE 8TH AVE
SR 20
LEGEND:
PIPE
RESERVOIR
PRESSURE REDUCING VALVE
PUMP
SOURCE
FIRE FLOW REQUIREMENT
1,000 GPM
2,000 GPM
3,000 GPM
3,500 GPM
OTHER REQUIREMENT NOTED
AVAILABLE FIRE FLOW
<1,000 GPM
1,000–1,500 GPM
1,500–2,000 GPM
2,000–2,500 GPM
2,500–3,000 GPM
3,000–3,500 GPM
>3,500 GPM
DEFICIENT NODE
NO HYDRANT
CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE
FIGURE 4–2
2033 AVAILABLE FIRE FLOW WITH EXISTING SYSTEM
Gray & Osborne, Inc.
CONSULTING ENGINEERS


AULT FIELD RD
OAK HARBOR RD
SR 20
NE 16TH AVE
NW CROSBY AVE
NE 7TH AVE
NE REGATTA DR
HIGH SCHOOL
1,500 GPM
2,750 GPM
3,250 GPM
1,750 GPM
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3,250 GPM
SR 20
SW SWANTOWN AVE
SE 8TH AVE
SR 20
LEGEND:
PIPE
RESERVOIR
PRESSURE REDUCING VALVE
PUMP
SOURCE
FIRE FLOW REQUIREMENT
1,000 GPM
2,000 GPM
3,000 GPM
3,500 GPM
OTHER REQUIREMENT NOTED
AVAILABLE FIRE FLOW
<1,000 GPM
1,000–1,500 GPM
1,500–2,000 GPM
2,000–2,500 GPM
2,500–3,000 GPM
3,000–3,500 GPM
>3,500 GPM
DEFICIENT NODE
NO HYDRANT
CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE
FIGURE 4–3
2033 AVAILABLE FIRE FLOW WITH CIPs
Gray & Osborne, Inc.
CONSULTING ENGINEERS

SYSTEM RECOMMENDATIONS

Based on results from the hydraulic model, the north booster station and new pressure zones will address many of the existing deficiencies. The remaining CIPs generally replace undersized pipe within the distribution system. These projects are described in Chapter 8 – Capital Improvement Program.

CHAPTER 5

WATER USE EFFICIENCY PROGRAM

INTRODUCTION

The following chapter presents the City's Water Use Efficiency (WUE) Program and information on program development and implementation, recommended measures and level of implementation, regional conservation programs, reclaimed water opportunities, and compliance with the Municipal Water Law (MWL).

WATER USE EFFICIENCY

A viable water use efficiency plan is a requirement of water system planning per WAC 246-290. Public awareness and participation are necessary for the City to develop an active and beneficial water use efficiency plan.

The Washington Legislature passed the Water Use Efficiency Act of 1989 (43.20.230 RCW) which directs DOH to develop procedures and guidelines relating to water use efficiency. In response to this mandate, Ecology, the Washington Water Utilities Council, and DOH jointly published a document titled *Conservation Planning Requirements* (RCW 90.46) in 1994. In 2003, the Municipal Water Supply – Efficiency Requirements Act (Municipal Water Law) was passed and amended RCW 90.46 to require additional conservation measures. The MWL, among other things, directed DOH to develop the Water Use Efficiency Rule (WUE Rule), which became effective January 22, 2007, and is outlined in the *Water Use Efficiency Guidebook* (DOH, 2011).

These documents provide guidelines and requirements regarding the development and implementation of conservation and efficiency programs for public water systems. Conservation and efficiency programs developed in compliance with these documents are required by DOH as part of water system planning documents and by Ecology as part of a public water system water right application. Conservation must be evaluated and implemented as an alternate source of supply before state agencies approve applications for new or expanded water rights.

The WUE Rule sets more stringent guidelines for public water purveyors. The three fundamental elements that comprise the WUE Rule are:

1. Planning Requirements,
2. Distribution Leakage Standards, and
3. Goal Setting and Performance Reporting.

PAST CONSERVATION PROGRAMS

The City adopted a conservation program as part of the 2003 *Water System Plan*. A copy of this conservation program is included in Appendix P. Through the development of this program, the City sought to meet the following goals and objectives:

- Maintain the current level of service while increasing water use efficiency,
- Protect water resources as valuable commodities,
- Reduce per capita water consumption,
- Meet current and long-term utility growth requirements,
- Maintain water system capacity for current and future system users,
- Adapt a regional approach to water quality and conservation,
- Reduce residential and/or irrigation water consumption,
- Develop a program for public education and awareness.

To meet these goals, the City implemented measures which included:

- Preventive replacement and installation of new water metering equipment,
- Modification of billing statement to more clearly show water use and water use trends,
- Modification of water rates to encourage conservation measures, and
- Consistent and regular source meter monitoring.

A variety of external measures targeted for consumers were also implemented and included:

- Distribution of free or cost-reduced conservation kits,
- Promotion of plants and vegetation that are adapted to the City's climate zone, and
- Public conservation education and outreach.

PLANNING REQUIREMENTS

Under the WUE Rule, water systems are required to implement planning methods to project future demands and determine necessary measures to reduce usage and demand. Elements of the planning requirements include:

- Data Collection and Reporting,
- Demand Forecasting, and
- Selection and Evaluation of WUE Measures.

DATA COLLECTION AND REPORTING

The WUE Rule requires regular collection of production and consumption data. Data must be reported in the City's planning documents and annual performance report to DOH. Water use data is used by the City to:

- Calculate leakage,
- Forecast demand for future water needs,
- Identify areas for more efficient water use,
- Evaluate the success of the City's WUE Program,
- Describe water supply characteristics, and
- Assist with water management decision-making.

Table 5-1 summarizes the water use data collection requirements, which must be accomplished through source and service meter monitoring. The MWL states that all water system connections must have active service meters on or before January 22, 2017.

TABLE 5-1

Summary of Water Use Data Collection

Data Type	Includes
Source of Supply Meter Data	Monthly and annual totals of water produced, purchased from another water system, and/or supplied to other water systems through interties.
Service Meter Data	Total annual water consumed, annual water consumed by each customer class, and customer class seasonal variations.

These data are needed to meet the planning and performance reporting requirements and to check compliance with the distribution system leakage standard of the WUE Rule. The City collects and tabulates monthly production and consumption data and separates these uses over 12 unique customer classes.

DEMAND FORECASTING

Demand forecasting is an essential element of water system planning. It provides a basis for comparison for growth and usage, and also helps in scheduling system improvements. For the purposes of the WUE Rule, forecasting is used in goal setting and measuring the success of the WUE program. Demand forecasting is meant to consider factors such as:

- Population (Current and Future),
- Historic Water Use Patterns,
- Local Land Use Plans and Zoning Restrictions,
- Water Rate Structure and Its Impact on Consumption,
- Employment (Economic Development and Employment Trends), and
- Projected WUE Savings.

Complete demand projections are provided in Chapter 2 – Basic Planning Information of this Plan, however, a summary is included in Table 5-2. These forecasts do not include anticipated reductions in use from conservation and efficient water use efforts, but do include an estimate of distribution system leakage of 4 percent. Demand projections that include WUE Program savings are discussed later in this chapter.

TABLE 5-2

Retail Service Area Projected Required Production

Year	Retail Service Area Population	Retail Service Area ERUs	Average Daily Consumption(1)	DSL(2)	Required Production		
					Average Daily (gpd)	Maximum Daily (gpd)(3)	Peak Hour (gpm)(4)
2013	18,778	8,700	1,305,000	80,030	1,385,000	2,493,000	2,839
2014	19,419	8,997	1,350,000	81,710	1,431,000	2,576,000	2,934
2015	19,835	9,190	1,378,000	82,800	1,461,000	2,630,000	2,995
2016	21,326	9,880	1,482,000	86,710	1,569,000	2,824,000	3,216
2017	22,053	10,217	1,533,000	88,610	1,621,000	2,918,000	3,323
2018	22,245	10,306	1,546,000	89,120	1,635,000	2,943,000	3,352
2019	22,440	10,396	1,559,000	89,630	1,649,000	2,968,000	3,380
2020	22,470	10,410	1,562,000	90,390	1,652,000	2,974,000	3,387
2021	22,667	10,502	1,575,000	91,600	1,667,000	3,000,000	3,417
2022	22,867	10,594	1,589,000	92,810	1,682,000	3,027,000	3,447
2023	23,068	10,687	1,603,000	94,020	1,697,000	3,055,000	3,479
2024	23,270	10,781	1,617,000	95,240	1,712,000	3,082,000	3,510
2025	23,475	10,876	1,631,000	96,460	1,728,000	3,110,000	3,542

TABLE 5-2 – (continued)

Retail Service Area Projected Required Production

Year	Retail Service Area Population	Retail Service Area ERUs	Average Daily Consumption(1)	DSL(2)	Required Production		
					Average Daily (gpd)	Maximum Daily (gpd)(3)	Peak Hour (gpm)(4)
2030	24,348	11,281	1,692,000	102,200	1,794,000	3,230,000	3,679
2033	24,999	11,582	1,737,000	106,000	1,843,000	3,318,000	3,779
2060	31,074	14,397	2,160,000	121,900	2,281,000	4,107,000	4,677

(1) Based on population projections and 69 gpcd.
(2) Assumes that only 80 percent of total DSL is due to City connections and facilities, while remaining losses are assumed to be from transmission mains and other facilities.
(3) Estimated as 1.8 * ADD + DSL.
(4) Estimated as 1.64 * required maximum daily production.

DISTRIBUTION SYSTEM LEAKAGE

The WUE Rule requires that water distribution systems have a leakage rate less than 10 percent of finished water production based on a 3-year rolling average. The deadline for the City to meet the 3-year rolling average was July 1, 2010.

Distribution system leakage (DSL) equals the difference between treated or purchased supply volume and volume measured at the customers' meters plus any other credibly estimated usage. Since 2008 the annual distribution system leakage has ranged from 53.8 million gallons to 5.6 million gallons at a rate between 6.7 percent and 0.7 percent of total treated supply. DSL from 2007 through 2012 is summarized in Table 5-3.

TABLE 5-3

Historical and Existing Distribution System Leakage Summary

Parameter	2007	2008	2009	2010	2011	2012	Average
Total Source Production (MG)(1)	880.04	809.48	865.55	755.12	774.59	746.66	805.24
Authorized Consumption (MG)(2)	800.54	755.64	829.22	749.53	757.25	716.24	768.07
DSL (MG)	79.50	53.84	36.33	5.59	17.34	30.42	37.17
DSL (percent)	9.0%	6.7%	4.2%	0.7%	2.2%	4.1%	4.5%
3-year Rolling Average	-	-	6.6%	3.9%	2.4%	2.4%	-

(1) Combined production from Anacortes and Wells 8, 9 and 11.
(2) Total Service Area Consumption from Table 2-10.

As shown in Table 5-3, the City's DSL has fluctuated since 2008, but has remained below 10 percent of total source production. Furthermore, since 2007, the 3-year rolling average DSL has also remained well below 10 percent. As such, the City is not required to prepare a water loss control action plan nor implement additional measures to reduce

DSL; however, the City will strive to maintain or reduce DSL to the maximum extent possible.

SELECTION AND EVALUATION OF WUE MEASURES

Under the WUE Rule, the City must set water use efficiency goals and measure progress each year toward meeting these goals. Goals must include a measurable outcome, address water supply or demand characteristics, and include an implementation schedule. The City must also evaluate or implement efficiency measures to help meet these goals.

GOAL 1: MAINTAIN DSL BELOW 10 PERCENT

The first goal of the City's WUE Program is to maintain its 3-year rolling average at its current level. In 2012, the City's three year rolling average DSL was 2.7 percent. Since 2007, the City's average annual DSL has been 4.8 percent.

The City plans to maintain its achievement of this goal through:

- Water meter accuracy testing,
- Leak detection and repair,
- Preventive maintenance replacement of old or leaking water mains, and
- Continued installation of new automated meter reading (AMR) equipment.

GOAL 2: MAINTAIN SINGLE-FAMILY RESIDENTIAL USE AT OR BELOW 64 GPCD

The second goal of the City's WUE Program is to maintain family household use at or below 64 gpcd based on a 3-year average. A secondary goal is to reduce irrigation usage.

Based on historical data, the current 3-year average single-family residence water usage within the retail service area is 67 gpcd. Furthermore, since 2009, the City has reduced its irrigation usage by approximately 39 percent, from 41.3 million gallons to 24.8 million gallons in 2012.

The City plans to continue to achieve this goal through:

- Consumer education and awareness,
- Leak detection and repair,
- Appropriate summer watering through customer education and voluntary participation (watering at dawn or dusk, and on even or odd days of the month), and

- Encouraging low-impact development measures.

PERFORMANCE REPORTING

The City must report progress toward water use efficiency goals annually and this report must include:

- Total source production,
- Distribution system leakage in percentage and volume, and
- Goal description, schedule, and quantitative progress toward meeting goals.

The City's annual reports for 2009 through 2012 are included in Appendix Q.

WATER USE EFFICIENCY MEASURES

The WUE Rule requires the evaluation and implementation of water use efficiency measures to help meet the WUE goals. The WUE Guidebook lists several measures that must be implemented or evaluated and also provides a list of measures that can be counted as additional measures in the WUE program. WAC 246-290-810 identifies the minimum number of water use efficiency measures that must be evaluated based on system size.

Because the City serves between 10,000 and 49,999 customers, they are required to evaluate or implement a minimum of nine supplementary water use efficiency measures. The following sections describe both the mandatory and supplementary water use efficiency measures evaluated, and indicate which have been, or will be implemented by the City.

MANDATORY MEASURES

Implement Source Metering and Meter Calibration

Source meters have been installed at all active sources and are evaluated and calibrated at least every 2 years. Current source meters were installed at Ault Field Booster Station in 2012, at Wells 8, 9 and 11 in 2004, and at NASWI in 2013. The meters remain in good condition and are compared monthly against data collected from Anacortes at the Sharpe's Corner meter.

Implement Service Metering and Meter Calibration

All water users including public and city facilities have individual service meters. Service meters vary in size according to the needs of the individual customer, and all new service connections are installed according to the City's developer standards.

Meters are inspected regularly as part of the City's preventive maintenance program and replaced as necessary. The City recently completed installation of new Automated Meter Reading (AMR) equipment as part of its meter replacement program, which began in 2005. AMR equipment electronically relay water consumption data to water and billing staff which increases meter reading efficiency, increases the availability and manipulability of consumption information, and allows staff to review an individual connection's water use history. This capability leads to more accurate leak detection and analysis of consumption patterns. Since the replacement program's inception in 2005 over 5,776 standard service meters have been replaced with AMR equipment.

The City has completed the replacement of a majority of service meters within the retail service area. There are approximately 20 existing meters which can not be replaced due to their location or restrictions on radio frequency for remote monitoring.

Implement Leak Detection and Water Accounting

The City maintains a rolling three-year average DSL of approximately 3 percent, which is well below the regulatory threshold of 10 percent. As such, the City has not conducted a leak detection survey since 2007.

However, the City staff does track unbilled water, such as water used for water main and tank flushing, street cleaning, or other maintenance uses.

Implement Customer Education

The City has several different brochures regarding conservation and efficient water use available on its website and also available in hard copy at City Hall. The City staffs educational booths at selected fairs and gatherings, and advertises conservation tips on local cable Channel 10.

Evaluate and Implement Conservation Rate Structure

The City recently completed the *Water Cost of Service Study* (HDR, 2010) which recommended a new inclined block water service rate structure to fund water system improvements and system maintenance. The City adopted the recommendations of the Study and will adjust future water service rates accordingly. These rates are tiered so that water service fees are assessed based on the amount of water consumed. This new rate structure is being implemented across seven different customer classes, and therefore, counts as seven water use efficiency measures.

Evaluate Reclaimed Water Opportunities

The City currently operates two wastewater treatment operations. The first is a rotating biological contactor (RBC) facility located near WindJammer Park, and the second is a lagoon treatment facility located along East Pioneer Way within the NASWI Seaplane Base. Neither of these facilities are currently capable of producing reclaimed water suitable for public non-potable use.

The City is currently in the design phase of constructing a new membrane bioreactor (MBR) facility near the location of the existing WindJammer Park WWTP. If constructed and equipped appropriately, the new MBR facility would be capable of producing Class A reclaimed water which could potentially be used for irrigation, heating and cooling, toilet flushing, and other non-potable uses. The *Water Reclamation and Reuse Standards* manual published in 1997 by DOH and Ecology outlines uses and standards governing the production and use of reclaimed water.

The City plans to further investigate uses of reclaimed both during and after construction of the new MBR wastewater treatment facility, and these uses will be implemented as time, schedule, and funding allows. There are more than 30 parks owned and operated by the City that encompass more than 150 acres. Once reclaimed water is produced, these City parks will be primary candidates for water reuse and other applications may follow in future years.

SUPPLEMENTARY MEASURES

The City has been implementing many of the following measures since 2003, when a conservation plan was adopted as part of the 2003 WSP. Since these measures proved effective in reducing overall demand, the City will continue to implement them.

Bills Showing Consumption History

The City includes consumption history on all bills to its customers. The City currently uses Eden billing software, which has the capability to include historic water use on billing statements. Currently, water use graphs for the most recent 12-month period, as well as the water usage and water consumption rate are indicated on customer billing statements.

Customer Leak Detection

The City's billing department monitors customers' water bills for abnormally high water use volumes. When a measurement occurs that is outside the range of normal use, the customer is notified of a potential leak on their side of the water meter. This detection and monitoring capability is also bolstered through the use of AMR equipment, which allows for nearly real-time monitoring of water consumption.

Purveyor Assistance

The City provides wholesale water to NASWI, Deception Pass State Park facilities, as well as to the North Whidbey Water District. Conservation and efficient water use efforts made by the City intended for residential customers will be extended to the connections in these systems as well and will begin with educational outreach and support.

SUMMARY OF WUE MEASURES

Based on their number of connections, the City must implement or evaluate a minimum of nine conservation measures (WAC 246-290-810). However, the City has chosen to implement or evaluate all mandatory and supplementary measures discussed above. Table 5-4 provides a summary of these measures and their impact to various customer classes and shows that the City meets the minimum measure requirements of the MWL.

TABLE 5-4

Water Use Efficiency Measures

Measure for Implementation	Customer Classes Affected
Bills Showing Consumption History	7
Customer Leak Detection	7
Implement Conservation Rate Structure	7
Purveyor Assistance	1
Total	**22**

WATER SAVINGS PROJECTIONS

An estimation of the WUE program water demand savings is listed in Table 5-5. Because DSL is already exceptionally low, the projections assume no additional savings from maintaining DSL below 10 percent. Residential/irrigation savings are projected to increase 0.5 percent per year through the 6-year planning period, and are projected to remain constant through the 20-year planning period

The demand forecasts listed in Table 5-2 and those listed in Chapter 2 – Basic Planning Information do not include projected WUE program water savings.
WAC 246-290-100(4) requires systems with more than 1,000 service connections to consider demand forecasts that include projected WUE program water savings, as well as projected demands if all WUE program measures deemed cost-effective were implemented. Table 5-5 compares the projected production forecast for the City with and without WUE program savings. Figure 5-1 shows the same information graphically.

DSL savings was assumed to be zero based on the City's goal to maintain their current average annual DSL of 4 percent. The City plans to maintain DSL at 4 percent by continuing their regular calibration of source meters as well as the regular maintenance and inspection of all source and service meters within the system. The City's billing software will also help notify them of abnormal water usage, which can be addressed to reduce inefficient water usage.

Residential and irrigation savings were assumed to increase 0.5 percent annually through the 6-year planning period and then remain at 3.0 percent of the total projected production through buildout. The City plans to achieve this reduction through consumer education, continued preventive maintenance, and utilization of the AMR and electronic billing system. The savings from DSL and residential and irrigation consumption reduction were then combined to estimate the average day and maximum day savings if the WUE measures and goals listed above are achieved. Only measures that were deemed cost-effective were included for water savings.

