CITY OF OAK HARBOR

ISLAND COUNTY, WASHINGTON

WATER SYSTEM PLAN

G&O #13404
SEPTEMBER 2014

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF OAK HARBOR

ISLAND COUNTY **WASHINGTON**

2013 WATER SYSTEM PLAN UPDATE

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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)	Peak Hour (gpm)
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

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	T-1A	Cross City Transmission Main	$1,559,000	$1,559,000
	BS-2	Ault Field Booster Station Pump Replacement	$86,000	$86,000
	DS-9	Steel/AC Pipe Replacement	$1,000,000	$1,000,000
	PZ-1	O'Leary Way Water Main	$599,000	$599,000
	PZ-2	North O'Leary Way Water Main	$511,000	$511,000
2014 Subtotal			**$3,755,000**	**$3,755,000**
2015	S-1	Well No. 9 Replacement	$236,000	$243,000
	BS-1	Ault Field Booster Station Surge Protection Analysis	$208,000	$214,000
2015 Subtotal			**$444,000**	**$457,000**
2016	S-4	Emergency Supply Well	$301,000	$319,000
	DS-9	Steel/AC Pipe Replacement	$1,000,000	$1,000,000
	PZ-4	West 384 Zone Development	$326,000	$346,000

TABLE E-2 – (continued)

Capital Improvement Project Summary

Construction Year	Project Number	Project Name	Estimated Cost (2013$)	Estimated Construction Cost
2016 Subtotal			**$1,627,000**	**$1,665,000**
2017	S-3	Eastside Reservoir Demolition	$100,000	$109,000
	DS-1	NE Regatta Drive Pipeline	$116,000	$127,000
2017 Subtotal			**$216,000**	**$236,000**
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
2018 Subtotal			**$3,614,000**	**$4,067,000**
2019	T-1B	PRV Stations	$2,000,000	$2,319,000
	T-2	North-End Trunk Main: Phase I & II	$1,767,000	$2,048,000
	DS-9	Steel/AC Pipe Replacement	$1,000,000	$1,000,000
2019 Subtotal			**$4,767,000**	**$5,367,000**
>2019	T-5	Westside Water Main Extension	$7,609,000	$9,086,000
	T-6	Campbell Lake Main Replacement	$1,970,000	$2,352,000
	BS-3	North Booster Pump Station	$2,398,000	$2,863,000
	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-3	East 384 Zone Development	$90,000	$107,000
	PZ-5	322 Zone Development	$485,000	$579,000
>2019 Subtotal			**$14,302,000**	**$17,076,000**
6-Year Planning Period Total			**$14,423,000**	**$15,547,000**
6-Year Planning Period Total (City Funded)			**$9,745,000**	**$10,214,000**
20-Year Planning Period Total			**$28,725,000**	**$32,623,000**
20-Year Planning Period Total (City Funded)			**$22,884,000**	**$25,901,000**

FINANCIAL PROGRAM

The Plan contains information on the water utility's financial program, which suggest that the City is able to maintain sufficient cash flow to fund all of the projected and recommended CIP projects while maintaining adequate surplus funds. 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	$100,841	$4,000	$30,000	$47,000	$125,000	$43,000	$384,000	$349,000
Capital Outlay	$1,701,063	$1,174,744	$1,500,000	$-	$-	$-	$-	$-
System Improvements	$6,450	$5,375,000	$30,000	$968,000	$1,189,000	$502,000	$173,000	$1,749,000
Total Expenditures	**$3,860,933**	**$9,072,661**	**$5,100,856**	**$4,660,180**	**$5,066,643**	**$4,408,337**	**$4,534,370**	**$6,192,833**
Annual Surplus/(Deficit)	**$703,874**	**$760,039**	**($423,156)**	**$125,180**	**($53,063)**	**$807,143**	**$896,920**	**($545,283)**
End of Year Balance	**$4,693,094**	**$4,016,055**	**$4,016,055**	**$4,141,235**	**$4,088,172**	**$4,895,315**	**$5,792,235**	**$5,246,952**

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.

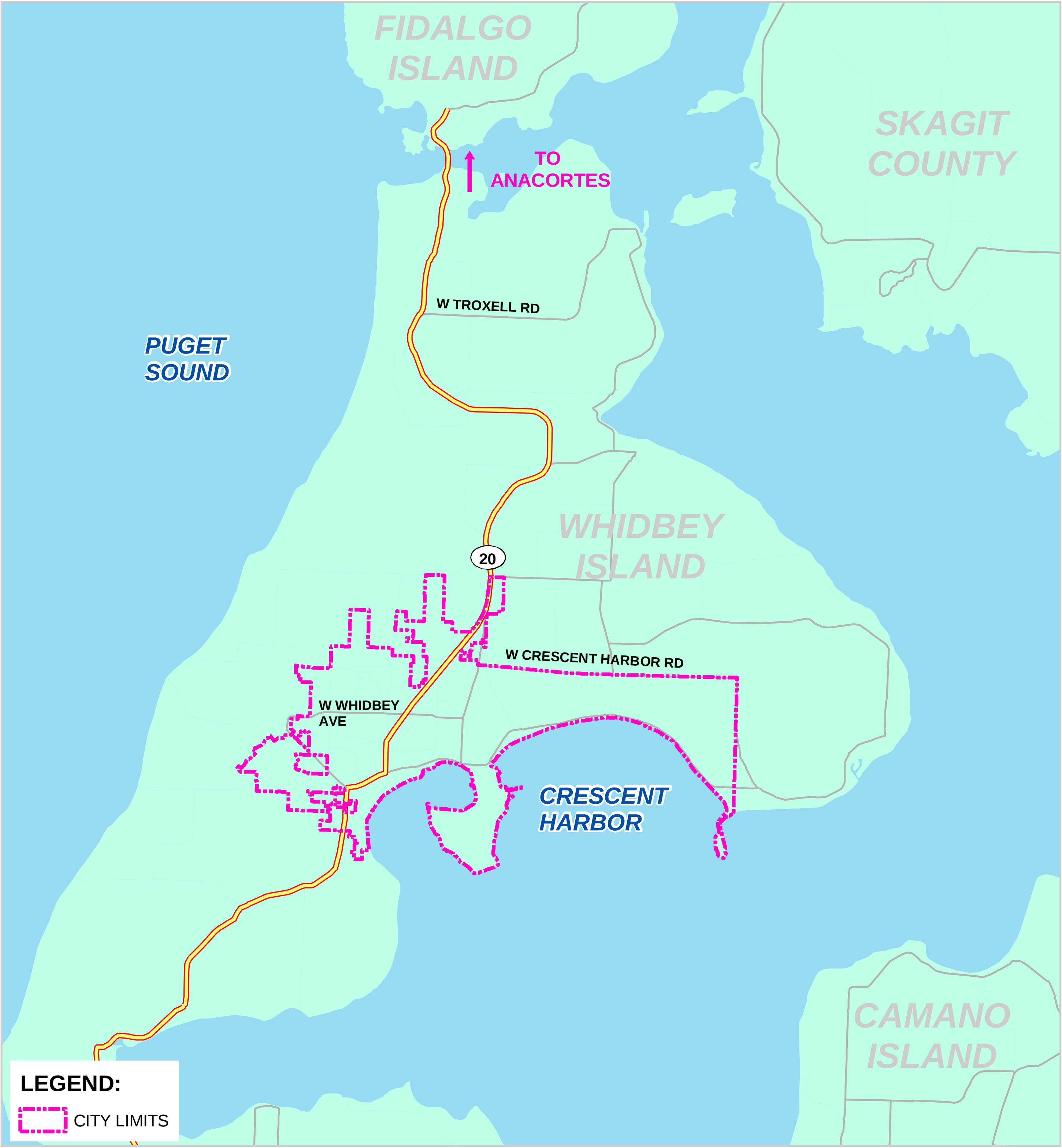
In 1942, the U.S. Navy constructed a 10-inch transmission main from the City of Anacortes (Anacortes) pipeline at Sharpe's Corner, which travels underneath the Deception Pass Bridge to the Ault Field facility to serve the then-growing needs of NASWI.

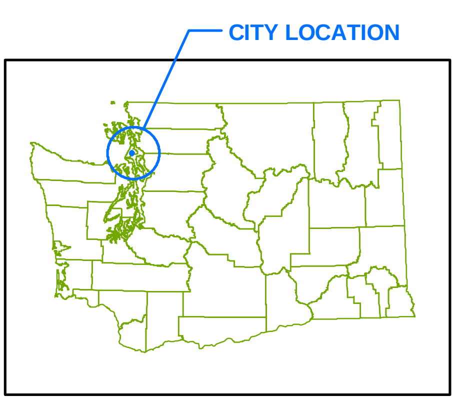
In 1949, Well 4 was drilled and the Eastside Reservoir, with a capacity of 270,000 gallons, was constructed. In 1959, the capacity of this reservoir was increased to 540,000 gallons. During the 1950s, Well 5 was acquired from the Navy, and Wells 6 and 7 were drilled to further increase the City's water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





N

0 10,000 Feet

CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-1
LOCATION MAP

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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, 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.

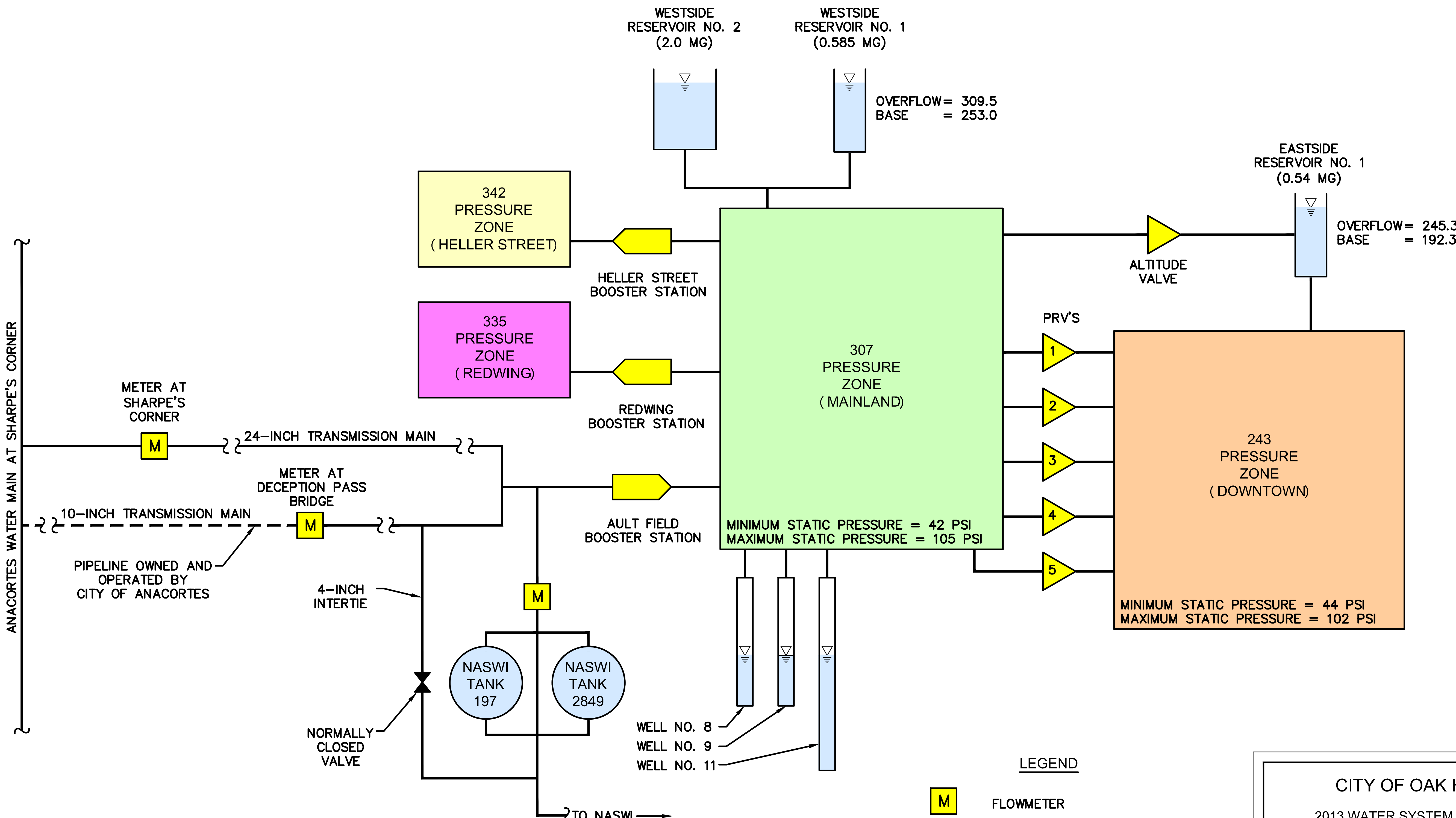
Retail Service Area

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 and is shown on Figure 1-4. The Seaplane Base, although within the City limits as well as the UGA, will remain a wholesale water customer through the City's wholesale water service agreement with NASWI. For the purposes of this plan, the future retail service area will be equal to 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



NOTES:

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

LEGEND

M	FLOWMETER
	BOOSTER STATION
1	PRESSURE REDUCING VALVE

CITY OF OAK HARBOR

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

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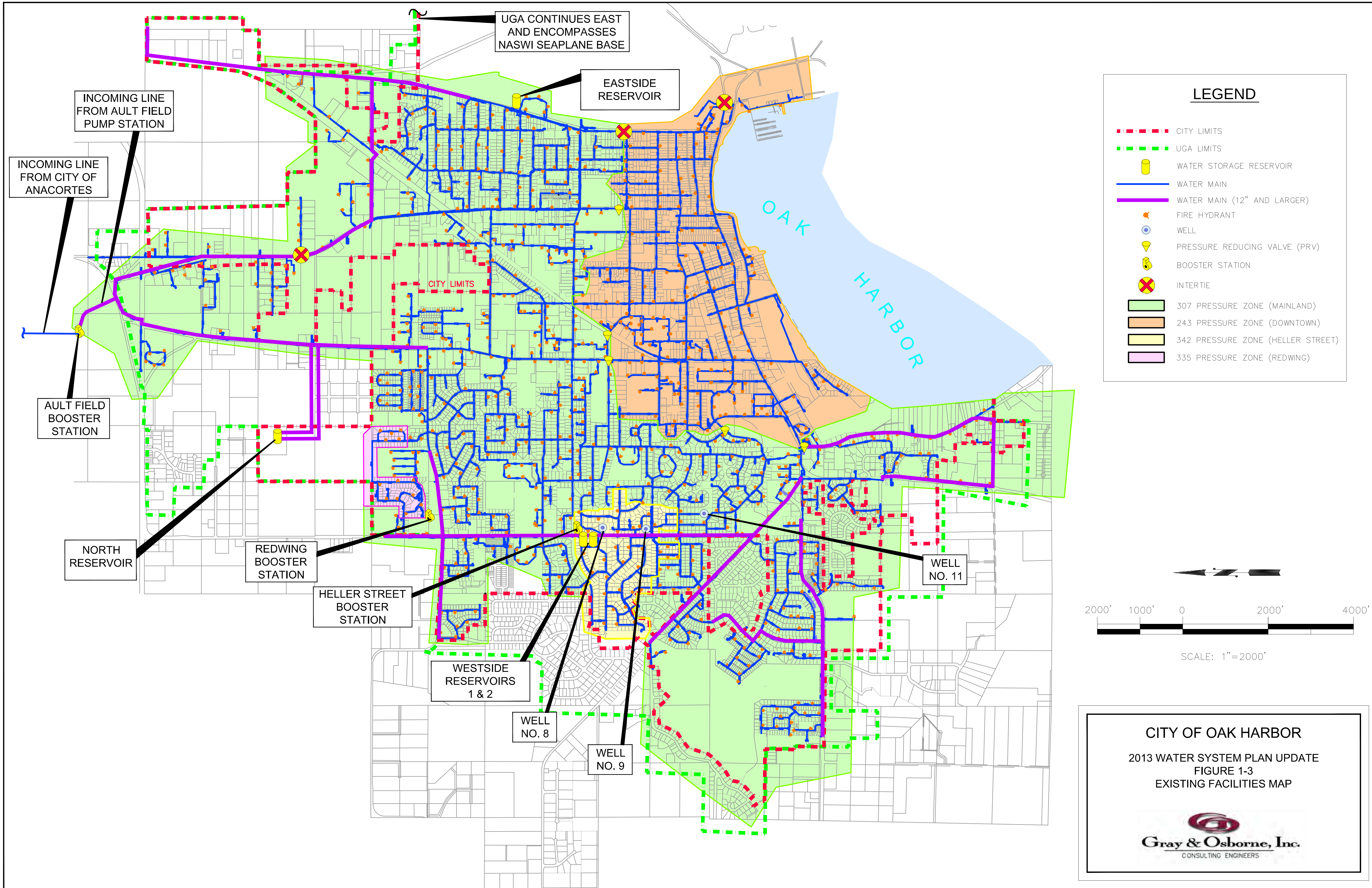
UGA CONTINUES EAST AND ENCOMPASSES NASWI SEAPLANE BASE
EASTSIDE RESERVOIR
INCOMING LINE FROM AULT FIELD PUMP STATION
INCOMING LINE FROM CITY OF ANACORTES
AULT FIELD BOOSTER STATION
NORTH RESERVOIR
REDWING BOOSTER STATION
HELLER STREET BOOSTER STATION
WESTSIDE RESERVOIRS 1 & 2
WELL NO. 8
WELL NO. 9
WELL NO. 11
CITY LIMITS
OAK HARBOR
LEGEND
CITY LIMITS
UGA LIMITS
WATER STORAGE RESERVOIR
WATER MAIN
WATER MAIN (12" AND LARGER)
FIRE HYDRANT
WELL
PRESSURE REDUCING VALVE (PRV)
BOOSTER STATION
INTERTIE
307 PRESSURE ZONE (MAINLAND)
243 PRESSURE ZONE (DOWNTOWN)
342 PRESSURE ZONE (HELLER STREET)
335 PRESSURE ZONE (REDWING)
2000' 1000' 0 2000' 4000'
SCALE: 1"=2000'
CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-3
EXISTING FACILITIES MAP
Gray & Osborne, Inc.
CONSULTING ENGINEERS
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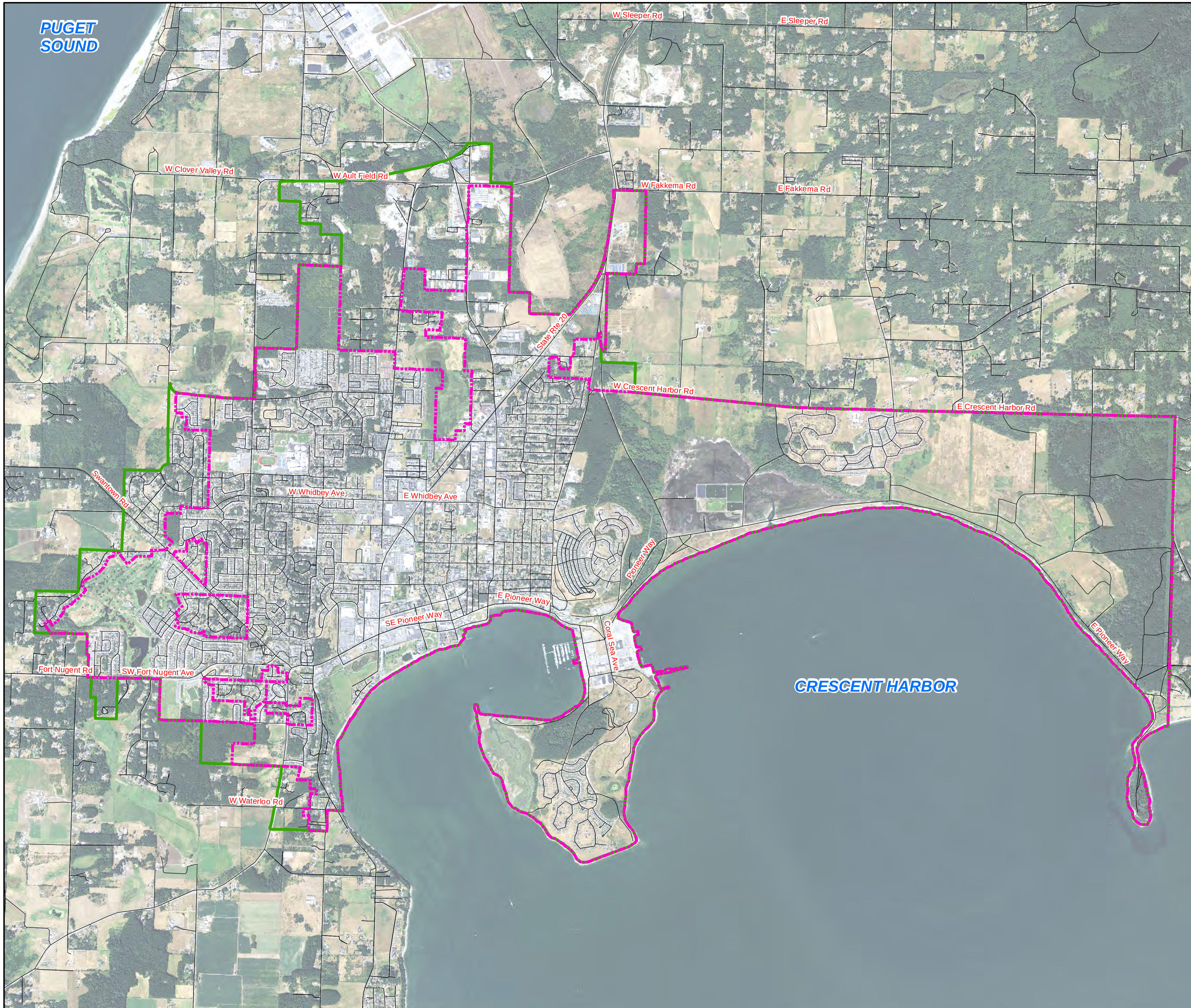

LEGEND:

- CITY LIMITS
- URBAN GROWTH AREA (UGA)
- 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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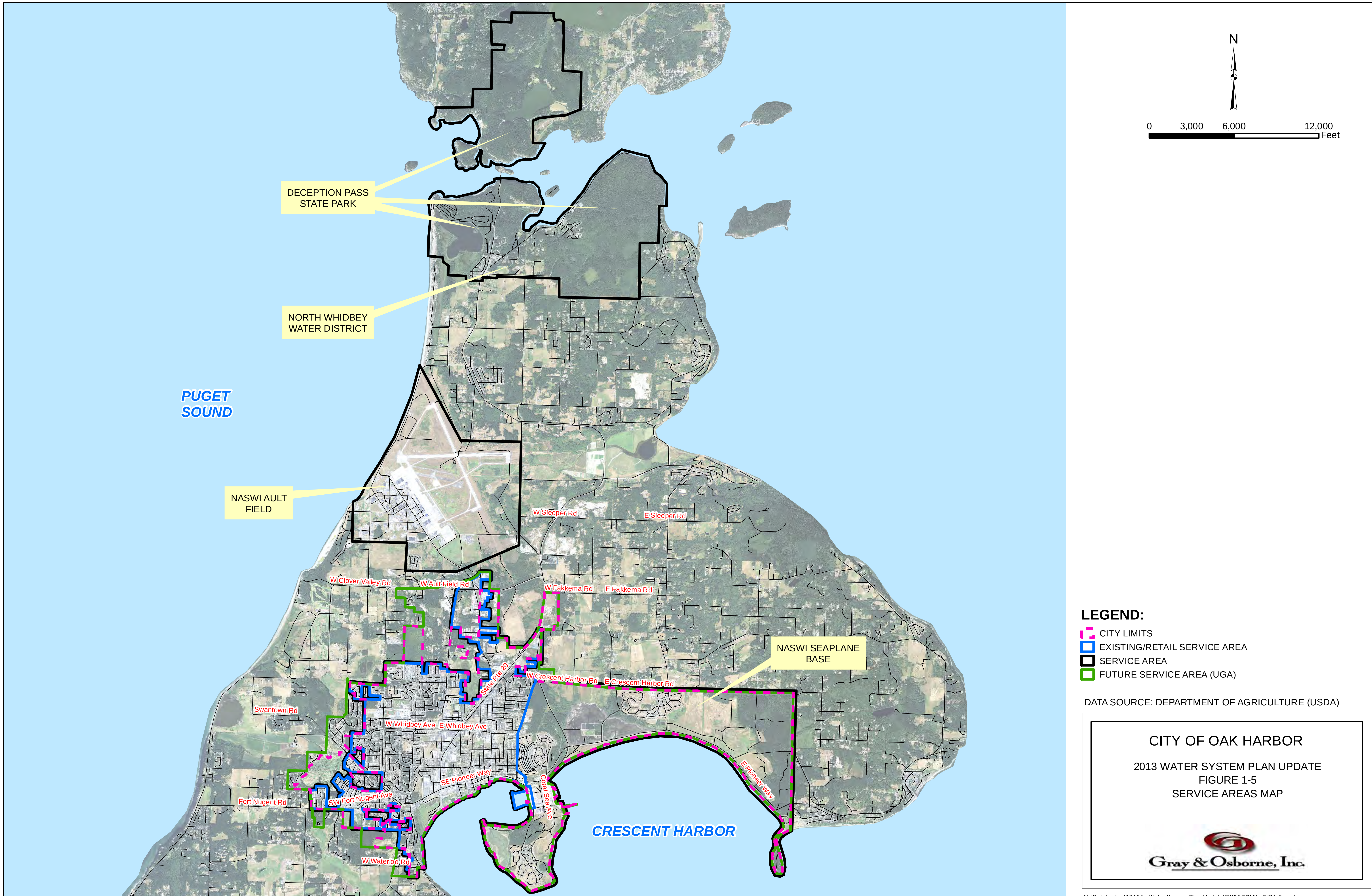

DATA SOURCE: DEPARTMENT OF AGRICULTURE (USDA)

CITY OF OAK HARBOR

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

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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 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 contract is currently being negotiated, and terms will remain similar to the existing contract. No deadline has been set for enactment of a new water services contract. 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

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.

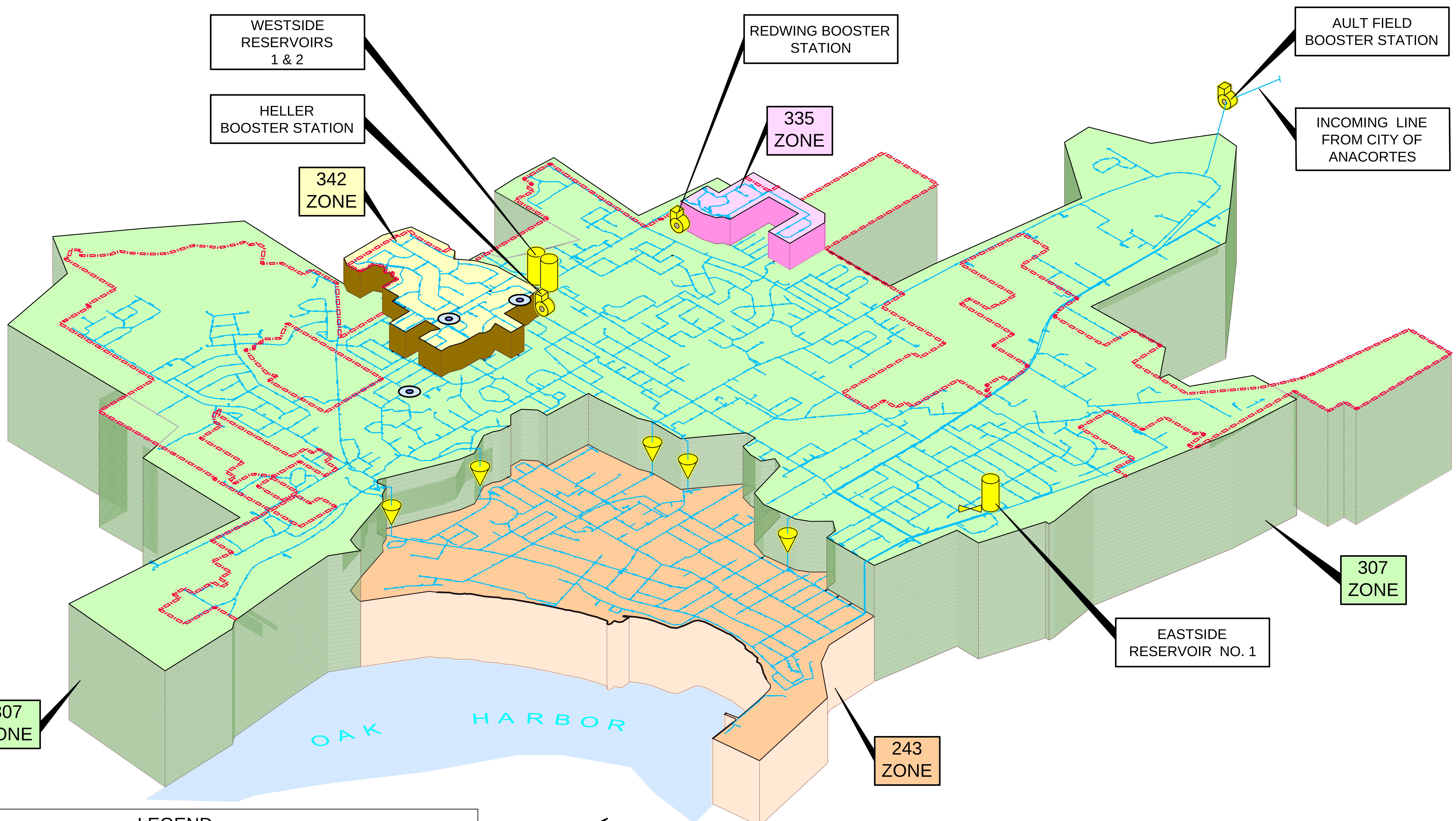
New zones will include a 384 Zone and a 328 Zone. The 384 Zone will be divided into East and West components. The City is currently constructing a transmission main to create the East 384 Zone and has plans to construct a transmission main to create the West 384 Zone within the 6-year planning period.

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.



LEGEND

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

CITY OF OAK HARBOR

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

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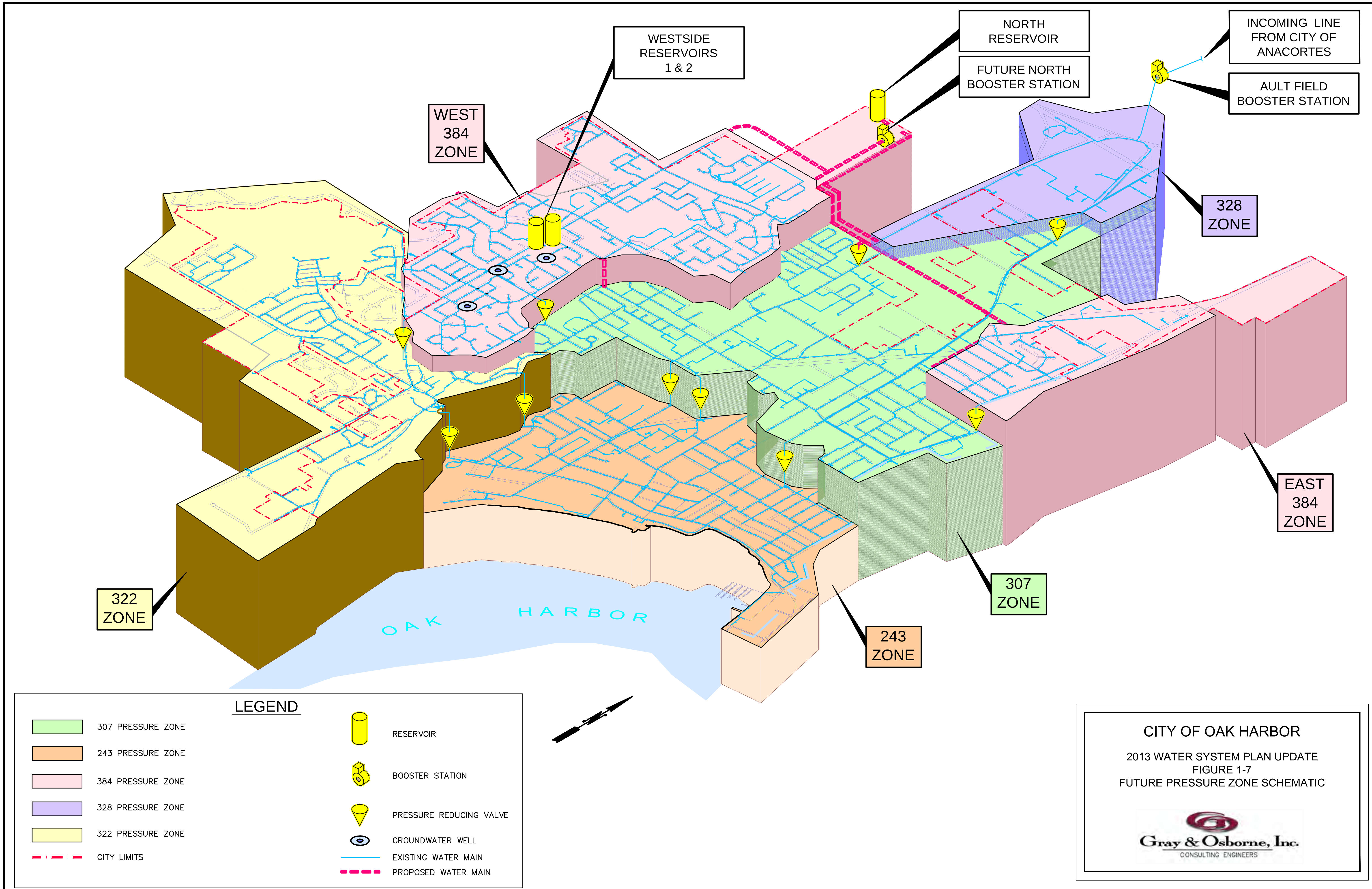

WESTSIDE RESERVOIRS 1 & 2
NORTH RESERVOIR
FUTURE NORTH BOOSTER STATION
INCOMING LINE FROM CITY OF ANACORTES
AULT FIELD BOOSTER STATION
WEST 384 ZONE
328 ZONE
EAST 384 ZONE
307 ZONE
243 ZONE
322 ZONE
OAK HARBOR
LEGEND
307 PRESSURE ZONE
243 PRESSURE ZONE
384 PRESSURE ZONE
328 PRESSURE ZONE
322 PRESSURE 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
Gray & Osborne, Inc.
CONSULTING ENGINEERS

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.

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

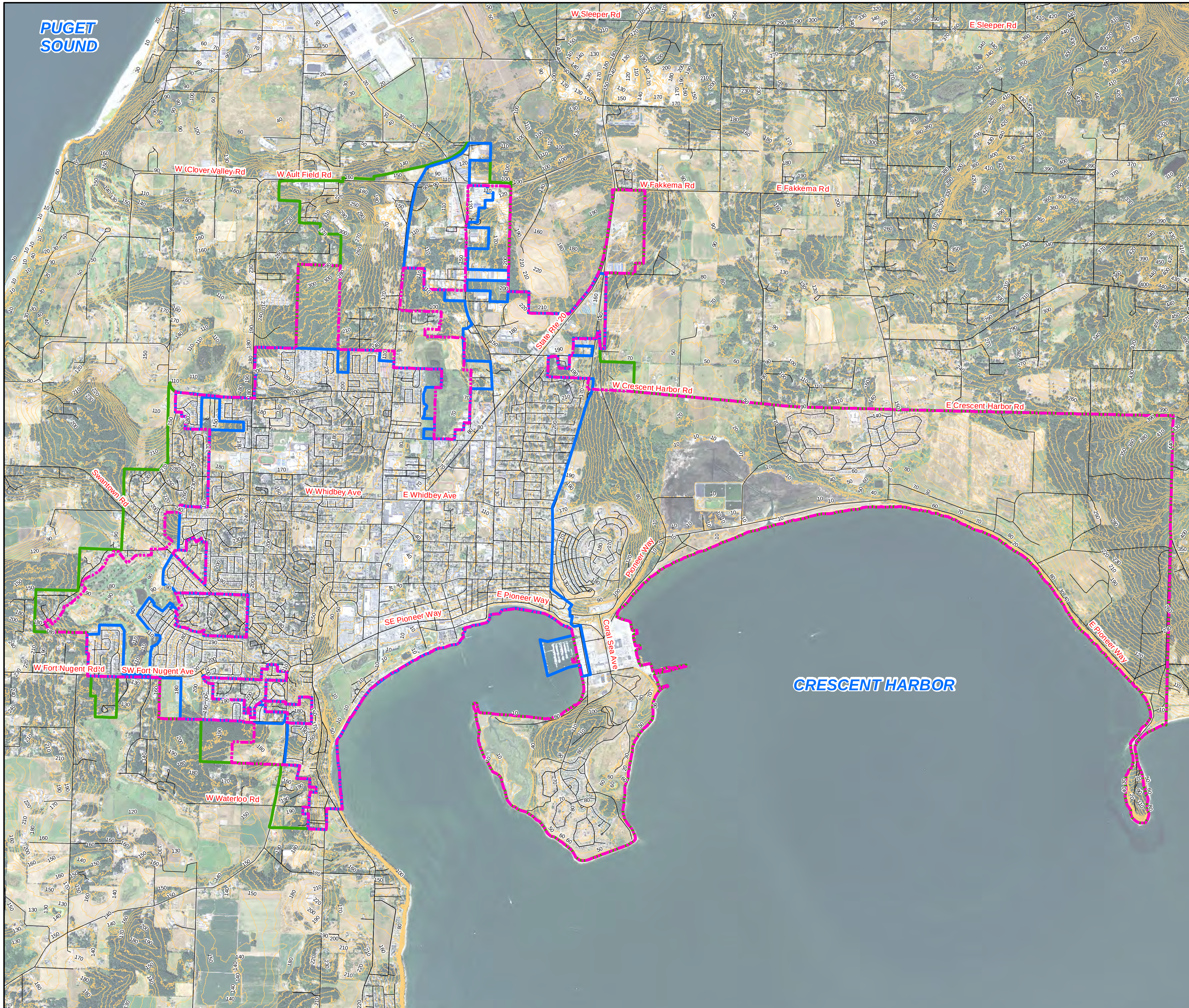
The following section outlines general information regarding the City's water system and characteristics that can impact water use or water system facilities.

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.



CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 1-8
TOPOGRAPHY MAP

Gray & Osborne, Inc.

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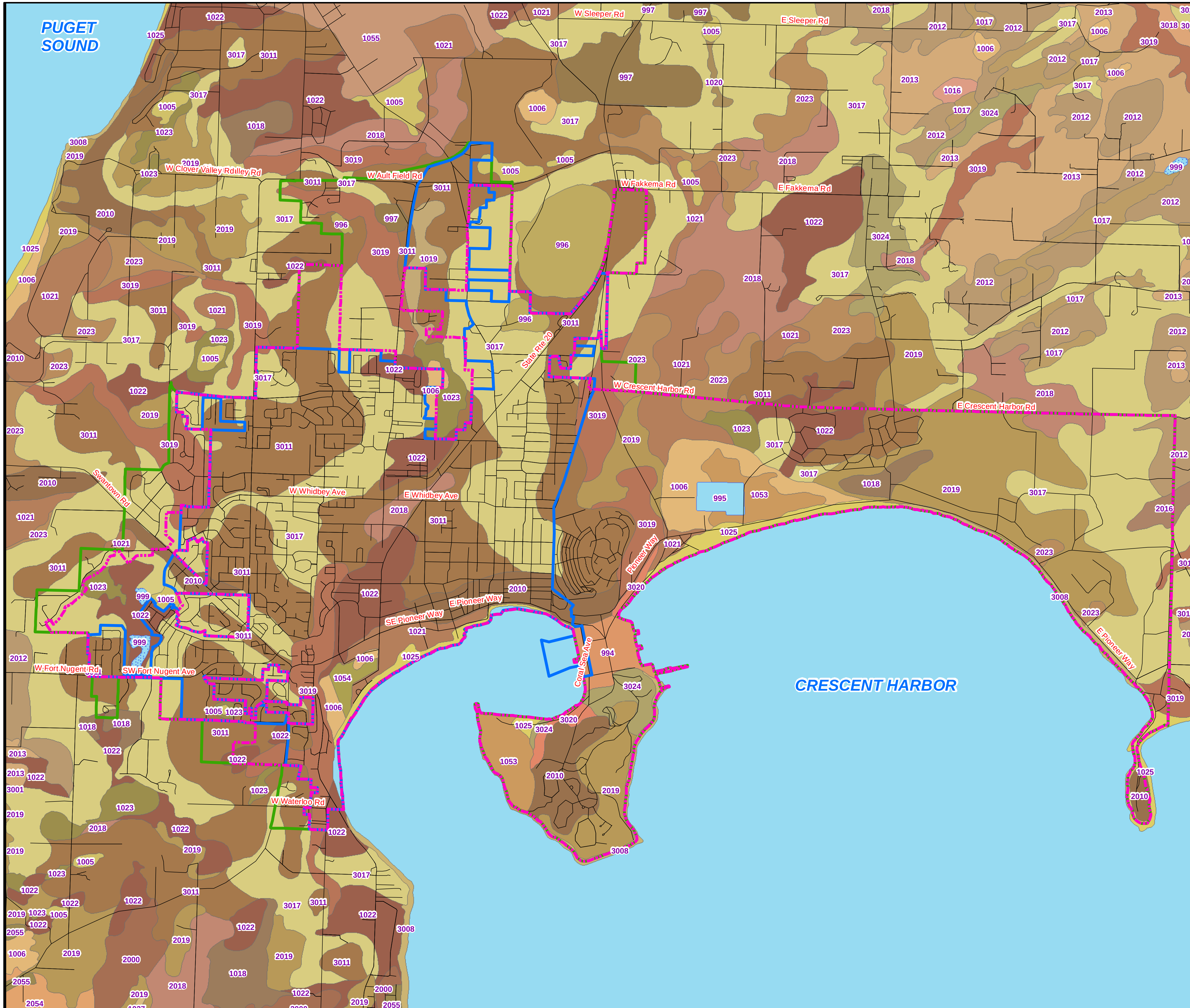

LEGEND:

- CITY LIMITS
- EXISTING/RETAIL SERVICE AREA
- FUTURE SERVICE 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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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.

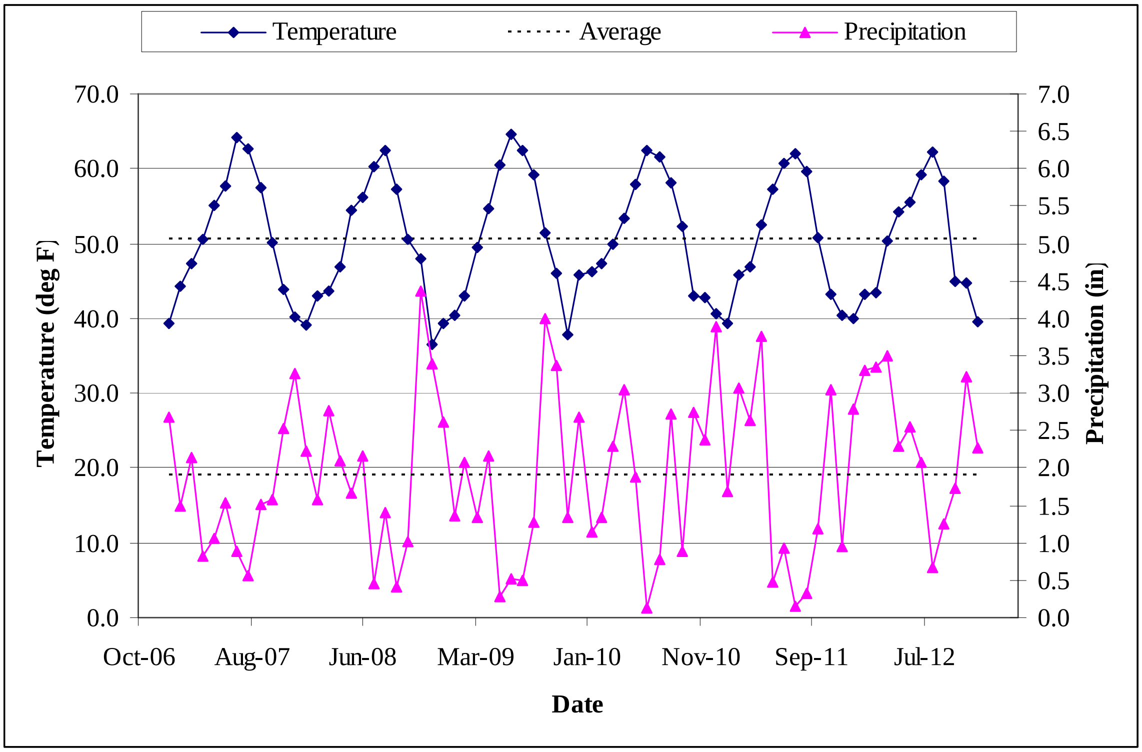


FIGURE 1-9

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.

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

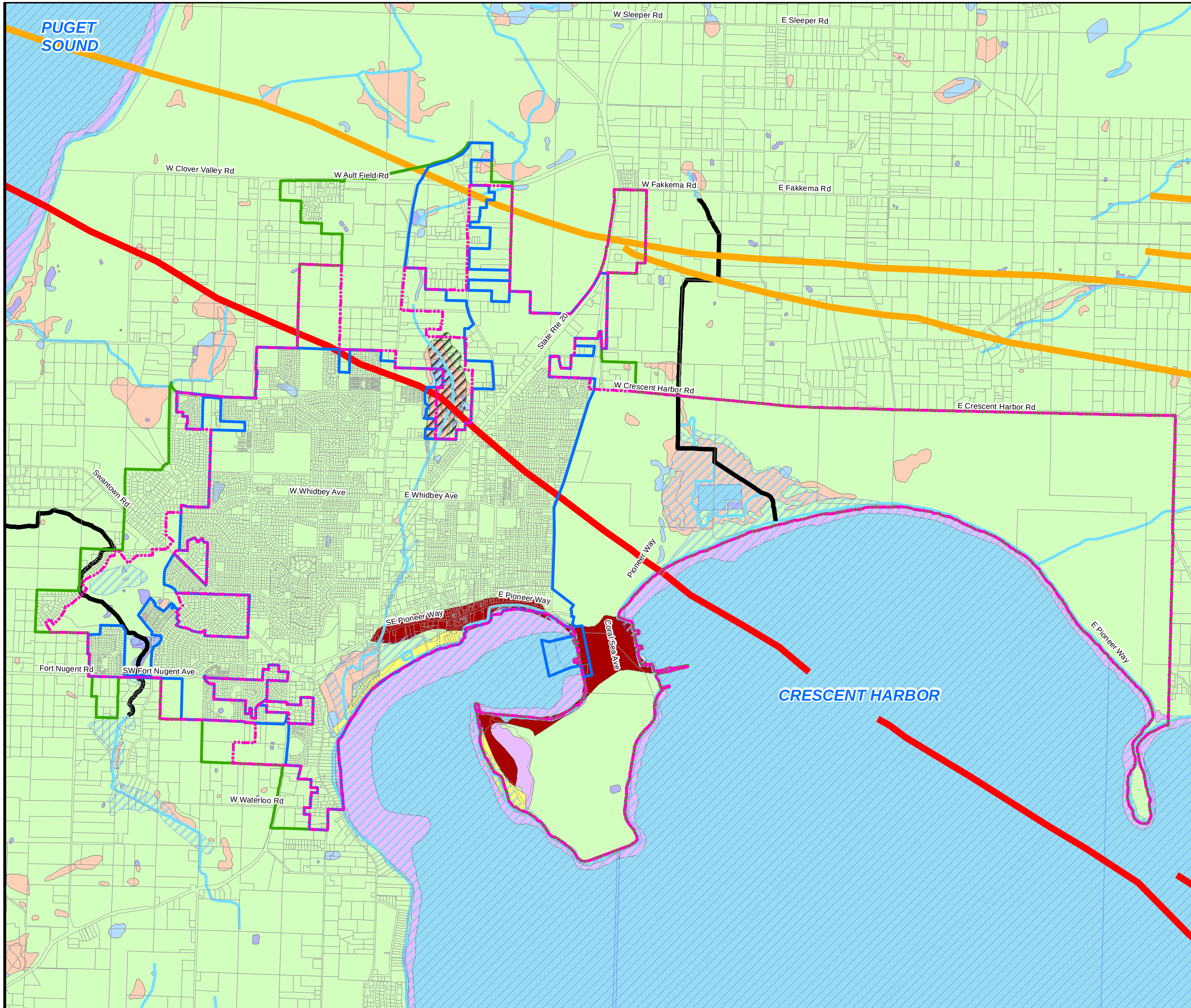
Erosion hazard areas are areas which are highly susceptible to erosion when disturbed. As such, these are also areas that may not be suited for development or the installation of infrastructure components such as booster stations or water piping. Erosion hazard areas are combined with other similar sensitive 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.



N

0 1,500 3,000 6,000 Feet

LEGEND:

CITY LIMITS
EXISTING/RETAIL SERVICE AREA
FUTURE SERVICE 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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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 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.

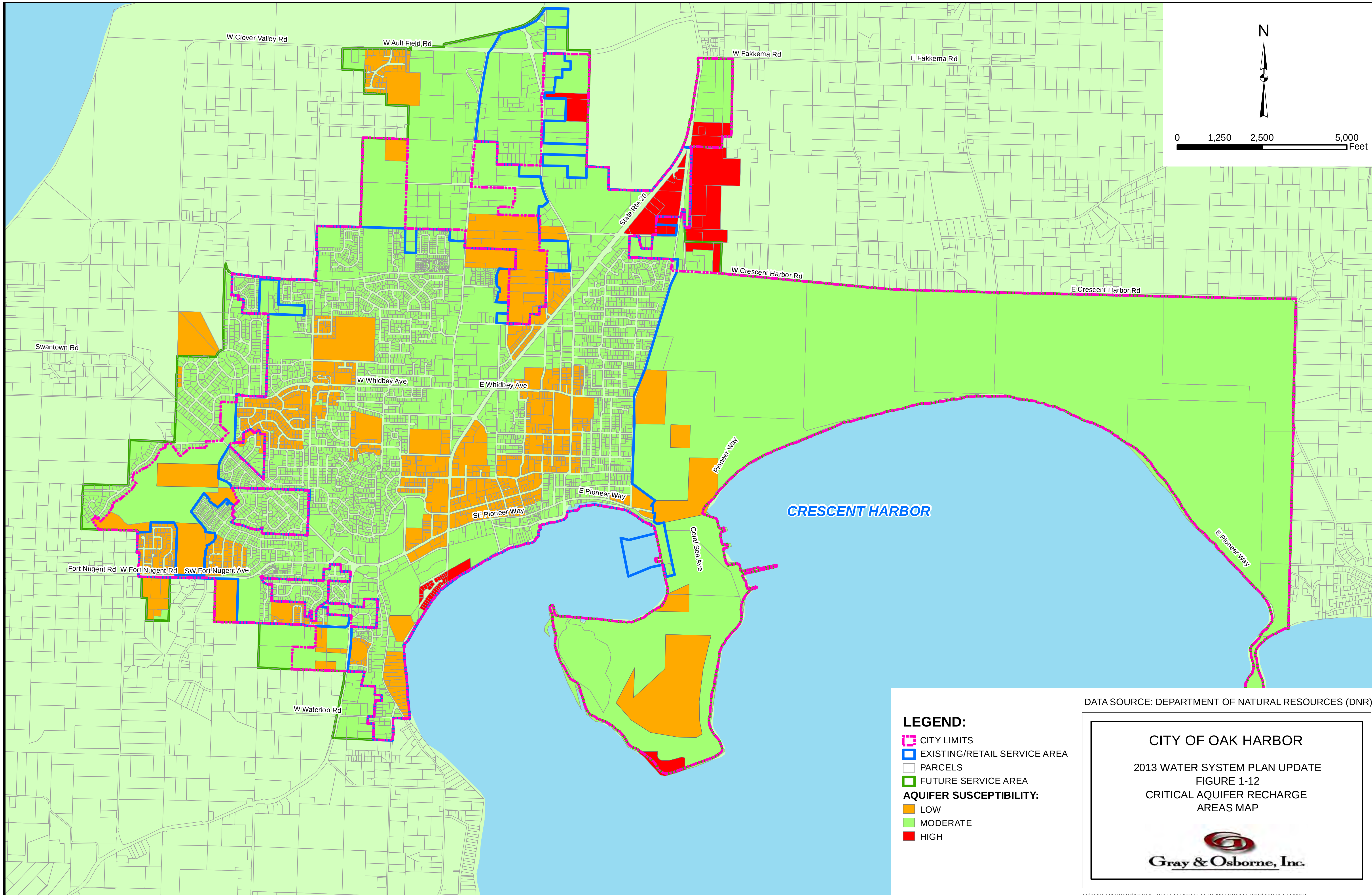
Critical Aquifer Recharge Areas

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.