TABLE 5-5

WUE Program Savings Summary

Year	Service Area Population	ERUs	DSL Savings (gpd)	Residential/ Irrigation Savings (gpd)	Production Without WUE Savings		Production With WUE Savings		Average Day Savings (gpd)	Maximum Day Savings (gpd)
					Average Day (gpd)	Maximum Day (gpd)	Average Day (gpd)	Maximum Day (gpd)		
2013	18,778	8,700	0	3,530	1,385,000	2,493,000	1,381,000	2,485,800	4,000	7,200
2014	18,964	8,786	0	7,120	1,398,000	2,517,000	1,391,000	2,503,800	7,000	13,200
2015	19,952	9,244	0	11,200	1,470,000	2,645,000	1,459,000	2,626,200	11,000	18,800
2016	20,942	9,702	0	15,800	1,541,000	2,774,000	1,525,000	2,745,000	16,000	29,000
2017	21,933	10,162	0	20,600	1,613,000	2,903,000	1,592,000	2,865,600	21,000	37,400
2018	22,925	10,621	0	25,800	1,684,000	3,031,000	1,658,000	2,984,400	26,000	46,600
2019	23,920	11,082	0	27,000	1,756,000	3,160,000	1,729,000	3,112,200	27,000	47,800
2020	24,116	11,173	0	27,300	1,771,000	3,187,000	1,744,000	3,139,200	27,000	47,800
2025	25,121	11,639	0	28,300	1,847,000	3,324,000	1,819,000	3,274,200	28,000	49,800
2030	26,169	12,124	0	29,500	1,926,000	3,466,000	1,897,000	3,414,600	29,000	51,400
2033	26,819	12,425	0	30,200	1,975,000	3,554,000	1,945,000	3,501,000	30,000	53,000
2060	33,472	15,508	0	37,800	2,454,000	4,418,000	2,416,000	4,348,800	38,000	69,200

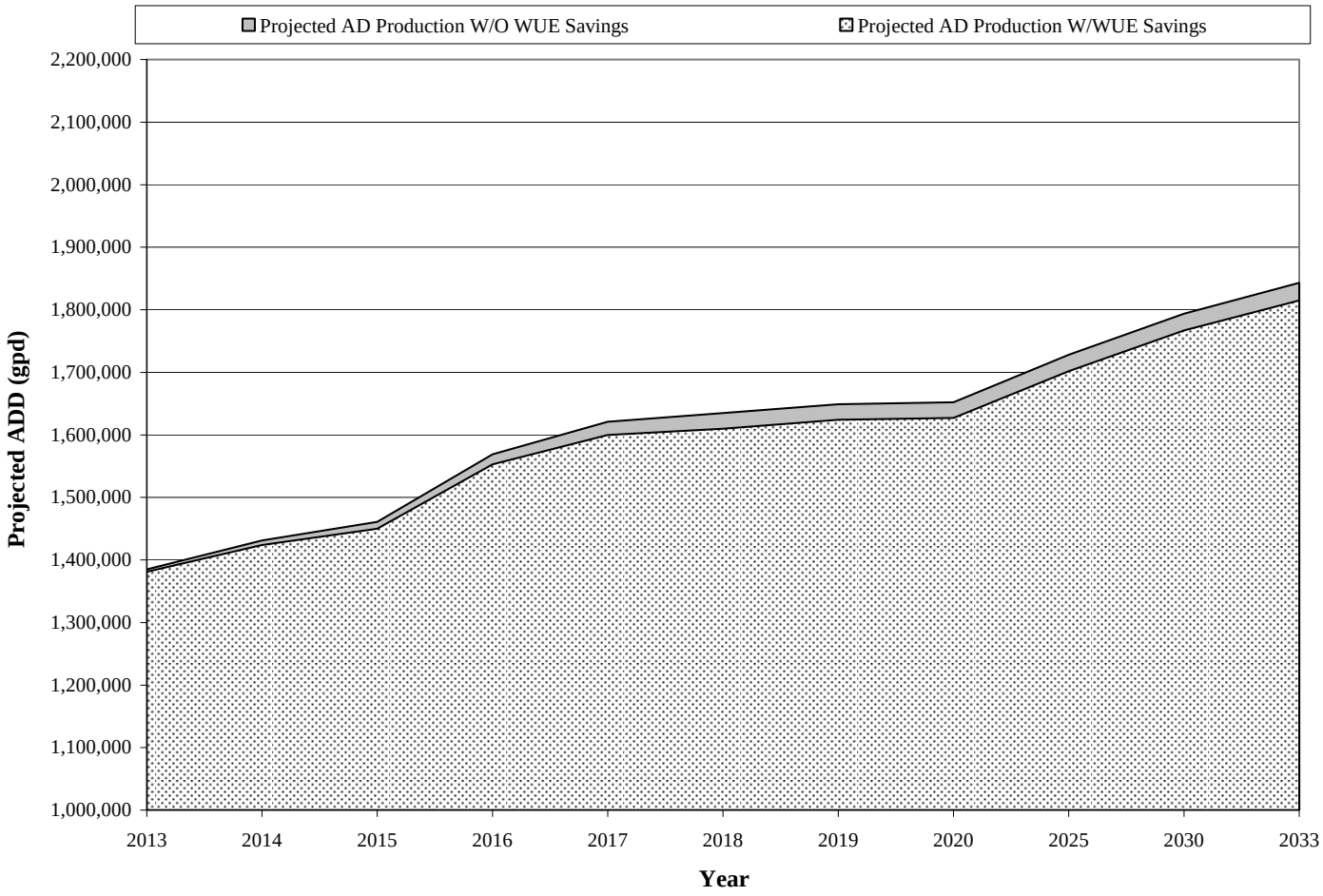


FIGURE 5-1

WUE Program Required Production

CHAPTER 6

SOURCE PROTECTION PROGRAM

INTRODUCTION

This chapter only discusses sources within the City's control, namely Wells 8, 9 and 11. A source protection plan was also developed by Anacortes for its groundwater sources as well as its primary source, the Skagit River. More information on the protection plan for these sources is available in the *Anacortes Water System Plan* (HDR, 2011).

Groundwater supplies can be susceptible to contamination from surface sources such as underground storage tanks (UST), pesticides, industrial and commercial activity, accidental spills, and nitrates from septic systems or leaky sewer pipes. In an effort to protect these groundwater resources, the EPA as well as DOH require all Group A water systems to develop a source protection plan as part of their Water System Plan.

The purpose of a source protection program is to provide local utilities with a proactive program for preventing groundwater contamination. A successful source protection program consists of a number of components that must be developed before the plan can be approved or fully implemented. The major components of the plan are described below and form the basis of the following chapter.

- A *susceptibility assessment* that determines the potential for contamination.
- A *delineated wellhead protection area (WHPA)* that is based on all reasonably available hydrogeologic information, including the Susceptibility Assessment.
- An *inventory* within each wellhead protection area of potential sources of contamination.
- A *spill response plan* for each wellhead protection area containing documentation for coordination with local first responders.
- *Contingency plans* for providing alternate sources of drinking water in the event that contamination does occur. The contingency plan will include management recommendations to reduce the likelihood that potential contaminant sources will pollute the drinking water supply.

The City's previous Wellhead Protection Plan was developed in 1998 in accordance with DOH requirements and a copy of the Plan is included in Appendix R. This chapter provides updated information based on new and current DOH regulations. Critical

aquifer recharge areas (CARA) are also formally defined in the OHMC and are shown on Figure 1-12.

SUSCEPTIBILITY ASSESSMENT

Susceptibility assessments are an important initial step in selecting appropriate delineation methods to define the wellhead protection area boundaries. Drinking water supplies vary as to their susceptibility to contaminants discharged at the surface. Wells that have been poorly constructed or have been improperly cased have a higher susceptibility to contamination. In addition, sources located in an unconfined aquifer with no confining layer (layer of low permeability) between the aquifer and surface have a much higher susceptibility. Drawing water from confined aquifers deep below the ground surface provides the best source of protection.

Susceptibility assessments for the City's wells have been submitted to DOH. Copies of these susceptibility assessments are included with the Wellhead Protection Plan in Appendix R. All three active wells within the City's control maintain a low susceptibility rating.

WELLHEAD PROTECTION AREA DELINEATION

The first step in developing a wellhead protection program is to identify the land area around each well from which groundwater may be flowing to the source. These areas are the most likely to contribute pollutants to groundwater and are referred to as zones of contribution (ZOCs). Zones of contribution require proper land use management to minimize the risk for contaminants to enter the groundwater system.

Also related to the wellhead protection plan and groundwater protection is the delineation of Critical Aquifer Recharge Areas (CARAs). CARAs are those areas with a critical recharging effect on aquifers used for potable water and have prevailing geologic conditions associated with infiltration rates that create a high potential for contamination of ground water resources. CARAs are described in Chapter 1 – System Description, are defined in the OHMC (Chapter 20.32), and are shown on Figure 1-12.

METHODS OF DELINEATION

The most commonly accepted methods for delineating wellhead protection zones are the calculated fixed radius method, analytical models, and numerical models.

Calculated Fixed Radius Method

The simplest groundwater model is the calculated fixed radius (CFR) method. In this method, ZOCs are delineated by concentric areas around each well. In the CFR method, the delineation is calculated based on pumping data and known or assumed aquifer and geologic characteristics.

Analytical Models

The analytical model requires the incorporation of basic hydrological information and certain physical characteristics of the aquifer and source. Major assumptions and simplifications to the hydrogeologic regime occur in analytical modeling. However, the incorporation of the hydraulic gradient and hydrogeologic boundaries allows for a more realistic representation of the groundwater flow regime than in the CFR method.

Numeric Method

In numeric modeling, a grid is superimposed over the study area. Each square in the grid, called a cell, is characterized by physical parameters that are estimated from data collected from a variety of sources. The sources may include well logs, geologic and hydrogeologic maps, geophysical data, groundwater elevation data, stream flow discharge, and meteorological data. The numeric method requires significantly more data than either the CFR method or analytical modeling. The numeric method generates more accurate results than the CFR or analytical method, but is very costly to develop. Consequently, numeric models are most commonly used by large utilities with complex aquifers that have the resources to collect the extensive model input required.

As in past Planning efforts, this WSP utilizes the CFR method to define ZOCs for the City's groundwater sources.

ANALYSIS

A WHPA is designated in order to protect groundwater sources from potential contamination, and to inform water system staff of any entities that represent potential sources of contamination. WHPAs are delineated based on existing and proposed development in the immediate vicinity of the source, and geographical, hydro-geologic, and geomorphologic data.

WHPAs are typically broken into four distinct ZOCs based on the estimated amount of time it would take for water to travel through the aquifer and be pumped to the City's storage facilities. The 6-month, 1-year, 5-year, and 10-year ZOCs for Wells 8, 9, and 11 are shown on Figure 6-1.

Well 8

Well 8 is located near the intersection of SW Heller Street and SW 2nd Way. The 10-year ZOC, which is the largest area of potential impact, includes only residential housing. All of the housing units within this ZOC are connected to the City wastewater collection system and do not contain any of the potential contaminant sources discussed later in this chapter.

Well 9

Well 9 is located near the intersection of SW Heller Street and SW 6th Avenue. The 10-year ZOC includes only residential housing and does not contain any of the potential contaminant sources discussed later in this chapter.

Well 11

Well 11 is located near the intersection of SW Heller Street and SW Barrington Drive. The 10-year ZOC includes only residential housing and does not contain any of the potential contaminant sources discussed later in this chapter.

The radii for the ZOCs for Wells 8, 9, and 11 are very similar and are summarized in Table 6-1 below.

TABLE 6-1

Zone of Contribution Groundwater Source Radii Summary

Well Number	6-month ZOC (feet)	12-month ZOC (feet)	5-year ZOC (feet)	10-year ZOC (feet)
Well 8	100	140	310	440
Well 9	100	140	310	440
Well 11	140	200	440	620

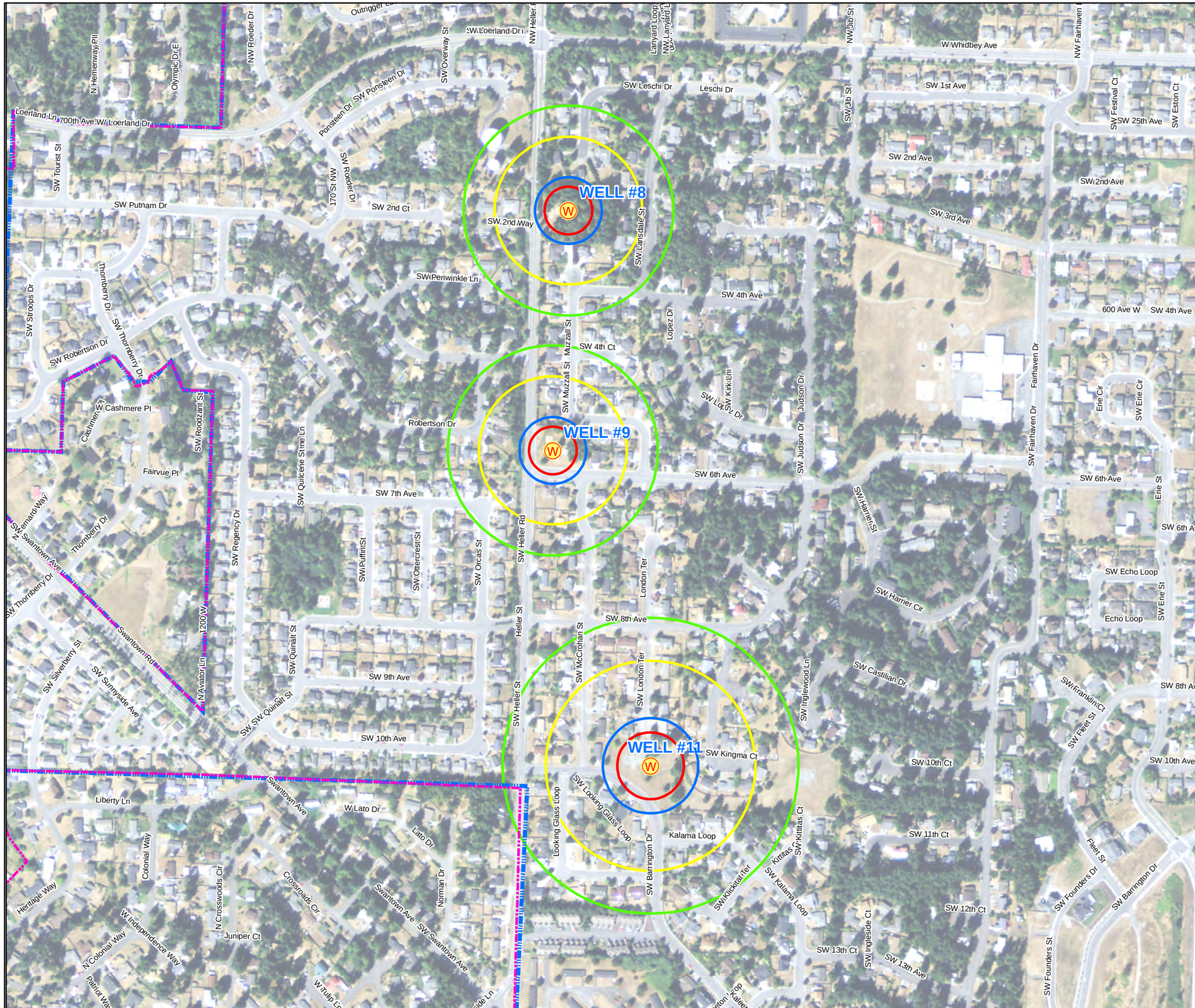
CONTAMINANT SOURCE INVENTORY

An essential element of source protection is an inventory of all potential sources of groundwater contamination in and around the delineated protection areas. The purpose of the inventory is to identify past, present, and proposed activities that may pose a threat to the source or surrounding area. The inventory can also help establish management strategies and compile a mailing list of businesses and/or residences located within the source protection areas.

POTENTIAL SOURCES OF CONTAMINATION

Within a source protection zone, there are many diverse activities that can contaminate an aquifer. A discussion of these activities, their potential effects on groundwater, and the regulatory requirements that may apply are included in the following sections.

There are no potential sources of contamination within the ZOCs for Wells 8, 9, or 11. The following sections describe types of sites classified as potential sources of contamination. The City should monitor development within the 10-year ZOC to ensure that any potential contamination source activities are notified of their presence within the source protection area.



N

0 200 400 800 Feet

LEGEND:

- CITY LIMITS
- EXISTING SERVICE AREA
- WELLS

ZONES OF CONTRIBUTION:

- 6 MONTH ZOC
- 1 YEAR ZOC
- 5 YEAR ZOC
- 10 YEAR ZOC

DATA SOURCE: CITY OF OAK HARBOR

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 6-1
WELLHEAD PROTECTION AREA

Gray & Osborne, Inc.

M:\Oak Harbor\13404 - Water System Plan Update\GIS\WELLHEAD.mxd

Landfills

A landfill is a disposal facility in which solid waste is permanently placed. Minimum functional standards for solid waste hauling are regulated by the Ecology under WAC 173-304. These regulations set siting and closure criteria, performance standards, and operating requirements for landfills. Abandoned and improperly maintained landfills and dumpsites are often a major source of groundwater contamination. Leachate from landfills poses a threat to groundwater quality should it migrate to the water table. Ecology is responsible for mitigating dumpsite cleanup when potentially hazardous leachates are present.

Both the City and NASWI have landfill sites in the NE part of Oak Harbor. The City's landfill site is located within both the city limits and the UGA, while the NASWI landfill facility is located outside both the city limits and UGA. Both landfill sites have been closed for many years but still contain waste. The City landfill accepted standard municipal solid waste, but it is not known whether leachate from the facility has entered the aquifer or groundwater under the site. The NASWI landfill was formerly an industrial waste disposal site where spent solvents were deposited in pits. Volatile organic contaminants from the site such as trichloroethene, 1,1-dichloroethene, 1,2-dichloroethene, and vinyl chloride have contaminated groundwater and migrated off site. The NASWI landfill facility is an EPA Superfund Cleanup Site (EPA ID: WA5170090059) and since 1992 has been using a "pump and treat" system to remove contaminants from groundwater. The contaminants listed above are being effectively reduced by the existing treatment system. One contaminant of concern, 1,4-dioxane, has not been successfully remediated using the existing treatment system. 1,4-dioxane has persisted in groundwater and has subsequently migrated off site in a southeasterly direction. The U.S. Navy is in the process of selecting new treatment methods in order to remove 1,4-dioxane from the groundwater.

Local geography and the discontinuous nature of aquifers on Whidbey Island make it unlikely that the aquifer zone that the wells are finished in is hydraulically connected to that underlying the landfill sites however this possibility has not been investigated to date.

There are no active landfills within the ZOCs for Wells 8, 9 or 11. The City's waste is consolidated at the Island County Transfer Station in Coupeville, Washington.

Commercial and Industrial Activity

Areas of commercial and industrial land use are located within most wellhead protection boundaries. Businesses that may contribute contaminants to the groundwater include dry cleaners, gas stations and other businesses with fuel storage tanks, auto repair shops, metal plating facilities, asphalt and concrete facilities, and machine shops. Wastes generated at these businesses include substances such as petroleum products, solvents,

surfactants, heavy metals, and other organic materials. These wastes can potentially enter the groundwater system through inadequate disposal practices or accidental spills. Table 6-2 presents typical commercial and industrial activities and the potentially hazardous chemicals that may be associated with them.

TABLE 6-2

Chemicals Associated with Commercial and Industrial Activities

Commercial/Industrial Activity	Contaminants
Automobile/Truck Service	Waste oils, solvents, acids, paints, soaps
Dry Cleaners	Solvents (perchloroethelyene, petroleum solvents, Freon) Spotting chemicals (trichloroethane, methylchloroform, ammonia, peroxides, hydrochloric acid, rust removers, amyl acetate)
Cemeteries	Fertilizers, pesticides
Country Clubs/Golf Courses	Fertilizers, herbicides, pesticides, swimming pool chemicals, automotive wastes
Electric/Electronic Equipment Manufacturers	Nitric, hydrochloric and sulfuric acid, heavy metal sludges, ammonium persulfate, cutting oil and degreasing solvent, corrosive soldering flux, waste plating solution, cyanide, methylene chloride, perchloroetheylene, trichloroethane, acetone methanol
Furniture/Wood Manufacturing	Paints, solvents, degreasing and solvent recovery sludge
Metal Plating Shops	Sodium and hydrogen cyanide, metallic salts, alkaline solutions, acids, solvents, heavy metal-contaminated wastewater/sludge
Lawns and Gardens	Fertilizers, herbicides, pesticides
Painters, Publishers	Solvents, inks, dyes, oils, miscellaneous organics, photographic chemicals
Sand and Gravel Mining	Diesel fuel, motor oil, hydraulic fluids
Scrap, Salvage and Junkyards	Used oil, gasoline, antifreeze, PCB-contaminated oil, lead acid batteries

The 10-year ZOCs for Wells 8, 9, and 11 do not contain any commercial or industrial activity. Commercial and industrial activity is concentrated east and north of the WHPA near Ault Field Road and Highway 20.

RCRA Generators

The siting and operation of facilities which treat, store, or dispose of hazardous waste are subject to the requirements of the Resource Conservation and Recovery Act (RCRA), Subtitle C. In Washington State, Ecology regulates facilities which generate more than

220 pounds of hazardous waste per month under WAC 173-303. The regulations are significant in that they establish a number of requirements for these facilities including surveillance and monitoring, recordkeeping, performance and design criteria, and siting and closure procedures. Ecology divides the facilities into three levels of hazardous waste accumulation:

- Level 1 facilities generate at least 2,200 pounds of waste per month;
- Level 2 facilities generate between 220 and 2,200 pounds per month; and
- Level 3 facilities generate less than 220 pounds per month.

Level 3 generators are exempt from the regulations. All Level 1 and 2 facilities must file an initial report of their activities with Ecology and update those reports annually. A summary of these activities are published by Ecology, thereby allowing water purveyors the opportunity to determine the types of activities present within their wellhead protection area.

Information available on Ecology's website and City zoning analysis show that the 10-year ZOCs Wells 8, 9, and 11 do not contain any known RCRA generators.

Underground Storage Tanks

Underground storage tanks (USTs) and leaking underground storage tanks (LUSTs) can be a major threat to groundwater quality. Petroleum products that may contain impurities that are mobile in the groundwater system are the most commonly stored substances in USTs. The EPA estimates that 35 percent of all USTs may be leaking. The most common causes of leaks are structural failure, corrosion, improper fittings, and improper installation.

Ecology regulates underground storage tanks in Washington State under WAC 173-360. The regulations require that owners and operators of underground storage tanks comply with the following regulations:

- Notification, reporting, and recordkeeping;
- Performance standards and operating closure requirements;
- Registration and licensing; and
- Financial responsibility.

As of July 1, 1991, owners and operators of all existing nonexempt underground storage tanks must have a permit from Ecology. A valid permit is a requirement for delivery of regulated substances. The permit must be updated annually.

Underground storage tank inspections are performed by Ecology primarily through the information developed in the permitting process. Ecology maintains a file on all permitted USTs in Washington State, as required by RCRA Subtitle 1. The file provides the site name and address, tank identification number, date of installation, size, tank

status, and the substance stored at the site. Results on file with Ecology indicate that there are 52 USTs within the City's UGA, all of which are related to fueling stations.

The 10-year ZOC for Wells 8, 9, and 11 do not contain any known USTs or suspected LUSTs.