N
0 1,250 2,500 5,000
Feet
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
Swantown Rd
W Whidbey Ave
E Whidbey Ave
E Pioneer Way
SE Pioneer Way
Pioneer Way
CRESCENT HARBOR
E Pioneer Way
Coral Sea Ave
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
FUTURE SERVICE 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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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).

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

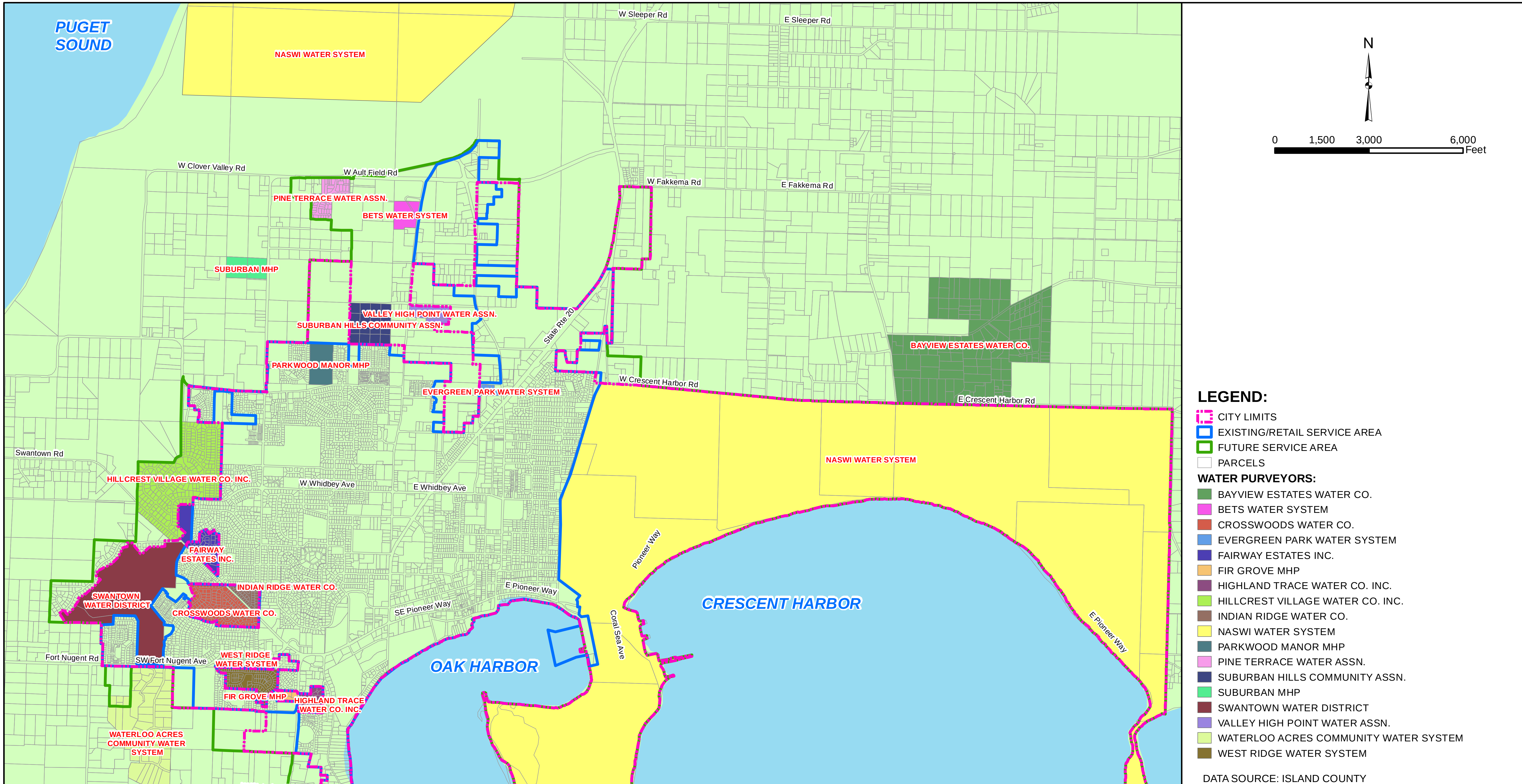
The City is in close proximity to a number of small and medium Group A water systems that serve communities around the City. These water systems are briefly described below, are summarized in Table 1-7, and their approximate locations are shown on Figure 1-13. In general, the systems listed below are 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



CITY OF OAK HARBOR

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

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

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**

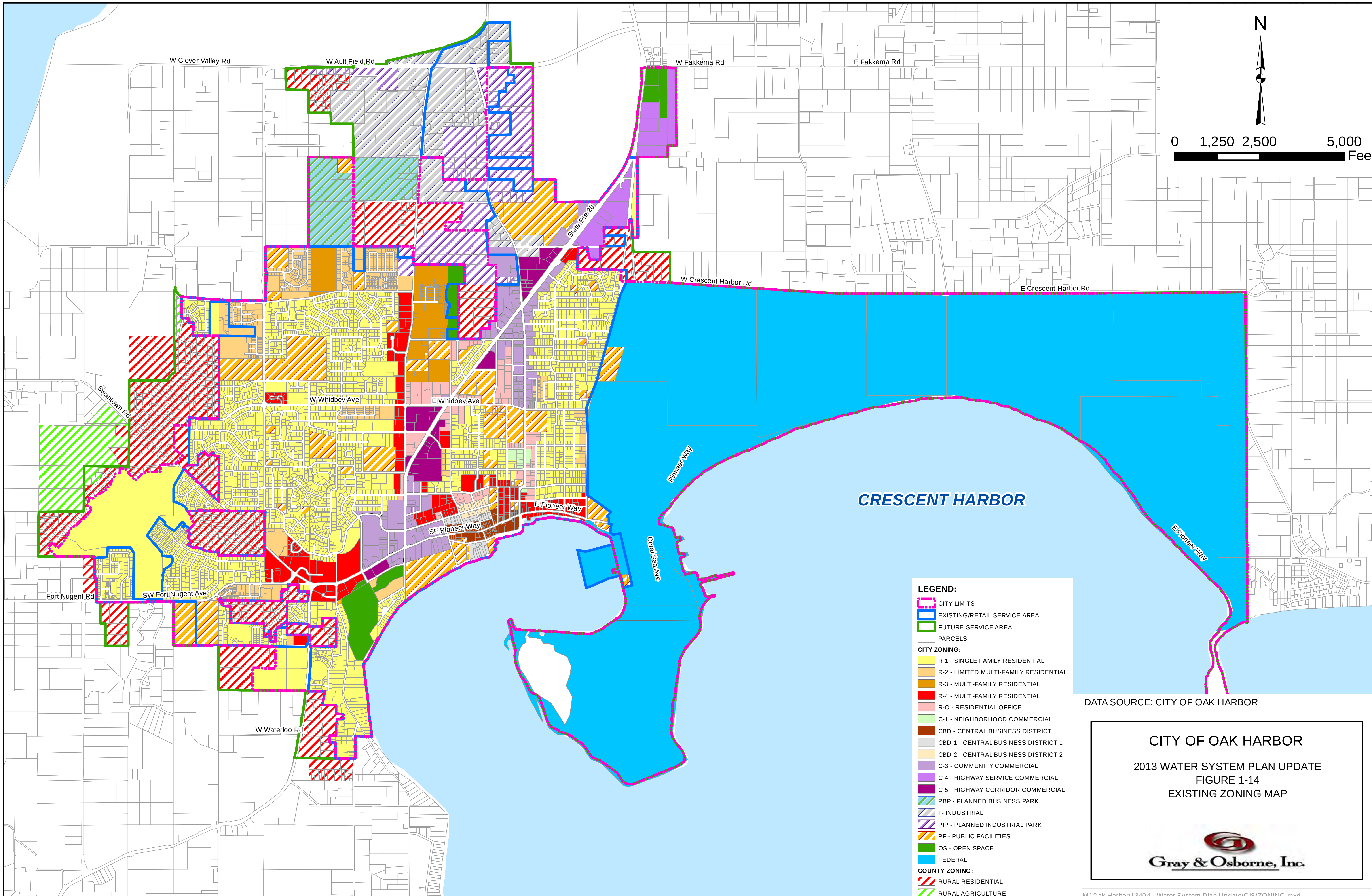
  Intended for low-density, urban, single-family uses with sufficient urban services. Densities range between 3 and 6 units per gross acre.

- **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.


N
0 1,250 2,500 5,000 Feet
W Clover Valley Rd
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E Fakkema Rd
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
E Pioneer Way
Fort Nugent Rd
SW Fort Nugent Ave
W Waterloo Rd
LEGEND:
CITY LIMITS
EXISTING/RETAIL SERVICE AREA
FUTURE SERVICE 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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- **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 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.

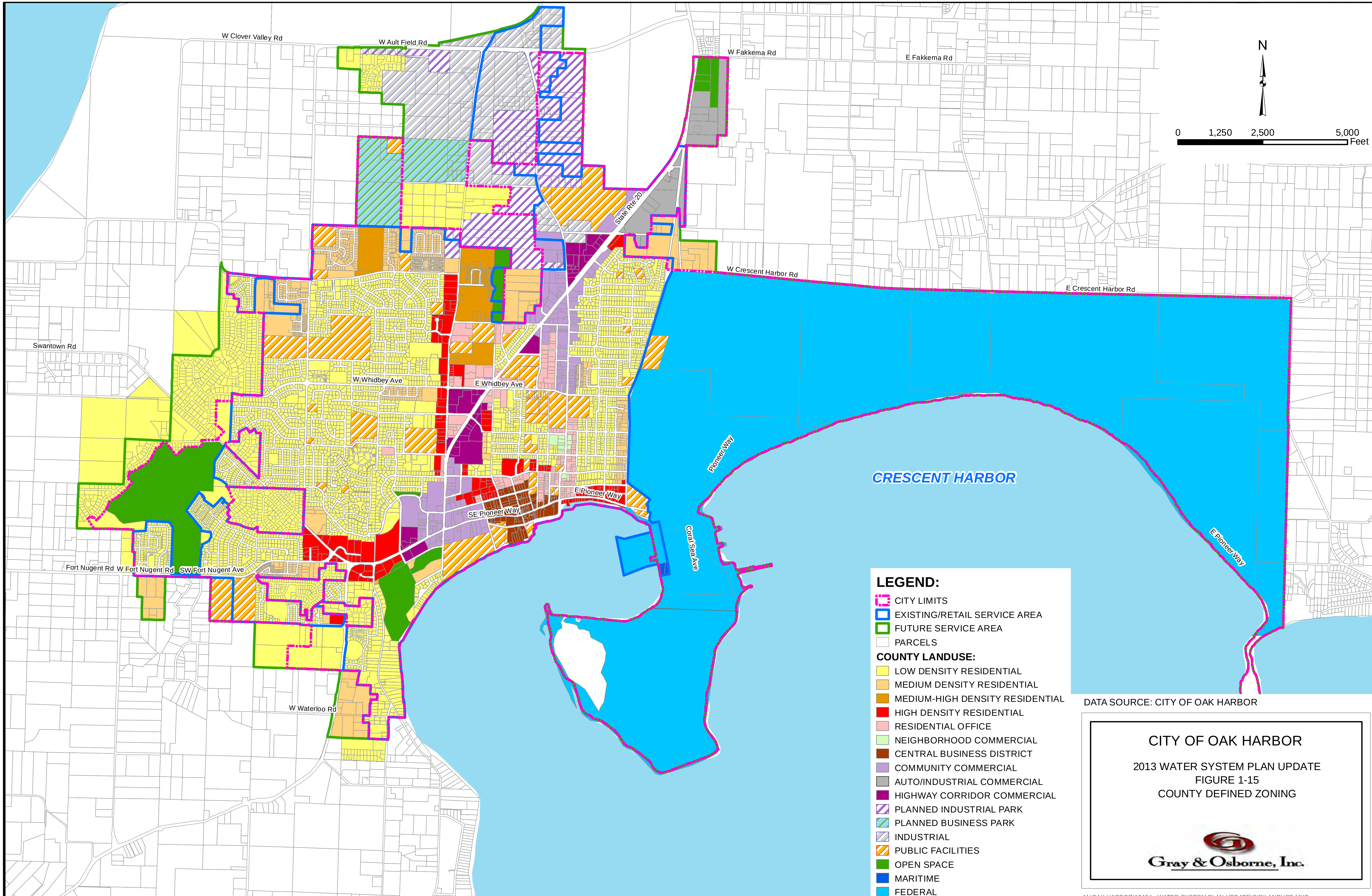
Areas outside of the city limits but within the UGA also contain land-use and zoning designations for their future development. Designations for these areas were obtained through Island County records and are included in Table 1-9 as well as on Figure 1-15.

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).



W Clover Valley Rd
W Ault Field Rd
W Fakkema Rd
E Fakkema Rd
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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
E Pioneer Way
Fort Nugent Rd
W Fort Nugent Rd
SW Fort Nugent Ave
W Waterloo Rd
LEGEND:
CITY LIMITS
EXISTING/RETAIL SERVICE AREA
FUTURE SERVICE 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
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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.

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. Complete developer standards are available at the City's Public Works Department. They include provisions on items such as hydrostatic testing, disinfection, bacteriological testing, and installation. In general, all distribution mains will be located within the right-of-way or the acquisition of an easement will be required. Additionally, hydrostatic testing, disinfection, and bacteriological testing of new water utilities shall be as specified in WSDOT Standard Specifications. Separation of potable water piping and wastewater or reclaimed water piping shall be as recommended in the *Criteria for Sewage Works Design* ("Orange Book", Ecology, 2008).	Design and Performance Standards

TABLE 1-10 – (continued)

Service Area Policy Summary

DOH Policy	Policy Description	Current City Policy	Source
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
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	Gallons			MG
	Anacortes	Well 8	Well 9	Well 11	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.

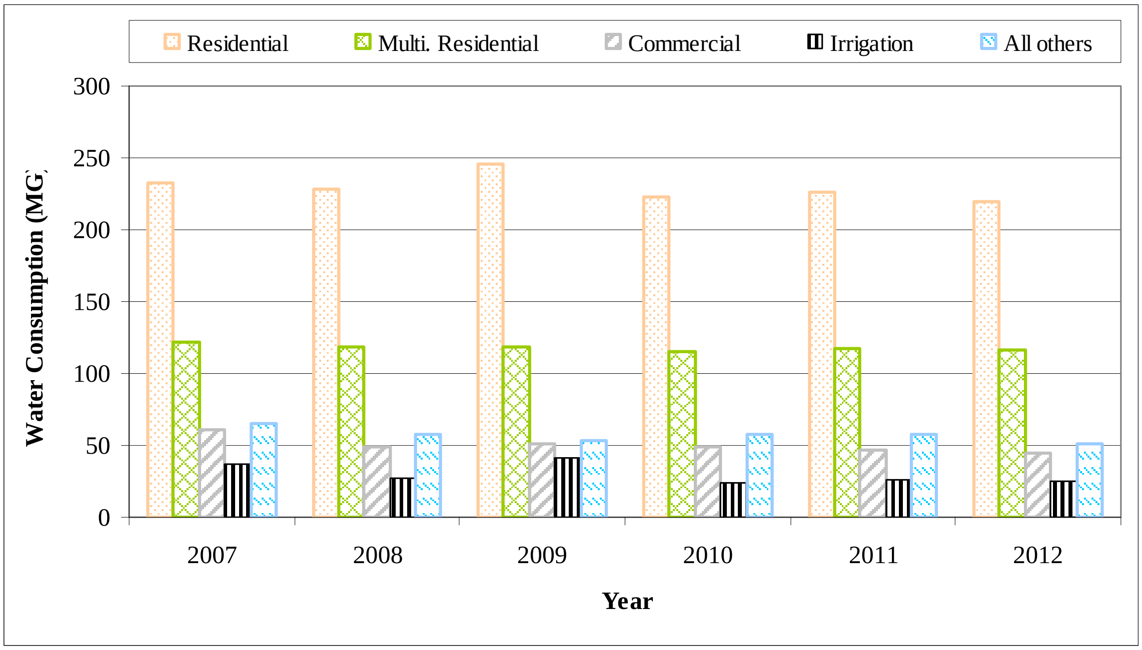


FIGURE 2-1

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.

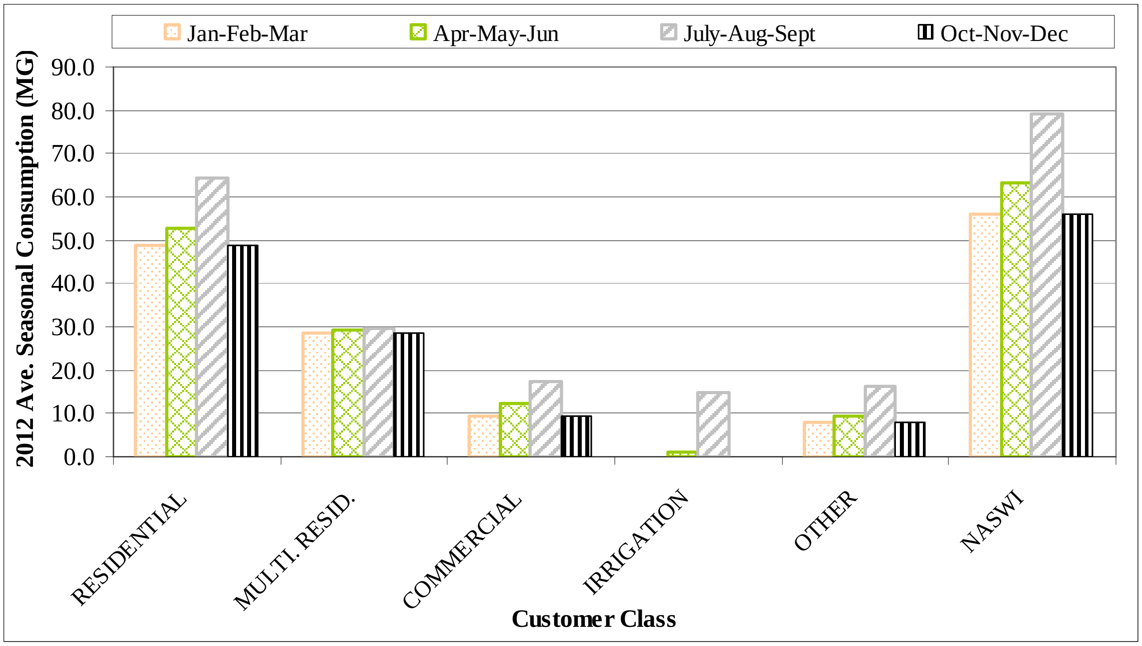


FIGURE 2-2

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)	Retail Service Area Population(3)	Service Area Population(4)
2013	22,080	18	18,778	27,444
2014	22,266	18	18,964	27,632
2015	22,454	18	19,952	28,621
2016	22,644	18	20,942	29,611
2017	22,835	18	21,933	30,603
2018	23,027	18	22,925	31,597
2019	23,222	18	23,920	32,593
2020	23,418	18	24,116	32,790
2021	23,615	18	24,313	32,989
2022	23,815	18	24,513	33,189
2023	24,016	18	24,714	33,391
2024	24,218	18	24,916	33,595
2025	24,423	18	25,121	33,801
2030	25,471	18	26,169	34,855
2033	26,121	18	26,819	35,510
2060	32,774	18	33,472	42,204

(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) City population plus population in UGA and retail service area minus NASWI Seaplane Base personnel. Also includes projected population increase due to proposed NASWI squadron additions.

(4) Includes City population, NASWI Ault Field and Seaplane Base, as well as DPSP and NWWD population.

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 0.8 percent annually, while UGA population was assumed to increase at an annual rate of 0.17 percent due to City annexation of lands within the UGA. NASWI personnel is anticipated to increase by 4,000 persons (2,000 NASWI personnel and their dependents) 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 service area. DPSP population was estimated using annual water use and per capita consumption (65 gpcd) for the City in 2012, and NWWD population was estimated based on annual water use and 65 gpcd. These populations were assumed to increase 1 percent annually.

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.

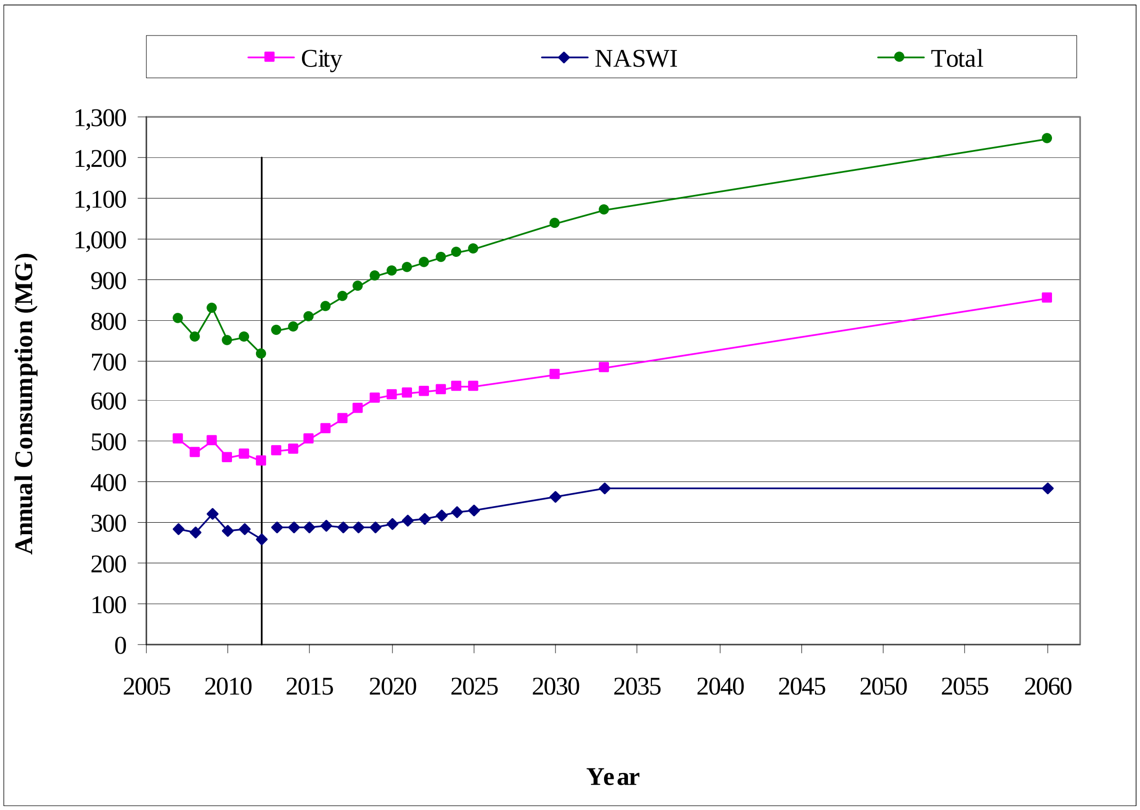


FIGURE 2-3

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)	Required Production: Maximum Daily (gpd)(3)	Required Production: 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:
5It is assumed that fire flow demand will occur during maximum day demand for

- 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 for an acute violation must be provided within 24 hours. Additional information is available in Chapter 7 – 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 routine sampling locations and repeat sample locations is included as part of the City's Coliform Monitoring Plan, which is included in Appendix L. In the event that a coliform detection occurs, the routine sample sites, as well as upstream and downstream repeat samples sites listed in Appendix L will also be used to determine that the potable water system is safe for public consumption. 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

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)
Monochlorobenzene	0.1	Heptachlor epoxide	0.0002
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 prior to the end of 2015. 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. Although the City does not use groundwater as a primary water source, these groundwater sources mix with water from the City of Anacortes, and as such, the City is subject to compliance with the Groundwater Rule. Guidance on compliance with the Groundwater Rule is provided in Appendix L. If any routine distribution system samples confirm the presence of total coliforms, a triggered source water sample for each groundwater source (pre-treatment) must be collected and tested for *E. coli*. If the source sample is discovered to contain *E. Coli*, then corrective action or additional testing will be required. After being notified of the presence of total coliforms, DOH will direct the City on a recommended course of action.

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.

Both NASWI and City customers currently receive fluoridated water. 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.

Combined Total Sources Scenario

- Anacortes annual CWV of 1,000 million gallons; and
- 3,000,000 gallons based on historical groundwater source production.

Water Right DOH Recommended Source Scenario

- Anacortes annual CWV of 1,000 million gallons; and
- Groundwater sources operated at the water right capacity (850 gpm) a total of 18 hours per day as recommended by the DOH design manual.

Installed Capacity Recommended Source Scenario

- Anacortes annual CWV of 1,000 million gallons; and
- Groundwater sources operated at the currently pumped value (370 gpm) 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)	Existing Source Scenario (MG/year)(2)	Surplus/ (Deficit)	Combined Total Sources (MG/year)(3)	Surplus/ (Deficit)	Water Right DOH Recommended Source Scenario (MG/year)(4)	Surplus/ (Deficit)	Installed Capacity Recommended Source Scenario (MG/year)(5)	Surplus/ (Deficit)
2012	798	1,000	202	-	-	-	-	-	-
2013	811	1,000	189	1,003	192	1,335	524	1,146	334
2014	816		184		187		519		329
2015	843		157		160		492		303
2016	871		129		132		464		275
2017	895		105		108		440		251
2018	922		78		81		413		224
2019	948		52		55		387		198
2020	963		37		40		372		183
2021	975		25		28		360		171
2022	987		13		16		348		158
2023	1,000		0		3		335		146
2024	1,012		-12		-9		323		134
2025	1,022		-22		-19		313		124
2030	1,084		-84		-81		251		61
2033	1,123		-123		-120		212		23
2060	1,299		-299		-296		36		-154

(1) Includes both retail service area and wholesale users.
(2) Includes only the CWV from Anacortes.
(3) Includes the CWV from Anacortes as well as 3,000,000 gallons to account for historical well production.
(4) Includes the CWV from Anacortes as well as a well pumping time of 18 hours per day for the allowable water right of 850 gpm. Note: additional pumping equipment would be required for the City to extract groundwater at this rate.
(5) Includes the CWV from Anacortes as well as a well pumping time of 18 hours per day for the current pumping rate of 370 gpm.

Results of the source capacity analysis in Table 3-11 suggest that the City's current arrangement with Anacortes will meet the projected ADD until approximately 2024 – regardless of whether or not water continues to be removed from Wells 8, 9 or 11 at the current rate. If the City were to maintain the current CWV with Anacortes as well as pump water from Wells 8, 9 and 11 at the maximum allowable rate based on currently installed pumping capacity (370 gpm), the City would have sufficient capacity to meet the projected ADD until approximately 2035. However, if the City were to maintain the CWV from Anacortes and remove water from Wells 8, 9, and 11 at the maximum allowable water right value of 850 gpm, the City would have sufficient capacity to meet the projected ADD through the year 2060.

Without the CWV from Anacortes, the City does not maintain sufficient source capacity to meet current or projected ADD, and as such should develop contingency plans in the event that the Anacortes source in unavailable. The City should investigate the possibility of developing additional sources of water to be used in the event of an emergency.

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

TABLE 3-12 – (continued)

Service Area MDD Capacity Analysis Summary

Year	Service Area MDD (gpm)(1)	Pipeline Capacity (gpm)(2)	Surplus/ (Deficit)	Sufficient Capacity?
2024	3,518	14,099	10,582	Yes
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	1,752	2,760	1,008	Yes
2013	2,302	2,760	458	Yes
2014	2,319	4,380(2)	2,061	Yes
2015	2,408	4,380	1,972	Yes
2016	2,497	4,380	1,883	Yes
2017	2,587	4,380	1,793	Yes
2018	2,676	4,380	1,704	Yes
2019	2,766	4,380	1,614	Yes
2020	2,798	4,380	1,582	Yes
2021	2,829	4,380	1,551	Yes
2022	2,861	4,380	1,519	Yes
2023	2,893	4,380	1,487	Yes
2024	2,926	4,380	1,454	Yes
2025	2,958	4,380	1,422	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 has devised a method to maintain sufficient operational storage and adequate turn-over of the water supply.

The West Reservoirs serve the 307 Zone downstream of the North Reservoir and the proposed 328 Zone and "float" on the system via a common inlet/outlet pipe.

Development of the 328 Zone will result in less pressure variation in the 307 zone, which is anticipated to reduce the daily water exchange in the West Reservoirs. To address this, a recurring valve closure scheme was developed to assure water exchange in the West Reservoirs.

Two PRVs located at the intersection of Gun Club and Goldie Road divide the 307 Zone and 328 Zone and regulate the level of the West Reservoirs. Closing the smaller of the two PRVs when the West Reservoirs are full will allow the water level to drop until system pressure decreases to the point at which the larger PRVs begin to open. This operating scenario will drop the water level in the West reservoirs approximately 5 feet overnight and refill them during the day. The new North Reservoir is upstream of the Goldie and Gun Club PRV stations and does not undergo this cycle.

For this analysis, operational storage was assumed to be 10 percent of the West Reservoir storage volume. If the level within the Reservoirs drops 5 feet each night, this would equal approximately 229,000 gallons, which is 9 percent of the Reservoir volume.

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.

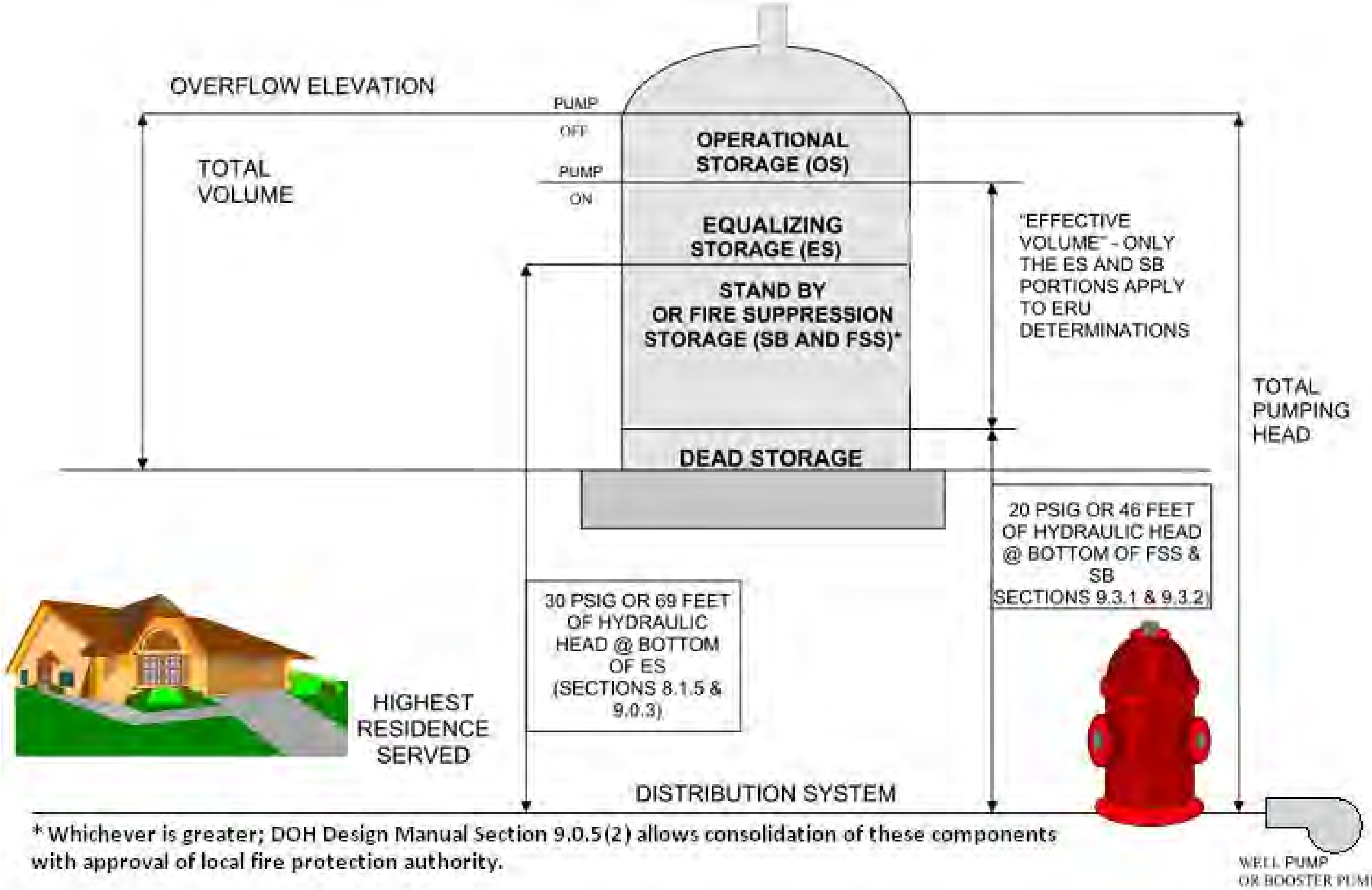
Equalizing storage is calculated using the following equation:

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

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.



* 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

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

Water System 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, and MDD 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	4,380	4,380	4,380
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	1,210	1,468	1,699	2,032
MDD (gpm) (5)	1,752	2,302	2,766	3,223	3,823
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 projected required production for the RSA and Seaplane Base.
(5) Calculated using projected data for the RSA and Seaplane Base.

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 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.

The Seaplane Base was not included in the hydraulic analysis because a value for pressure and flow requirements had not been finalized. Figures 4-2 and 4-3 include proposed CIP projects that would provide water service to the eastern edge of the City limits.

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.

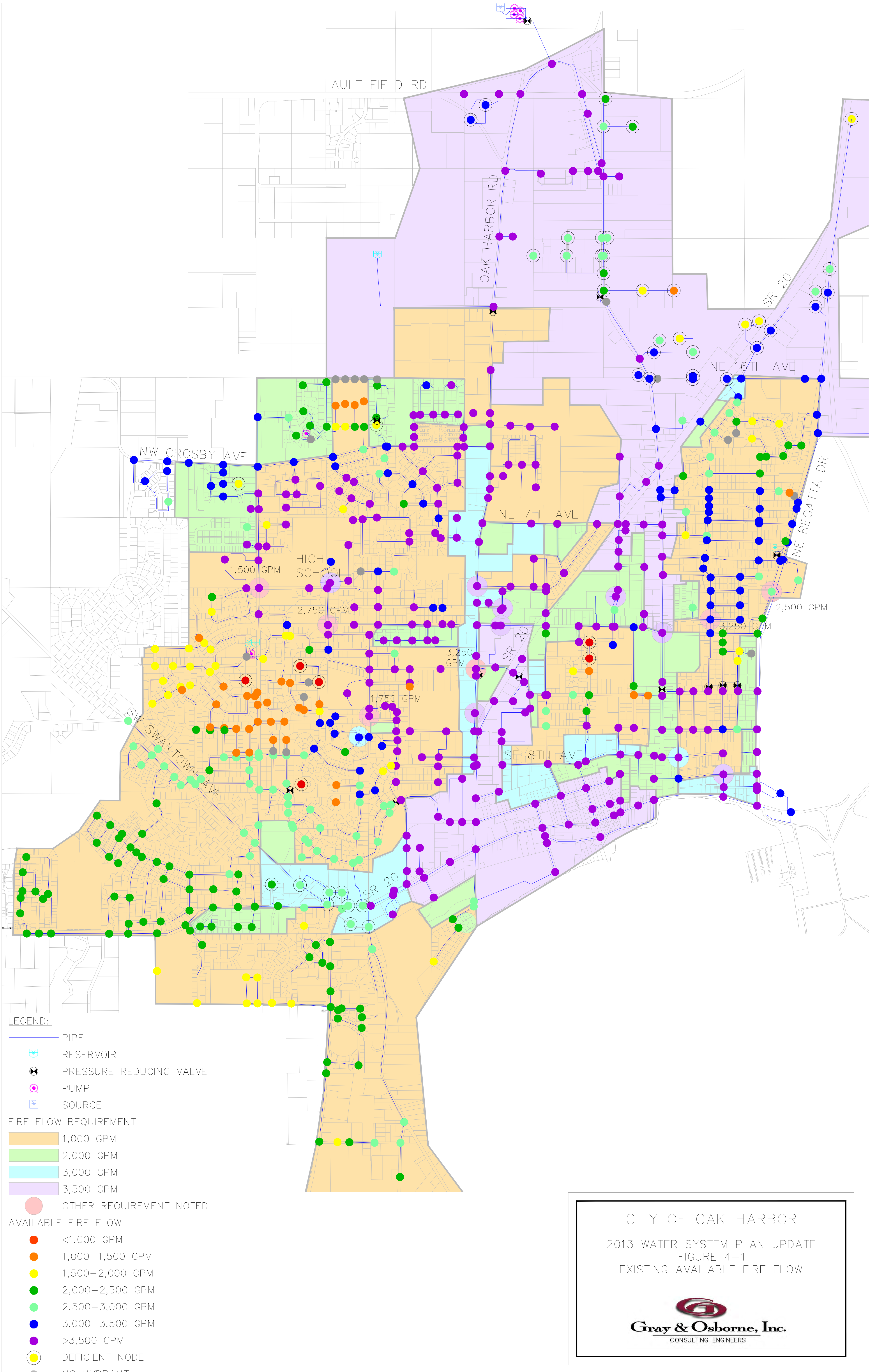
TABLE 4-3

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.

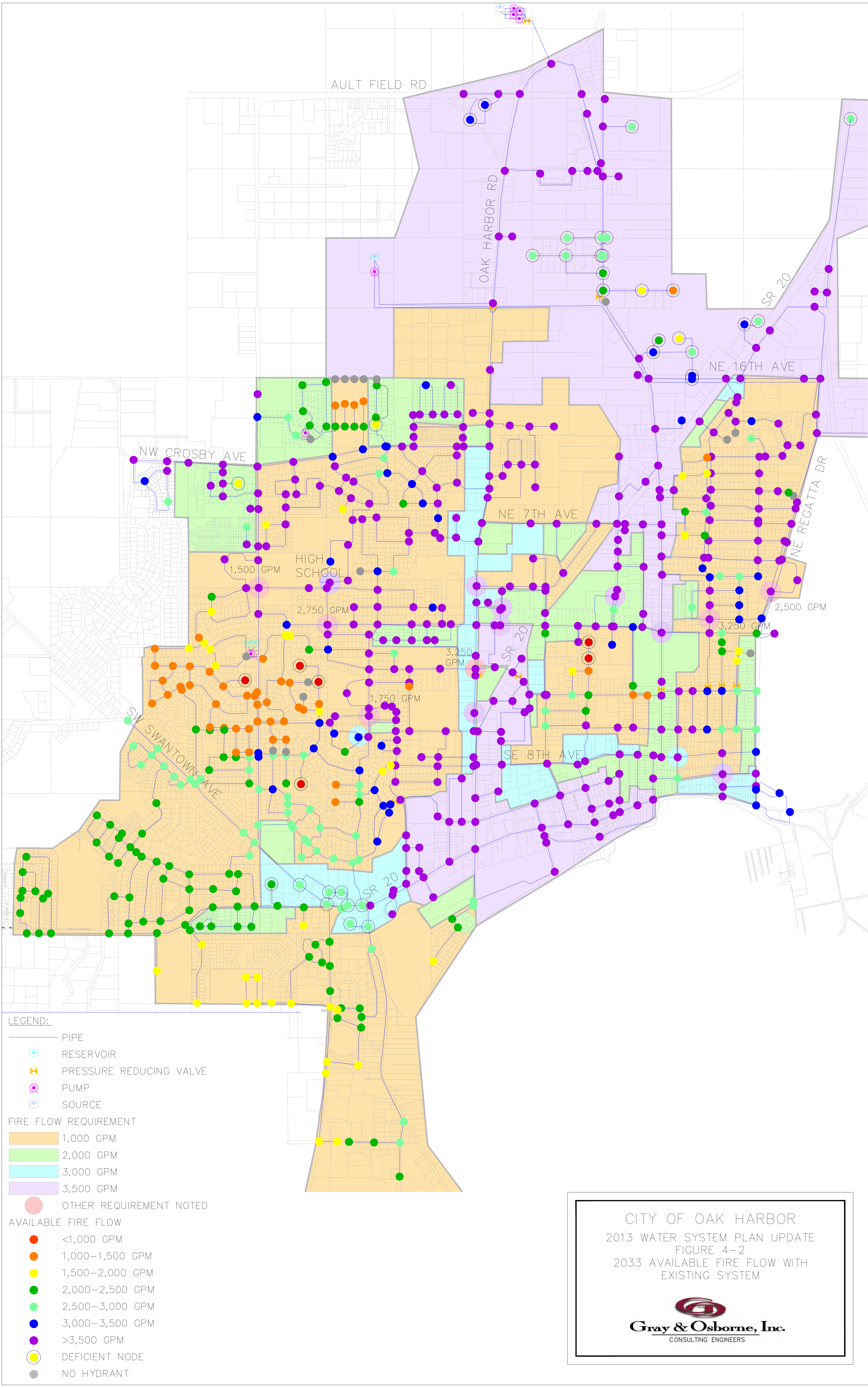
(2) No specific project planned, existing system assumed sufficient to meet actual fire flow requirements and development will drive any improvements to the area.



CITY OF OAK HARBOR

2013 WATER SYSTEM PLAN UPDATE
FIGURE 4–1
EXISTING AVAILABLE FIRE FLOW

Gray & Osborne, Inc.
CONSULTING ENGINEERS



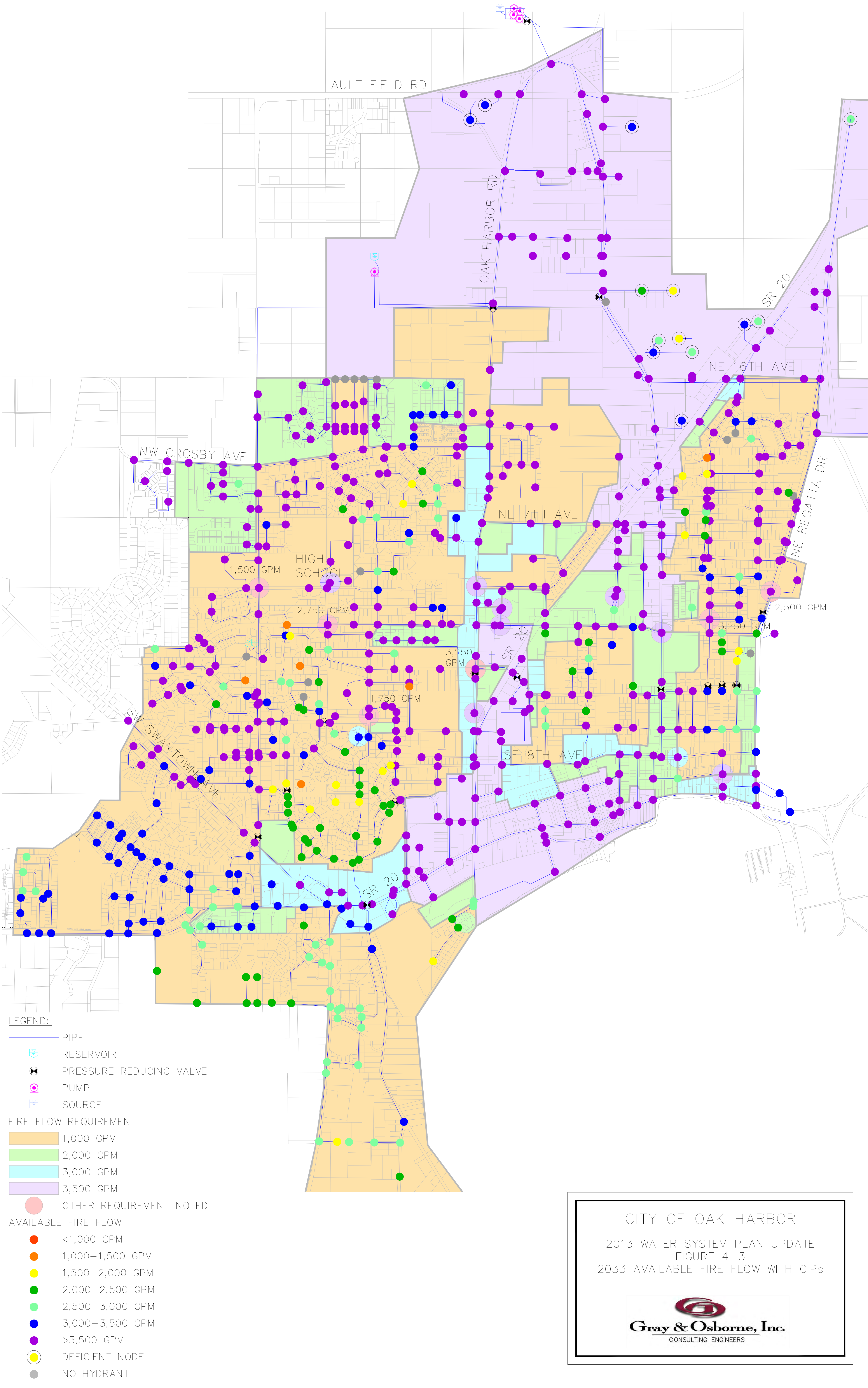
CITY OF OAK HARBOR

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
2,500 GPM
3,250 GPM
SR 20
SE 8TH AVE
SW SWANTOWN 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,
- Implementation of monthly 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)	Required Production Maximum Daily (gpd)(3)	Required Production 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 DSL at a 3-year rolling average of less than 10 percent. 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.

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 bills on a monthly basis and 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

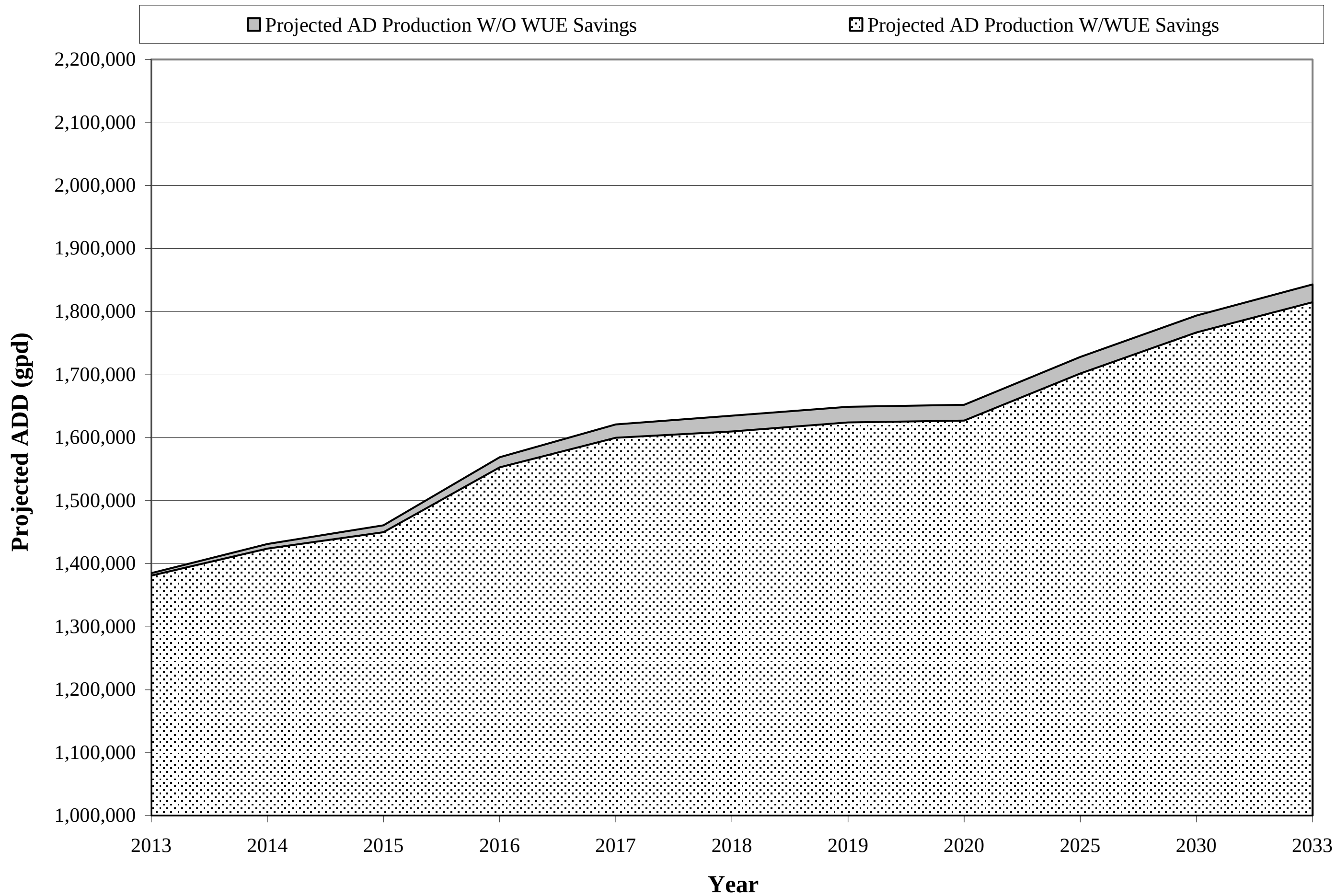


FIGURE 5-1

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

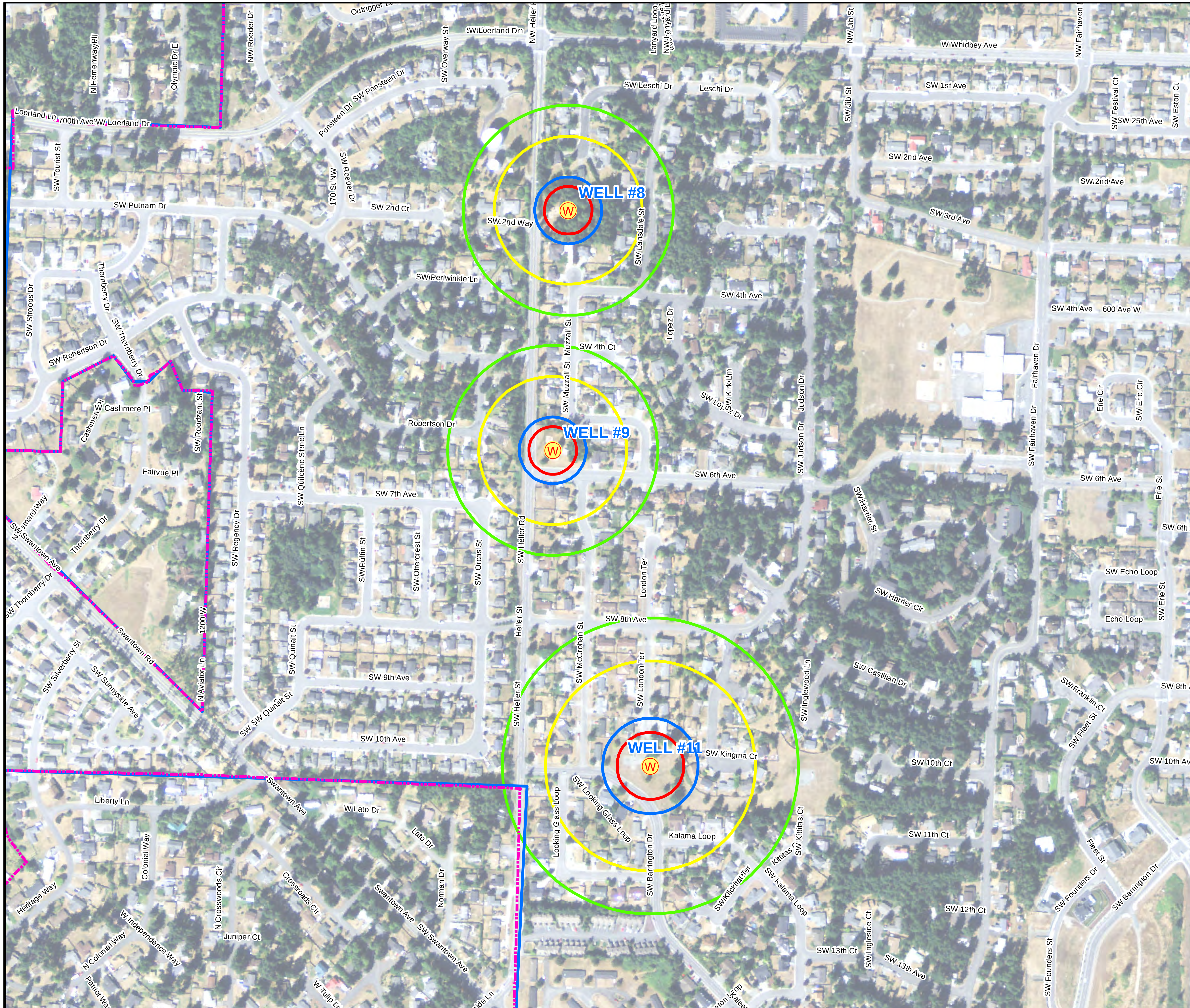
CONTAMINANT SOURCE INVENTORY

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/RETAIL 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.