Confirmed or Suspected Contamination Sites

Under the Model Toxics Control Act cleanup regulation, WAC 173-340, Ecology is responsible for ensuring that all hazardous waste sites are properly remediated. Confirmed and suspected sites of contamination include leaking underground storage tanks (LUSTs). A separate inventory for each LUST, including the status of cleanup efforts, is maintained by Ecology. Ecology conducts an initial site investigation within 90 days of learning of a potentially contaminated site. If this investigation shows that remediation action is required, the site will appear on the Confirmed and Suspected Contaminated Sites Report. The sites are also given a Washington Ranking Mode BIN number between 1 and 5. A rank of 1 indicates the greatest assessed risk to human health and the environment. The contaminant type and the affected media, such as groundwater, are also noted. Once the remedial action has been completed, Ecology's Toxics Cleanup Program determines if the site can be removed from the list.

There are no confirmed contamination sites within the City's WHPA. Ecology lists 24 confirmed contamination sites within the UGA that are either being cleaned or awaiting remediation. These sites are located far east or north of the WHPA.

Septic Systems

Island County is responsible for regulating and permitting residential and small commercial on-site sewage disposal systems within the County, excluding federal facilities. Contaminants associated with septic tank effluent include pathogenic organisms, toxic substances, and nitrogen compounds. Ammonia and nitrate nitrogen are highly soluble in water. The City will send a letter to current septic system owners within the source protection zone to notify them of the possible influence of their septic systems on the aquifer, and will also continue to monitor nitrates according to DOH requirements.

All residences within the WHPA for Wells 8, 9, and 11 are connected to the City sewer lines. There are no known active or inactive septic systems within the 10-year ZOC for Wells 8, 9, or 11.

Improperly Sealed or Secured Wells

Improperly sealed or secured wells can act as direct conduits for contaminants to reach groundwater. The City maintains water rights over six wells that have been abandoned in

recent years. Two of these wells, Wells 10 and 12 are within or near the 10-year ZOC of Wells 8 and 11, respectively.

The City has sent written correspondence to homeowners within the WHPA notifying them of the risk for contamination to the groundwater supply.

Accidental Spills

Under the Model Toxics Control Act cleanup regulation, WAC 173-340, Ecology is responsible for ensuring all hazardous waste sites are properly remediated. Confirmed and suspected sites of contamination, such as accidental spills or releases of contaminants, can potentially impact groundwater supplies. Potential sources of spills and leaks can originate from underground storage tanks, accidents, and poor disposal practices. The City will notify the local fire department of the zones of contribution for the groundwater supply. The local authorities who are responsible for cleanup and containment of these spills can properly prepare for the possibility of a spill in the area.

INVENTORY DATA SOURCES

Agencies such as Ecology and EPA maintain contaminant databases that list businesses that handle and store potential contaminants. The following databases were used to create the inventory for the City's WHPA:

- *Underground Storage Tank Report, April 2011*. This version of the Underground Storage Tanks Report was obtained from Ecology's Toxics Cleanup Program. This list was used to locate the facilities that contain underground storage tanks and verifies facilities located by field surveys in the wellhead protection areas.

- *Leaking Underground Storage Tank Report, April 2011*. This version of the Leaking Underground Storage Tank (LUST) Report was also obtained from the Ecology Toxics Cleanup Program. The LUST report lists the site name, address, age, volume, and status of sites that contain leaking underground storage tanks.

- *Dangerous Waste and Materials Generators*. The EPA's RCRA program has been taken over by Ecology within the State of Washington and is regulated under the Dangerous Waste Regulations (173-303 WAC).

- *Title III Facilities*. Title III facilities are identified as those facilities that generate, treat, store, or dispose of hazardous materials in sufficient quantity to pose a threat to the community. There are several different types of Title III facilities depending upon the quantity and the nature of the material handled. All companies that are designated as Title III facilities must report to the County on an annual basis. This reporting was

a result of the 1986 Superfund Amendments and Reauthorization Act. Title III of the act was subsequently renamed to the Emergency Planning and Community Right to Know Act (EPCRA).

- *Confirmed and Suspected Contaminated Sites Report, May 2011*. Ecology maintains the Confirmed and Suspected Contamination Sites Report. The list is updated as new information becomes available. Each site is given a site status code indicating the status of the cleanup process.

SPILL/INCIDENT RESPONSE PROGRAM

Spill response planning is an important aspect of both an emergency management plan and a wellhead protection program. Specific response procedures for WHPAs must be in place prior to the occurrence of a contamination incident. The information obtained as a result of the susceptibility assessment and the wellhead protection area inventory can be used to determine what types of spill response measures are necessary for the protection of drinking water sources. In order to be accepted by local emergency responders, spill response procedures for wellhead protection areas must be realistic and feasible.

In order for spill response procedures to be effectively executed, coordination, cooperation, and communication among the responding agencies, organizations, and individuals is imperative. In Washington State, depending on the magnitude and type of the release, any of the following organizations may be involved in a spill response for a wellhead protection area:

- *Department of Ecology (Ecology):* Ecology's Spill Response Team is responsible for determining the source and cause of the release and responsible party. If the responsible party is unknown, Ecology will investigate to determine who is responsible and ensure that containment, cleanup, and disposal proceedings begin. Ecology's 24-Hour Spill Response Team can be contacted at (360) 753-2353.

- *Department of Health (DOH):* The Department of Health, in conjunction with organizations such as Ecology's Spill Operations Section and the Association of Fire Chiefs, is developing a set of standard operating procedures that first responders can use in wellhead protection areas, critical aquifer recharge areas, and other sensitive groundwater areas. If necessary to the cleanup effort, DOH also provides assistance through laboratory support and services.

- *Department of Transportation (DOT):* The Washington State DOT can provide spill response assistance through traffic control, equipment, and personnel for non-hazardous cleanup activities on state and interstate highways.

- *Washington State Patrol:* The state patrol is responsible for managing spills on interstate and state highways.

- *Oak Harbor Fire Department*: Initial response to a hazardous spill would most likely come from the fire department that serves the City of Oak Harbor. The Fire Department will be notified of the wellhead protection area boundaries.

The City maintains a current spill/incident response program as part of the operations and maintenance program emergency procedures. More information on this topic is available in Chapter 7 – Operation and Maintenance Program.

CONTINGENCY PLANNING

Contingency planning is an important component of a wellhead protection program. In the event that any of the City's sources must be taken offline due to contamination, a contingency plan would provide immediate mitigation. A properly prepared and updated contingency plan helps ensure the water system and local officials are prepared to respond to emergency situations. Contingency planning also includes provision of alternative sources of drinking water. The following steps are necessary for the development of an effective contingency plan:

1. Identify maximum capacities of the existing system as to source, distribution system, and water rights restrictions. Assume loss of source and re-evaluate.

   The City has three separate groundwater sources in addition to the primary source from Anacortes. In the event that Well 8, 9, or 11 becomes contaminated, the City may rely on source water from Anacortes to provide average and peak demands for a sustained period.

2. Evaluate the expansion options of the existing system's capacities relative to existing water rights.

   Anacortes currently supplies sufficient water to meet the average and peak demands of the City. If all three groundwater sources were to become contaminated, the City may wish to employ cautionary voluntary water conservation measures, especially during warmer summer months. The City has an additional 110 gpm available from Well 9, and approximately 1,000 gpm available from currently inactive groundwater sources. These sources would require redevelopment in order to provide reliable drinking water to the City's customers.

ACTIONS

The City will take the following steps to protect its existing sources from contamination.

1. Notify commercial businesses, hazardous waste generators, homeowners, and septic system owners of their presence within the City's WHPA.

2. Monitor for nitrates annually.

   Contaminants associated with septic tank effluent include pathogenic organisms, toxic substances, and nitrogen compounds. The City will remain aware of non-compliance with MCLs for nitrates as well as trends of increased nitrate levels over time. Increasing nitrate levels could be an indication of source contamination.

3. Utilize management strategies provided by the *Island County Coordinated Water System Plan* and the *Island County Water Resources Management Plan.*

   These plans were described fully in Chapter 1 – System Description, and outline the results of source water studies, outline factors that affect source water, and highlight methods of protecting and maintaining responsible use of all available water resources.

CHAPTER 7

OPERATION AND MAINTENANCE PROGRAM

INTRODUCTION

It is extremely important for public water systems to have a program in place that ensures successful operation of the water infrastructure components. To address this need, the City maintains an operations and maintenance program for its water system. This program includes information on staffing, maintenance techniques, job duties, emergency procedures, and other activities that help the utility run efficiently.

This chapter reviews the City's water system management, personnel, operator certification, routine operating procedures, preventative maintenance, record keeping, and water quality sampling procedures. Emergency response and coliform detection procedures are also outlined.

WATER SYSTEM MANAGEMENT AND PERSONNEL

STAFFING

A brief description of the City's organization is given in Chapter 1 – System Description. The water system organization chart is shown on Figure 7-1, while Table 7-1 summarizes these staff positions and gives a brief description of major duties and the number of water system staff assigned. Current full-time equivalent (FTE) values are based on the amount of time spent on water system activities.

TABLE 7-1

Water System Staffing and Responsibility Summary

Title	Water System Responsibilities	Current Staff	Name
Mayor	Budget coordination, water system policy and planning	N/A	Scott Dudley
City Administrator	Coordination of multiple City utility services, water system planning	N/A	Larry Cort
Finance Director	Supervises Finance Department, organizes planning, coordination, budgeting and utility functions for the City	N/A	Doug Merriman
Utilities Manager	Maintains accurate billing records and data management, coordinates with multiple utility activities	0.25 FTE	-(1)

TABLE 7-1 – (continued)

Water System Staffing and Responsibility Summary

Title	Water System Responsibilities	Current Staff	Name
Public Works Director	Supervises PW Dept., organizes planning, coordination, and utility functions for the City	0.25 FTE	Cathy Rosen
Public Works Admin. Assistant	Supports the Director	N/A	Debbie Mueller
Budget/Purchasing Specialist	Supervises ordering and budgeting of equipment purchases for utility divisions	N/A	Sandra Place
City Engineer	Coordinates engineering division, develops design and construction standards	0.25 FTE	Joe Stowell
Engineering Admin. Assistant	Supports the City Engineer	N/A	Wendy Hobert
Project Engineer	Develops and reviews plans, system projection planning, supports city engineer	0.25 FTE	Arnie Peterschmidt, John Piccone
Civil Engineer	Develops and reviews plans, system project planning, supports City Engineer	0.25 FTE	Brad Gluth
Construction Inspector	Provides field observation and adherence to City standards	0.5 FTE	Jack Smith
Engineering Technician	Reviews plans, drafts drawings, supports civil engineer	0.25 FTE	Craig Taylor
Utility Operations Manager	Supervises and coordinates City water and streets divisions	1 FTE	Rich Tyhuis
Lead Water Specialist	Coordinates with water system staff on operational procedures	1 FTE	Tim Shelley
Water Specialist II	Performs troubleshooting, maintenance, installation/repair work for water system equipment, performs routine water sampling	3 FTE	Kyle Biddle, Chris Price, Will Jennings
Water Specialist I	Supports Lead Water Specialist	1 FTE	Tim Jupin
Water Utility Total		**8 FTE**	**-**

(1) Currently vacant.

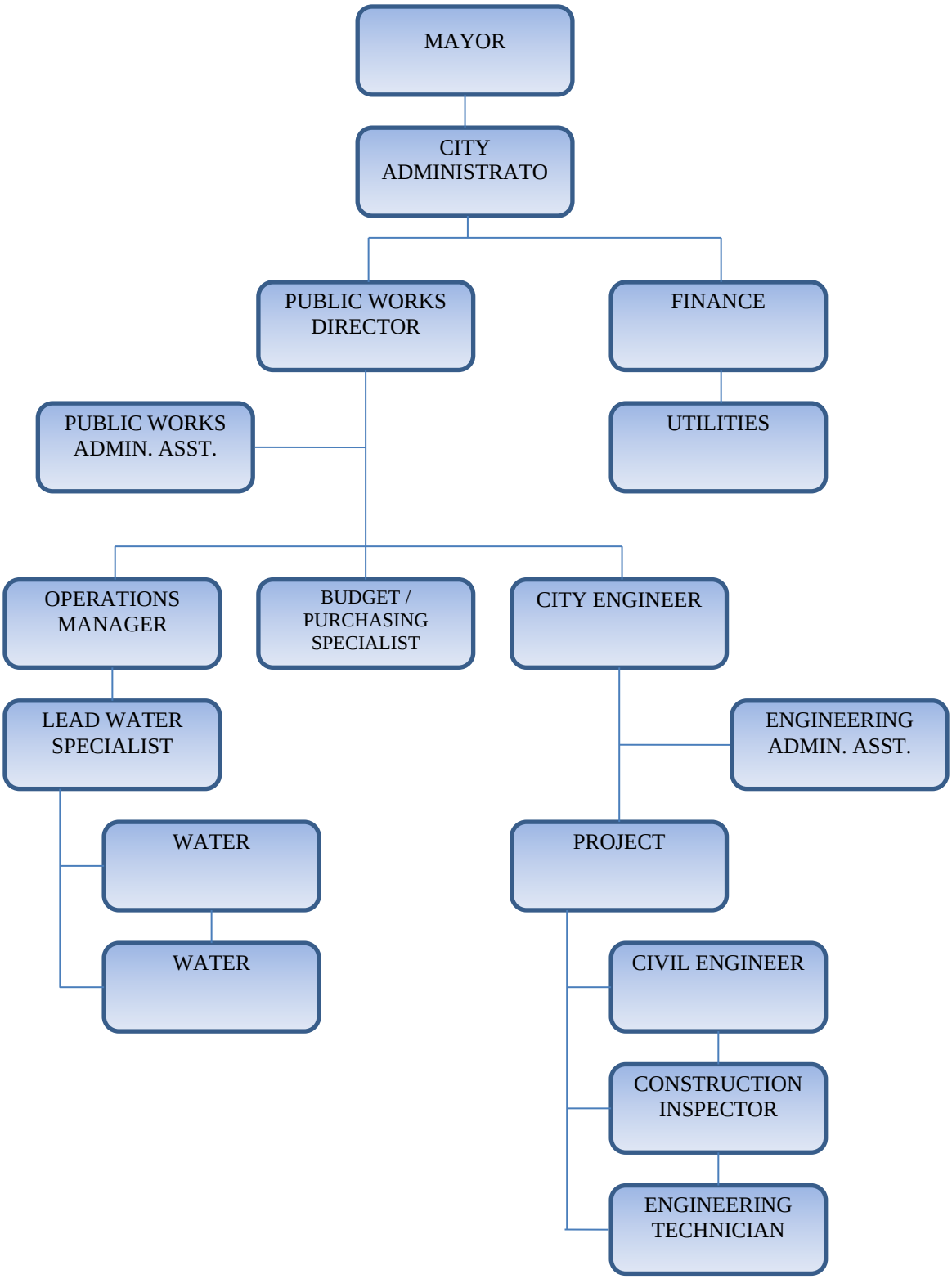


FIGURE 7-1

Water System Operation and Management Personnel Flow Chart

CERTIFICATION REQUIREMENTS

Water Works Operator Certification, required under WAC 246-292-060, mandates large Washington State public water systems retain in their employment individuals who are certified, by examination, as competent in water supply operation and management. DOH determines the required level and number of certified positions based on the population and complexity of the water system. The public water system classification provided in WAC 246-292-040 is listed in Table 7-2.

TABLE 7-2

Water System Classification

Classification	Population Served	Operator Certification Requirement
Group 1	251 – 1,501	Level 1
Group 2	1,501 – 15,000	Level 2
Group 3	15,001 – 50,000	Level 3
Group 4	Greater than 50,000	Level 4

The City is classified as a Group 3 system, which corresponds to a specific required level of certification. The various certification levels and their minimum education and experience requirements are summarized in Table 7-3.

TABLE 7-3

Minimum Education and Experience Requirements for Water Works Operator Certifications

Water Works Operator Classification		Certification Level				
		Operator in Training	Level One	Level Two	Level Three	Level Four
Water Distribution Manager (WDM)	Education	12 years	12 years	12 years	14 years	16 years
	Experience	3 months	1 year	3 years	4 years	4 years
Water Treatment Plant Operator (WTPO)	Education	12 years	12 years	12 years	14 years	16 years
	Experience	3 months	1 year	3 years	4 years	4 years
Water Distribution Specialist (WDS)	Education	12 years	12 years	12 years	NA	NA
	Experience	3 months	1 year	3 years		
Cross-Connection Control Specialist (CCS)	Education	NA	12 years	12 years	NA	NA
	Experience		3 months	3 years		
Backflow Assembly Tester (BAT)		NA	NA	NA	NA	NA
Basic Treatment Operator (BTO)		NA	NA	NA	NA	NA

Because the City does not operate a certified water treatment plant, they are not required to maintain a certified WTPO on staff. Table 7-4 below summarizes the title and certification level of current water system staff members.

TABLE 7-4

Water System Staffing and Certification Level Summary

Name	Title	Certifications
Rich Tyhuis	Operations Manager	WDS, WDM3, CCS
Tim Shelley	Lead Water Specialist	WDS, WDM3, CCS
Kyle Biddle	Water Specialist II	WDS, WDM3, CCS
Chris Price	Water Specialist II	BTO, WDM2, CCS, WTPO2
Will Jennings	Water Specialist II	BTO, WDM2
Tim Jupin	Water Specialist I	CCS, WDM IT

PROFESSIONAL GROWTH

In order to promote and maintain expertise for the various grades of operator certification, Washington State requires that all certified operators meet professional growth requirements by completing no less than three continuing education units (CEU) within each three year period. Programs sponsored by both Washington Environmental Training Resources Center (WETRC) and the American Water Works Association (AWWA) Pacific Northwest Subsection are the most popular source of CEUs for certified operators in Washington State. The professional growth requirement may also be met by advancement by examination or certification by examination in a different classification. The City's public works personnel have traditionally been active in operator training programs.

All of the certifications listed in Table 7-4 are current with respect to CEU requirements.

WATER SYSTEM OPERATION AND CONTROL

MAJOR SYSTEM COMPONENTS

The locations of the major system components are shown on Figure 1-3. The City maintains a thorough operation and maintenance (O&M) manual, which is updated continually, but a synopsis of equipment operational parameters is given for each component below.

The water system is monitored continually by a telemetry system located at the municipal shops facility. The supervisory control and data acquisition (SCADA) system calls water system personnel in the event of water system malfunctions including, but not limited to, pump failure, high or low water pressures, and high or low reservoir levels. System data is collected and stored electronically and all SCADA information is copied to a tape drive every 24 hours.

Source Operation and Control

City of Anacortes

The City of Anacortes provides approximately 99.7 percent of the City's water demand. Water is provided to the City via a 24-inch and 10-inch diameter pressure mains, which are described below. The original source for water delivered by Anacortes is the Skagit River. Water extracted from the Skagit River is transported to the City of Anacortes Water Treatment Plant for purification and chlorination prior to transport to the 24-inch pipeline at Sharpe's Corner on Fidalgo Island. Anacortes is contractually required to deliver water to the Sharpe's Corner intersection at a minimum pressure of 120 psi. Water is supplied through 12-inch Panametric meter and a 10-inch Sensus turbo meter that are owned and maintained by the City of Anacortes.

Wells 8, 9 and 11

These three City wells draw water from the same aquifer, but they are not designated as a wellfield by DOH. Since the wells serve as an auxiliary supply to the primary supply received from Anacortes, they are only exercised monthly to ensure functionality of the equipment should the primary supply somehow be interrupted or become unavailable.

Well pumps are activated manually at each well house, and flows are monitored via magnetic flow meters. The wells are fully described in Chapter 1 – System Description.

Chlorine solution is added to water from each of the three wells in order to disinfect the well water and provide a disinfectant residual in the distribution system. A diaphragm injection pump is located at each well and operates concurrently with the well pumps. These injector pumps are adjusted manually to match the desired chemical dosage. Chlorine dosage is calculated manually based on the flow rate from the wells, and a graduated solution tank is used to dispense the calculated dosage of 5.25 percent Chlorox solution. Sampling locations immediately downstream of the chemical injection point, as well as in the distribution system are available to confirm the chemical dosage and residual.

Equipment associated with Well 8 and Well 11 also include diaphragm injection pumps and chemical saturators in order to inject fluoride solution into the well water. These injection pumps are adjusted manually based on the desired target concentration (0.7 to 1.0 mg/L), and include meters to determine the daily fluoride usage. Well 9 uses a chemical solution tank and a peristaltic injection pump to inject fluoride into the well water. Fluoride dosage is calculated by weight of the chemical storage tank before and after well operation. Well 9 has very low production, and is scheduled to be abandoned and redrilled in 2014. If production from the new well matches that from Well 8 or Well 11, saturators and chemical meters similar to those at these locations will also be installed at the new Well 9. As with chlorine disinfection, fluoride sampling locations are

located immediately downstream of the chemical injection point as well as in the distribution system.

The City does not maintain backup systems for chemical injection to its well water, but since each well is operated manually, chemical injection malfunctions are addressed at the time of well pump operation.

Transmission Line Operation and Control

There are two major transmission lines from Anacortes to the City. The first is a 24-inch ductile iron pipe that extends from Sharpe's Corner to the Ault Field Booster Station. The second is a 10-inch asbestos-cement line that also stretches from Sharpe's Corner to the Ault Field Booster Station. Both the 10-inch and 24-inch pipelines generally follow Highway 20. The 10-inch water pipe is metered directly north of the Deception Pass State Park Bridge, while the 24-inch main is metered directly south of the Sharpe's Corner connection point. Both pipelines contain air release and vacuum valves as well as blow-off valves at regular, appropriate locations along the pipe alignment.

Under normal operating condition, the 24-inch line continuously supplies water to the Ault Field Booster Station, which in turn supplies the City with water service. The 10-inch line provides water service to Deception Pass State Park, and the North Whidbey Water District upstream, then continues south to the Ault Field Booster Station.

The City maintains ownership of the 10-inch pipeline south of the meter at Deception Pass State Park Bridge, as well as the 24-inch pipeline south of the Sharpe's Corner connection point.

Reservoir Operation and Control

Each of the City's four existing reservoirs are described in Chapter 1 – System Description, and in Table 1-3. Additional information regarding individual tank set points which are used to call various pumps within the City water system is provided in the City's O&M manual.

<u>Westside Reservoirs 1 and 2</u>

These reservoirs serve the 307 Zone and receive water directly from the Ault Field Booster Station. The reservoirs are filled through the distribution system by pressure form Anacortes during seasonal low demand periods, and are filled from the Ault Field Booster Station during seasonal high demand periods. Reservoir levels also depend on the Anacortes hydraulic gradeline. Ault Field Booster Pumps are controlled by water levels in the Westside Reservoirs. Table 7-5 summarizes the elevations and associated controls for the Westside Reservoirs 1 and 2. Both Westside reservoirs have shutoff valves that prevent water from either entering or leaving the reservoirs in case of an emergency. These are exercised occasionally to ensure successful operation. For both

Westside Reservoirs, a key distribution valve is closed during periods of low demand (typically in winter) to encourage draw-down of the reservoir levels and water circulation.

TABLE 7-5

Westside Reservoirs Alarms and Controls

Parameter	Setting(1)
High-High Water Alarm	55
High Water Alarm	53.5
Low Water Alarm	45
Low-Low Water Alarm	42

(1) Values are measured in feet from the base elevation of 253 feet.

Eastside Reservoir

The Eastside Reservoir serves the 243 Zone. The reservoir is filled through an altitude valve from the 307 Zone. The altitude valve opens when the reservoir water surface elevation has dropped approximately two feet. The reservoir contains two separate shutoff valves. One controls inflow from the upstream altitude valve, and the second controls inflow and outflow to or from the reservoir itself. These valves are exercised occasionally to ensure successful operation.

Under normal operation, the Eastside Reservoir is filled when the water level drops to an elevation of 241 feet. Table 7-6 summarizes the elevations and associated controls for the Eastside Reservoir. As is discussed in Chapter 1 – System Description, the City plans to abandon use of the Eastside Reservoir after construction is completed on the North Reservoir, and the impending North Booster Station and transmission main projects. These two projects will be designed and completed after completion of the North Reservoir and are part of the new pressure zone scheme for the City.

TABLE 7-6

Eastside Reservoir Alarms and Controls

Parameter	Setting(1)
High-High Water Alarm	50
High Water Alarm	49.8
Low Water Alarm	35
Low-Low Water Alarm	30
Altitude Valve: Open	47(2)
Altitude Valve: Close	49

(1) Values are measured in feet from the base elevation of 190 feet.
(2) Controlled by the HGL of the 307 Zone.

North Reservoir

This reservoir is currently under construction and is slated for completion in early 2014. The reservoir is a major component in restructuring the water zone designation of the City. The *New Reservoir Project Predesign Report* (Gray & Osborne, 2009) describes this zone designation in greater detail. Briefly, the proposed restructured zone system will divide the City into five distinct pressure zones instead of the current four pressure zones. These new zones will address water supply and pressure issues as well as allow for greater water system reliability, coverage, and adaptability for future service connections in the western half of the City.

The water level in the new reservoir will be controlled by demand within the City. Level is controlled by a pressure transducer and contains level floats for redundancy. Control points are not set at this point in time, and will be finalized once construction of the reservoir is complete and the facility is connected to the water system.

Booster Station Operation and Control

Ault Field Booster Station

The Ault Field Booster Station boosts water from the incoming 24-inch transmission line from Anacortes. The booster station fills both Westside Reservoirs which in turn provide water to the 307 Zone. The station utilizes two 125-horsepower Aurora 6 x 8 x 18 Series 410 variable-speed pumps as well as two 75-horsepower Worthington 5LR-15 constant-speed pumps. Under normal operating conditions, the water level in the Westside Reservoir 2 controls pump operation and variable pump speed is adjusted in response to changing water demand. The constant speed pumps provide redundancy and are not typically used to supply water to the Mainland Zone. Table 7-7 summarizes the control set points at the Ault Field Booster Station.

TABLE 7-7

Ault Field Booster Station Control Set-points

Parameter	Setting
High-High Pressure Alarm	170 psi
High Pressure Alarm	160 psi
Low Pressure Alarm	20 psi
Low-Low Pressure Alarm	10 psi
High Chlorine Alarm	0.5 mg/L
Low Chlorine Alarm	0.2 mg/L
High Fluoride Alarm	1.3 mg/L
Low Fluoride Alarm	0.7 mg/L
Lead VFD Start(1)	48 feet (21 psi)
Lead VFD Stop(1)	52 feet (23 psi)
Lag VFD Start(1)	46 feet (20 psi)
Lag VFD Stop(1)	50 feet (22 psi)

(1) Data refer to the Westside Reservoir levels.

Heller Street Booster Station

The Heller Street Booster Station serves approximately 245 single-family water connections in the 342 Zone. The station consists of two Weinman 2.5 x 3 x 12B constant-speed pumps that supply domestic water pressure from both Westside Reservoirs to the Heller Booster Zone. Under normal operation, one of the pumps runs continuously to supply water at the appropriate pressure. When demand is high, the second pump is called to supply additional water at the correct pressure. When demand is low, pump impellers are trimmed to maintain a constant system pressure. Fire flows bypass the pump station through a check valve from the 307 Zone and both Westside Reservoirs. Table 7-8 summarizes the control set points at the Heller Street Booster Station.

TABLE 7-8

Heller Street Booster Station Control Set Points

Parameter	Setting
Lead Pump	60 psi(1)
Lag Pump Start	50 psi
Lag Pump Stop	57 psi

(1) Operates continuously.

Redwing Booster Station

The Redwing Booster Station services approximately 215 single-family and multi-family residential water connections in the 335 Zone. The booster station has three 7.5-horsepower Aurora domestic booster pumps and one 60-horsepower Aurora fire flow pump. There is a 2,200 gallon hydropneumatic pressure tank in the building that feeds the 335 Zone through a pressure reducing valve set at 68 psi.

The Redwing Booster Station receives water from the 307 Zone, which is served by both Westside Reservoirs. Pump cycles and hydropneumatic pressure tank volumes are controlled by the demand within the area served by the booster station. Table 7-9 summarizes the control set points at the Redwing Booster Station.

TABLE 7-9

Redwing Booster Station Control Set Points

Parameter	Setting
High Suction Alarm	60 psi
Low Suction Alarm	20 psi
High System Pressure Alarm	70 psi
Low System Pressure Alarm	55 psi
High Tank Pressure Alarm	100 psi
Low Tank Pressure Alarm	75 psi
Lead Pump Start	39 psi
Lead Pump Stop	48 psi
Lag 1 Pump Start	36 psi
Lag 1 Pump Stop	45 psi
Lag 2 Pump Start	33 psi
Lag 2 Pump Stop	42 psi
Fire Flow Pump Start	50 psi(1)

(1) Discharge pressure reading.

Distribution System Operation and Control

The City's distribution system is summarized in Table 1-6. The pipes are inspected as part of the City's preventive maintenance program.

Isolation valves are located throughout the distribution system and their locations are shown on the water system maps kept in the City Public Works Office and on Figure 1-3.

Pressure Reducing Valve Operation and Control

There are seven pressure reducing valve (PRV) stations in the system. All seven stations reduce the water pressure as it moves from the 307 Zone to the 243 Zone. Locations and

set points for the PRVs are summarized in Table 1-5. There are also three 3/4-inch PRVs which act to circulate water from three dead end mains between the 307 Zone and the 243 Zone.

Altitude Valve Operation and Control

A single altitude valve is located between the 307 Zone and the Eastside Reservoir. When the water elevation in the Eastside reservoir drops to an elevation of 241.4 feet, the altitude valve engages and water from the 307 Zone fills the Eastside Reservoir.

SAFETY PROGRAM

An important consideration of any successful operation and maintenance program is the safety of the employees. The City's safety program is in compliance with the Occupational Safety and Health Administration (OSHA) and the Washington State Department of Labor and Industries (L&I). The safety program addresses the situations that employees may encounter during the performance of O&M tasks.

The City's primary safety document is its Accident Prevention Manual. Each utility division maintains a hard copy of the manual as well as other supporting documents such as material safety data sheets (MSDS) sheets and chemical safety bulletins. The Accident Prevention Manual is updated continually by the City safety committee as a result of monthly safety committee meetings.

A Safety Management Committee, made up of representative employees from each operating department, assists in the development of safety programs, coordination of interdepartmental safety practices, and maintenance of a loss control and safety program.

All water system staff receives regular training in basic first aid and CPR, confined space entry, forklift operation, and traffic flagging, among other topics.

RECORDKEEPING

MAINTENANCE

The City has a work order form which is used to document maintenance and repair work which must be approved by the water superintendent prior to beginning work. This allows the water department to track maintenance work and adjust budgets accordingly.

The operations manager evaluates and maintains all records associated with the operation and maintenance of the water system. The operations manager keeps records of all scheduled and unscheduled maintenance tasks for the water system, which are stored electronically. These files and records are backed up on a daily basis. Hard copies and electronic copies of completed files are filed and stored by category and date. The City maintains historical records for at least 7 years and only authorized City staff and

administrators have access to the records. Records involved with consumer consumption and billing are retained by the City's finance department.

The engineering staff is responsible for maintaining a current inventory of the water system infrastructure. One of the engineering department's tasks is to maintain a current map of the City showing the location of all mains, valves and hydrants. Construction drawings of new developments, system improvements, and system expansions showing the location of all utilities are also maintained.

Specific data that are collected and maintained as well as the frequency with which they are collected are summarized in Table 7-10.

TABLE 7-10

Required Data Acquisition and Recordkeeping Frequency

Parameter	Reading/Recording Frequency
Service Meters	Monthly
Transmission Meters	Monthly (24-inch), Monthly (10-inch)
Well Meters	Daily
NASWI Meters	Daily
Fluoride Dosage	Daily
Fluoride Chemical Level	Daily
Chorine Residual	Daily
Water Quality	Monthly and as required
pH	Daily
Temperature	Daily
Other Repairs/Maintenance	As required

CUSTOMER COMPLAINTS

Complaints are logged on a complaint form by the maintenance department staff. Hard copies of each complaint are tracked, investigated, and resolved in the order they are received and with consideration of priority and or risks to system safety and reliability. Resolved complaint forms are scanned and electronically stored in a publicly accessible computer drive. After hours issues are routed through the Island County Emergency Communication Center (I-COM) to the appropriate utility personnel.

The City typically receives less than one complaint per month on average. Some of the most common water system customer complaints and the most typical responses or solutions are listed below.

- **High Water Bill**

  Meter reading is cross-checked with billing information. Consumption

history at that address is analyzed. If applicable, conservation materials and information is provided.

- **High/Low Water Pressure**

  Water pressure at the service line is tested. If high, customer is encouraged to install a PRV upstream of the service meter. If low, SCADA and water system data is analyzed to try to isolate systemic causes for low pressure at the specific location.

- **Air in Line**

  Lines are flushed to remove the air.

EXISTING WATER SYSTEM EQUIPMENT

Table 7-11 lists the equipment used to regularly maintain the water system.

TABLE 7-11

Water System Operation and Maintenance Equipment

Description	Equipment Number	Model Year
International Service Truck	4015	2000
Ford Ranger Pickup	4017	2008
Ford F350 Pickup	4019	1999
Ford Ranger Pickup	4003	2003
Ford F250 Pickup	4049	2005
Chevy S-15 Utility Vehicle	4048	2005
Vactor Truck	4081	1990
Dodge Pickup	4087	1999

PREVENTIVE MAINTENANCE SCHEDULE

Preventive maintenance actions are performed by water system operations staff in order to maintain functionality of the equipment, provide a high level of customer service, and decrease overall repair and maintenance costs. For this, the staff has developed a routine maintenance schedule. A summary of this schedule is listed in Table 7-12.

TABLE 7-12

Water System Routine Maintenance Schedule

Equipment	Description	Activity	Frequency
Reservoirs	All	Inspect general operation	Daily
	All	Interior and exterior cleaning	Every 5 years
	All	Exterior painting	Every 15 years
	All	Interior painting	Every 15 years
Booster Stations	Ault Field	Inspect general operation	Daily
	Redwing	Inspect general operation	Daily
	Heller Street	Inspect general operation	Daily
Wells	8	Inspect general operation	Monthly
	9	Inspect general operation	Monthly
	11	Inspect general operation	Monthly
Transmission Mains	24-inch	Inspect general operation and condition	Annually, or as needed
	10-inch	Inspect general operation and condition	Annually, or as needed
Transmission Main Valves	All	Inspect general operation, exercise	Annually, or as needed
Distribution System Valves	All	Inspect general operation, exercise	Biennially
Hydrants	All	Inspect and test	Annually, or as needed
Chemical Equipment		Inspect general operation	Daily

EMERGENCY RESPONSE PROGRAM

The operation of the water system under emergency conditions is an important responsibility of City public works personnel. Emergency response procedures are rehearsed and reviewed by personnel. The City has developed an Emergency Response Manual to provide Public Works personnel responding to an emergency situation with enough information to assess the situation, make decisions, and take action to control the situation. A copy of the Emergency Response Manual is provided in Appendix S.

If an emergency occurs, the 24-hour Duty Utility Person can be reached by telephone. Island County Emergency Services Communication Center (I-COM) has a duty roster showing who is on call at any given time, and can notify the 24-hour Duty Utility Person if a call is made to 911.

Once aware of an emergency, the 24-hour Duty Utility person evaluates the situation and takes corrective action if applicable. If additional assistance is needed, the following personnel are contacted, in order:

- Utility Operations Manager
- Public Works Superintendent
- City Administrator

The next section lists the phone numbers of personnel who could be contacted in the event of an emergency.

EMERGENCY PHONE CONTACTS

An updated emergency phone list is shown in Table 7-13. This list will be kept on file and visible at city hall, the public works building, and the fire and police departments for use in the event of an emergency. It is also present in the Emergency Response Program document kept by water system personnel.

TABLE 7-13

Emergency Phone Contact List

Title/Entity	Name	Phone Number
Emergency Services		
Fire/Police/Medical	—	911
Oak Harbor Fire Department	—	360-279-4700
Oak Harbor Police Department	—	360-279-4600
Whidbey General Hospital	—	360-678-5151
Water System Personnel		
Utility Operations Manager	Rich Tyhuis	360-914-7251
Lead Water Specialist	Tim Shelley	360-914-7233
Water Specialist II	Kyle Biddle	360-914-7978
Water Specialist II	Chris Price	360-914-7262
Water Specialist II	Will Jennings	360-914-7999
Water Specialist I	Tim Jupin	360-914-7240
Utility Services 24-hour Mobile Phone	—	360-914-7246
City Administrative Personnel		
Mayor	Scott Dudley	360-279-4503
City Administrator	Larry Cort	360-279-4501
Engineers Office	Joe Stowell	360-720-8796
Public Works Superintendent	Cathy Rosen	360-914-7266

TABLE 7-13 – (continued)

Emergency Phone Contact List

Title/Entity	Name	Phone Number
Service Providers		
Cascade Natural Gas	Ted McCammant	360-675-6641
		360-708-4689
Puget Power and Light (after hours)	—	888-225-5773
NASWI - Utility pager	—	360-914-7600
NASWI - Trouble desk	—	360-257-3358
Controls, Flow meters, Recorders	TSI	425-678-4770
SCADA	Tim Hecox	425-678-4152
	TSI	425-678-4770
Electrical	Wayne McAninch, A Electrical	360-675-2203
General Contracting	QDEC	360-675-8888
Pipe/Fitting Suppliers	HD Fowler Inc.	360-734-8400
	C. Johnson Construction	360-675-4848
Testing Laboratory	Edge Analytical	360-757-1400
Engineering, Gray & Osborne	Russell Porter, P.E.	206-284-0860
Utility Location - Statewide 1-Call	—	800-424-5555
		811
State Authorities		
WA Department of Health	—	877-481-4901
Drinking water emergency		
WA Department of Health, NWRO	Jennifer Kropack	253-395-6750
WA Department of Ecology,	—	360-407-6300
Spill Response		
Island County Public Health Office	—	360-679-7350
Island County Public Works Office	—	360-679-7331
News Entities		
KWDB Radio, Oak Harbor	—	360-675-7320
KOMO TV, Seattle	—	206-404-4000
KING TV, Seattle	—	448-352-1206
KIRO TV, Seattle	—	800-777-5476
Whidbey News Times	—	360-675-6611

PUBLIC NOTIFICATION

There may be instances in which the general public must be informed of a water system related emergency. The primary method to notify the public of a drinking water emergency would be through radio and the local cable channel, Channel 10. Additional notification procedures are as follows:

- Newspaper notice to water system users within 14 days of violation
- Direct mail notice or hand delivery to all consumers served by the system within 45 days of the violation. The DOH may waive the City's mail or hand delivery if the violation is corrected within 45 days. The waiver shall be in writing and made within the 45-day period
- Notice to radio and television stations serving the area within 72 hours of violation of an acute coliform MCL, a nitrate MCL, occurrence of a waterborne disease outbreak or other acute violations.
- Repeat mail or hand delivery every 3 months until the violation is corrected.

Where notification to system users is required the notification shall conform to WAC 246-290-71002 and shall include the following:

- A clear, concise and simple explanation of the violation;
- A discussion of potential adverse health effects and any segments of the population that may be at higher risk;
- Potential health effects information;
- A list of steps the City has taken or is planning to take to remedy the situation;
- A list of steps the consumer should take, including advice on seeking an alternative water supply if necessary; and
- Water department contact name and telephone number.

Additional specific procedures for bacteriological and IOC/VOC/SOC detections are outlined below.

BACTERIOLOGICAL PRESENCE DETECTION PROCEDURE

Notification procedures for notifying system customers, the local health department, and DOH of water quality emergencies are an important component of an emergency response program. Many public water systems will occasionally detect positive coliform samples, mainly as a result of minor contamination in distribution mains or sample taps, or improper bacteriological sampling procedures. However, the persistent detection of coliforms in the water supply, particularly E. coli or fecal bacteria, may require issuing a public boil water notice to ensure the health and safety of the water customers. Emergencies such as floods, earthquakes, and other disasters can affect water quality as a

result of damage to water system facilities, thereby warranting a boil water order in advance of supply. WAC 246-290-320 requires water utilities to follow specific procedures in the event coliform bacteria are detected in the water system. These procedures are outlined on Figure 7-2.

IOC/VOC/SOC DETECTION PROCEDURES

A procedure to comply with DOH requirements in the event of an inorganic chemical/physical property, volatile organic chemical or synthetic organic chemical detection is presented on Figure 7-3.

UNREGULATED CONTAMINANT DETECTION PROCEDURES

No formal detection procedure exists at this time. Contaminants are not currently regulated, and no formal public announcement or other notification would be required should any of the 21 unregulated contaminants be detected in the City's groundwater sources. Data must be reported to the EPA, and should a serious issue arise with contamination, the City should work with the EPA and State Health officials to develop an appropriate plan of action.

EMERGENCY ACTION PLAN

The following is a brief overview of the City's water emergency response plan detailing how the water system should be operated under a variety of emergency situations. Resolution 2001-08 passed by the city council provides for water shortage response to drought conditions or emergency water shortages.

The general goals of the water system emergency operation are as follows:

- Maintain as much potable water in storage as possible
- Restore water service to critical facilities such as medical care facilities, emergency services and residences
- Provide assistance and support to adjacent service areas

In general, these goals will be achieved by the following:

- Protect water supply from contamination
- Treat contaminated water by chlorination
- Restore to operation damaged distribution, transmission and storage facilities

- Locate alternate sources of supply

The City's Emergency Response Manual provides guidelines for the general assessment of an emergency situation. The first order of business is to assess whether or not an Emergency Operations Center (EOC) should be established. An EOC is most likely not necessary under the following conditions.

- A single event has occurred
- A small number of similar events have occurred
- The event has already peaked or ended

Establishing an EOC should be considered under the following conditions.