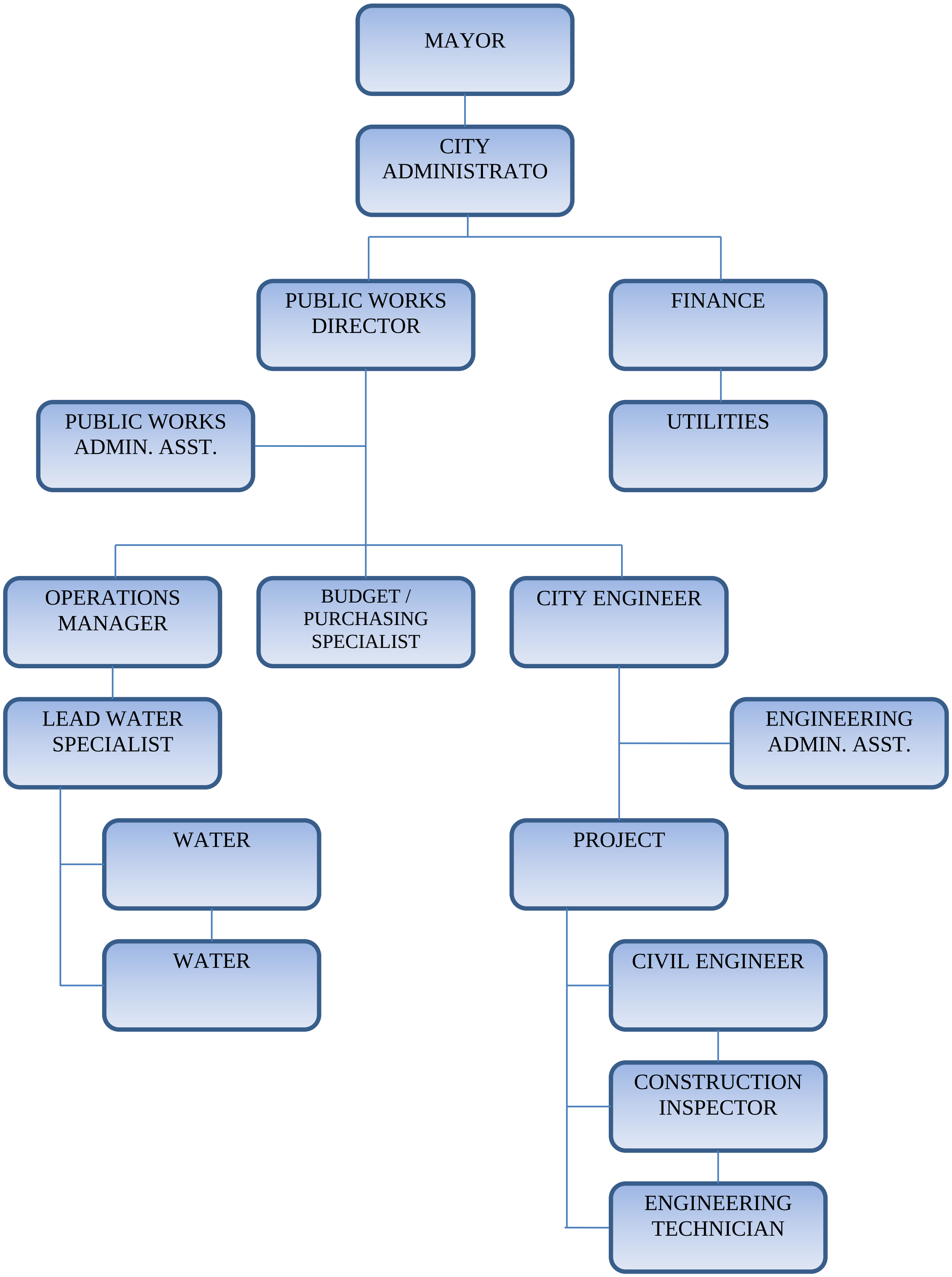


FIGURE 7-1

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

<table>
<tr><th colspan="2" rowspan="2">Water Works Operator Classification</th><th colspan="5">Certification Level</th></tr>
<tr><th>Operator in Training</th><th>Level One</th><th>Level Two</th><th>Level Three</th><th>Level Four</th></tr>
<tr><td rowspan="2">Water Distribution Manager (WDM)</td><td>Education</td><td>12 years</td><td>12 years</td><td>12 years</td><td>14 years</td><td>16 years</td></tr>
<tr><td>Experience</td><td>3 months</td><td>1 year</td><td>3 years</td><td>4 years</td><td>4 years</td></tr>
<tr><td rowspan="2">Water Treatment Plant Operator (WTPO)</td><td>Education</td><td>12 years</td><td>12 years</td><td>12 years</td><td>14 years</td><td>16 years</td></tr>
<tr><td>Experience</td><td>3 months</td><td>1 year</td><td>3 years</td><td>4 years</td><td>4 years</td></tr>
<tr><td rowspan="2">Water Distribution Specialist (WDS)</td><td>Education</td><td>12 years</td><td>12 years</td><td>12 years</td><td rowspan="2">NA</td><td rowspan="2">NA</td></tr>
<tr><td>Experience</td><td>3 months</td><td>1 year</td><td>3 years</td></tr>
<tr><td rowspan="2">Cross-Connection Control Specialist (CCS)</td><td>Education</td><td rowspan="2">NA</td><td>12 years</td><td>12 years</td><td rowspan="2">NA</td><td rowspan="2">NA</td></tr>
<tr><td>Experience</td><td>3 months</td><td>3 years</td></tr>
<tr><td colspan="2">Backflow Assembly Tester (BAT)</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td colspan="2">Basic Treatment Operator (BTO)</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td></tr>
</table>

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.

<u>Heller Street Booster Station</u>

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.

<u>Redwing Booster Station</u>

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	—	360-720-6953
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 24 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 testing and confirmation of contamination. 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 in Table 7-14.

TABLE 7-14

Bacteriological Presence Detection Procedures

Routine #1	Routine #2	Repeat #1	Repeat #2	Repeat #3	Violation	Required Action[2]
Coliform detected, No *E.coli*/Fecal	None detected	None detected			No Violation	No Required Notification
Coliform detected, No *E.coli*/Fecal	Coliform detected, No *E.coli*/Fecal	None detected			Non Acute	Public Notification as soon as practical (required by 30 days)[3]
Coliform detected, No *E.coli*/Fecal	None detected	Coliform detected - No E.coli/Fecal in 1, 2, or 3 of the samples			Non Acute	Public Notification as soon as practical (required by 30 days), Certification form within 10 days[3]
Coliform detected, *E.coli*/Fecal detected[1]	None detected	Coliform detected - No E.coli/Fecal in 1, 2, or 3 of the samples			Acute	Public Notification Within 24 Hours, Boil Water Advisory, Certification form within 10 days[3]
Coliform detected, No *E.coli*/Fecal	None detected	**Coliform detected - E.coli/Fecal detected in 1, 2, or 3 of the samples[1]**			Acute	Public Notification Within 24 Hours, Boil Water Advisory, Certification form within 10 days[3]
Coliform detected, *E.coli*/Fecal detected[1]	None detected	None detected			No Violation	No Required Notification, Contact DOH after Routine Results
Coliform detected, *E.coli*/Fecal detected[1]	Coliform detected, *E.coli*/Fecal detected[1]	None detected			Non Acute	Public Notification as soon as practical (required by 30 days), Recommended Boil Water Advisory[3]

(1) Contact DOH immediately after receiving a sample testing positive for Fecal or *E. coli* Presence.
(2) The required action following detection of *ANY* type of coliform is to increase monitoring the following month to five routine samples.
(3) Notification forms are available from DOH.

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 7-2.

Although nitrate and nitrite are classified as inorganic constituents, they are subject to a unique process of action should a violation of the nitrate or nitrite MCL occur. If the nitrate or nitrite MCL (10.0 mg/L) is exceeded, a confirmation sample is required as soon as possible. Compliance actions will then be based on the average of the routine and confirmation samples. Quarterly monitoring would be required if the average result is greater than 5.0 mg/L. In any event, DOH should be notified of the violation, and can provide guidance on subsequent steps.

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.

In the event that unregulated contaminants are found in the City's drinking water supplies, these results should be included in the next published consumer confidence report.

EMERGENCY ACTION PLAN

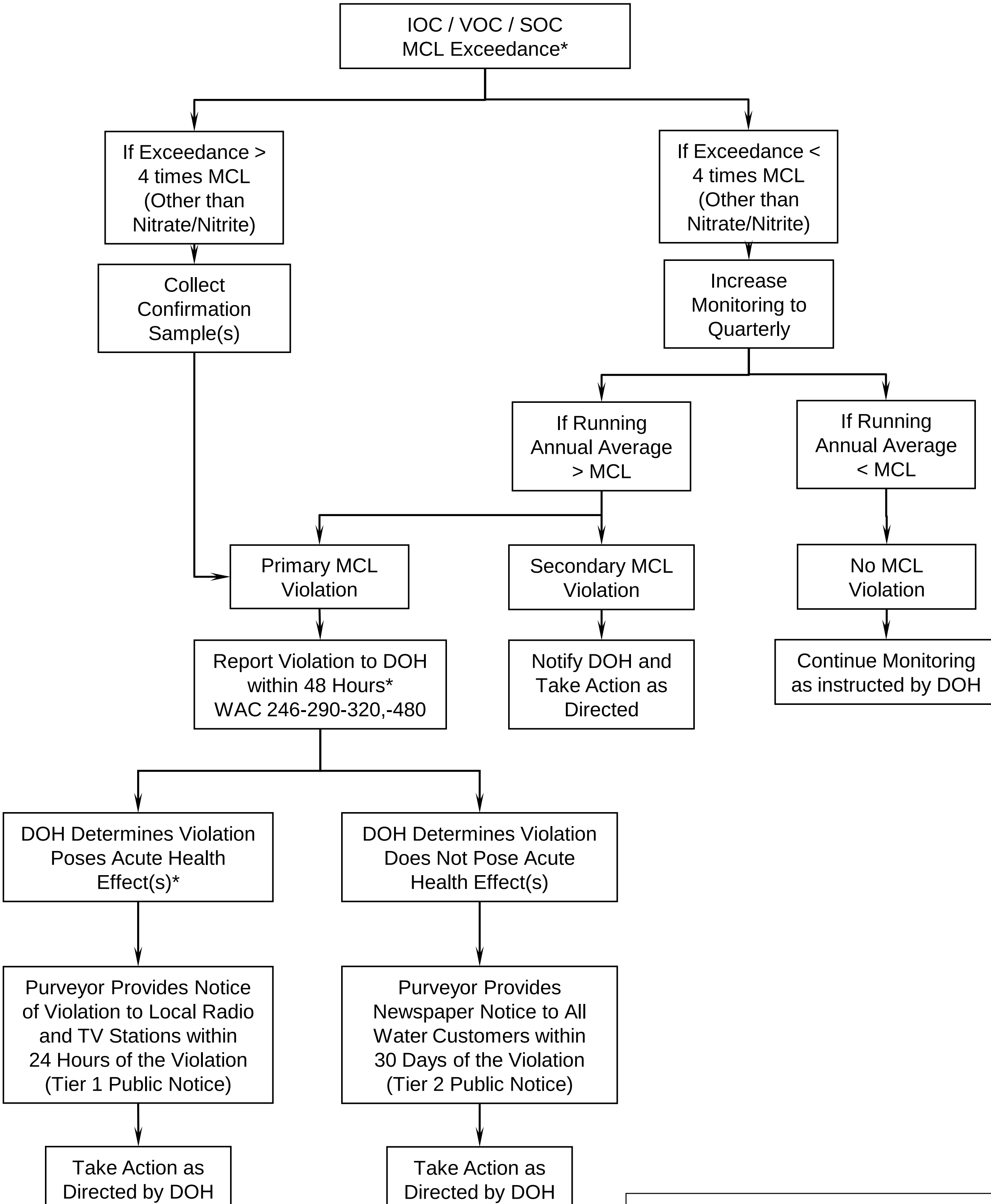
The following is a brief overview of the City's water emergency response plan detailing how the water system should be operated under a variety of emergency situations. Resolution 2001-08 passed by the city council provides for water shortage response to drought conditions or emergency water shortages.

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



* Nitrate and Nitrite represent acute contaminants and have a separate violation process. See WSP text.

DOH: Washington State Department of Health

WAC: Washington Administrative Code

CITY OF OAK HARBOR
2013 WATER SYSTEM PLAN UPDATE

FIGURE 7-2
IOC/VOC/SOC DETECTION PROCEDURE

Gray & Osborne, Inc.
CONSULTING ENGINEERS

- 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 7-15 presents the potential effects of a power failure on the water system components.

TABLE 7-15

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 7-16 presents potential effects of a severe earthquake on water system components.

TABLE 7-16

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 7-17 provides the emergency response procedures for a severe snowstorm.

TABLE 7-17

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 7-17 – (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 7-18 presents the emergency response procedures for flooding.

TABLE 7-18

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 7-18 – (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 7-19 presents the emergency response procedures for a fire.

TABLE 7-19

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 7-19 – (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 7-20 presents the emergency response procedures for contamination of the water supply.

TABLE 7-20

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 7-20 – (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 7-20 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: 2015
Proposed Construction Year: 2016

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

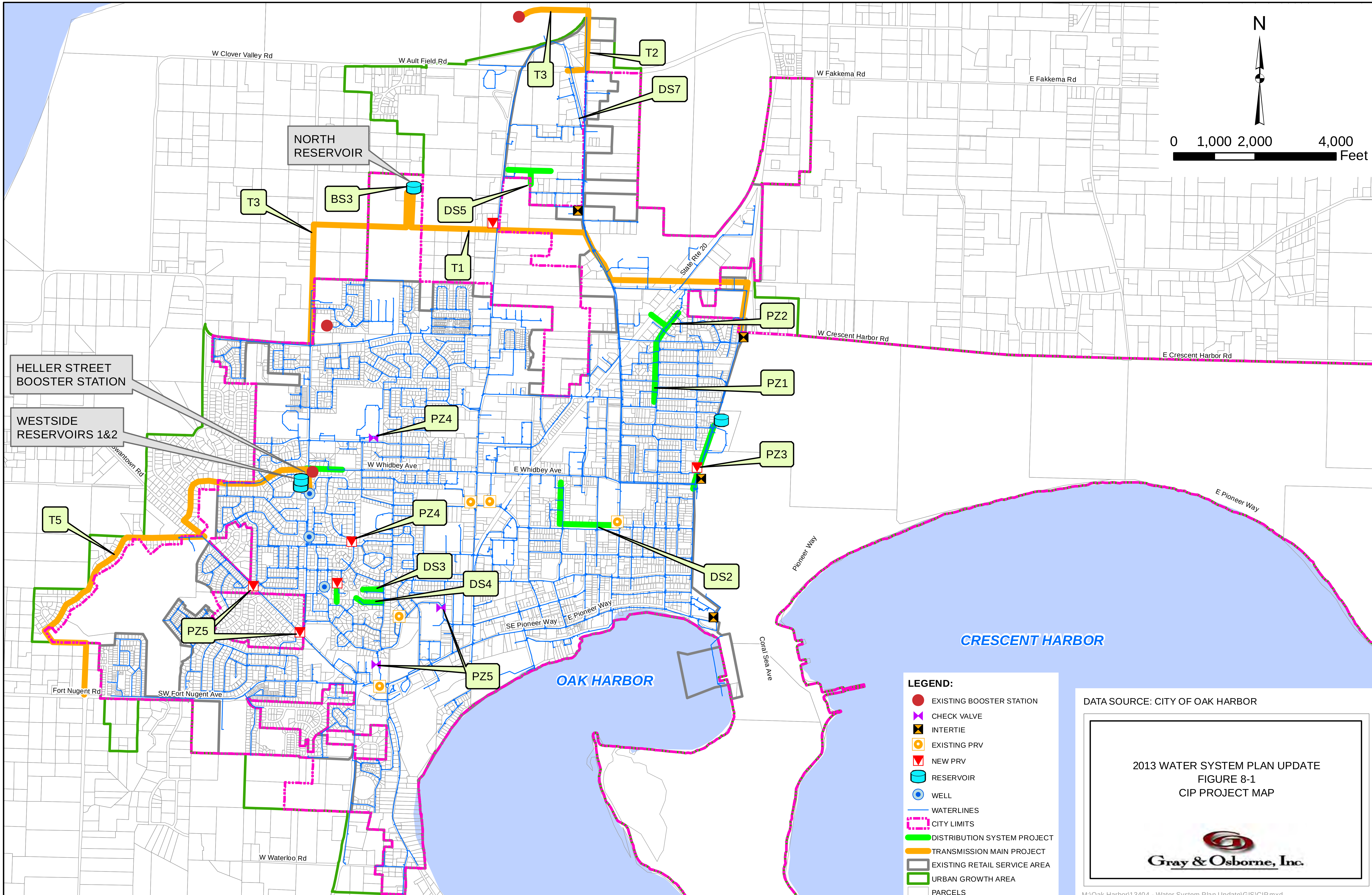
Project Description:
Investigate the potential for additional groundwater sources to be used as emergency supply (~1,000 gpm). It is anticipated that the investigation will determine the feasibility and potential locations of new emergency supply wells.

This project is not a specific capital improvement, and as such is not included in subsequent budgeting tables. It is included here for informational purposes only.

S-3: Eastside Reservoir Demolition

Estimated Cost: $100,000
Proposed Design Year: 2017
Proposed Construction Year: 2018

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.



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Feet
W Clover Valley Rd
W Ault Field Rd
W Fakkema Rd
E Fakkema Rd
W Crescent Harbor Rd
E Crescent Harbor Rd
State Rte 20
W Whidbey Ave
E Whidbey Ave
E Pioneer Way
SE Pioneer Way
Pioneer Way
Coral Sea Ave
Swantown Rd
Fort Nugent Rd
SW Fort Nugent Ave
W Waterloo Rd
T1
T2
T3
T5
DS2
DS3
DS4
DS5
DS7
BS3
PZ1
PZ2
PZ3
PZ4
PZ5
NORTH RESERVOIR
HELLER STREET BOOSTER STATION
WESTSIDE RESERVOIRS 1&2
OAK HARBOR
CRESCENT HARBOR
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 AREA
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	2015	2016	$236,000
S-2	Emergency Supply Study	Emergency groundwater supply feasibility study	2014	2014	N/A
S-3	Eastside Reservoir Demolition	Remove and wastehaul existing Eastside reservoir	2017	2018	$100,000
S-4	Emergency Supply Well	Drill and equip a new emergency supply well	2016	2017	$301,000
				Source Project Subtotal	**$637,000**

TRANSMISSION LINE PROJECTS

T-1: Cross City Transmission Main
Estimated Project Cost: $3,559,000
Proposed Design Year: 2014 and 2019
Proposed Construction Year: 2015 and 2020

Project T-1 is further split into two projects, T-1A and T-1B. In total, Project T-1 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.

Project Description:
Project T-1A 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 Road and terminate at the intersection of NE Goldie

Road and NE 16th Street. This portion of project T-1 would be designed starting in 2014.

Project T-1B will provide an additional connection point that will allow the City to serve the NASWI Seaplane Base facilities. This project will extend the 18-inch main described in T-1A east along NE 16th Street and south along NE Regatta Drive to the intersection of NE Regatta Drive and West Crescent Harbor Road. This portion of T-1 would be designed starting in 2019 or later.

T-2: North-End Trunk Main: Phases 1 and 2

Estimated Project Cost: $1,767,000
Proposed Design Year: 2019
Proposed Construction Year: >2019

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 GEREF HYPERLIN

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: 2018
Proposed Construction Year: 2019

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.

This project is not a specific capital improvement, and as such is not included in subsequent budgeting tables. It is included here for informational purposes only.

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	2014	2015	$3,559,000
T-2	North-End Trunk Main: Phases 1 and 2(1)	4,000 lf of 18-inch pipe	2019	>2019	$1,767,000
T-3	West 384 Zone Extension: Phase 1	5,300 lf of 24-inch pipe from North Reservoir	2018	2019	$2,678,000
T-4	24-Inch Transmission Line Investigation	Transmission line reliability & soundness study	2017	2017	N/A
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	>2019	>2019	$1,970,000
				Transmission Main Project Subtotal	**$17,583,000**

(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: 2015
Proposed Construction Year: 2016

<u>Project Description</u>:
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: >2019

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 Year	Construction Year	Estimated Cost (2013 $)
No.	**Title**	**Description**			
BS-1	Ault Field Booster Station Surge Protection Analysis	800 cubic foot hydropneumatic surge arrestor	2015	2016	$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	>2019	>2019	$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: 2017
Proposed Construction Year: 2018

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: 2018
Proposed Construction Year: 2019

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: $1,000,000

Proposed Construction Year: Bi-annually

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.

In this project, design for replacement of a portion of the City's AC pipe will occur one year, and will be followed the next year by construction of the design replacement. The design/construction process will then be repeated.

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	2017	2018	$116,000
DS-2	Glencoe Street Fire Flow Improvements	2,400 lf of 8-inch pipe	2018	2019	$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	Bi-annually	Bi-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 during the year of construction.

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: South-End NASWI Connection

Estimated Cost: $904,000
Proposed Design Year: >2019

Project Description:
Project PZ-3 will provide an additional connection point that will allow the City to better serve NASWI connections within the Seaplane Base. The project includes the construction of a new PRV station near the intersection of NE Regatta Drive and East Whidbey Avenue. It also includes the installation of approximately 1,200 LF of 12-inch ductile iron pipe along NE Regatta Drive between E. Whidbey Avenue and NE 5th Avenue.

PZ-4: West 384 Zone Development

Estimated Cost: $326,000
Proposed Design Year: 2016
Proposed Construction Year: 2017

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 Year	Construction Year	Estimated Cost (2013 $)
No.	**Title**	**Description**			
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	>2019	>2019	$904,000
PZ-4	West 384 Zone Development	780 lf of 8-inch pipe and new 6-inch PRV station	2016	2017	$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	**$2,825,000**

(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 Number	Project Name	Estimated Cost (2013$)(1)	Estimated Construction Cost(2)
2014	T-1A	Cross City Transmission Main(3)	$1,559,000	$1,559,000
	BS-2	Ault Field Booster Station Pump Replacement	$86,000	$86,000
	DS-9	Steel/AC Pipe Replacement	$1,000,000	$1,000,000
	PZ-1	O'Leary Way Water Main	$599,000	$599,000
	PZ-2	North O'Leary Way Water Main	$511,000	$511,000
		2014 Subtotal	**$3,755,000**	**$3,755,000**
2015	S-1	Well No. 9 Replacement	$236,000	$243,000
	BS-1	Ault Field Booster Station Surge Protection Analysis	$208,000	$214,000
		2015 Subtotal	**$444,000**	**$457,000**

TABLE 8-6 – (continued)

Projected Capital Improvement Project Schedule

Construction Year	Project Number	Project Name	Estimated Cost (2013$)[1]	Estimated Construction Cost[2]
2016	S-4	Emergency Supply Well	$301,000	$319,000
	DS-9	Steel/AC Pipe Replacement	$1,000,000	$1,000,000
	PZ-4	West 384 Zone Development	$326,000	$346,000
		2016 Subtotal	**$1,627,000**	**$1,665,000**
2017	S-3	Eastside Reservoir Demolition	$100,000	$109,000
	DS-1	NE Regatta Drive Pipeline	$116,000	$127,000
		2017 Subtotal	**$216,000**	**$236,000**
2018	T-3	West 384 Zone Extension: Phase I[5]	$2,678,000	$3,014,000
	DS-2	Glencoe Street Fire Flow Improvements	$936,000	$1,053,000
		2018 Subtotal	**$3,614,000**	**$4,067,000**
2019	T-1B	PRV Stations[5]	$2,000,000	$2,319,000
	T-2	North-End Trunk Main: Phase I & II[3]	$1,767,000	$2,048,000
	DS-9	Steel/AC Pipe Replacement	$1,000,000	$1,000,000
		2019 Subtotal	**$4,767,000**	**$5,367,000**
>2019[4]	T-5	Westside Water Main Extension	$7,609,000	$9,086,000
	T-6	Campbell Lake Main Replacement	$1,970,000	$2,352,000
	BS-3	North Booster Pump Station[6]	$2,398,000	$2,863,000
	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[5]	$578,000	$690,000
	DS-6	Erin Park Road Tie-In[5]	$50,000	$60,000
	DS-7	Industrial Avenue Tie-In[5]	$50,000	$60,000
	DS-8	Westside Reservoir Extension	$696,000	$831,000
	PZ-3	East 384 Zone Development[3]	$904,000	$1,079,000
	PZ-5	322 Zone Development[5]	$485,000	$579,000
>2019 Subtotal			**$15,116,000**	**$18,048,000**
6-Year Planning Period Total			**$14,423,000**	**$15,547,000**
6-Year Planning Period Total (City Funded)			**$9,745,000**	**$10,214,000**
20-Year Planning Period Total			**$29,539,000**	**$33,595,000**
20-Year Planning Period Total (City Funded)			**$23,698,000**	**$26,873,000**

(1) Values given are in 2013 dollars and represent project costs including 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.
(5) Provided through developer funds and is not counted against the City's projected CIP expenditures.
(6) Will be constructed using City and private developer funds. Full construction cost is allocated to the City for planning purposes.

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. 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 surplus through the majority of the 6-year planning period. Figure 9-1 shows slowly increasing the expenditures, with revenues rising accordingly. The start-of-year fund balance also increases slightly through the 6-year planning period. Annual operating surpluses are stable through 2019 and should provide the City with the necessary financial flexibility to continue their projected improvement schedule as well as providing funding for emergency projects, should the need arise.

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 NASWI 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	$4,016,055	$4,141,235	$4,088,172	$4,895,315	$5,792,235
Charges for Service - Residential	$4,200,000	$4,271,480	$4,495,510	$4,695,360	$4,907,910	$5,120,800
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**	**$4,785,360**	**$5,013,580**	**$5,215,480**	**$5,431,290**	**$5,647,550**
Expenditures						
Salaries, Wages, and Benefits	$193,491	$199,300	$205,280	$211,440	$217,780	$224,310
Operating Supplies and Equipment	$151,832	$156,390	$161,080	$165,910	$170,890	$176,020
Administrative Costs	$2,000	$2,060	$2,120	$2,180	$2,250	$2,320
Professional Services(3)	$30,000	$47,000	$125,000	$43,000	$384,000	$349,000
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	$54,568	$54,310	$54,053	$53,797	$53,540	$53,283
Capital Outlay(4)	$1,500,000	$-	$-	$-	$-	$-
System Improvements(5)	$30,000	$968,000	$1,189,000	$502,000	$173,000	$1,749,000
Miscellaneous	$332,800	$342,780	$353,060	$363,650	$374,560	$385,800
Total Expenditures	**$5,100,856**	**$4,660,180**	**$5,066,643**	**$4,408,337**	**$4,534,370**	**$6,192,833**
Surplus / (Deficit)	**($423,156)**	**$125,180**	**($53,063)**	**$807,143**	**$896,920**	**($545,283)**
Year-End Fund Balance	**$4,016,055**	**$4,141,235**	**$4,088,172**	**$4,895,315**	**$5,792,235**	**$5,246,952**

(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.

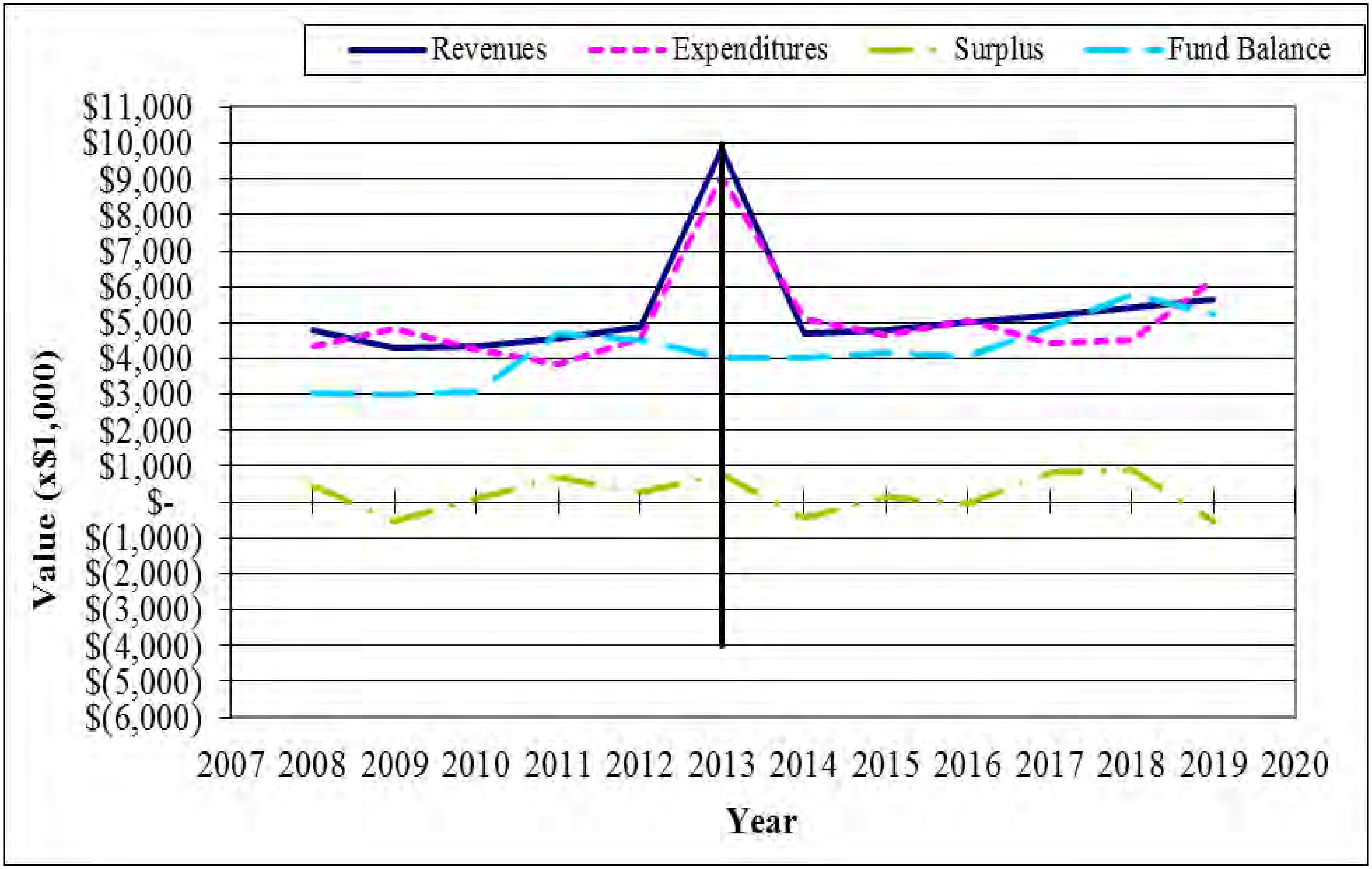
(3) Professional services include anticipated design fees for individual CIP projects. Does not include developer funded projects.

(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.

APPENDIX A

DOH INFORMATION AND
WATER FACILITIES INVENTORY

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Water System Plan Submittal Form

This form must be completed and submitted along with the Water System Plan (WSP). It will expedite review and approval of your WSP. **All water systems should contact their regional planner before developing any planning document for submittal.**

OAK HARBOR, CITY OF	62650	CITY OF OAK HARBOR	
1. Water System Name	PWS ID# or Owner ID#	System Owner Name	
ARNOLD PETERSCHMIDT, P.E.		ENGINEER	
Contact Name for Utility	Phone Number	Title	
865 SE BARRINGTON DR.	OAK HARBOR	WA,	98277
Contact Address	City	State	Zip
RUSSELL PORTER, P.E.	(206) 284-0860	PRINCIPAL	
2. Project Engineer	Phone Number	Title	
701 DEXTER AVE N. SUITE 200	SEATTLE	WA,	98109
Project Engineer Address	City	State	Zip
3. Billing Contact Name (required if not the same as #4)	Billing Phone Number	Billing Fax Number	
Billing Address	City	State	Zip

4.	How many services are presently connected to the system?	~5,863	
5.	Is the system expanding? (seeking to extend service area or increase number of approved connections)	☒ Yes	☐ No
6.	If number of services is expected to increase, how many <u>new</u> connections are proposed in the next six years?	> 500	
7.	If the system is private-for-profit, is it regulated by the State Utilities and Transportation Commission?	☐ Yes	☒ No
8.	Is the system located in a Critical Water Supply Service Area (i.e., have a Coordinated Water System Plan)?	☒ Yes	☐ No
9.	Is the system a customer of a wholesale water purveyor?	☒ Yes	☐ No
10.	Will the system be pursuing additional water rights from the State Department of Ecology in the next twenty years?	☒ Yes	☐ No
11.	Is the system proposing a new intertie?	☐ Yes	☒ No
12.	Do you have projects currently under review by the Department of Health?	☒ Yes	☐ No
13.	Are you requesting distribution main project report and construction document submittal exception, and if so, does the WSP contain standard construction specifications for distribution mains?	☐ Yes	☒ No
14.	Are you requesting distribution related project report and construction document submittal exception, and if so, does the WSP contain distribution facilities design and construction standards, including internal engineering review procedures?	☐ Yes	☒ No
15.	The purveyor is responsible for sending a copy of the WSP to adjacent utilities for review or a letter notifying them that a copy of the WSP is available for their review and where the review copy is located. Has this been completed?	☒ Yes	☐ No
16.	The purveyor is responsible for sending a copy of the WSP to all local governments within the service area. (County and City Planning Departments, etc). Has this been completed?	☒ Yes	☐ No
17.	Are you proposing a change in the place of use of your water right?	☐ Yes	☒ No

If answer to questions 7, 8, 11, 15and/or 16 is "yes," list who you sent the WSP to: Island County, Island County Water Resources Advisory Council

Is this plan: ☒ an Initial Submittal ☐ a Revised Submittal

Please enclose the following number of copies of the WSP:

3 copies for Northwest and Southwest Regional Offices **OR 2** copies for Eastern Regional Office (We will send one copy to Ecology)
1 additional copy if you answered "yes" to question 7. 3 Total copies attached

Please return completed form to the Office of Drinking Water regional office checked below.

☒ **Northwest Drinking Water Operations** **Department of Health** **20425 72nd Avenue South, Suite 310** **Kent, WA 98032-2358** **(253) 395-6750**	☐ **Southwest Drinking Water Operations** **Department of Health** **PO Box 47823** **Olympia, WA 98504-7823** **(360) 236-3030**	☐ **Eastern Drinking Water Operations** **Department of Health** **16201 East Indiana Avenue Suite 1500** **Spokane Valley, WA 99216** **(509) 329-2100**

If you need this publication in an alternate format, call (800) 525-0127. For TTY/TDD, call (800) 833-6388.

Water System Plan (WSP)
Pre-Plan Agenda
City of Oak Harbor
August, 2013

	√Required	Content Description	WSP Page #
Chapter 1		**Description of Water System**	
	(√)	Ownership and management	1-1
	(√)	System history and background	1-2
	(√)	Inventory of existing facilities	1-3
	(√)	Related plans / Coordinated Water System Plan (CWSP)	1-30
	(√)	Information & Maps: Service area, identify retail service area✰(WAC 106), designated land use & zoning, future comprehensive plan request for changes to land use, agreements (interlocal, etc.)	Chapter 1
	(√)	Policies: Service area, SMA, conditions of service, annexation	1-32
	(√)	Duty to serve✰ (WAC 106): identify process, timeframes, conditions, appeals	1-35
	(√)	Consistency from local planning✰ (WAC 108) agency	1-36
	(?)	Consistency from local watershed planning group (Ecology comments)	1-36
Chapter 2		**Basic Planning Data**	
	(√)	Current water use: Population, service connections, & ERUs and data reporting	2-1
	(√) (√)	Consecutive 6 & 20th year projections: Population, service connections, & ERUs Consecutive 6 & 20th year: Demand forecasts: w/ & w/o efficiency savings✰	2-13
	(√)	Total water loss percent and volume for Distribution System Leakage Standard	2-10
	(√) (√) (?)	Monthly and annual production. Totals per source. Water supply characteristics. Annual usage by customer class. Demand characteristics. Annual usage for water supplied to other systems Historical total water loss (DSL) – percent and volumes	2-3
	(√)	>1000, seasonal variations in consumption by customer class✰	2-11
Chapter 3		**System Analysis**	
	(√)	Capacity analysis with water right self assessment (cc to DOH per MOU)	3-16
	(√)	System design standards	3-1
	(√)	Water quality analysis	3-4
	(√) (√) (√) (√) (√)	System inventory, description and analysis Source Treatment Storage Distribution system/hydraulics	3-16
	(√)	Summary of system deficiencies	3-28
	(√)	Analysis of possible improvement projects	3-28
Chapter 5		**Water Use Efficiency Program and Water Rights**	
	(√)	Water Use Efficiency Program-WAC 246-290-810✰ - describe program, goal(s), public process, measures. Evaluate DSL, transmission leakage, Budget line item	5-1

	√Required	Content Description	WSP Page #
		for measures.	
		> 1,000 – Estimate past 6 years of water savings	
	(√)	Source & Service Meters / or schedule w/activities to minimize leakage☆	5-7
	(√)	Water right self assessment☆ for existing and 20-year projections	App. B
	(√)	Water supply & demand characteristics, describe & discuss water use effect☆	5-10
	(?)	Source of supply analysis and evaluation of supply alternatives	
	(?)	Interties	
	( )	≥1,000 connections evaluate reclaimed water opportunities☆	
Chapter 6		**Source Water Protection (Check One or Both)**	
	(√)	Wellhead protection program	6-1
	( )	Watershed control program	
Chapter 7		**Operation and Maintenance Program**	
	(√)	Water system management and personnel	7-1
	(√)	Operator certification	7-5
	(√)	Routine operating procedures and preventive maintenance	7-5
	(√)	Water quality sampling procedures & program – Identify WQ PN Requirements	
	(√)	Coliform monitoring plan. Add groundwater rule narrative.	
	(√)	Emergency program, water shortage plan, service reliability per WAC 246-290-420 Address sanitary survey findings	7-15
	(√)	Cross-connection control program. Summarize next actions to address.	7-33
	(√)	Recordkeeping, reporting, and customer complaint program	7-12
	(√)	Summary of O&M deficiencies	
Chapter 7		**Distribution Facilities Design & Construction Standards**	
	(?)	Standard construction specification for distribution mains	App. H
Chapter 8		**Improvement Program**	
	(√)	Capital improvement schedule for 6 and 20 years	8-1
Chapter 9		**Financial Program**	
	( )	≥1000 connections – Balanced 1-year budget	
	(√)	<1000 connections – Balanced 6-year budget, w/ Financial Viability-Feasibility	9-5
	(√)	Revenue and cash flow stability to fund capital and emergency improvements	9-5
	(√)	Evaluation of implementing rate structure that encourages water demand efficiency☆	9-2
APPEND.		**Miscellaneous Documents**	
	(√)	Meeting with consumers (date & description). Approval by EGB prior to DOH approval (New MWL Change☆	1-37, App. J
	(√)	County/Adjacent Utility Correspondence	1-37, App. J
	( )	≥1000 connections - State Environmental Policy Act (SEPA) Determination	
	(?)	Agreements (intertie, service area, franchise, etc.)	
	(?)	Satellite Management Program	

WATER FACILITIES INVENTORY (WFI) FORM

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

ONE FORM PER SYSTEM

Quarter: 1
Updated: 10/21/2013
Printed: 10/31/2013
WFI Printed For: On-Demand
Submission Reason: Annual Update

RETURN TO: Northwest Regional Office, 20425 72nd Ave S STE 310, Kent, WA, 98032

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
62650 C	OAK HARBOR, CITY OF	ISLAND	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS

RICHARD A. TYHUIS [OP MANAGER]
865 SE BARRINGTON DR
OAK HARBOR, WA 98277

STREET ADDRESS IF DIFFERENT FROM ABOVE
ATTN
ADDRESS
CITY STATE ZIP

7. OWNER NAME & MAILING ADDRESS

8. Owner Number 004166

OAK HARBOR, CITY OF
RICHARD A. TYHUIS
865 SE BARRINGTON DR
OAK HARBOR, WA 98277

TITLE: OP MANAGER

STREET ADDRESS IF DIFFERENT FROM ABOVE
ATTN
ADDRESS
CITY STATE ZIP

9. 24 HOUR PRIMARY CONTACT INFORMATION

Primary Contact Daytime Phone:	(360) 279-4753
Primary Contact Mobile/Cell Phone:	(360) 914-7251
Primary Contact Evening Phone:	(360) 675-7027
Fax: (360) 679-3902	E-mail: rtyhuis@oakharbor.org

10. OWNER CONTACT INFORMATION

Owner Daytime Phone:	(360) 279-4500
Owner Mobile/Cell Phone:	
Owner Evening Phone:	
Fax: (360) 675-2122	E-mail: rtyhuis@oakharbor.org

WAC 246-290-420(9) requires that water systems provide 24-hour contact information for emergencies.

11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)

- [x] Not applicable (Skip to #12)
- [ ] Owned and Managed
- [ ] Managed Only
- [ ] Owned Only

SMA NAME: ______ SMA Number: ______

12. WATER SYSTEM CHARACTERISTICS (mark ALL that apply)

- [ ] Agricultural
- [x] Commercial / Business
- [x] Day Care
- [x] Food Service/Food Permit
- [ ] 1,000 or more person event for 2 or more days per year
- [x] Hospital/Clinic
- [x] Industrial
- [x] Licensed Residential Facility
- [x] Lodging
- [x] Recreational / RV Park
- [x] Residential
- [x] School
- [ ] Temporary Farm Worker
- [x] Other (church, fire station, etc.): ______

13. WATER SYSTEM OWNERSHIP (mark only one)

- [ ] Association
- [x] City / Town
- [ ] County
- [ ] Federal
- [ ] Investor
- [ ] Private
- [ ] Special District
- [ ] State

14. STORAGE CAPACITY (gallons)

3,100,000

15 Source Number	16 SOURCE NAME: LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456. IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME. Example: SEATTLE	17 INTERTIE: INTERTIE SYSTEM ID NUMBER	18 SOURCE CATEGORY: WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	19 USE: PERMANENT	SEASONAL	EMERGENCY	20 SOURCE METERED	21 TREATMENT: NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	22 DEPTH: DEPTH TO FIRST OPEN INTERVAL IN FEET	23 CAPACITY (GALLONS PER MINUTE)	24 SOURCE LOCATION: 1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	02200C/ANACORTES	02200 C											X			Y				X				2000			00N	00E
S11	AGA866 WELL 8		X										X			Y		X		X			210	160	NE NW	03	32N	01E
S12	AGA865 WELL 9		X										X			Y		X		X			201	160	NE NW	03	32N	01E
S14	AGA887 WELL 11		X										X			Y		X		X			210	160	NW NE	03	32N	01E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
62650 C	OAK HARBOR, CITY OF	ISLAND	A	Comm

	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)	0	7810	Unspecified
A. Full Time Single Family Residences (Occupied 180 days or *more* per year)	4403		
B. Part Time Single Family Residences (Occupied *less than* 180 days per year)	0		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	765		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied *more than* 180 days/year	3407		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied *less than* 180 days/year	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units)	0	0	
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	513	513	
28. TOTAL SERVICE CONNECTIONS		8323	

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or *more* days per year? 18716

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?												
B. How many days per month are they present?												

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?												
B. How many days per month is water accessible to the public?												

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students daycare children and/or employees are present each month?												
B. How many days per month are they present?												

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	20	20	20	20	20	20	20	20	20	20	20	20

35. Reason for Submitting WFI:

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other ______

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: ______________________ DATE: ______________

PRINT NAME: ______________________ TITLE: ______________

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Table 1

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – EXISTING STATUS

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		EXISTING CONSUMPTION		CURRENT WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
G1-05858CWRIS	City of Oak Harbor	3/6/1961	SO11 Well No.8	No	200 gpm	320 acre-ft	160 gpm	3 acre-ft	40 gpm	317 acre-ft
G1-05901CWRIS	City of Oak Harbor	3/6/1961	SO12 Well No. 9	No	200 gpm	320acre-ft	50 gpm	1 acre-ft	150 gpm	319 acre-ft
G1-22778CWRIS	City of Oak Harbor	12/27/1976	SO14 Well No. 11	No	180 gpm	290 acre-ft	160 gpm	3 acre-ft	20 gpm	287 acre-ft
TOTAL	*************	*********	*********	*************	**580 gpm**	**930 acre-ft**	**370 gpm**	**7 acre-ft**	**210 gpm**	**923 acre-ft**

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		EXISTING CONSUMPTION THROUGH INTERTIE		CURRENT INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 02200CANACORTES	City of Anacortes	**-**	**3,068 acre-ft**	**-**	**2,198 acre-ft**	**-**	**870 acre-ft**
TOTAL	**						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1.					
2.					
3.					
4.					

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Please return completed form to the Office of Drinking Water regional office checked below.

☒ Northwest Drinking Water
Department of Health
20425 72nd Ave S, Suite 310
Kent, WA 98032-2358
Phone: (253) 395-6750
Fax: (253) 395-6760

☐ Southwest Drinking Water
Department of Health
PO Box 47823
Olympia, WA 98504-7823
Phone: (360) 236-3030
Fax: (360) 664-8058

☐ Eastern Drinking Water
Department of Health
16201 E Indiana Ave, Suite 1500
Spokane Valley, WA 99216
Phone: (509) 329-2100
Fax: (509) 329-2104

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Table 2

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 6 YEAR FORECAST

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		FORECASTED WATER USE FROM SOURCES (6-year Demand)		FORECASTED WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
G1-05858CWRIS	City of Oak Harbor	3/6/1961	SO11 Well No.8	No	200 gpm	320 acre-ft	160 gpm	3 acre-ft	40 gpm	317 acre-ft
G1-05901CWRIS	City of Oak Harbor	3/6/1961	SO12 Well No. 9	No	200 gpm	320acre-ft	50 gpm	1 acre-ft	150 gpm	319 acre-ft
G1-22778CWRIS	City of Oak Harbor	12/27/1976	SO14 Well No. 11	No	180 gpm	290 acre-ft	160 gpm	3 acre-ft	20 gpm	287 acre-ft
TOTAL	**************	*********	*********	****************	**580 gpm**	**930 acre-ft**	**370 acre-ft**	**7 acre-ft**	**210 acre-ft**	**923 acre-ft**

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 02200C/ANACORTES	City of Anacortes	-	**3,068 acre-ft**	-	**2,777 acre-ft**	-	**291 acre-ft**
TOTAL	**						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1.					
2.					
3.					
4.					