- Multiple events have occurred
- Several system outages
- Severity or length of event is increasing
- Communications are down or failing
- Event is regional

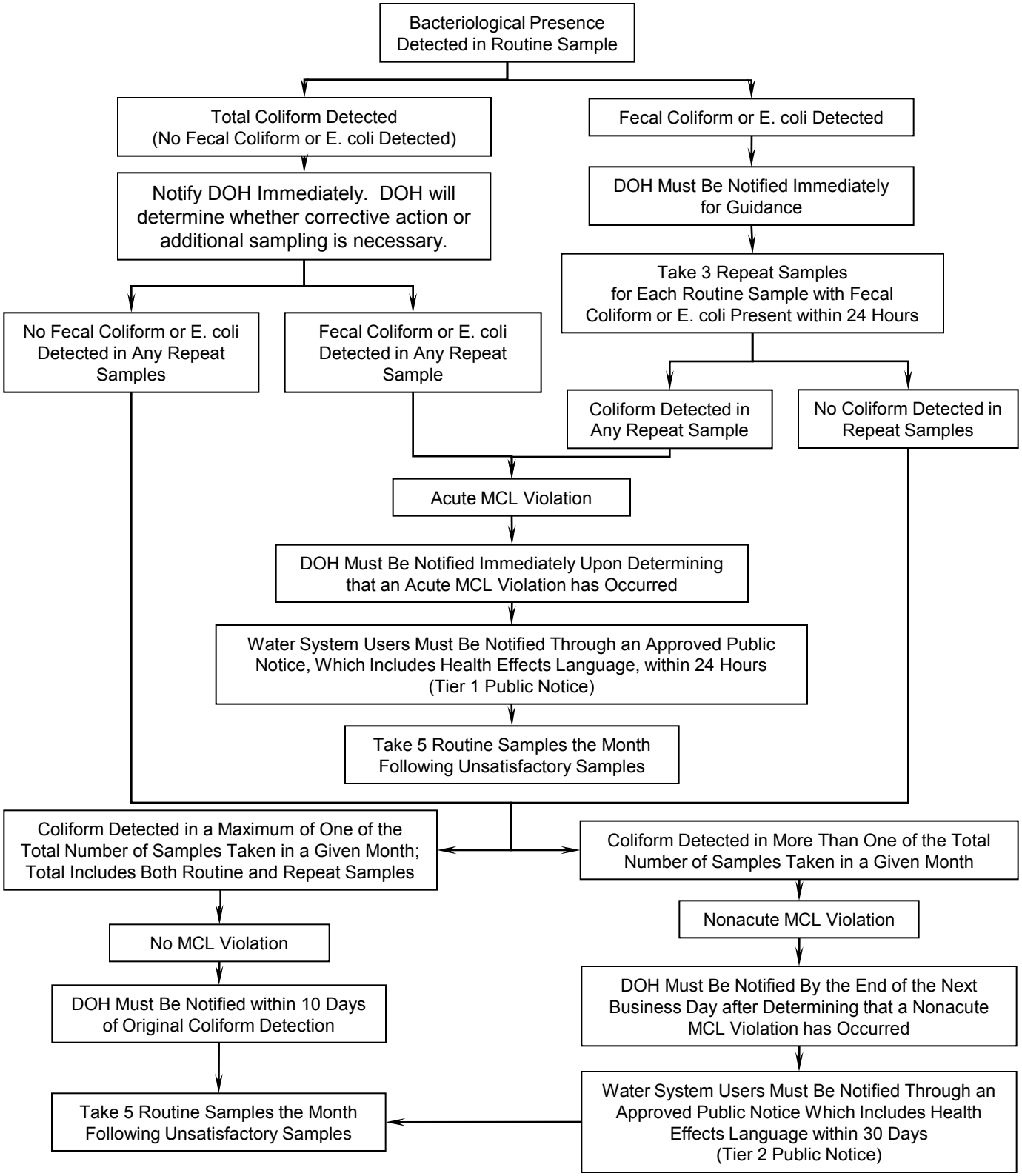
Once a general assessment of the situation has been completed, the Manual outlines procedures for emergency situations such as distribution line breaks and low water levels in reservoirs.

VULNERABILITY ANALYSIS

It is important to estimate the degree in which system facilities may be vulnerable to various types of emergency situations in order to identify system weaknesses. The following sections provide information regarding which facilities would be vulnerable to various types of emergency situations and recommended actions that Public Works personnel could take to mitigate the problem.

POWER FAILURE

Various types of weather can cause loss of power. Table 7-14 presents the potential effects of a power failure on the water system components.



CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE

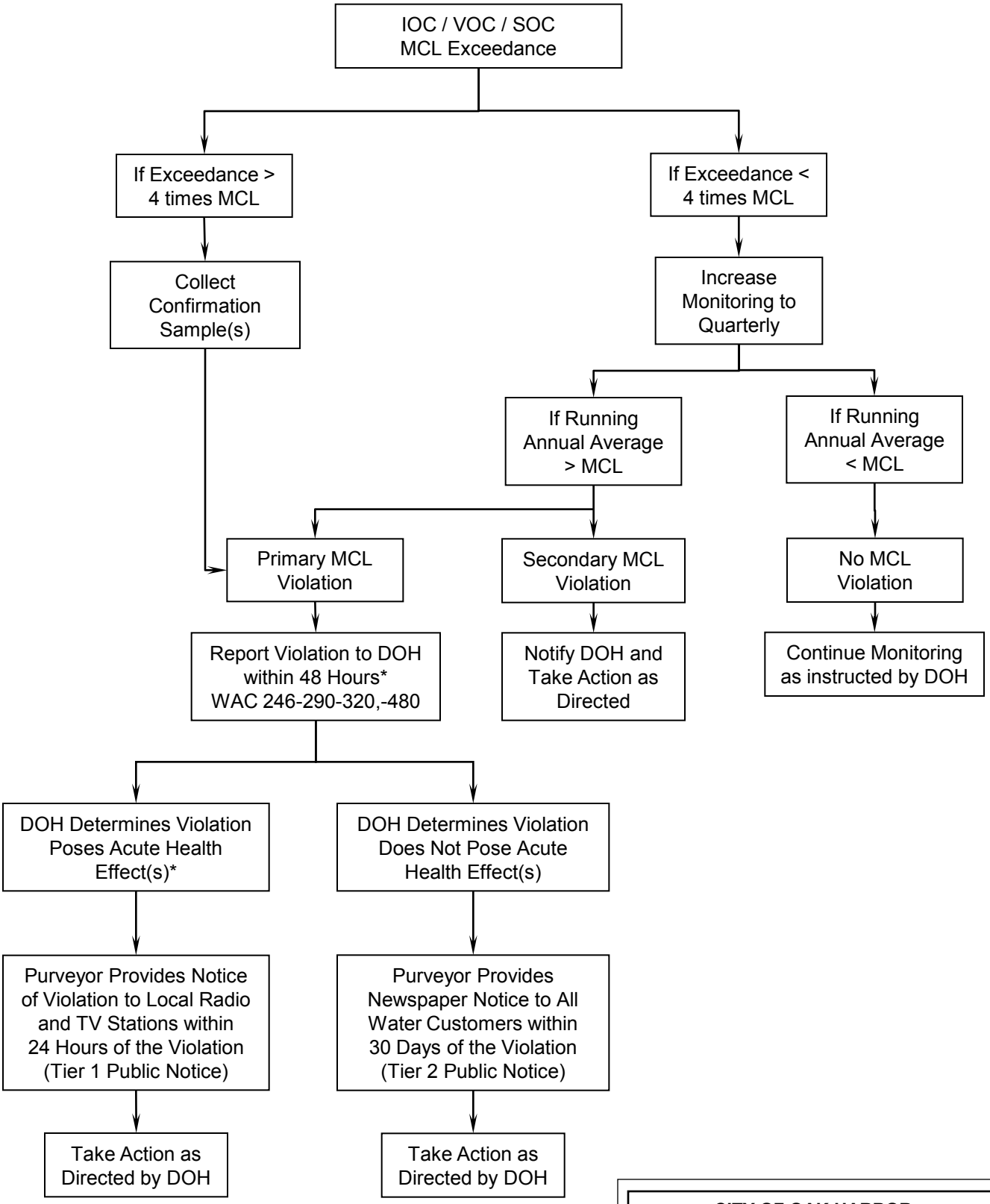
FIGURE 7-2
BACTERIOLOGICAL DETECTION PROCEDURE

Gray & Osborne, Inc.
CONSULTING ENGINEERS

DOH: Washington State Department of Health

NWRO: (253) 395-6750

After Hours Hotline: (877) 481-4901



* A violation of the 10.0 mg/L nitrate MCL constitutes an acute health effect concern. DOH must be notified immediately upon violation of the nitrate MCL.

DOH: Washington State Department of Health

WAC: Washington Administrative Code

CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE

FIGURE 7-3
IOC/VOC/SOC DETECTION PROCEDURE

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE 7-14

Emergency Response Procedures for Power Failure

Water System Component	Potential Effect	Response
Transmission Mains	Electrically operated valves would be inoperable. (However, the City maintains no electronically operated valves.)	• Contact power supplier. • Restore power as quickly as possible. • If no electrically operated valves, no action required. • If electric valves exist, operate manually if required. • Mobilize auxiliary generator.
Booster Stations	Pumps would be inoperable.	• Contact power supplier. • Restore power as quickly as possible. • Confirm auxiliary generator operation. • Mobilize auxiliary generator if necessary.
Reservoirs	Telemetry may be inoperable.	• Check reservoir levels manually and continue to monitor.
Wells	Well pumps would be inoperable. Disinfection equipment inoperable.	• Contact power supplier. • Restore power as quickly as possible. • Confirm auxiliary generator operation. • Mobilize auxiliary generator if necessary.
Distribution System	No effect.	• Contact power supplier. • Restore power as quickly as possible.

EARTHQUAKE

A severe earthquake may have a substantial impact on the City's water system. An earthquake could cause damage to the distribution system and water system facilities. In addition, communication and transportation systems may be interrupted. The Puget Sound is a seismically active region and the Strawberry Point and Utsalady faults could impact the City's water system components. The City should review and evaluate its earthquake response procedures annually. Table 7-15 presents potential effects of a severe earthquake on water system components.

TABLE 7-15

Emergency Response Procedures for an Earthquake

Water System Component	Potential Effect	Response
Transmission Mains	Rupture, cracking, or other damage.	• Monitor for leaks or water loss. Record variances from normal conditions. • Isolate and repair damaged pipe sections as quickly as possible. • Operate groundwater sources and enact water use restrictions.
Booster Stations	Structural damage to pump stations. Mechanical damage to pumps or piping	• Inspect pump station buildings and equipment. • Isolate and repair damaged equipment as quickly as possible.
Reservoirs	Structural damage (and/or leaking) to reservoirs.	• Inspect reservoirs for structural damage. • Increase monitoring for water loss or variances from normal conditions. • Isolate and repair damaged reservoirs as quickly as possible.
Wells	Structural damage to well buildings. Mechanical damage to well pumps, casing, or other equipment.	• Inspect well buildings and equipment for damage. • Isolate and repair damaged buildings or equipment as quickly as possible.
Distribution System	Mechanical damage to pipes, PRVs, or other equipment. Limited access to facilities due to damaged roads.	• Increase system monitoring for leaks or variance from normal conditions. • Isolate and repair damaged piping or equipment as quickly as possible.

SEVERE SNOWSTORM

A severe snowstorm will limit motor vehicle transportation, including the transportation of Public Works personnel. Table 7-16 provides the emergency response procedures for a severe snowstorm.

TABLE 7-16

Emergency Response Procedures for a Severe Snowstorm

Water System Component	Potential Effect	Response
Transmission Mains	Limited access to facilities.	• Clear access to facilities at earliest opportunity.
Booster Stations	Limited access to facilities.	• Clear access to facilities as quickly as possible. • Inspect facilities for structural or mechanical damage. • Isolate and repair damaged equipment as quickly as possible.
Reservoirs	Limited access to facilities. Structural damage to roof structures due to ice and snow buildup.	• Clear access to facilities as quickly as possible. • Inspect reservoirs for structural damage. • Increase monitoring for water loss or variances from normal conditions. • Isolate and repair damaged reservoirs as quickly as possible.
Wells	Limited access to facilities. Structural damage to roof structures due to ice and snow buildup.	• Clear access to facilities as quickly as possible. • Inspect facilities for structural or mechanical damage. • Increase monitoring for water loss or variances from normal conditions. • Isolate and repair damaged reservoirs as quickly as possible.

TABLE 7-16 – (continued)

Emergency Response Procedures for a Severe Snowstorm

Water System Component	Potential Effect	Response
Distribution System	Limited access to facilities. Freezing of pipes and/or valves or other controls.	• Prepare vehicles with necessary snow equipment (sand, shovels, chains, etc.). • Prepare and distribute listing of current valve locations in maintenance vehicles. • Monitor pipes and equipment in exposed areas or areas of low water use. • Contact WSDOT personnel to expedite clearing of important access points.
PRV Vaults	Vault lid freezing	• Keep ice-breaking materials in maintenance vehicles. • Inspect and de-ice vault lids as required.

FLOODING

Although relatively protected by Oak Harbor, its proximity to Puget Sound makes the potential for flooding by waves a possibility. Because of its location within the Puget Sound/Olympic Peninsula rain shadow, flooding from high rains is unlikely, however, localized flooding from rainfall and stormwater collection may occur. Table 7-17 presents the emergency response procedures for flooding.

TABLE 7-17

Emergency Response Procedures for Flooding

Water System Component	Potential Effect	Response
Transmission Mains	Limited access to facilities.	• Develop access plan for transmission main route from Sharpe's corner.
Booster Stations	Limited access to facilities.	• Develop alternate access routes.
Reservoirs	Limited access to facilities.	• Develop alternate access routes.

TABLE 7-17 – (continued)

Emergency Response Procedures for Flooding

Water System Component	Potential Effect	Response
Wells	Limited access to facilities.	• Develop alternate access routes. • Implement water diversion tactics if necessary.
Distribution System	Limited access to facilities.	• Develop alternate access routes to high-profile locations. • Increase bacteriological testing frequency to ensure water safety.
PRV Vaults	Limited access to facilities. Vault flooding. Vault sump pump overloading.	• Remove debris from sump. • Install additional temporary sump pump. • Use sandbags to block inflow.

FIRE

An extensive fire may result in low distribution system pressures and drawing down of City reservoirs. Table 7-18 presents the emergency response procedures for a fire.

TABLE 7-18

Emergency Response Procedures for Fire

Water System Component	Potential Effect	Response
Transmission Mains	Limited access to facilities.	• Develop alternate access routes.
Booster Stations	Structural damage to pump stations. Mechanical damage to pumps or piping. Limited access to facilities. Additional water demand may be required to combat fires	• Develop alternate access routes. • Inspect building and equipment for damage. • Isolate and repair damaged equipment as quickly as possible. • Initiate alternatives to provide additional water pressure / flow.

TABLE 7-18 – (continued)

Emergency Response Procedures for Fire

Water System Component	Potential Effect	Response
Reservoirs	Structural damage to reservoirs. Mechanical damage to valves or piping. Limited access to facilities. Additional water demand may be required to combat fires	• Develop alternate access routes. • Inspect building and equipment for damage. • Isolate and repair damaged equipment as quickly as possible. • Initiate alternatives to provide additional water pressure / flow.
Wells	Structural damage to well facilities. Mechanical damage to pumps or piping. Limited access to facilities. Additional water demand may be required to combat fires	• Develop alternate access routes. • Inspect building and equipment for damage. • Isolate and repair damaged equipment as quickly as possible. • Initiate alternatives to provide additional water pressure / flow.
Distribution System	Limited access to facilities. Low system pressure.	• Develop alternate access routes. • Inspect high profile locations for damage. • Isolate and repair damaged equipment as quickly as possible. • Monitor available system pressures and flows. • Consider enacting water use restrictions.

VANDALISM/BIOTERRORISM/TERRORISM

Many potential terrorist attacks would resemble other emergencies in effect. Such attacks may cause infrastructure damage like an earthquake or fire, or may contaminate the water as would happen in an accidental spill or main break.

Private and government agencies are working to help prevent and respond to terrorist attacks. The agencies that will be useful to the City for updated information and strategies include:

- Environmental Protection Agency
- Center for Disease Control and Prevention
- Department of Defense
- Federal Emergency Management Agency
- American Water Works Association
- Association of Metropolitan Water Agencies

The City has many security measures in place; all the reservoirs are covered and the wells and booster stations are housed in locked structures. Operators, maintenance staff, or the general public should report any suspicious persons or findings to the local police department.

CONTAMINATION OF WATER SUPPLY

Contamination of the water supply may occur due to main breaks, pollution from an isolated source, or from a deliberate act of vandalism or terrorism. Table 7-19 presents the emergency response procedures for contamination of the water supply.

TABLE 7-19

Emergency Response Procedures for Contamination of the Water Supply

Water System Component	Potential Effect	Response
Transmission Mains	Contamination of pump stations, reservoirs, and/or distribution system. Human health hazard.	• Notify the City of Anacortes. • Notify DOH if necessary. • Notify DOE if necessary. • Isolate water system components from source of contamination. • Increase groundwater production. • Clean up source of contamination. • Decontaminate water facilities. Initiate water quality compliance and safety testing.
Booster Stations	Contamination of pump stations, reservoirs, and/or distribution system. Human health hazard.	• Notify DOH if necessary. • Notify DOE if necessary. • Isolate water system components from source of contamination. • Increase groundwater production. • Clean up source of contamination. • Decontaminate water facilities. • Initiate water quality compliance and safety testing.

TABLE 7-19 – (continued)

Emergency Response Procedures for Contamination of the Water Supply

Water System Component	Potential Effect	Response
Reservoirs	Contamination of reservoirs and/or distribution system. Human health hazard.	• Notify DOH if necessary. • Notify DOE if necessary • Isolate water system components from source of contamination. • Clean up source of contamination. • Decontaminate water facilities in accordance with AWWA standards (consider draining, cleaning, and disinfecting reservoir if water is deemed unsuitable for consumption). • Initiate water quality compliance and safety testing.
Wells	Contamination of wells and/or distribution system. Human health hazard.	• Notify DOH if necessary. • Notify DOE if necessary. • Isolate water system components from source of contamination. • Clean up source of contamination. • Decontaminate water facilities (flush thoroughly). • Initiate water quality compliance and safety testing.
Distribution System	Contamination of distribution system. Human health hazard.	• Notify DOH if necessary. • Notify DOE if necessary. • Isolate water system components from source of contamination. • Notify affected water system customers. • Clean up source of contamination. • Decontaminate affected areas (flush thoroughly). • Initiate water quality compliance and safety testing.

CHEMICAL SPILL

Chemical spills of toxic or hazardous chemicals may result from accidents, traffic accidents, industrial processes, or other commercial activities and have the potential to negatively affect the City's ground water sources. Emergency procedures for chemical spills are identical to those listed in Table 7-19 for contamination of the water system components.

The City has had only two significant chemical spills within the last 5 years. Both spills were less than 200 gallons. The first spill was diesel fuel from a vehicle parked at a local business. The fuel was contained in a storm drain detention system and cleaned without further downstream contamination. The second spill was mineral oil from an electrical transformer. The oil traveled through the stormwater detention system and contaminated downstream soils and surface water. Cleanup of this oil is nearly complete.

CONTINGENCY OPERATIONAL PLAN

A contingency operational plan is necessary for operation of the system when normal operating procedures are not appropriate. The following sections provide information regarding alternate modes of operation of the system facilities.

SOURCE OF SUPPLY

Although the City has several sources of water supply, over 99 percent of water used by the City comes from water supplied by the City of Anacortes. Booster stations, altitude valves, and PRVs allow water from all sources to be used throughout the water system.

In the event of a significant interruption or reduction in water supply from the City of Anacortes, the City is prepared to implement the following water conservation measures, if necessary:

- Limit outdoor water use for lawn sprinkling to alternating days
- Eliminate outdoor water use
- Restrict all water use by imposing mandatory water use reduction with a maximum water use per equivalent residential unit
- Restrict water use by commercial/industrial water customers
- Activate City wells

The City will notify the local radio stations and television entities, will notify customers door to door, and will mail a postcard notice of water use restrictions to each water user.

STORAGE FACILITIES

Westside Reservoirs 1 and 2 serve the Mainland Zone, which can provide water to the City's entire water system if necessary. Water from the City of Anacortes is, however, directly routed to the Mainland Zone and could continue to serve the City's customers if either of the Westside Reservoirs should become unavailable.

If the Eastside Reservoir should become unavailable, the Downtown Zone is served by the Mainland Zone through any of the five PRVs located within the distribution system.

System redundancy and flexibility will increase when the proposed North Reservoir is constructed in early 2014. Should this proposed reservoir be unavailable, the remaining pressure zones can be served directly from the incoming supply from the City of Anacortes through the installed PRVs.

BOOSTER STATIONS

Ault Field Booster Station

The Ault Field Booster Station serves the Mainland Zone and responds to water levels within the Westside Reservoirs. Should this booster station become unavailable, the Westside Reservoirs would fill via the supplied source pressure from the City of Anacortes during periods of low demand. During periods of high demand, standby storage and equalizing storage would be required to serve the City's water customers. This booster station contains two constant-speed and two variable-speed pumps for redundancy.

Redwing Booster Station

The Redwing Booster Station is the only station serving the small service area on the north end of the City. The Redwing Booster Station does contain two pumps for redundancy, but if both pumps were unavailable, customers within the Redwing service area would experience low domestic water pressures, and lower than required fire flows until the pumps were returned to service. These customers are served by water within the Westside Reservoirs, so would not be completely without water service.

Heller Street Booster Station

The Heller Street Booster Station is the only station serving the small service area on the west end of the City. The Heller Street Booster Station contains two pumps for redundancy, but if both pumps were unavailable, customers within the Heller Street service area would experience low water pressures until the pumps were returned to service. These customers would be served by water within the Westside Reservoirs, so would not be completely without water service.

TRANSMISSION MAINS

In the event of transmission main failure along Highway 20, the series of actions below should maintain appropriate capacity for the City until a determination can be made on how to proceed.

Loss of 10-inch Transmission Main

Possible Causes

A break in line, temporary shut down for construction or maintenance, loss of supply from the City of Anacortes, vandalism or other accidental disruption are all possible causes for the loss of the 10-inch transmission main.

Results

The 24-inch transmission line has adequate capacity to provide water to the City's water service customers as well as the City's wholesale customers.

Response Action

Immediately notify the City of Anacortes, open interties as needed, repair disruption in the pipeline, disinfect and/or flush as appropriate, and coordinate with Anacortes to restore supply. Provide additional water supply using three available groundwater sources. A public notification or news briefing may also be in order. Water use restrictions may be necessary if the problem is not able to be resolved quickly.

Loss of 24-inch Transmission Main

Possible Causes

A break in line, temporary shut down for construction or maintenance, loss of supply from the Anacortes, vandalism or other accidental disruption are all possible causes for the loss of the 24-inch transmission main.

Results

The 10-inch transmission line from Anacortes has a capacity of approximately 1 mgd. Wells 8, 9, and 11 have an additional production of approximately 0.62 mgd. With mandatory water conservation measures in place, the City's wells and the 10-inch transmission line have adequate capacity to temporarily serve the City's water system and wholesale customers for a short duration of time.

Response Action

Upon noticing a disruption in the 24-inch transmission main, the City should immediately notify Anacortes, activate City wells as applicable, open interties as needed, request residents and NASWI to reduce water consumption, evaluate the need for potential water rationing measures, repair the disruption in the pipeline, disinfect and flush the line as required, and coordinate with Anacortes to restore supply. Provide additional water supply using three available groundwater sources.