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DOH Form 331-372 (Updated 08/10)

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☒ Northwest Drinking Water
Department of Health
20425 72nd Ave S, Suite 310
Kent, WA 98032-2358
Phone: (253) 395-6750
Fax: (253) 395-6760

☐ Southwest Drinking Water
Department of Health
PO Box 47823
Olympia, WA 98504-7823
Phone (360) 236-3030
Fax: (360) 664-8058

☐ Eastern Drinking Water
Department of Health
16201 E Indiana Ave, Suite 1500
Spokane Valley, WA 99216
Phone: (509) 329-2100
Fax: (509) 329-2104

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Table 3

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 20 YEAR FORECAST

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		FORECASTED WATER USE FROM SOURCES (20-year Demand)		FORECASTED WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
G1-05858CWRIS	City of Oak Harbor	3/6/1961	SO11 Well No.8	No	200 gpm	320 acre-ft	160 gpm	3 acre-ft	40 gpm	317 acre-ft
G1-05901CWRIS	City of Oak Harbor	3/6/1961	SO12 Well No. 9	No	200 gpm	320acre-ft	50 gpm	1 acre-ft	150 gpm	319 acre-ft
G1-22778CWRIS	City of Oak Harbor	12/27/1976	SO14 Well No. 11	No	180 gpm	290 acre-ft	160 gpm	3 acre-ft	20 gpm	287 acre-ft
TOTAL	**************	*********	*********	****************	**580 gpm**	**930 acre-ft**	**370 acre-ft**	**7 acre-ft**	**210 acre-ft**	**923 acre-ft**

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 02200C/ANACORTES	City of Anacortes	-	**3,068 acre-ft**	-	**3,289 acre-ft**	-	**(221) acre-ft (1)**
TOTAL	**						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1.					
2.					
3.					
4.					

(1) The water agreement between the City of Oak Harbor and the City of Anacortes is renegotiated at least every three years. It is presumed that the contract will be amended prior to 2033 (20-year planning period) to provide adequate water for the City of Oak Harbor.

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☒ Northwest Drinking Water Department of Health 20425 72nd Ave S, Suite 310 Kent, WA 98032-2358 Phone: (253) 395-6750 Fax: (253) 395-6760	☐ Southwest Drinking Water Department of Health PO Box 47823 Olympia, WA 98504-7823 Phone (360) 236-3030 Fax: (360) 664-8058	☐ Eastern Drinking Water Department of Health 16201 E Indiana Ave, Suite 1500 Spokane Valley, WA 99216 Phone: (509) 329-2100 Fax: (509) 329-2104

WAC 197-11-960 Environmental checklist.

ENVIRONMENTAL CHECKLIST

Purpose of checklist:

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply." Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of proposed project, if applicable:

City of Oak Harbor Water System Plan

2. Name of applicant:

City of Oak Harbor

3. Address and phone number of applicant and contact person:

Mr. Arnold Peterschmidt P.E.
City of Oak Harbor Project Engineer
865 SE Barrington Drive
Oak Harbor, WA 98277

(360) 279-4520

4. Date checklist prepared:

February 27, 2014

5. Agency requesting checklist:

City of Oak Harbor

6. Proposed timing or schedule (including phasing, if applicable):

Water System Plan to obtain regulatory approval and adoption by the City in the spring of 2014. Projects are identified for construction over 6-and 20-year planning periods. Separate project specific SEPA checklists will be prepared for projects included in the Plan prior to construction.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

None at this time.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

Chapter 1 of the Plan evaluates the sensitive areas, including groundwater, within the City.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

None at this time.

10. List any government approvals or permits that will be needed for your proposal, if known.

Washington State Department of Health approval will be required for certain projects as defined by DOH guidelines. Ecology approval will be required for projects affecting groundwater or buried aquifer disturbance. Project specific permits may include federal, state, local, and/or construction permits, which will be obtained prior to construction.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

The City's Water System Plan is a planning document describing the location and types of facilities needed to provide water service to the study area in order to meet projected needs for at least the 20-year planning period. The proposal provides a method of implementation of the various prioritized components, each of which will require environmental evaluations and assessments as the projects are designed and implemented in their various phases.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The City is located in central Whidbey Island along Highway 20 and borders both Oak Harbor and Crescent Harbor. The City is located in Townships 32N and 33N, Ranges 1E and 2E, with Sections varying by location.

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site (circle one): *Flat, rolling*, hilly, steep slopes, mountainous, other . . . . . .

The general description of the City is flat and rolling.

b. What is the steepest slope on the site (approximate percent slope)?

The steepest slope is approximately 15 percent.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

A majority of the soils present in the area are of the Everett Alderwood Complex or Whidbey-Hoypus Complex with select regions of Coveland loam. Figure 1-10 shows a full soil classification map of the region.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

None associated with the Plan. Project specific soil stability analyses will be completed prior to project construction.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

No filling or grading of any significance is associated with the Plan.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

No erosion is associated with the Plan. Project construction work identified in the Plan will include protective measures and current best management practices for possible minor erosion problems.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

An individual SEPA review will be performed for individual proposed construction projects.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Individual project construction specifications will address additional erosion control measures.

2. Air

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

No impacts to air are associated with preparation of the Plan.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

No off-site emission sources are associated with the Plan.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Not applicable.

3. Water

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The City is located on Whidbey Island and is influenced by the waters in Puget Sound. The City immediately borders both Oak Harbor and Crescent Harbor. The Island has had some minor issues with saltwater intrusion to groundwater in locations, but currently, the City obtains a vast majority of its drinking water from the City of Anacortes.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

No work associated with the Plan is associated with the above-listed water bodies. It is possible that select construction projects will take place near the above described waters. The impact to nearby water bodies for individual projects described in the Plan will be determined on a project specific basis through the appropriate permitting process. Shoreline permitting consistent with the City's master plan will be obtained for construction projects identified in the Plan that will occur within 200 feet of Puget Sound.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

No dredging or filling is associated with preparation of the Plan.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No withdrawals or diversions are associated with preparation of the Plan.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

It is possible that select projects will take place in a flood plain. Each of these projects and their location relative to the 100-year floodplain are described in the Plan and will be determined on a project specific basis.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

The Plan identifies construction projects and measures the City will take to maintain compliance with its green operating permit and classification as a Type A water system. No waste discharges to surface waters are proposed.

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

No groundwater impacts are associated with preparation of the Plan.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

No waste is generated in preparation of the Plan. A vast majority of the City's residents are connected to the City sanitary system and do not rely on septic tanks. Sanitary waste is treated at the City's wastewater treatment plant.

c. Water runoff (including stormwater):

1) **Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.**

No stormwater impacts are associated with preparation of the Plan. Methods of collection, treatment (if applicable) and disposal of stormwater will be determined for projects identified in the Plan on a project specific basis.

2) **Could waste materials enter ground or surface waters? If so, generally describe.**

Waste materials could enter groundwater through one of the City's three wells. These wells are kept under surveillance, and clearly marked. There are no industrial activities or entities within the 10-year ZOCs for any of the three wells. Residents living within the 10-year ZOC have been notified through written correspondence that their actions may affect groundwater quality. Additional information is provided in Chapter 6 of the Plan.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

In general, best management practices will be employed to limit water impacts, but the specific measures to reduce and control surface, ground, or storm water will be project specific.

4. Plants

a. Check or circle types of vegetation found on the site:

X deciduous tree: red alder, big-leaf maple, willow, garry oak
X evergreen tree: Douglas fir, Western red cedar, hemlock, Grand fir
X shrubs: ocean spray, salmonberry, Oregon grape, snowberry
X grass: colonial bentgrass, orchard grass, tall fescue
X pasture: alfalfa, barley
– crop or grain:
X wet soil plants: reed canyongrass, soft rush, salmonberry
X water plants: water parsley, lesser duck weed
X other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

No vegetation was removed or altered as a result of the Plan. Affected vegetation will vary depending on the specific project.

c. List threatened or endangered species known to be on or near the site.

None known.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Vegetation will vary depending on the specific project.

5. Animals

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

The following animals are present within the City:

birds:	hawk, eagle, ducks, songbirds, geese
mammals:	deer, coyote, rabbits, rodents
reptiles:	snakes, alligator lizards
amphibians:	frogs, salamanders

fish: salmon, trout

b. List any threatened or endangered species known to be on or near the site.

Puget Sound chinook salmon, steelhead, and bulltrout are listed as "threatened" under the Endangered Species Act. Several Puget Sound rockfish are listed as "threatened" or "endangered" in the Strait of Juan de Fuca. ORCA resident southern pod is listed as "endangered".

c. Is the site part of a migration route? If so, explain.

Waterfowl, shorebirds, and neotropical migrants pass through the area. In addition, waterfowl and wintering raptors may occur within the water system area.

d. Proposed measures to preserve or enhance wildlife, if any:

SEPA reviews will be performed on each proposed construction project identified in the Plan as required. Projects identified in the Plan will observe critical area setbacks to protect sensitive fish and wildlife habitat.

6. Energy and natural resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

No energy needs were associated with preparation of the Plan.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

High efficiency pumps and energy efficient building materials will be used where applicable. Construction activities will be streamlined to minimize fossil fuel use where possible.

7. Environmental health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

No hazards are associated with preparation of the Plan.

1) Describe special emergency services that might be required.

None anticipated.

2) Proposed measures to reduce or control environmental health hazards, if any:

All industrial safety standards associated with design, construction, and operation of facilities identified in the Plan will be observed.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

Ambient noise is primarily from traffic and is not anticipated to affect the projects listed in the Plan.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

No noise was associated with preparation of the Plan. During construction of any of the proposed projects, noise from equipment will be generated from the site. Construction work will typically occur between the hours of 7:00 AM (PST) and 6:00 PM (PST) from Monday through Friday.

3) Proposed measures to reduce or control noise impacts, if any:

For construction projects identified in the Plan, noise reduction methods will be based on individual project requirements, but will generally include proper operation of noise reduction technology for pumps and motors, and limiting work and special construction traffic hours between 7:00 AM and 5:00 PM, Monday through Friday.

8. Land and shoreline use

a. What is the current use of the site and adjacent properties?

Land use in the City's service area includes residential, commercial, military, and agricultural activities.

b. Has the site been used for agriculture? If so, describe.

Not applicable to development of the Plan, no significantly producing agricultural areas exist within the service area.

c. Describe any structures on the site.

Existing distribution system projects and associated structures are described in Chapter 1, and proposed facilities are discussed in Chapter 8 of the Plan.

d. Will any structures be demolished? If so, what?

No structures were demolished in preparation of the Plan. The Eastside Reservoir is schedule for demolition in either 2014 or 2015. Additional details for this project are given in Chapter 1 and Chapter 8 of the Plan.

e. What is the current zoning classification of the site?

Zoning of the individual project sites is variable. A combination of areas zoned residential, commercial, and mixed-use contain individual projects. .

f. What is the current comprehensive plan designation of the site?

The comprehensive plan designation for areas containing system projects will be determined on an individual project basis. SEPA reviews will be performed on each proposed project as required.

g. If applicable, what is the current shoreline master program designation of the site?

SEPA, shoreline, and master plan consistency reviews will be performed on each proposed project identified in the Plan.

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

SEPA reviews will be performed on each proposed project as required. The City's service area includes sensitive areas, but none associated with preparation of the Plan.

i. Approximately how many people would reside or work in the completed project?

This number will be determined by the individual project. The population of the City's retail service area is approximately 18,800.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

None.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The Plan will be reviewed by all applicable land use authorities for compatibility.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Not applicable.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

Not applicable.

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

No proposed structures are associated with preparation of the Plan. SEPA reviews will be performed on each proposed construction project identified in the Plan as required.

b. What views in the immediate vicinity would be altered or obstructed?

No views were impacted during preparation of the Plan.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Sites disturbed by construction activities identified in the Plan will be restored to their original condition as much as possible.

11. Light and glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

No light or glare was associated with the preparation of the Plan. No light or glare issues are anticipated for the individual construction projects, but impacts from light and/or glare will be assessed at the time of construction.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No impacts are associated with preparation of the Plan. Light or glare impacts are not anticipated with any of the proposed construction projects.

c. What existing off-site sources of light or glare may affect your proposal?

None anticipated.

d. Proposed measures to reduce or control light and glare impacts, if any:

None anticipated.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

Recreational opportunities in the area include boating, hiking, diving, fishing, hunting, and bird watching, among others.

b. Would the proposed project displace any existing recreational uses? If so, describe.

Preparation of the Plan did not displace any recreational activities. Impacts to activities from proposed construction projects will be evaluated on an individual project basis.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

None measures required for preparation of the Plan. Proposed construction projects will be designed to minimize the impact to recreational activities.

13. Historic and cultural preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

None known or anticipated in association with preparing this Plan.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

None known or anticipated. Archaeological resources are known to exist within the retail service area of the City of Oak Harbor.

c. Proposed measures to reduce or control impacts, if any:

No impacts are associated with preparation of the Plan. Proposed construction projects in the Plan will undergo either an NHPA Section 106 Consultation or Governors EO05-05 review prior to construction. The City has established an Unintended Discovery Protocol that will be enacted in the event any culturally sensitive materials are discovered. The City has also included contingency funds in each CIP project to deal with any unexpected discoveries.

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

Distribution system projects identified in the Plan must be considered on an individual project basis.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

Transit access will be considered on an individual project basis. The City is served by Island Transit.

c. How many parking spaces would the completed project have? How many would the project eliminate?

Impacts to parking are not associated with preparation of the Plan. Parking will be considered on an individual project basis.

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

The proposed projects included in the Plan do not anticipate the need for new roads or streets.

e. **Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.**

The proposed projects will not use water, rail or air transportation. The City's water system includes service to Naval Air Station Whidbey Island.

f. **How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.**

Vehicular movement must be considered on an individual project basis, however, no additional trips were generated in preparation of the Plan.

g. **Proposed measures to reduce or control transportation impacts, if any:**

Transportation access and impacts will be considered on an individual project basis, however, there were no impacts in preparation of the Plan.

15. Public services

a. **Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.**

No increase is anticipated in preparation of this Plan. Individual construction projects identified in the Plan will provide additional water supply and pressure for the City's service area to accommodate growth.

b. **Proposed measures to reduce or control direct impacts on public services, if any.**

None anticipated.

16. Utilities

a. **Circle utilities currently available at the site: electricity, water, refuse service, telephone, sanitary sewer, communications.**

All the above utilities are available at some of the proposed project locations. Specific needs will be considered on an individual project basis.

b. **Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.**

Water and Sewer services:	City of Oak Harbor;	(360) 279-4520	www.oakharbor.org
Garbage and waste services:	City of Oak Harbor;	(360) 279-4530	www.oakharbor.org
Electricity services:	Puget Sound Energy;	(360) 675-9027	www.pse.com

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: [signature]

Date Submitted: MARCH 3, 2014

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS

Do not use this sheet for project actions.

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

The proposal will allow development within the retail service area per the City of Oak Harbor and Island County land use plans. Use or involvement with hazardous substances is not anticipated. Temporary increases in air and/or noise emissions during construction of projects described in the Plan are expected to occur, but their impacts are not expected to be significant.

Proposed measures to avoid or reduce such increases are:

Minimizing machinery operations and vehicle idling during construction and project planning with City and construction personnel should limit the impact of noise and air emissions. Construction best management practices for the control of erosion will be implemented to minimize impacts to surface and groundwater.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

Storm water runoff, dust, and noise pollution could occur during construction activities. Their impact will be controlled implementation of current best management practices (BMPs) and is expected to be minimal.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

Comprehensive sediment and erosion control planning for construction projects should limit the effect, if any, of dust and stormwater runoff.

3. How would the proposal be likely to deplete energy or natural resources?

New pumps, pumping facilities, or water reclamation facility modifications would require electrical power. Additionally, vehicles associated with construction would consume fossil fuels.

Proposed measures to protect or conserve energy and natural resources are:

New pumps and/or motors will be designed to be as efficient as possible, and construction activities will be thoroughly planned and coordinated to minimize vehicle usage. Proposed conveyance and treatment systems will be designed to flow by gravity as much as possible, and new, energy efficient pump and blower models will be specified.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

The proposed Plan is consistent with applicable land use plans, which address environmentally sensitive areas such as those listed above.

Proposed measures to protect such resources or to avoid or reduce impacts are:

1. The City will coordinate with its cultural liaison and local tribal authorities prior to individual project initiation. Critical area setbacks will be observed during planning and construction of projects identified in the Plan.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

The proposal is consistent with applicable land use plans, which address shoreline areas. The projects identified in the Plan will support existing land uses and planned development within the service area through the 6- and 20-year planning period but do not encourage uses incompatible with existing plans.

Proposed measures to avoid or reduce shoreline and land use impacts are:

Projects identified in the Plan will undergo shoreline and critical area land-use reviews as required by state and local regulations.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

The proposal addresses the provision of water delivery and distribution system development to serve future growth within the service area. Future development most likely will increase demands on transportation and public services and utilities.

Proposed measures to reduce or respond to such demand(s) are:

Construction projects identified in the Plan will include provisions for traffic control to minimize impacts or increases in demand on public transportation during construction.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

The proposal will be consistent with laws or requirements for environmental protection. All construction projects will undergo SEPA review (and NEPA review, if required) and will be reviewed by the appropriate federal, state, and local jurisdictions.

APPENDIX B

WATER SERVICE AGREEMENTS AND WATER RIGHTS

Water Right Tracking System
Department of Ecology
WR Document List Sorted By Priority Date Report

Reported By: ARHA461																
Report Date: 12/4/2013																
File #	**Cert #**	**Person**	**Stat**	**Doc**	**Priority Dt**	**Purpose**	**Qi**	**UOM**	**Qa**	**Ir Acres**	**WRIA**	**County**	**TRS**	**QQ/Q**	**Src's**	**1stSrc**
G1-*05858CWRIS	3967	Oak Harbor City	A	Cert	3/6/1961	MU	200	GPM	320		6	ISLAND	32.0N 01.0E 03	NE/NW	1	WELL
G1-*05901CWRIS	4114	Oak Harbor City	A	Cert	4/10/1961	MU	200	GPM	320		6	ISLAND	32.0N 01.0E 03		1	WELL
G1-*08370CWRIS	6201	Oak Harbor City	A	Cert	10/27/1966	MU	450	GPM	720		6	ISLAND	33.0N 01.0E 26	SW/SE	1	WELL
G1-22778CWRIS		Oak Harbor City	A	Cert	12/27/1976	MU	180	GPM	290		6	ISLAND	32.0N 01.0E 03	SE/NW	1	WELL
G1-00101PWRIS		Oak Harbor City	I	Pmt	9/27/1971	MU	400	GPM	640		6	ISLAND	33.0N 01.0E 34		1	WELL
G1-20913PWRIS		Oak Harbor City	I	Pmt	7/16/1973	MU	500	GPM	800		6	ISLAND	33.0N 01.0E 36		1	WELL
G1-20914PWRIS		Oak Harbor City	I	Pmt	7/16/1973	MU	300	GPM	480		6	ISLAND	33.0N 01.0E 36		1	WELL
G1-20915PWRIS		Oak Harbor City	I	Pmt	7/16/1973	MU	100	GPM	160		6	ISLAND	33.0N 01.0E 35		1	WELL
G1-20916PWRIS		Oak Harbor City	I	Pmt	7/16/1973	MU	160	GPM	256		6	ISLAND	32.0N 01.0E 03		1	WELL
TOTAL RECORDS:	9															
SELECTION CRITERIA																
Region	Northwest															
Person	%Oak Harbor City%															
Role	Primary															

This data may not be complete or accurate.Validity of water rights documented by statements of claims can only be determined in Superior Court. Ecology cannot guarantee the validity of the water rights documented by Permits and Certificates

Water Right Tracking System
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S1-*01034AWRIS		Anacortes City	I	NewApp	1/28/1924	MU	6	CFS			3	SKAGIT	35.0N 01.0E 18		1	LAKE CAMPBELL
S1-*01268CWRIS	2187	Anacortes City	A	Cert	3/2/1925	MU,CI	4	CFS			3	SKAGIT	34.0N 02.0E 07		1	LAKE CAMPBELL
R1-*01269CWRIS	2188	Anacortes City	A	Cert	3/2/1925	MU		CFS	1000		3	SKAGIT	34.0N 01.0E 13		1	LAKE ERIE
S1-*03012AWRIS		Anacortes City	I	NewApp	6/19/1930	MU	5	CFS			3	SKAGIT	34.0N 01.0E 12		1	LAKE ERIE
S1-*03031ALC	01161A	Anacortes City	I	Cert	7/2/1930	MU	15	CFS	0		3	SKAGIT	34.0N 03.0E 13		2	SKAGIT RIVER
G1-*03767C	3959	Anacortes City	A	Cert	9/13/1954	MU	14500	GPM	23200		3	SKAGIT	34.0N 03.0E 13		2	WELL
S1-00709CWRIS		Anacortes City	A	Cert	2/14/1963	MU	70	CFS	50680		3	SKAGIT	34.0N 03.0E 13	SW/NW	1	SKAGIT RIVER
CG1-*03767C		Anacortes City	A	Chng/ROE	4/11/1985	MU	1453	GPM	23200		3	SKAGIT	34.0N 03.0E 13	SW/NW	1	SKAGIT RIVER
CS1-*03031ALC		Anacortes City	I	ChgApp	2/27/1995		15	CFS	0		3	SKAGIT	34.0N 03.0E 12		2	SKAGIT RIVER
TOTAL RECORDS:	9															
SELECTION CRITERIA																
Role	Primary															
Region	Northwest															
Person	%Anacortes City%															

This data may not be complete or accurate.Validity of water rights documented by statements of claims can only be determined in Superior Court. Ecology cannot guarantee the validity of the water rights documented by Permits and Certificates

1/30/08 TRANSFERS

WATER RIGHT TRANSFERS
ARE A PERMIT APPLICATION PROCESS

5 YEARS OF CONTINUOUS NON-USE
WATER RIGHT IS FORFIT - RELINQUISHMENT
UNLESS SUFFICINT REASON FOR
NON-USE. THERE ARE ALSO EXCEPTIONS
INCLUDING MUNICIPAL PURPOSES

DID CITY STAFF ACTUALLY NOTIFY
ECY THAT WATER RIGHTS WERE
ABANDONED/RELENQUISHED?

ARE FACILITIES ASSOCIATED WITH
WATER RIGHT BEING MAINTAINED?
YES

ALWAYS POTENTIAL FOR REVERSAL
ON ABANDONMENT/RELENQUISHMENT

RCW 90.

WATER SYSTEM PLANS ARE KEY
DOCUMENTS IN DETERMINATION
OF ~~EXISTE~~ MAINTAINING OR
RELENQUISHMENT OF WATER RIGHTS
EXTENT & VALIDITY

INVENTORY WELLS, PUMP CAPACITY,
PIPE SIZES, USE OF WATER,
RECONSTRUCTION, REHABILITATION
EFFORTS, MAINTENANCE RECORDS
~~OBS~~ RECORD AFFIDAVITS FROM STAFF
OR FORMER STAFF REGARDING
WATER RIGHT USE

TREAT WATER RIGHT
TRANSFERS LIKE A
REAL PROPERTY TRANSACTION

Smith
Alling
Lane

A Professional Services Corporation

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August 13, 1999

Mr. Ryan Goodman, City Engineer
City of Oak Harbor
865 SE Barrington Drive
Oak Harbor, WA 98277-4092

Re: Water Rights Issues

Dear Mr. Goodman:

This is in response to your request for an opinion regarding various aspects of water rights for the City of Oak Harbor. I have divided this letter into a number of sections, and the discussion of the issues in each section follows.

A. BACKGROUND

1. Current Water Rights City of Oak Harbor.

The current records of the Department of Ecology ("DOE") show that the City of Oak Harbor has ten water rights on file with the state. They consist of five permits, four certificates, and one claim. All are for ground water withdrawals.

The oldest right is the claim, with a first date of use of 1942.

2. City of Anacortes.

The Department of Ecology records indicate that the City of Anacortes has eleven recorded water rights of some type or other. Six of those rights are in certificate status.

The largest ground water withdrawal for the City of Anacortes is in a certificate status, with a priority date of September 13, 1954. That certificate has a stated annual amount of 23,200 acre-feet ("AF").

The largest surface water right of the City of Anacortes is a diversion from the Skagit River, with a priority date of February 14, 1963. The authorized annual amount of the diversion is 50,680 AF. (The Department of Ecology summary of rights held by the Cities of Oak Harbor and Anacortes is attached.)

3. **Water Supply Agreement**.

It is my understanding that, since 1971, the City of Oak Harbor has been supplied water as a wholesale customer of the City of Anacortes under the terms of a Water Supply Agreement ("Supply Agreement"). The Supply Agreement was most recently amended in 1998, to reflect new billing rates for the water supplied under the Agreement. I have reviewed a copy of the Supply Agreement, which you provided me.

The Supply Agreement has a duration of 20 years (until 2009). The "Anacortes Water Supply System" from which the water is derived for delivery under the Supply Agreement includes "the water intake and treatment facilities near Avon on the Skagit River." I assume that the water delivered under the Supply Agreement is water diverted from the Skagit River by the City of Anacortes pursuant to the terms of its certificate for Skagit River water.

Under the terms of the Supply Agreement, the City of Anacortes has agreed to supply water to the City of Oak Harbor's "existing industrial operations and/or water service area." Paragraph 8. The City of Oak Harbor, in return, has agreed not to "increase its water requirements by more than 10% without the prior approval of the" City of Anacortes. Id. The Supply Agreement does not specify over what period of time the "10%" is to be measured. In that and other respects, the Supply Agreement limits the obligation of Anacortes to provide water to Oak Harbor.

In addition, Anacortes has agreed to operate its water system "so as to meet the volumes contracted for by its customers and to supply additional volumes as may be required by the [City of Oak Harbor] in the future, consistent with the needs of all its customers."

Therefore, under the Supply Agreement, Anacortes has agreed to provide additional future water to Oak Harbor. This obligation terminates in 2009, but may be renewable.

Under the terms of that Agreement, Oak Harbor is essentially a wholesale customer of Anacortes, with no statutorily-based claim to the underlying water rights used by the City of Anacortes as the wholesale provider.

4. **Skagit River Basin Water Agreement**.