Implementation of the water shortage response plan outlined in Resolution 2001-08 may be required (Appendix P).

Loss of 10-inch and 24-inch Transmission Mains

Possible Causes

A break in line, temporary shut down for construction or maintenance, loss of supply from the City of Anacortes, vandalism or other accidental disruption are all possible causes for the loss of the transmission mains.

Results

This is the situation when no water is available from Anacortes. Wells 8, 9, and 11 produce approximately 0.62 mgd. With water rationing measures enacted, these wells should be sufficient to temporarily supply water to the City's water system customers. Wholesale water customers such as NASWI would not receive water from the City and must rely on other sources.

Response Action

Upon noticing a disruption in the transmission mains, the City should immediately notify Anacortes, activate City wells as applicable, enact Resolution 2001-08 water use restrictions, inform the City's wholesale water customers of the disturbance, repair the disruption in the pipeline, disinfect and flush the line as required, and coordinate with the Anacortes to restore supply.

The City of Anacortes maintains ownership of a reverse osmosis package water treatment plant for use in the case of an emergency. If the City's water supplies reach significantly low levels, or the disruption in service is anticipated to last at least 7 days, the City should request use of the package water treatment plant until normal service is resumed.

Also, there are two interties between the City's water system and NASWI. These interties may be opened to allow a sharing of City and NASWI water resources. The City has an agreement and policy in place for the activation of the City/NASWI interties.

Auxiliary Supply

The City is interested in expanding its auxiliary water production capability in the event that either the 24-inch transmission main, or both the 10-inch and 24-inch transmission mains become unavailable. This auxiliary supply would likely come from additional groundwater sources. The City is currently investigating the feasibility of acquiring additional water supplies (~1,000 gpm) that could serve both the City and NASWI in the event of an emergency.

CROSS-CONNECTION CONTROL

As required by WAC 246-290-490, Cross-Connection Control, utilities have the responsibility to protect customers from water contamination due to cross-connections. A cross-connection is any physical arrangement where the potable water supply is connected, directly or indirectly, to any liquid of unknown or unsafe quality that may contaminate the public water supply through backflow. The regulation also requires utilities to develop and implement a comprehensive program to control cross-connections within the system. An acceptable cross-connection control program must address the following elements:

- Adoption of the appropriate ordinance, code, or rule-of-service for the purveyor to establish local authority to implement the cross-connection control program.
- Written procedures for implementing the cross-connection control program.
- Identification of staff positions delegated the responsibility for the organization and implementation of the cross-connection control program.
- Establishment of the qualifications necessary for the personnel working in the cross-connection control program. Detailed procedures for conducting surveys of new and existing facilities to identify all existing and potential cross-connections that could result in contamination of the distribution system.
- Requirements that only approved backflow assemblies shall be installed at locations where cross-connection protection is required.
- A procedure or system for testing all backflow prevention assemblies upon installation.
- An adequate record keeping system.

- Customer information and public education regarding the cross-connection control program.

HISTORY

The City adopted its original cross-connection control ordinance to comply with the Washington Administrative Code (WAC). The State has since adopted revised cross-connection control (CCC) regulation (WAC 246-290-490) that includes additional detail and clarification on the requirements of a cross-connection control program. In April 2006 the City adopted a revised CCC ordinance (No. 1456).

Historically, the City water system staff has administered the CCC with little involvement from outside entities. The water system staff is deemed responsible for water service to the customer all the way to the inside plumbing, thus creating a conflict with the local plumbing official's authority. The new regulations encourage the purveyor and the local plumbing authority to coordinate with a joint CCC program that combines the use of cross-connection regulations with provisions of the Uniform Plumbing Code to control cross-connections inside and outside the customer's premises.

CURRENT ACTIVITY

The City currently administers an active CCC program through the City's Municipal Code (Title 13.13). Enforcement of the program is established in the OHMC and compliance is required to maintain water service. The City maintains a database of all known backflow prevention devices. Annual test notices are sent to owners, and results are recorded in the database.

The following records are included in the City's CCC database:

- Date of inspection
- Results of inspection
- Recommended protection
- List of approved assemblies
- Test and maintenance reports
- List of certified testers
- Customer account number, billing address, service address, device details and history, and maintenance records

CCC ORDINANCE AND PROGRAM

The current version of the City's CCCP is included as Appendix G, and was approved by DOH in 2006.

CCC PROGRAM STAFFING AND TRAINING

Currently, the City's CCC program is conducted in a joint venture between water system staff and the City's building department. Staffing for CCC related activities require 0.5 water system full-time employees (FTEs) in addition to 0.25 FTEs from the building department. Future staffing level will depend on the number of enforcement actions required, the level of cooperation by property owners, and actual growth of the City's water system.

The State of Washington requires that anyone who manages a CCC program must maintain certification as a Cross-Connection Control Specialist (CCS). The water system staff currently employs five certified cross-connection control specialists. Building department employees are trained in cross-connection control, but are ineligible for CCS certification because they are not water system utility employees.

TESTING AND INSPECTION

There are five City staff members certified for cross connection inspections. These personnel conduct initial cross connection surveys on new commercial services or when there is a change in use, a change in the plumbing system, or scheduled re-evaluations. The water system staff works with the building department in a joint program.

The water system staff and building departments rely on premise and in-premise protection from cross connection hazards to protect the public water system. The building department inspects residential services upon construction and forwards any issues of special concern to the water system staff. All backflow prevention assemblies are inspected and tested upon installation, repair, after a backflow incident, reinstallation, relocation, or replumbing, and annually thereafter, or on a more frequent basis as deemed appropriate by the City. All backflow assembly test reports are managed and kept on file using backflow prevention database software.

CHAPTER 8

CAPITAL IMPROVEMENT PROGRAM

INTRODUCTION

This chapter presents a Capital Improvement Program (CIP) in accordance with the requirements of WAC 246-290. Planned water system improvements, associated costs, and scheduling are presented in the following sections. These improvements are based on deficiencies identified in the City's 2003 Water System Plan and Chapters 3 – System Analysis, and Chapter 4 – Hydraulic Modeling of this Plan. Financing of these improvements is discussed in Chapter 9 – Financial Planning.

In the future, other projects may arise that are not identified as part of the City's water system CIP. Such projects may be deemed necessary for ensuring water quality, preserving emergency water supply, accommodating transportation improvements proposed by other agencies, or addressing unforeseen problems with the City's water system. Due to budgetary constraints, the completion of these projects may require that the proposed completion date for the projects in the CIP be rescheduled. The City retains the flexibility to reschedule proposed projects and to expand or reduce the scope of proposed projects, as best determined by the City when new information becomes available for evaluation.

The CIP is categorized into five categories:

- Source/Supply Projects (S)
- Transmission Projects (T)
- Booster Station Projects (BS),
- Distribution System Projects (DS), and
- Pressure Zone Projects (PZ).

Each category is further divided into a detailed list of projects presented chronologically over the 6-year and 20-year planning periods. Projects required or recommended after the 6-year planning period are described, and a budgetary cost estimate is provided, but projects are not scheduled for a specific year. Figure 8-1 highlights the locations of all capital improvement projects.

RECOMMENDED IMPROVEMENTS

Recommended capital improvement projects are listed below. Cost estimates include state taxes (8.7 percent), contingency (20 percent), archaeological mitigation (variable, 10, 15, 20 or 25 percent) and engineering and administrative costs (25 percent). Archaeological mitigation values were assigned based on the potential to negatively impact cultural artifacts. Detailed cost estimates are provided in Appendix T. Cost

estimates are based on 2013 dollars and were developed with an Engineering News Record Construction Cost Index value of 10,143.

For projects that offer benefit to the NASWI water supply system, it is anticipated that NASWI will provide financial assistance to the City for financing a particular project. Specific details regarding the amount and form of assistance are not known at this time, and must be negotiated upon project acceptance and prior to construction.

WATER RIGHTS AND SOURCE CAPACITY PROJECTS

S-1: Well No. 9 Replacement

Estimated Project Cost: $236,000
Proposed Design Year: 2014
Proposed Construction Year: 2015

Project Description:
This project includes removing the pumping equipment from the existing Well 9. The existing casing and screen will be abandoned in place. A new 10-inch-diameter well will be drilled directly adjacent to the existing well location and new casing and screen will be installed. The existing pumping equipment and building will be inspected and reused if possible.

S-2: Emergency Supply Study

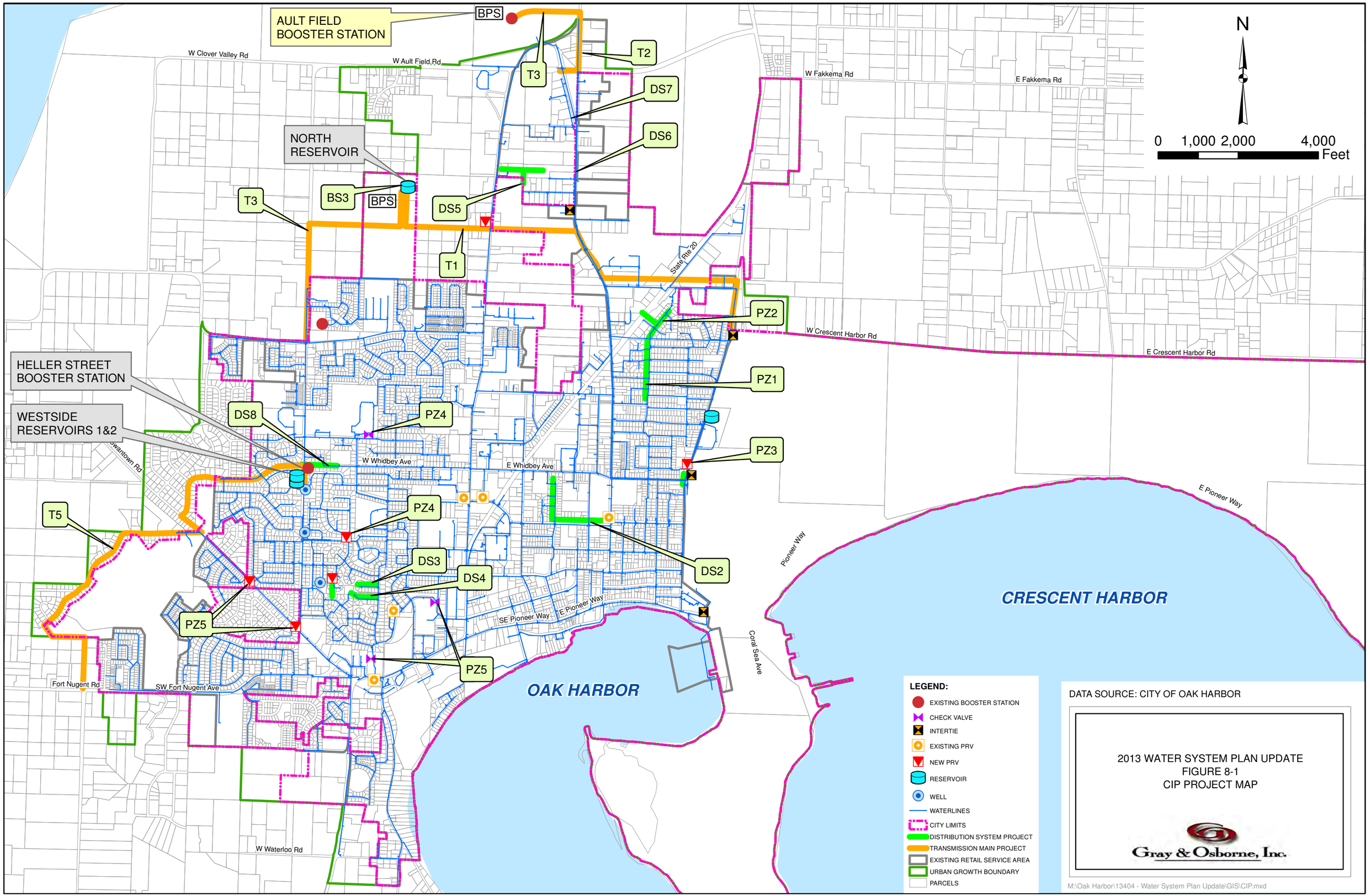
Estimated Cost: $100,000
Proposed Year: 2014

Project Description:
Investigate the potential for additional groundwater sources to be used as emergency supply (~1,000 gpm). It is anticipated that the investigation will determine the feasibility and potential locations of new emergency supply wells.

S-3: Eastside Reservoir Demolition

Estimated Cost: $100,000
Proposed Design Year: 2014
Proposed Construction Year: 2015

Project Description:
This project includes decommissioning and demolition of the existing Eastside Reservoir. The reservoir was constructed in 1949 and does not have a foundation structure. Retrofitting this reservoir or modifications to meet current seismic requirements are not cost-effective.


AULT FIELD BOOSTER STATION
BPS
T2
T3
DS7
DS6
NORTH RESERVOIR
BS3
BPS
T3
DS5
T1
PZ2
PZ1
HELLER STREET BOOSTER STATION
WESTSIDE RESERVOIRS 1&2
DS8
PZ4
PZ3
T5
PZ4
DS3
DS4
DS2
PZ5
PZ5
W Clover Valley Rd
W Ault Field Rd
W Fakkema Rd
E Fakkema Rd
State Rte 20
W Crescent Harbor Rd
E Crescent Harbor Rd
W Whidbey Ave
E Whidbey Ave
Swantown Rd
E Pioneer Way
Pioneer Way
SE Pioneer Way
Coral Sea Ave
Fort Nugent Rd
SW Fort Nugent Ave
W Waterloo Rd
CRESCENT HARBOR
OAK HARBOR
N
0 1,000 2,000 4,000 Feet
LEGEND:
EXISTING BOOSTER STATION
CHECK VALVE
INTERTIE
EXISTING PRV
NEW PRV
RESERVOIR
WELL
WATERLINES
CITY LIMITS
DISTRIBUTION SYSTEM PROJECT
TRANSMISSION MAIN PROJECT
EXISTING RETAIL SERVICE AREA
URBAN GROWTH BOUNDARY
PARCELS
DATA SOURCE: CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE
FIGURE 8-1
CIP PROJECT MAP
Gray & Osborne, Inc.
M:\Oak Harbor\13404 - Water System Plan Update\GIS\CIP.mxd

S-4: Emergency Supply Well
Estimated Cost: $301,000
Proposed Design Year: 2016
Proposed Construction Year: 2017

Project Description:
It is anticipated that a new well and associated peripheral items will be necessary to provide the required volume of groundwater for emergency supply for the City and its customers. The exact location, sizing, and details for the new emergency well will be finalized from the emergency supply study (S-2) prior to initiation of this project.

TABLE 8-1

Source Related Capital Improvement Project Summary

Project			Design Year	Construction Year	Estimated Cost (2013 $)
No.	**Title**	**Description**			
S-1	Well 9 Replacement	Pump, casing, and piping replacement	2014	2015	$236,000
S-2	Emergency Supply Study	Emergency groundwater supply feasibility study	2014	2014	$100,000
S-3	Eastside Reservoir Demolition	Remove and wastehaul existing Eastside reservoir	2014	2015	$100,000
S-4	Emergency Supply Well	Drill and equip a new emergency supply well	2016	2017	$301,000
				Source Project Subtotal	**$737,000**

TRANSMISSION LINE PROJECTS

T-1: Cross City Transmission Main
Estimated Project Cost: $3,559,000
Proposed Design Year: 2013
Proposed Construction Year: 2014

Project Description:
This project is required to create the East 384 pressure zone and will include the installation of approximately 8,200 linear feet of 18-inch ductile iron water pipe, and 100 feet of 8-inch-diameter ductile iron pipe between the North Reservoir and West Crescent Harbor Road. The pipe will connect to the existing transmission main at the intersection of Gun Club Road and N Oak Harbor Road and will head east along Gun Club Road Road, south along NE Goldie Street, east along NE 16th Avenue, and south along NE Regatta Drive.

This project will also provide two additional connection points that will allow the City to serve the NASWI Seaplane Base facilities. Points of connection will be at

the intersection of NE Regatta Drive and W Crescent Harbor Road, and also at NE Regatta Drive and E Whidbey Avenue.

T-2: North-End Trunk Main: Phases 1 and 2

Estimated Project Cost: $1,767,000
Proposed Design Year: 2013
Proposed Construction Year: 2014

Project Description:
This project will provide an alternate connection between the Ault Field Pump Station and the City's distribution system. The project will occur in two phases. Phase 1 will include a tie-in connection to the existing 18-inch pipe at the intersection of West Ault Field Road and NE Goldie Street. Approximately 500 feet of 12-inch-diameter ductile iron pipe will be installed along West Ault Field Road to the intersection with Old Goldie Road. Approximately 2,000 feet of new 18-inch-diameter ductile iron pipe will head north to the termination of Old Goldie Road.

Phase 2 of the North-End trunk main project, which will complete the alternate connection between the Ault Field Pump Station and the City's distribution system, includes the installation of approximately 2,000 feet of 18-inch ductile iron water main from the northern terminus of Old Goldie Road west through undeveloped property, and will cross North Charles Porter Road prior to final connection with the Ault Field Booster Station. This pipeline will be installed by the City but will cross NASWI property and will involve review, coordination, and cooperation by both parties.

T-3: West 384 Zone Extension: Phase 1

Estimated Project Cost: $2,678,000
Proposed Design Year: 2017
Proposed Construction Year: 2018

Project Description:
This project includes piping and appurtenances that would help create the West 384 pressure zone. The project includes approximately 5,300 feet of 24-inch ductile iron transmission main from the new North Reservoir across undeveloped land west of the termination of Gun Club Road to North Heller Road. The pipe would then continue south to the intersection of NW Heller Street and NW Crosby Avenue.

T-4: 24-Inch Transmission Line Investigation

Estimated Project Cost: $150,000
Proposed Year: 2017

Project Description:
Fully investigate the soundness of the 24-inch transmission from Sharpe's Corner along Highway 20 to the Ault Field Pump Station. This investigation would likely include a technical memorandum, geotechnical evaluation, pothole investigations at several locations along the transmission main, corrosive soil sampling, and a structural examination of the crossing at the Deception Pass Bridge. Based on this investigation and their results, provide recommendations for replacement and/or modifications.

T-5: Westside Water Main Extension

Estimated Project Cost: $7,609,000
Proposed Year: >2019

Project Description:
This project is intended to accommodate future growth to the west and south of the existing urbanized area and to provide service, pressure and fire flows to the area. This project is not required within the 20-year planning window, but could become necessary if development in this area requires additional flow and connections. This project will likely be developer funded.

The project includes up to 16,000 feet of 18-inch ductile iron water main, and would likely be divided up into three of four phases to be completed as development occurs within sections of the region. The final alignment for this project will be determined at a later date prior in conjunction with development in the area and projected needs for City water customers.

T-6: Campbell Lake Transmission Main Replacement

Estimated Project Cost: $1,786,000
Proposed Design Year: 2018
Proposed Construction Year: >2019

Project Description:
This project will replace approximately 3,100 feet of 24-inch ductile iron transmission main with 24-inch HDPE pipe along the eastern shores of Lake Campbell. A corrosion survey in 2007 revealed that mildly corrosive soils along the shore of Lake Campbell on Fidalgo Island have begun to damage the transmission main. The existing ductile iron pipe is located under the northbound traffic lane of Highway 20. Ideally, the new HDPE pipe will be located within a new utility easement adjacent to the existing right-of-way. This project will require the acquisition of necessary permits and easements required to install new pipe in this location.

TABLE 8-2

Transmission Main Related Capital Improvement Project Summary

Project			Design Year	Construction Year	Estimated Cost (2013 $)
No.	**Title**	**Description**			
T-1	Cross City Transmission Main(1)	8,200 lf of 18-inch pipe and new PRV station	2013	2014	$3,559,000
T-2	North-End Trunk Main: Phases 1 and 2(1)	4,000 lf of 18-inch pipe	2013	2014	$1,767,000
T-3	West 384 Zone Extension: Phase 1	5,300 lf of 24-inch pipe from North Reservoir	2017	2018	$2,678,000
T-4	24-Inch Transmission Line Investigation	Transmission line reliability & soundness study	2017	2017	$150,000
T-5	Westside Water Main Extension	16,500 lf of 16- or 18-inch pipe	>2019	>2019	$7,609,000
T-6	Campbell Lake Main Replacement	3,100 lf of HDPE pipe along east shores of Lake Campbell	2018	>2019	$1,970,000
				Transmission Main Project Subtotal	**$17,733,000**

(1) This project is a joint City/NASWI project and final cost sharing has not been determined. Project timing and scope may change depending on the level of NASWI financial contribution.

BOOSTER STATION

BS-1: Ault Field Booster Station Surge Protection Analysis

Estimated Project Cost: $208,000
Proposed Design Year: 2014
Proposed Construction Year: 2014

Project Description:
The previous Water System Plan recommended installing an 800 cubic foot capacity surge protection unit upstream of the Ault Field water pumps. As part of this project, a new surge suppression analysis will be completed. If necessary, a new surge suppression device will be installed and connected to protect the Ault Field Pump Station equipment.

BS-2: Ault Field Booster Station Pump Replacement

Estimated Project Cost: $86,000
Proposed Design Year: 2014
Proposed Construction Year: 2015

Project Description:
This project will replace two of the existing pumps at the Ault Field Pump Station. The existing pumps were not sized correctly and will be replaced with appropriately sized, higher efficiency units.

BS-3: North Booster Pump Station

Estimated Project Cost: $2,398,000
Proposed Design Year: 2014
Proposed Construction Year: 2015

Project Description:
This project includes construction of a new booster station at the location of the new North Reservoir. The booster station will pump water from the North Reservoir to the eastern portion of the City near the intersection of NE Regatta Drive and West Crescent Harbor Road. The booster station will include a new concrete masonry unit (CMU) building that will house horizontal split case pumps to handle the City's projected water demands to the proposed East 384, West 384, and 322 pressure zones. Space and electrical connections will be provided for two additional pumps to be installed as system demands increase. This project will provide pressure and flow necessary to serve the NASWI Seaplane Base portion of the U.S. Navy water distribution system.

TABLE 8-3

Booster Station Related Capital Improvement Project Summary

Project			Design	Construction	Estimated
No.	**Title**	**Description**	**Year**	**Year**	**Cost (2013 $)**
BS-1	Ault Field Booster Station Surge Protection Analysis	800 cubic foot hydropneumatic surge arrestor	2014	2014	$208,000
BS-2	Ault Field Booster Station Pump Replacement	Existing Ault Field Booster pump replacement	2014	2014	$86,000
BS-3	North Booster Pump Station(1)	Construct new north booster station and pumps	2014	2015	$2,398,000
				Booster/Pump Station Subtotal	**$2,692,000**

(1) This project is a joint City/NASWI project and final cost sharing has not been determined. Project timing and scope may change depending on the level of NASWI financial contribution.

DISTRIBUTION SYSTEM

DS-1: NE Regatta Drive Pipeline
Estimated Cost: $116,000
Proposed Design Year: 2015
Proposed Construction Year: 2016

Project Description:
This project includes installation of 300 feet of 8-inch DI pipe to replace the existing 6-inch asbestos cement pipe between East Whidbey Avenue and NE 1st Avenue. This project is part of the City's regular pipe replacement schedule and will improve local pressures and fire flow in the area surrounding the project.

DS-2: Glencoe Street Fire Flow Improvements
Estimated Cost: $936,000
Proposed Design Year: 2017
Proposed Construction Year: 2018

Project Description:
This project will replace 4-inch-diameter asbestos-cement pipe on SE Glencoe Street with new 8-inch-diameter ductile iron pipe. This project includes installation of approximately 2,400 feet of 8-inch ductile iron pipe along SE 4th Avenue between SE Midway Boulevard and SE Glencoe Street, and along SE Glencoe Street between 4th Avenue and 40th NW Street. This project will increase available fire flow in the immediate vicinity to levels above the required 1,000 gpm.

DS-3: SW 10th Court Pipe Replacement
Estimated Cost: $188,000
Proposed Design Year: >2019

Project Description:
This project includes replacement of the existing 6-inch PVC pipe along the full extent of SW 10th Court with approximately 480 feet of 8-inch ductile iron pipe.

DS-4: SW 11th Court Pipe Replacement
Estimated Cost: $188,000
Proposed Design Year: >2019

Project Description:
This project includes replacement of the existing 6-inch PVC pipe along the full extent of SW 11th Court with approximately 480 feet of 8-inch ductile iron pipe.

DS-5: Erin Park Main Road Extension
Estimated Cost: $578,000
Proposed Design Year: >2019

Project Description:
This project includes the installation of approximately 1,100 feet of 12-inch water pipe along West Erin Park Road between North Painters Way and North Oak Harbor Road. It also includes approximately 350 feet of new 12-inch pipe from the end of West Oak Street to the new main along West Erin Park Road. This project will provide adequate fire flow to meet the 3,500 gpm requirement for businesses in this region of the City.

DS-6: Erin Park Road Tie-In
Estimated Cost: $50,000
Proposed Design Year: >2019

Project Description:
This project includes a tie-in connection between the 12-inch ductile iron pipe in the North Goldie Road right-of-way to the existing 8-inch C900 parallel line at West Erin Park Road. This project will help provide adequate fire flow to meet the 3,500 gpm requirement for businesses in this region of the City.

DS-7: Industrial Avenue Tie-In
Estimated Cost: $50,000
Proposed Design Year: >2019

Project Description:
This project includes a tie-in connection between the 12-inch ductile iron pipe in the Goldie Road right-of-way to the existing 8-inch PVC parallel line at Industrial Avenue. This project will help provide adequate fire flow to meet the 3,500 gpm requirement for businesses in this region of the City.

DS-8: Heller Reservoir Extension
Estimated Cost: $696,000
Proposed Design Year: >2019

Project Description:
This project includes the installation of a dedicated water pipe between the Heller Street Reservoirs and the Mainland Zone along West Whidbey Avenue to allow it to be isolated from the West 384 Zone. Approximately 2,000 feet of 16-inch ductile iron water main will be installed from the Westside Reservoirs north along SW Heller Street and east along West Whidbey Avenue to the intersection of West Whidbey Avenue and SW Jib Street.

DS-9: Steel/AC Pipe Replacement
Estimated Cost: $500,000
Proposed Construction Year: Annual

Project Description:
This project will systematically replace the existing steel and asbestos-cement (AC) water pipes located throughout the City's distribution system. The City currently has approximately 100,000 linear feet of old steel and AC pipes, where are typically undersized. Steel and AC pipe deteriorate over time and constitute a major fraction of the City's distribution system leakage. These pipes also have higher regular maintenance requirements than currently specified ductile iron pipes.

TABLE 8-4

Distribution System Related Capital Improvement Project Summary

Project			Design Year	Construction Year	Estimated Cost (2013 $)
No.	**Title**	**Description**			
DS-1	NE Regatta Drive Pipeline	300 lf f 8-inch pipe	2015	2016	$116,000
DS-2	Glencoe Street Fire Flow Improvements	2,400 lf of 8-inch pipe	2017	2018	$936,000
DS-3	SW 10th Court Pipe Replacement	480 lf of 8-inch pipe	>2019	>2019	$188,000
DS-4	SW 11th Court Pipe Replacement	480 lf of 8-inch pipe	>2019	>2019	$188,000
DS-5	Erin Park Main Road Extension	1,450 lf of 12-inch pipe	>2019	>2019	$578,000
DS-6	Erin Park Road Tie-In	Existing 8-inch pipe and proposed 12-inch pipe tie-in	>2019	>2019	$50,000
DS-7	Industrial Avenue Tie-In	Existing 8-inch pipe and proposed 12-inch pipe tie-in	>2019	>2019	$50,000
DS-8	Heller Reservoir Extension	2,000 lf of 16-inch pipe	>2019	>2019	$696,000
DS-9	Steel/AC Pipe Replacement	Replace existing small diameter steel and AC pipe	Annually	Annually	$500,000 (1)
				Distribution System Subtotal	**$5,802,000**

(1) Costs were assumed to occur through 2019 (6 years), and the total ($3,000,000) is added to the distribution system subtotal cost.

PRESSURE ZONE

PZ-1: O'Leary Way Water Main
Estimated Cost: $599,000
Proposed Design Year: 2014
Proposed Construction Year: 2015

Project Description:
This project would further develop the East 384 Zone and provide adequate service and fire flows to the area. The project includes installation of approximately 1,900 feet of 8-inch ductile iron pipe along O'Leary Way between NE 5th Avenue and NE 11th Avenue. New pipe would be installed parallel to the existing 6-inch buried pipe and would include tie-ins to the existing system.

PZ-2: North O'Leary Way Main Extension
Estimated Cost: $511,000
Proposed Design Year: 2014
Proposed Construction Year: 2015

Project Description:
This project would completely develop the East 384 Zone and provide adequate service and fire flows to the area. The project includes installation of approximately 1,200 feet of 8-inch ductile iron pipe along O'Leary Way north of NE 11th Avenue across NE Narrows Way to the end of the cul-de-sac. This new pipe would replace the existing 6-inch diameter asbestos-cement water pipe.

PZ-3: East 384 Zone Development
Estimated Cost: $90,000
Proposed Design Year: 2014
Proposed Construction Year: 2014

Project Description:
This project will help develop the East 384 Zone and will include the installation of a new PRV station along East Regatta Drive immediately south of Olympic View Elementary School.

PZ-4: West 384 Zone Development
Estimated Cost: $326,000
Proposed Design Year: 2015
Proposed Construction Year: 2016

Project Description:
These two small projects are part of a larger project that will help fully develop the West 384 Zone. The first is the installation of a 6-inch PRV station along SW 6th Avenue between SW Judson Drive and SW Harrier Street. The second is

includes approximately 780 feet of new 8-inch-diameter ductile iron water pipe will replace the existing 6-inch asbestos-cement water pipe and connect SW Barrington Drive and SW London Terrace. A new PRV station will also be included at this location.

This project also includes installation of an 8-inch check valve between the future west 384 Zone and the existing 307 Zone (Mainland Zone) break to provide additional fire flow to Oak Harbor High School from the 307 Zone. The valve will be installed near the intersection of NW 2nd Avenue and SW Jib Street and will include a vault.

PZ-5: 322 Zone Development
Estimated Cost: $485,000
Proposed Design Year: >2019

Project Description:
These two small projects are part of a larger project that will help fully develop the 322 Zone. The first is the installation of a 6-inch PRV station along SW Quinalt Street between SW Swantown Road and SW 10th Avenue. The second includes a new PRV station along SW Heller Street immediately north of SW Swantown Road.

This project also includes installation of an 8-inch check valve between the future 322 Zone and existing 307 Zone (Mainland Zone) break to provide additional fire flow to Walmart and other large businesses from the 307 Zone. The valve will be installed near the intersection of SW Barrington Drive and Highway 20 and will include a vault.

TABLE 8-5

Pressure Zone Related Capital Improvement Project Summary

Project			Design	Construction	Estimated
No.	**Title**	**Description**	**Year**	**Year**	**Cost (2013 $)**
PZ-1	O'Leary Way Water Main	1,900 lf of 8-inch pipe	2014	2015	$599,000
PZ-2	North O'Leary Way Water Main	1,200 lf of 8-inch pipe	2014	2015	$511,000
PZ-3	East 384 Zone Development(1)	2 PRV installations	2014	2014	$90,000
PZ-4	West 384 Zone Development	780 lf of 8-inch pipe and new 6-inch PRV station	2015	2016	$326,000
PZ-5	322 Zone Development	Two separate 6-inch PRV stations and fire flow check valve	>2019	>2019	$485,000
				Pressure Zone Subtotal	**$2,011,000**

(1) This project is a joint City/NASWI project and final cost sharing has not been determined. Project timing and scope may change depending on the level of NASWI financial contribution.

SUMMARY OF RECOMMENDED IMPROVEMENTS

A proposed schedule and cost summary for the recommended capital improvements is shown in Table 8-5. Estimated construction costs have been adjusted for inflation and are increased at annual rate of 3 percent. Detailed cost estimates for the City's improvement projects are included in Appendix T. A water system facility map that shows the locations of the proposed improvements is included as Figure 8-1.

TABLE 8-6

Projected Capital Improvement Project Schedule

Construction Year	Project No.	Project Name	Estimated Cost(1)	Estimated Construction Cost(2)
2014	S-2	Emergency Supply Study	$100,000	$100,000
	T-1	Cross City Transmission Main(3)	$3,559,000	$3,559,000
	T-2	North-End Trunk Main: Phases 1 and 2(3)	$1,767,000	$1,767,000
	BS-1	Ault Field Booster Station Surge Protection Analysis	$208,000	$208,000
	BS-2	Ault Field Booster Station Pump Replacement	$86,000	$86,000
	PZ-3	East 384 Zone Development(3)	$90,000	$90,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
		2014 Subtotal	**$6,310,000**	**$6,310,000**
2015	S-1	Well 9 Replacement	$236,000	$243,000
	S-3	Eastside Reservoir Demolition	$100,000	$103,000
	BS-3	North Booster Pump Station(3)	$2,398,000	$2,470,000
	PZ-1	O'Leary Way Water Main	$599,000	$617,000
	PZ-2	North O'Leary Way Water Main	$511,000	$526,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
		2015 Subtotal	**$4,344,000**	**$4,464,000**
2016	DS-1	NE Regatta Drive Pipeline	$116,000	$123,000
	PZ-4	West 384 Zone Development	$326,000	$346,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
		2016 Subtotal	**$942,000**	**$969,000**
2017	T-4	24-Inch Transmission Line Investigation	$150,000	$150,000
	S-4	Emergency Supply Well	$301,000	$329,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
		2017 Subtotal	**$951,000**	**$979,000**
2018	T-3	West 384 Zone Extension: Phase 1	$2,678,000	$3,014,000
	DS-2	Glencoe Street Fire Flow Improvements	$936,000	$1,053,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
		2018 Subtotal	**$4,114,000**	**$4,567,000**

TABLE 8-6 – (continued)

Projected Capital Improvement Project Schedule

Construction Year	Project No.	Project Name	Estimated Cost(1)	Estimated Construction Cost(2)
>2019(3)	T-5	Westside Water Main Extension	$7,609,000	$9,086,000
	DS-3	SW 10th Court Pipe Replacement	$188,000	$224,000
	DS-4	SW 11th Court Pipe Replacement	$188,000	$224,000
	DS-5	Erin Park Main Road Extension	$578,000	$690,000
	DS-6	Erin Park Road Tie-In	$50,000	$60,000
	DS-7	Industrial Avenue Tie-In	$50,000	$60,000
	DS-8	Heller Reservoir Extension	$696,000	$831,000
	PZ-5	322 Zone Development	$485,000	$579,000
	T-6	Campbell Lake Main Replacement	$1,970,000	$2,352,000
	DS-9	Steel/AC Pipe Replacement	$500,000	$500,000
		>2019 Subtotal	**$12,314,000**	**$14,606,000**
		6-Year Planning Period Total	**$16,661,000**	**$17,284,000**
		20-Year Planning Period Total	**$28,975,000**	**$31,890,000**

(1) Values given are in 2013 dollars and represent project costs include archaeological mitigation, contingency, tax, and engineering/administrative services.

(2) Values given are estimated project costs and include items listed in (1) above.

(3) This project is a joint City/NASWI project and final cost sharing has not been determined. Project timing and scope may change depending on the level of NASWI financial contribution.

(4) Costs for these years are assumed to be 2020 dollars.

CHAPTER 9

FINANCIAL PROGRAM

INTRODUCTION

This chapter contains an analysis of the City's ability to fund water system improvements outlined in Chapter 8 – Capital Improvement Program. Potential funding sources, financial status of the water utility, funding required to finance the scheduled improvements, and the impact of water system improvements on water rates are presented.

EXISTING WATER UTILITY FINANCIAL STATUS

CURRENT WATER RATES

The City's water rates are defined in Ordinance 1587 and outline the costs for water service through the year 2016. These rates were adopted in response to the *Water Cost of Service Study* (HDR, 2010). Rates through the year 2016 are summarized in Table 9-1.

TABLE 9-1

Water Service Rates Through 2016[(1)]

Parameter	2012	2013	2014	2015	2016
Monthly Base Rate					
Residential, Residential/Commercial, School, and Irrigation					
5/8" or 3/4"	$23.50	$24.25	$25.00	$25.50	$26.25
1"	$32.30	$36.40	$40.65	$44.65	$47.80
1 1/2"	$64.65	$72.75	$81.25	$89.20	$95.65
2"	$103.40	$116.40	$130.00	$142.80	$153.00
3"	$193.90	$218.25	$243.75	$267.75	$2,868.90
4"	$323.15	$363.75	$406.25	$446.25	$478.15
6"	$387.75	$400.15	$412.50	$420.75	$433.15
8"	$620.40	$640.20	$660.00	$673.20	$693.00
Multi-Family, Multi-Commercial					
Per Base unit rate	$19.95	$20.60	$21.25	$21.70	$22.30
Additional Consumption Charges					
Single-Family and Multi-Family (per unit)					
0 - 3 CCF	$1.75	$2.10	$2.35	$2.60	$2.85
4 - 6 CCF	$2.55	$2.80	$3.15	$3.75	$4.30
> 7 CCF	$4.80	$5.45	$5.95	$6.35	$6.75

TABLE 9-1 – (continued)

Water Service Rates Through 2016(1)

Parameter	2012	2013	2014	2015	2016
Commercial (per unit), Schools, and Churches (2)					
0 - 10 CCF	$4.20	$4.25	$3.75	$3.45	$3.50
11 - 20 CCF	$3.80	$4.00	$3.75	$3.70	$3.75
> 21 CCF	$2.60	$3.15	$3.75	$3.95	$4.10
Irrigation					
0 - 10 CCF	$4.50	$4.50	$4.20	$4.20	$4.45
> 11 CCF	$3.00	$3.60	$4.20	$5.00	$5.50

(1) Prices listed are for connections within city limits. Connections outside of city limits are subject to a 1.5 rate differential.

(2) Commercial laundromats will receive a 10 percent reduction in the water consumption rate to accommodate for evapotranspiration that occurs during drying.

As previously mentioned, the City maintains three primary wholesale customers and billing for these three customers varies slightly. Currently, NASWI is billed as a wholesale customer based on the agreements between the two entities. North Whidbey Water District is billed as a commercial entity outside of the city limits and as such is subject to 1.5 times the in-city billing rate. Lastly, Deception Pass State Park is billed as an in-city commercial customer.

CURRENT CONNECTION FEES

In-City Connections

A connection charge shall be levied upon any customer prior to connection with city water service. The connection charge shall be the actual cost of installation. An initial sum, based on the cost estimated by the water superintendent, or their designee, must be paid in advance of service installation. Upon completion of the connection, the actual cost will be determined and if this amount is greater than the initial estimate, the customer will be billed for the balance. If the actual cost is less than estimated, the overpayment will be refunded to the customer. The actual cost of an installation shall include all labor, equipment and material, plus a charge for overhead as set in the utility rate ordinance.

Out-of-City Connections

For water connections outside the city limits of Oak Harbor, a surcharge of 50 percent is added to the charges specified above for the extra costs involved in working beyond the normal service area.

HISTORICAL REVENUES AND EXPENSES

The City maintains a single Water Fund 401. Historical revenues and expenditures for Water Fund 401 are shown in Table 9-2.

The City accounts for the water utility as a self-supporting enterprise fund with revenues, expenses, debt and reserves specified for water services. Monthly water sales are the primary source of revenue for maintenance and operations. New customers pay a combination of a one-time system development charge, meter installation and initiation fees. The City primarily pays for capital improvements on a pay-as-you-go basis. There is no outstanding long-term debt for the water utility.

The Public Works Department prepares biennial budgets along with the City's Finance Department. Most activity for the water utility takes place within Water Fund 401, including operations (including indirect costs) and capital outlay for improvement projects. Through the biennial budget process, the City balances the water needs with the stream of revenue and planned capital projects. With each update of the Water System Plan, the City adjusts its 6-year outlook and planned budget.

TABLE 9-2

Historical Revenues and Expenditures for Water Fund 401

Parameter	2008	2009	2010	2011	2012	2013[1]
Revenues						
Start of Year Balance	$3,144,753	$3,948,780	$2,660,542	$3,356,221	$4,546,673	$4,015,855
Charges for Service - Residential	$3,392,311	$3,814,910	$3,822,303	$3,987,138	$4,253,119	$4,000,000
Charges for Service - NASWI	$318,170	$380,918	$399,206	$356,912	$486,973	$360,000
Connection, Admin., and Other Fees[1]	$66,624	$33,473	$34,448	$54,167	$40,260	$31,200
Miscellaneous Revenues[2]	$58,967	$42,830	$72,886	$161,398	$74,613	$64,500
Military Capital Contributions	$570,364	$-	$-	$-	$-	$-
Revenue Bond Proceeds	$-	$-	$-	$-	$-	$3,000,000
Transfers	$399,927	$-	$-	$-	$-	$2,373,000
Insurance	$-	$12,033	$2,728	$-	$1,262	$-
NASWI Meter & Maintenance Revenues	$3,000	$3,000	$5,806	$5,192	$5,340	$4,000
Total Revenues	**$4,809,363**	**$4,287,164**	**$4,337,377**	**$4,564,807**	**$4,861,567**	**$9,832,700**
Expenditures						
Salaries, Wages, and Benefits	$542,810	$615,945	$601,630	$519,802	$514,215	$537,194
Operating Supplies and Equipment	$96,392	$215,202	$142,233	$41,711	$72,277	$128,250
Administrative Costs	$16,225	$15,411	$18,601	$24,686	$20,944	$27,000
Professional Services	$19,850	$40,640	$23,582	$27,243	$24,110	$40,000
Equipment and Supplies for Resale	$859,552	$738,636	$979,086	$1,043,079	$1,146,947	$1,136,265
Insurance, Services, and Taxes	$439,581	$522,628	$517,663	$539,895	$550,643	$540,453
Interfund Expenditures	$228,753	$403,289	$445,390	$562,246	$551,645	$659,675
Operating Transfers	$577,587	$397,955	$390,987	$261,942	$307,950	$224,000
Public Works Trust Fund Expenditures	$736,493	$864,366	$60,177	$55,336	$55,079	$54,824
Capital Outlay	$763,734	$-	$989,177	$738,965	$1,254,037	$5,373,000
System Improvements	$17,459	$975,761	$29,909	$1,138	$24,386	$30,000
Miscellaneous	$44,721	$38,723	$53,289	$44,890	$43,591	$322,000
Total Expenditures	**$4,343,157**	**$4,828,556**	**$4,251,724**	**$3,860,933**	**$4,565,824**	**$9,072,661**
Annual Surplus/(Deficit)	**$466,206**	**($541,392)**	**$85,653**	**$703,874**	**$295,743**	**$760,039**
Year-End Fund Balance	**$3,020,821**	**$2,963,586**	**$3,095,494**	**$4,693,094**	**$4,525,551**	**$4,016,055**

(1) Values for 2013 are not finalized, but were approved by City Council in 2012.

(2) Line items shown are a combination of City line items. Items for similar categories were combined for clarity and planning purposes.

PROJECTED REVENUES AND EXPENSES

PROJECTED GROWTH

Estimates of the number of future customers and the demand they will place on the water system are required in order to estimate future revenues and expenditures. Chapter 2 – Basic Planning Data, provides detailed population and water demand projections.

Projected revenues and expenditures are listed in Table 9-3. Revenue projections for the year 2013 and 2014 were provided by the City and were approved by the City Council in late 2012. Water service charges for City connections are based on the historical cost ($/ccf) of water from 2009-2012. This base cost was multiplied by the water consumption projections formulated in Chapter 2 – Basic Planning Data. Projected revenues for NASWI water service are also based on the historical cost of water consumed by NASWI from 2009-2012 and their projected usage until 2020. Revenues from connection/admin/other fees, miscellaneous revenues, and NASWI meter and maintenance revenues were assumed to increase with inflation at an annual rate of 3 percent. Professional service expenditures included engineering and administrative services costs shown in the detailed cost estimates in Appendix T as well as studies or investigations. Capital outlay expenditures were assumed to be actual construction costs for selected new large-scale projects associated with system expansion such as booster stations or transmission main replacements outlined in Chapter 8 – Capital Improvement Program. System improvement expenditures were assumed to include smaller scale pipe replacement projects, ongoing maintenance replacement projects, and water quality projects outlined in Chapter 8 – Capital Improvement Program.

Projected revenues and expenditures are also shown graphically in Figure 9-1.

Projected expenditures for 2013 and 2014 were provided by the City and also approved by the City Council in late 2012. Projected expenditures for 2015-2020 are based on values for 2014 and adjusted for inflation at an annual rate of 3 percent. PWTF expenditures were taken from the City's planned payment schedule to Troxell Construction and Quiet Cove Construction. These payments occur in July of each year until year 2025 for Troxell Construction, and year 2026 for Quiet Cove Construction. Capital outlay and system improvement expenditures are based on estimated costs for the capital improvement projects described in Chapter 8 – Capital Improvement Program.

Table 9-3 shows that, given the proposed capital improvements and their estimated costs, the City would operate an annual deficit through the majority of the 6-year planning period. Costs included in Table 9-3 include the full cost of proposed projects. Several of these projects provide mutual benefit to both the City and Navy water systems. Cost sharing of the improvements serving both systems is anticipated to either significantly reduce capital costs paid by the City or increase water rate revenue sufficiently to repay financing that would otherwise be necessary. Break down of cost sharing will be determined on an individual project basis. The scope, cost share and schedule for capital

projects will be adjusted as necessary to fit within the financial and managerial capacities of the City.

TABLE 9-3

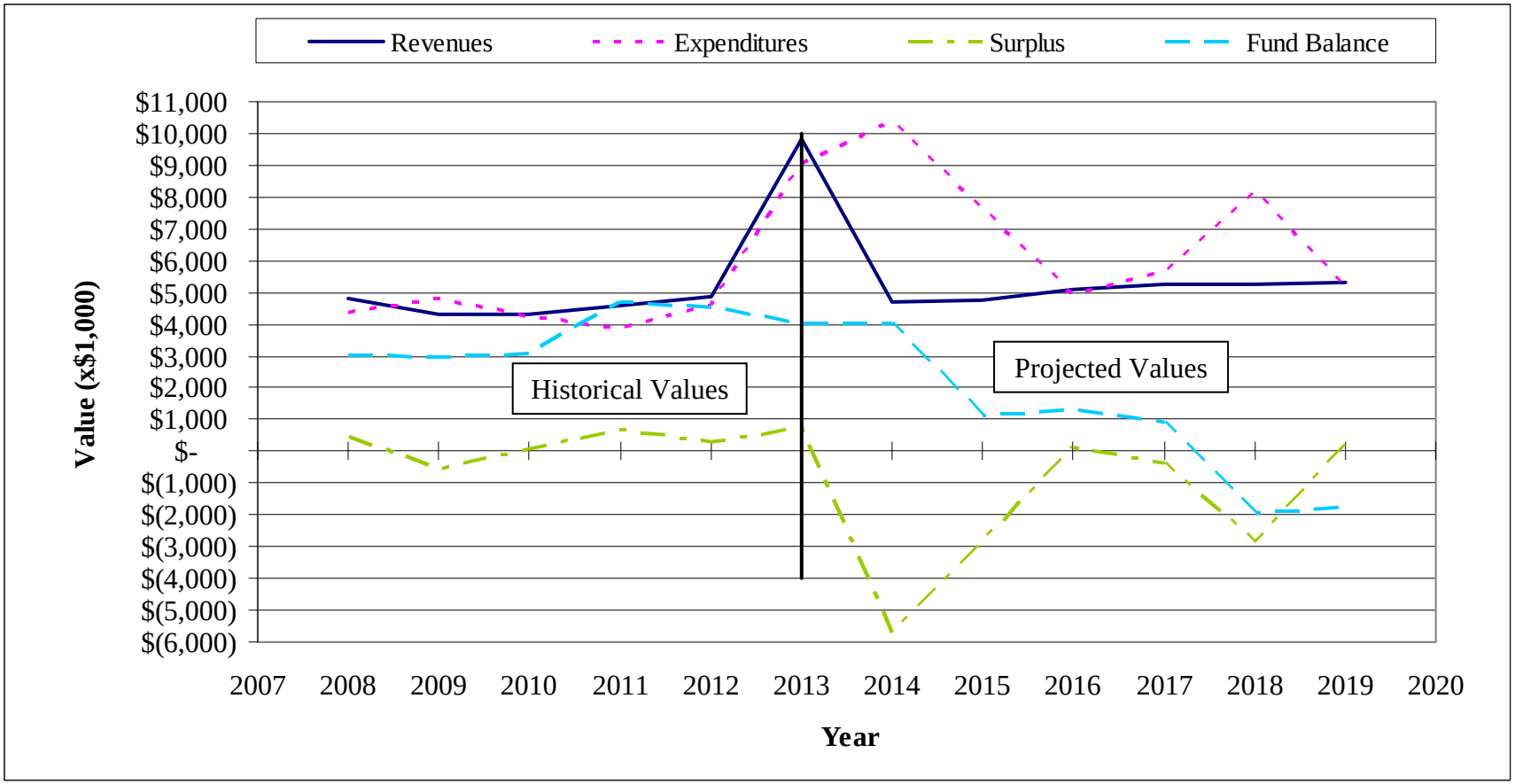
Projected Revenues and Expenditures for Water Fund 401

Parameter	2014[1]	2015	2016	2017	2018	2019
Revenues						
Start of Year Balance	$4,016,055	$-	$-	$-	$-	$-
Charges for Service - Residential	$4,200,000	$4,246,440	$4,577,960	$4,721,100	$4,762,330	$4,803,900
Charges for Service - NASWI	$378,000	$411,180	$412,300	$411,180	$411,180	$411,180
Connection, Admin., and Other Fees	$31,200	$32,140	$33,100	$34,090	$35,110	$36,160
Miscellaneous Revenues	$64,500	$66,440	$68,430	$70,480	$72,590	$74,770
Military Capital Contributions[2]	$-	$-	$-	$-	$-	$-
Revenue Bond Proceeds	$-	$-	$-	$-	$-	$-
Transfers	$-	$-	$-	$-	$-	$-
Insurance	$-	$-	$-	$-	$-	$-
NASWI Meter & Maintenance Revenues	$4,000	$4,120	$4,240	$4,370	$4,500	$4,640
Total Revenues	**$4,677,700**	**$4,760,320**	**$5,096,030**	**$5,241,220**	**$5,285,710**	**$5,330,650**
Expenditures						
Salaries, Wages, and Benefits	$519,214	$534,790	$550,830	$567,350	$584,370	$601,900
Operating Supplies and Equipment	$103,250	$106,350	$109,540	$112,830	$116,210	$119,700
Administrative Costs	$28,000	$28,840	$29,710	$30,600	$31,520	$32,470
Professional Services[3]	$869,000	$88,000	$10,000	$933,000	$197,000	$197,000
Equipment and Supplies for Resale	$1,376,265	$1,417,550	$1,460,080	$1,503,880	$1,549,000	$1,595,470
Insurance, Services, and Taxes	$568,041	$585,080	$602,630	$620,710	$639,330	$658,510
Interfund Expenditures	$637,859	$656,990	$676,700	$697,000	$717,910	$739,450
Operating Transfers	$224,000	$230,720	$237,640	$244,770	$252,110	$259,670
Public Works Trust Fund Expenditures	$54,567	$54,310	$54,053	$53,797	$53,540	$53,283
Capital Outlay[4]	$5,087,400	$1,918,000	$-	$-	$2,142,000	$-
System Improvements[5]	$590,000	$1,657,000	$854,000	$500,000	$1,490,000	$500,000
Miscellaneous	$332,800	$342,780	$353,060	$363,650	$374,560	$385,800
Total Expenditures	**$10,390,396**	**$7,620,410**	**$4,938,243**	**$5,627,587**	**$8,147,550**	**$5,143,253**
Surplus / (Deficit)	**($5,712,696)**	**($2,860,090)**	**$157,787**	**($386,367)**	**($2,861,840)**	**$187,397**
Year-End Fund Balance	**$4,016,055**	**$1,155,965**	**$1,313,752**	**$927,385**	**($1,934,455)**	**($1,747,058)**

(1) Values for 2014 are not finalized, but were approved by City Council in 2012.
(2) Level of NASWI contribution, if any has not been determined at this time. NASWI financial contributions to CIP projects will significantly affect overall annual surplus/deficit levels, as well as the year end fund balance.
(3) Professional services include anticipated design fees for individual CIP projects, as well as studies or investigations.
(4) Capital Outlay includes new large scale CIP projects required for system expansion.
(5) System Improvements includes continual maintenance and pipe replacement, and general pipe replacement or expansion projects.

FIGURE 9-1

Historical and Projected Revenues, Expenditures, and Surplus



CAPITAL IMPROVEMENT PROJECT FUNDING SOURCE ALTERNATIVES

In addition to the pay-as-you-go method of financing capital improvements, seeking grants and selling revenue bonds, the City may also consider low-interest loans from the Public Works Trust Fund (PWTF) or the Drinking Water State Revolving Fund (DWSRF). These funds are available for eligible municipalities with system improvement projects that meet their listed criteria. A variety of capital improvement funding sources are briefly discussed below.

Grants:	Island County Community Development Block Grant (CDBG) US Economic Development Administration (US EDA)
Loans:	Public Works Trust Fund (PWTF) Community Economic Revitalization Board (CERB) Drinking Water State Revolving Fund (DWSRF) USDA Rural Development (RD)
Bonds:	Revenue Bonds General Obligation Bonds
Other:	Utility Local Improvement Districts

GRANTS

Grant funding is a good source of capital funding because the money does not have to be repaid. Some of the grants that may be available to the City are Federal grants, the Clean Water State Revolving Fund (CWSRF), the Drinking Water State Revolving Fund (DWSRF), and Performance Partnership grants (PPG). The City should continue to pursue grants when appropriate, considering matching requirements, and availability.

Washington General Purpose Community Development Block Grant (CDBG)

The CDBG program is a competitive source of federal funding for a broad range of community development projects. A primary requirement of the CDBG program is that the project must principally benefit at least 51 percent of the low-to-moderate income residents of the project area. CDBG has two programs including General Purpose and Planning Only. The General Purpose program provides grant funds for the design, construction, or reconstruction of water and sewer (among others) systems up to the amount of $750,000. The Planning Only program includes projects such as comprehensive plans, community development plans, capital improvement plans, and other plans such as land use and urban environmental design, economic development, floodplain and wetlands management, transportation, and utilities. Planning Only grants are limited to $24,000 for a single applicant or $40,000 for a joint applicant.

Eligible applicants for the CDBG programs include cities and towns with less than 50,000 people or counties with populations less than 200,000.

US Economic Development Administration (US EDA)

US EDA offers competitive grants up to $1 million for projects within Region 10. Projects are selected locally by an economic development district and submitted to Congress for competitive selection among other regions in the US. Similar to CERB, applicants must have an industrial partner ready to proceed or a feasibility study to provide evidence that the proposed project establishes realistic job creation.

LOANS

Public Works Trust Fund (PWTF)

The PWTF is a revolving loan fund designed to help local governments finance public works projects through low-interest loans and technical assistance. The PWTF, established in 1985 by legislative action, offers loans substantially below market rates, payable over periods ranging up to 20 years. To be eligible for the PWTF programs, an applicant must be a local government such as a city, county, or utility district.

PWTF has four loan programs including Construction, Preconstruction, Planning, and Emergency. PWTF loan terms are summarized in Table 9-4.

TABLE 9-4

PWTF Loan Terms

Local Match	Interest Rate	Term	Loan Limit
Construction			
15%	0.5%	20	$10,000,000
10%	1.0%	20	
5%	2.0%	20	
Preconstruction(1)			
15%	0.5%	5	$1,000,000
10%	1.0%	5	
5%	2.0%	5	
Emergency(2)			
0%(3)	3.0%	20	$500,000 (4)
Energy and Water Efficiency(5)			
0%(3)	0.5%	< 5	$1,000,000
0%(3)	1.0%	5-10	$1,000,000
0%(3)	1.5%	11-20	$1,000,000

(1) Preconstruction loans can be refinanced to a 20-year term if the applicant obtains a subsequent PWTF construction loan.

(2) At the Board's discretion, the loan amount may be increased to a maximum of $1 million per biennium with an interest rate as low as 0.5 percent interest for those jurisdictions located in distressed counties with projects stemming from a Governor, Federal, or other locally declared natural disaster.

(3) While a match is not required, it is recommended.

(4) Per jurisdiction, per biennium.

(5) Funding requests for projects costing $250,000 or more must be accompanied by a completed audit (per the Department of Enterprise Services' Energy Savings Performance Contracting Guidelines) that is no more than three years old and contains revised costs for capital upgrades if applicable.* Funding requests for projects costing less than $250,000 must be accompanied by a document signed by a system appropriate licensed engineer attesting to the anticipated energy savings. The document must be less than three years of age and contain revised costs for capital upgrades if applicable. The cost of an investment grade audit may be a retroactively reimbursable expense.

The Construction Program accepts applications once per year in the spring, and the money becomes available approximately one year later. The Preconstruction and Planning programs are open on a year-round basis and must be submitted to the Public Works Board prior the 15th of the month to be reviewed at the next Board meeting. These funds become available shortly after the Public Works Board makes their final decision as to the award. Emergency projects must have a locally declared emergency and are applied for on an open cycle depending on the availability of funds. Project expenditures are reimbursable from the date of the declared emergency.

An applicant must have a long-term plan for financing its public works needs. If the applicant is a county or city, it must adopt the 1/4 percent real estate excise tax that is dedicated to public works construction projects. Eligible public works projects include streets and roads, bridges, storm sewers, sanitary sewer collection and treatment systems, and domestic water. Loans are presently offered only for purposes of repair, replacement, rehabilitation, reconstruction, or improvement of existing eligible public works systems. Eligible project costs can include expenses related to serving 20-year forecasted growth as identified in a growth management comprehensive plan.

Since substantially more trust fund dollars are requested than are available, local jurisdictions must compete for the available funds. The applications are carefully evaluated, and the Public Works Boards submits a prioritized list of those projects to the Legislature that are recommended to receive low-interest financing. The Legislature reviews the list and indicates its approval through the passage of an appropriation from the Public Works Assistance Account to cover the cost of the proposed loans. Once the Governor has signed the appropriation bill into law (an action that usually occurs by the following April), those local governments recommended to receive loans are offered a formal loan agreement with appropriate interest rates and terms as determined by the Public Works Board.

The 2014 allocation for the PWTF has been re-directed into the Washington State General Fund and no funds are currently available. The next tentative construction application cycle is scheduled to begin in spring 2014 with funds to be awarded in 2015. This schedule is subject to approval by the State Legislature. Upon reinstatement, it is possible that the State Legislature will revamp the program in order to bring interest rates closer to current market values and more clearly defined the fund to benefit community based infrastructure projects.

Community Economic Revitalization Board (CERB)

The Community Economic Revitalization Board's prime mission is to partner with business and industry and local governments to maintain and create jobs. Established by the Legislature in 1982, CERB provides low-interest loans or, in unique circumstances, grants to help finance local public infrastructure necessary to develop or retain stable business and industrial activities. Projects eligible for funding include roads, domestic and industrial waters systems, sanitary and storm sewers, port facilities, and general-purpose industrial buildings.

Typically, CERB provides loans in the amount of $1 million and, where applicable, grants in the amount of $300,000. The interest rate is tied to the current cost of a 10-year bond and a local match of 10 percent is required.

Eligible applicants include Washington State subdivisions in partnership with private enterprise. If there is no economic partner, a local government can produce a feasibility study that documents realistic job retention or creation. Applications must be submitted

45 days prior to a regularly scheduled CERB Meeting, which typically occur in January, March, July, and November

Drinking Water State Revolving Fund (DWSRF)

In 1996, Congress established the DWSRF through the reauthorization of the federal Safe Drinking Water Act. The program is managed by both DOH and the Washington State Public Works Board. The purpose of the program is to provide low-interest loans to assist publicly- and privately-owed water systems improve drinking water and protect public health.

Eligible publicly owned water systems include city and county governments, public utility districts, and special purpose districts. Privately owned systems are eligible as long as they are Group A systems.

Eligible projects include the following:

- Water systems that exceed health standards;
- Replacement of aging infrastructure;
- Acquisition of real property;
- Planning and design costs;
- Water conservation projects;
- Reservoirs (clear wells) that are part of a treatment process;
- Distribution reservoirs (finished water);
- Existing systems who chose to connect to a municipal system;
- Upgrade to or creation of a Group A system.

Maximum award per single water system is $12,000,000 and for combining systems an award of $24,000,000 is available. These loans are often allowed a high level of forgiveness if the system is consolidated due to water quality issues. A summary of interest rates and loan terms is summarized in Table 9-5.

TABLE 9-5

DWSRF Loan Terms

Applicant's Income Level	Interest Rate(1)	Principal Forgiveness	Loan Fee	Repayment period(2)
Water system is not economically disadvantaged.	1.5%	-	1.0%	20 years
Water system with an affordability index between 1.5 percent and 2.0 percent.	1.0%	-	1.0%	20 years
Water system with an affordability index between 2.01 percent and 3.5 percent.	1.0%	30.0%	-	20 years
Water system with an affordability index greater than 3.5 percent.	1.0%	50.0%	-	20 years
Eligible restructuring/consolidation projects proposed for municipal Group A water systems. Projects must result in a change in ownership prior to signing the funding contract.	1.0%	50.0%	-	20 years

(1) Interest rates are fixed.
(2) Payment period shall be 20 years or the life of the project, whichever is shorter.

BONDS

The City has the authority to sell several types of bonds that would be appropriate for capital projects: revenue, general obligation, limited general obligation and local improvement district bonds. In general, bonds are a more costly form of funding capital projects than grants and low-interest loans from the State, but the timing is controlled by the City. No federal environmental documentation associated with the national Environmental Policy Act, Endangered Species Act, or National Historic Presentation Act is required.

Revenue Bonds

The most common source of funds for construction of major utility improvements is the sale of revenue bonds. These are tax-free bonds issued by a city. The major source of funds for debt service on revenue bonds is from monthly sewer service charges. In order to qualify to sell revenue bonds marketable to investors, the bonds typically contain contractual provisions for the city to meet debt coverage requirements. The City must show that its annual net operating income (gross income less operation and maintenance expenses) is equal to or greater than a factor, typically 1.2 to 1.4 times the annual debt service on all debt. If a coverage factor has not been specified it will be determined at the time of any future bond issues.

General Obligation Bonds

A city may by council action or special election issue general obligation bonds to finance almost any projects of general benefit to the city. The bonds are repaid by tax

assessments levied against all privately owned properties within the city. This includes vacant property that would not otherwise contribute to the cost of the specific improvements. This type of bond issue is usually reserved for municipal improvements that are of general benefit to the public, such as arterial streets, bridges, lighting, municipal buildings, firefighting equipment, parks, and water and wastewater facilities. General obligation bonds are the most attractive bonds to investors because they are backed by the municipality's full taxing authority and carry the lowest rate of interest of any type of bond that a city may issue.

Disadvantages of general obligation bonds include the following:

- Voter approval is often required. The city will incur the legal costs of drafting a ballot measure and pay for the cost of holding a special election. There is also the additional cost of investing staff time in public education of the need for the project, yet there is always uncertainty to the outcome of elections.

- There are legal, as well as practical limits on the amount of general obligation debt a city can issue. Financing capital improvements through general obligation debt reduces the ability of the city to issue additional general obligation debt, which is often the only source of outside financing for many general government facilities.

OTHER FUNDING OPPORTUNITIES

UTILITY LOCAL IMPROVEMENT DISTRICTS (ULIDS)

Another potential source of funds for improvements can be obtained through the formation of ULIDs involving a special assessment made against properties benefiting by the improvements. ULID bonds are further backed by a legal claim to the revenues generated by the utility, similar to revenue bonds.

Typically, ULIDs are formed by the city at the written request (by petition) of the property owners within a specific section of the city's service area. Upon receipt of a sufficient number of signatures or petitions, and acceptance by the city council, the local improvement area is formed. Each separate property in the ULID is assessed in accordance with the special benefits the property receives from the water system improvements. A citywide ULID could form part of a financing package for large-scale capital projects that benefit all residents in the service area. The assessment places a lien on the property that must be paid in full upon sale of the property. ULID participants have the option of paying their assessment immediately upon receipt, thereby reducing the portion of the costs financed by the ULID bonds.

The advantages of ULID financing, as opposed to rate financing, to the property owner include:

- The ability to avoid interest costs by early payment of assessments.
- If the ULID assessment is paid in installments, it may be eligible to be deducted from federal income taxes.
- Low-income senior citizens may be able to defer assessment payments until the property is sold.
- Some Community Block Grant funds are available to property owners with incomes near or below poverty level. Funds are available only to reduce assessments.

The major disadvantage to the ULID process is that it may be politically difficult to approve formation. The ULID process may be stopped if 40 percent of the property owners protest its formation. Also, there are significant legal and administrative costs associated with the ULID process, which increases total project costs by approximately 30 percent over other financing options.