In 1996, a number of government agencies and tribes entered into an agreement regarding the use of water from the Skagit River Basin. The full title of the agreement was a

"Memorandum of Agreement Regarding Utilization of Skagit River Basin Water Resources for Instream and Out of Stream Purposes" (hereinafter "Skagit River Agreement"). Those parties included the City of Anacortes and the Washington State Department of Ecology. No other city or town was a party to the Skagit River Agreement.

The Skagit River Agreement has a 50 year term (from December 26, 1996 to December 26, 2046).

The Skagit River Agreement has a number of stated purposes. Among them are the following:

a. To "ensure the establishment of instream flows...";

b. To provide for "coordinated management of water resources in areas described by the Skagit County Coordinated Water System Plan, Regional Supplement,..."; and

c. To assist the Department of Ecology in its "water right decision-making within the CWSP service area;..."

Under the terms of the Agreement, the "Skagit River Basin" is defined as those watersheds included within Washington Water Resources Inventory Areas (WRIAs) 3 and 4. WRIA no. 3 is the Lower Skagit-Samish WRIA, and WRIA no. 4 covers the Upper Skagit. Oak Harbor and Island County lie within WRIA no. 6, the "Island" WRIA. WRIA no. 3 has been identified by the state as a "Priority Salmon Recovery Region for habitat protection restoration." (Attached is a copy of the Department of Ecology table, dated February 18, 1999, that shows the ESA status of each watershed.)

Under the Skagit River Agreement, the City of Anacortes established a "relative order of priorities" for the use of its existing water rights, and for future water rights.

The first priority was given to the Anacortes right evidenced by certificate no. C-709, with a priority date of February 14, 1963. The Agreement states that that right "provides 70 cfs" for the following described place of use: "areas served by the City of Anacortes Water Supply System."

The second priority was given to the Anacortes right evidenced under certificate no. C-1161. That right provides 15 cfs for the following named place of use: "City of Anacortes."

The Skagit River Agreement provides how a request for a change in point of diversion for certificate C-1161 may be handled by the Department of Ecology. The provisions of the agreement dealing with this subject apparently intend to have any change in point of diversion under that right subject to instream flows established for Cultus Mountain and the Lower Skagit River. The Agreement has various provisions regarding actions to be taken by the city, the Snohomish County PUD, and the tribes that are parties to the Agreement, as well as by the Department of Ecology. The tribes that are parties to the Agreement are the Upper Skagit Indian Tribe, the Swinomish Indian Tribal Community, and the Sauk-Suiattle Indian Tribe.

If DOE approves a change in point of diversion to the certificate referred to above, Anacortes must "ensure that any water rights documents issued by Ecology that purport to effectuate these changes shall be expressly and clearly conditioned to require compliance with this Agreement."

The Skagit River Agreement also includes provisions regarding additional water service by the parties to the Agreement. For example, the Agreement provides that the parties must "reach agreement prior to expanding service areas beyond those identified in the CWSP." Agreement by the parties on this issue "will be based on evaluations of additional needs existing at the time, and after considering additional needs that may exist after the 50-year term of this Agreement." If the parties cannot come to an agreement on expanded service areas, then no party may "seek or approve any changes relating to water quantity associated with the expansion of services areas for a period of 50 years from the effective date of this Agreement." An expansion of Oak Harbor's current service area may be interpreted to fall under these provisions.

By its very terms, the Skagit River Agreement was not intended to provide any benefit to any third party, such as the City of Oak Harbor. Section V.G of the Agreement provides as follows:

> No Third Party Beneficiaries. No third party is intended to, or shall have, any rights under this Agreement. The Parties intend that this Agreement be strictly between themselves, and therefore, only the Parties have any right to enforce this Agreement or any provision of this Agreement.

5. **Water Shortage Response Plan**.

The Skagit River Agreement includes a Water Shortage Response Plan, which was attached to the Agreement as "Exhibit A." The Response Plan includes provisions that may cover wholesale customers of any of the parties to the Skagit River Agreement, including the City of Anacortes. The Water Shortage Response Plan ("WSRP") defines a wholesale customer as a "customer who resells the water for commercial/industrial or residential use." This definition would appear to include the City of Oak Harbor as a wholesale customer under the terms of the WSRP.

The general purpose of the WSRP is to establish a "Response Plan" to take effect whenever the Skagit River is "projected to fall below the State Department of Ecology Instream Flow Level,..." The Response Plan will be adjusted and carried out by the Skagit River Flow Management Committee (WRFMC), which is required to meet in May of every year to "review the projected stream flows and to identify possible management strategies to meet the collective water needs of the participants." It is anticipated this group could have some impact on the diversion of waters from the Skagit River by such water rights holders as the City of Anacortes.

6. **Current Water Right Status.**

In a recent document (April 9, 1999), DOE has indicated the current status of existing water rights, applications for new water rights, and applications for transfer (which includes proposals for amendment of water rights for changes in place of use, place of diversion, etc.). The data are reported on a county-by-county basis. For Island and Skagit Counties, they are as follows:

	Island County	Skagit County
Outstanding certificates	709	879
Water right claims	2936	4174
Outstanding permits	169	232
Applications for new water rights	229	618
Application for transfers	35	29

Some of the above may represent unused existing rights that could be transferred to the city.

7. **Federal Reserved Rights.**

Although I have no evidence of such rights, a federally based reserved right may be held by the United States for the naval facility. Further research on whether such a right exists would be warranted.

B. RELEVANT STATUTORY PROVISIONS

1. **Water Supply Plans.**

The Washington State Department of Health ("DOH") has authority, pursuant to chapter 43.20 RCW, to review and approve water system plans. Such plans must be provided by public water purveyors.

DOH has adopted regulations dealing with water system plans. See WAC 246-290-100. Through their plans, water purveyors are intended to:

(a) Identify present and future needs;

(b) Set forth means for addressing those needs; and

(c) Do so in a manner consistent with other relevant plans and local, state, and federal laws.

WAC 246-290-100(1).

Such a plan should show sources of water for a public water system, as well as the service area for the system. In addition, they must have a "Source of supply analysis when additional water rights are being pursued;..." WAC 246-290-100(4)(e).

I assume that both Oak Harbor and Anacortes have such plans, and that the plans specify both sources of water, and territories to be served.

2. Public Water Systems Coordination Act of 1977.

The Public Water Systems Coordination Act of 1977 is codified at chapter 70.116 RCW.

Under that act, DOH has the authority to review and approve coordinated water systems plans, which are plans "for public water systems within a critical water supply service area which identifies the present and future needs of the systems and sets forth means for meeting those needs in the most efficient manner possible." RCW 70.116.030(1).

Such plans must include discussions of future service areas, transmission facilities, and other relevant matters related to the delivery of water by a public purveyor within its current and proposed service areas.

A completed plan must include "service area boundaries of public water systems within the critical water supply service area." RCW 70.116.070(1).

DOH regulations dealing with review of such systems are found at chapter 246-290 WAC.

If either the City of Anacortes or the City of Oak Harbor has its area of supply, or its service areas, included within a critical water service plan, the elements of that plan may be relevant in answering questions about current rights of the City of Oak Harbor, and the establishment of future rights.

3. **Growth Management Act**.

Your letter of March 9, 1999 raises certain questions regarding service outside urban growth areas, as defined pursuant to the Growth Management Act. The following provisions of the Growth Management Act deal with that subject.

First, the overall planning goals of the Growth Management Act ("GMA") include provisions relating to providing utility service within and outside urban growth areas. The following goals have some relevance:

> (1) Urban growth. Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner.
>
> . . .
>
> (5) Economic development. Encourage economic development throughout the state that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens of the state, especially for unemployed and for disadvantaged persons, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the state's natural resources, public services, and public facilities.
>
> . . .
>
> (12) Public facilities and services. Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.

RCW 36.70A.020.

The GMA defines urban government services as follows:

> "Urban governmental services" or "urban services" include those public services and public facilities at an intensity historically and typically provided in cities, specifically including storm and sanitary sewer systems, domestic water systems,

> street cleaning services, fire and police protection services, public transit services, and other public utilities associated with urban areas and normally not associated with rural areas.

RCW 36.70A.030(19) (emphasis added).

"Public facilities" are defined to include "domestic water systems,..." RCW 36.70A.030(12).

GMA comprehensive plans are required to address various issues by having a "land use element", a "housing element", a "facilities plan element", a "utilities element", and a "rural element."

The "land use element" is to designate, among other things, the location and extent of use of "public utilities, public facilities,..." RCW 36.70A.070(1). These include public water system facilities.

The "facilities plan element" is to include "a forecast of the future needs for such capital facilities;..." RCW 36.70A.070(3)(b). It is also to include "the proposed locations and capacities of expanded or new capital facilities..." RCW 36.70A.070(3)(c).

The "utilities element" is to include "the general location, proposed location, and capacity of all existing and proposed utilities,..." RCW 36.70A.070(4).

The provisions of the GMA dealing with urban growth areas also deal with what public utility services are allowed, and at what intensity, outside the urban growth areas. The relevant provisions are as follows:

> (3) Urban growth should be located first in areas already characterized by urban growth that have adequate existing public facility and service capacities to serve such development, second in areas already characterized by urban growth that will be served adequately by a combination of both existing public facilities and services and any additional needed public facilities and services that are provided by either public or private sources, and third in the remaining portions of the urban growth areas. Urban growth may also be located in designated new fully contained communities as defined by RCW 36.70A.350.
>
> (4) In general, cities are the units of local government most appropriate to provide urban governmental services. In general, it is not appropriate that urban governmental services be extended to or expanded in rural areas except in those limited circumstances shown to be necessary to protect basic public health and

safety and the environment and when such services are financially supportable at rural densities and do not permit urban development.

RCW 36.70A.110.

Although the above language might constrain the sale of water on a retail basis for use outside of an urban growth area ("UGA"), it would not affect providing the water on a wholesale basis to another purveyor. Various cities provide water at retail, and at wholesale, for areas outside of a UGA. It is the responsibility of the wholesale customer to subsequently purvey the water to retail customers consistent with the relevant GMA plan provisions.

4. **Watershed Planning**.

In 1997 and 1998, the legislature enacted provisions of state law dealing with watershed planning on a local level. These have been codified at chapter 90.82 RCW. Under that statute, WRIA planning units may be established, and previous efforts may be recognized, for the purpose of establishing watershed plans.

Such plans could include components involving water quantity, instream flow setting, water quality, and habitat protection. WRIA 6 is in the "startup" phase of watershed planning, whereas WRIAs 3 and 4 are in what DOE terms "phase 2" of their planning, and will be addressing water quality, habitat, and instream flow issues.

All three WRIAs are included within the salmon recovery region of Puget Sound identified as part of the Endangered Species Act ("ESA") effort. WRIA 3 has been identified by DOE as among the "highest" priority for setting or revising current instream flows, whereas WRIA 4 has been identified as a "high" priority for setting or revising instream flows.

I am not aware of the participants in the watershed basin planning efforts for WRIAs 3 and 4. However, given the unique role of Oak Harbor as a large wholesale customer of Anacortes, I would suggest that Oak Harbor consider involvement as a participant in watershed basin planning, if not for WRIA 4, at least for WRIA 3 -- if it is not so participating now.

C. ANSWERS TO YOUR SPECIFIC QUESTIONS

1. **What rights does the City of Oak Harbor have to Skagit River water?**

From my review of the documents provided me, I would conclude the City of Oak Harbor has no rights itself to any diversion of water from the Skagit River, at least as represented by any certificate, permit, or water right claim on file with DOE.

Neither does the City of Oak Harbor have any right to water under the current terms of the Skagit River Agreement, since Oak Harbor is a third party excluded under the terms of the agreement from having any rights under the agreement.

However, Oak Harbor does have a right to water under the terms of the Supply Agreement with the City of Anacortes, and the main source of water for the City of Anacortes arises from a diversion from the Skagit River. However, there are limitations both on the supplying utility and on the receiving utility under the terms of that agreement, as discussed above.

It is noteworthy that one other city is a recipient of water as a result of a wholesale transaction from the City of Anacortes: the Town of LaConner.

It is also noteworthy that Oak Harbor is the largest wholesale customer of the City of Anacortes. Indeed, according to the 1997 records of water consumption for the City of Anacortes you have provided me, use by Oak Harbor of water delivered by Anacortes exceeds all commercial and residential uses within the City of Anacortes.

Except for some derivative contractual right to the use of water for which Anacortes has a right to divert from the Skagit River, the City of Oak Harbor has no current right to Skagit River water. Its right to use water for which a right has been established by the City of Anacortes is contingent and conditioned on contractual agreements with the City of Anacortes.

You should note that the two certificated water rights referred to in the Skagit River Agreement for Anacortes have different descriptions for their places of use. Certificate no. C-709 refers to the place of use as the "area served by the City of Anacortes Water Supply System." That term could be interpreted broadly to include the area served as wholesale customers of Anacortes, and therefore could be assumed to include Oak Harbor's service area.

However, certificate no. C-1161 describes the authorized place of use as the "City of Anacortes." It is arguable what this term means. Although I am not aware of any litigation on the issue, the question of the appropriate place of use of municipal water rights when a certificate of water right refers has a reference similar to "City of Anacortes" is one that may arise in the future.

The issue of an expanding place of use for a municipal water right is related to the issue of an expanding volume of water under municipal water rights, sometimes called the "Growing Community Doctrine." (I am attaching a paper I delivered on April 9, 1999 on questions related to municipal water rights that discusses this matter).

If someone were to challenge the use of water under certificate no. C-1161 by the City of Anacortes outside of the boundaries of the "City of Anacortes", it is possible that a court would hold that use of water under that certificate would be limited to the actual boundaries of the City of Anacortes, either as they existed at the time the water rights certificate was issued (1930), or as they exist at present. Regardless, a court might hold that water under that certificate could not be delivered for use outside of the current boundaries of the City of Anacortes. Conceivably, this could have a negative impact on service of water by Anacortes to its wholesale customers outside of the city.

2. **Can Oak Harbor sell water outside its urban growth area?**

Generally, under the GMA a municipal utility may provide water service outside of its established urban growth area "in those limited circumstances shown to be necessary to protect basic public health and safety and the environment and when such services are financially supportable at rural densities and do not permit urban development." RCW 36.70A.110(4).

The phrase "urban development" is not defined in the GMA. However, it is similar to the term "urban growth", which is defined to mean "growth that makes intensive use of land for the location of buildings, structures, and impermeable surfaces to such a degree as to be incompatible with...rural development,..." RCW 36.70A.030(17).

Arguably, a city could extend water supply outside of its urban growth area, consistent with the GMA, under certain circumstances. One of these is where such service is consistent with the comprehensive plan of Island County.

Another is where the City of Oak Harbor could establish service outside its urban growth area using satellite management agencies, or as a wholesaler of water to another purveyor.

Satellite management agencies are authorized under chapter 70.116 RCW and chapter 246-295 WAC. A "satellite management agency" is defined to mean "an individual, purveyor. or entity that is approved by the secretary [of DOH] to own or operate more than one public water system on a regional or county-wide basis, without the necessity for a physical connection between such systems." WAC 246-295-010.

Pursuant to regulations adopted by DOH, each county was to identify and submit a list of potential satellite management agencies to DOH by January 1, 1995 that would include areas "not within a designated future service area of any utility pursuant to the Water System Coordination Act;..." WAC 246-295-030(1)(a). I do not know whether Island County submitted such a list.

The City would not need to operate under the authority of Chapter 70.116 RCW, if it sold water to another purveyor by means of a wholesale contract.

3. **<u>What should be done to improve Oak Harbor's water rights</u>?**

The answer to this question depends on a number of factors and questions. For example, is the city now using the maximum amount of water allowed under its various certificates, permits and claims? If not, could the city physically withdraw additional water to meet the maximum amount set out in those certificates, permits, and claims?

If the city must look for new sources of water outside of Island County, and especially from the Skagit River Basin, then it could pursue any of the following possibilities (which are listed in preferred order.)

a. Amend the existing contract with the City of Anacortes.

The City of Oak Harbor may wish to amend its existing contract with the City of Anacortes to provide for a number of things.

One of these may be greater assurances of future supply by Anacortes. Another may be assurances of involvement in watershed planning efforts involving the City of Anacortes and its water rights, such as those involving WRIA 3.

There may be other possible areas of amendment which I have not considered.

b. Apply for a transfer of an existing right, preferably an unused or under utilized right.

Existing water rights may be transferred or assigned under the terms of chapters 90.03 RCW and 90.44 RCW. However, the right may only be transferred for the amount of water that has been put to "beneficial use" in its original proposed place of use.

It is conceivable that the city may wish to do further research on existing authorized water rights in Island and Skagit Counties. Such research may identify outstanding municipal or group domestic water rights that are either not in current use, or are under utilized, or may identify rights for other beneficial uses that could be amended to include municipal uses.

Because of provisions in state statute and the interpretation given them recently by the state supreme court in a number of cases, any proposal for a transfer or amendment of existing water right may raise questions involving whether the right to be transferred has been abandoned or relinquished under Washington State law.

I am not familiar with whether there are any existing water rights in the counties of importance to Oak Harbor that represent significant volumes of water that could be transferred under an application to be filed with DOE. However, this is one area that the city may wish to pursue.

c. Condemn an unused or under-utilized existing water right.

Under Washington State law, any "beneficial use of water is" considered "to be a public use,..." RCW 90.03.040. Any person, including a municipality, "may exercise the right of eminent domain" to require any right in the use of water. Id.

An existing water right may be condemned for use by another in a condemnation proceeding if the court can determine that a new "use will be for the greatest public benefit, and that you shall be deemed a superior one:..." Id.

Although I am unaware of any recent use of the statutory provisions, nevertheless the right to obtain a water right through the use of condemnation is authorized under the statute.

I am looking into this alternative in more detail, and will be providing you a supplemental letter on the subject.

d. Apply for a new point of diversion or place of withdrawal.

The city could apply for a new water right under either chapter 90.03 RCW (surface water code) or chapter 90.44 RCW (groundwater code). Such an application could be made, theoretically either for a source of water in Island County or in Skagit County.

However, DOE has been extremely reluctant to process and grant any new water right applications. This reluctance is enhanced in such areas as WRIAs 3 and 4, where watershed basin planning efforts have just begun. It would be unlikely that any application for new water use would be granted.

However, an argument could be made that one advantage of filing any new application for a water right would be to establish a priority date (the date of priority of a right is the date on which the application is received by DOE).

I am not familiar with the engineering and financing obstacles that would face Oak Harbor in attempting to obtain a water right outside of Whidbey Island, but I assume that such obstacles would be formidable.

I hope that this analysis may be of some help to you. If there are additional matters you would wish me to investigate, please let me know. I would welcome the opportunity to meet with you to discuss the questions you have asked, and the responses I have provided.

Sincerely,

SMITH ALLING LANE, P.S.

Bob Mack

Robert E. Mack

REM:cjs
Enclosure

0/1999

** WATER RIGHTS APPLICATION TRACKING SYSTEM **

Northwest Regional Office

WRATS REPORT BY NAME

WR'S

CONTROL NUMBER	TYPE/ STAT	BUSINESS/PERSON NAME	PRIORITY DATE	WRIA CODE	COUNTY NAME	Q1	ACRE FT/YR	ACRES IRR	DOM UNITS	PURPOSES	SOURCE	TRS	QUAD
20916PWRIS	PE/CAN	OAK HARBOR CITY OF,	7/16/73	6	ISLAND	160.000	256.00			MU·	WELL	T32N/R 1E- 3	
22778CWRIS	CE	OAK HARBOR CITY OF,	12/27/76	6	ISLAND	180.000	290.00			MU·	WELL	T32N/R 1E- 3	SE/4NW/4
00101PWRIS	PE/CAN	OAK HARBOR CITY OF,	9/27/71	6	ISLAND	400.000	640.00			MU·	WELL	T33N/R 1E-34	
20915PWRIS	PE/CAN	OAK HARBOR CITY OF,	7/16/73	6	ISLAND	100.000	160.00			MU·	WELL	T33N/R 1E-35	NE/4NE/4
20913PWRIS	PE/CAN	OAK HARBOR CITY OF,	7/16/73	6	ISLAND	500.000	800.00			MU·	WELL	T33N/R 1E-36	
20914PWRIS	PE/CAN	OAK HARBOR CITY OF,	7/16/73	6	ISLAND	300.000	480.00			MU·	WELL	T33N/R 1E-36	
·05858CWRIS ·03967	CE	OAK HARBOR TOWN OF,	3/06/61	6	ISLAND	200.000	320.00			MU·	WELL	T32N/R 1E- 3	NE/4NW/4
·05901CWRIS ·04114	CE	OAK HARBOR TOWN OF,	4/10/61	6	ISLAND	200.000	320.00			MU·	WELL	T32N/R 1E- 3	
·08370CWRIS ·06201	CE	OAK HARBOR TOWN OF,	10/27/66	6	ISLAND	450.000	720.00			MU·	WELL	T33N/R 1E-26	SW/4SW/4SE/4
039420CL	CL [L]	OAK HARBOR, CITY OF	0/0/1942	6	ISLAND					DG	WELL	T32N/R 1E- 2	

N O T E

report contains information about water right Certificates, Permits, and Claims. Because of unauthorized changes or non-use, Ecology cannot guarantee the idity of the Permits, and Certificates. Validity of Claims can only be determined in Superior Court. You are encouraged to verify that current use is sistent with the document as described.

** WATER RIGHTS APPLICATION TRACKING SYSTEM **
Northwest Regional Office
WRATS REPORT BY NAME
WR'S

CONTROL NUMBER	TYPE/ STAT	BUSINESS/PERSON NAME	PRIORITY DATE	WRIA CODE	COUNTY NAME	QI	ACRE FT/YR	ACRES IRR	DOM UNITS	PURPOSES	SOURCE	TRS	QUAD
03012AWRIS	AP/REJ	ANACORTES CITY OF,	6/19/30	3	SKAGIT	5.000				MU·	LAKE ERIE	T34N/R 1E-12	SW/4SW/4NW/4
·01269CWRIS ·02188	CE	ANACORTES CITY OF,	3/02/25	3	SKAGIT		1000.00			MU·	LAKE ERIE	T34N/R 1E-13	
·01268CWRIS ·02187	CE	ANACORTES CITY OF,	3/02/25	3	SKAGIT	4.000				MU·CI·	LAKE CAMPBELL	T34N/R 2E- 7	
*03767C	CH	ANACORTES CITY OF,	4/11/85	3	SKAGIT	14500.000	23200.00	0	0		WELL	T34N/R 3E-13	
·03767C ·03959	CE	ANACORTES CITY OF,	9/13/54	3	SKAGIT	14500.000	23200.00			MU·	WELL	T34N/R 3E-13	
10709CWRIS	CE	ANACORTES CITY OF,	2/14/63	3	SKAGIT	70.000	50680.00			MU·	SKAGIT RIVER	T34N/R 3E-13	SW/4NW/4
·01034AWRIS	AP/REJ	ANACORTES CITY OF,	1/28/24	3	SKAGIT	6.000				MU·	LAKE CAMPBELL	T35N/R 1E-18	
*03031ALC	CH	ANACORTES, CITY OF,	2/27/95	3	SKAGIT	15.000	0.00	0	0		SKAGIT RIVER	T34N/R 3E-12	
·03031ALC ·01161A	CE	ANACORTES, CITY OF,	7/02/30	3	SKAGIT	15.000	0.00			MU·	SKAGIT RIVER	T34N/R 3E-12	
·*03031ALC	CH	ANACORTES, CITY OF,	2/27/95	3	SKAGIT	15.000	0.00	0	0		SKAGIT RIVER	T34N/R 3E-13	
·03031ALC ·01161A	CE	ANACORTES, CITY OF,	7/02/30	3	SKAGIT	15.000	0.00			MU·	SKAGIT RIVER	T34N/R 3E-13	

N O T E

ı report contains information about water right Certificates, Permits, and Claims. Because of unauthorized changes or non-use, Ecology cannot guarantee the ıdity of the Permits, and Certificates. Validity of Claims can only be determined in Superior Court. You are encouraged to verify that current use is ıistent with the document as described.

WATER SUPPLY AGREEMENT

This agreement entered into this 1st day of January, 2006 between the City of Anacortes, hereinafter referred to as "the City", and City of Oak Harbor is for the purpose of the City supplying water to City of Oak Harbor, hereinafter referred to as "the Customer." It replaces and supersedes any previous agreements or understandings between the parties.

The Customer is entering into this agreement to secure a supply of water for its industrial and/or municipal water supply requirements. The City owns and operates a Water Supply System, has water available to serve the Customers, and is willing to supply water according to the terms and conditions of this agreement.

The City's Water Supply System is defined for purposes of this agreement to include: 1) the water intake and treatment facilities near Avon on the Skagit River; 2) the City's water transmission pipelines from the water treatment facilities to Sharpe's Corner; and 3) the 10-inch water supply pipeline along SR20 from Sharpe's Corner to the Oak Harbor metering point just north of the Deception Pass Bridge.

In accordance with this agreement, the City agrees to supply the Customer water in accordance with the following terms and conditions:

1. Quantity

   The City agrees to supply quantities and pressures of water at location(s) and in amounts as stated in this agreement (Exhibits A & B), and any subsequent amendments to this agreement (Exhibit C).

2. Delivery Points

   2.1 Approved Delivery Points The City shall deliver water to the Customer at the approved delivery points listed in Exhibit A.

   2.2 New Delivery Points The Customer may request service at additional delivery points subject to the approval of the City. The City may approve new service connections consistent with the concept that the Water Supply System is not a distribution system but the Customer has responsibility for constructing and maintaining a distribution system adequate for its service area.

   The Customer shall be responsible for paying all costs associated with installing new service connections. The connection shall include the necessary piping and valves, metering equipment of standard manufacture, and suitable isolating or backflow prevention devices as appropriate. If required by the City, the meter shall be of a type capable of transmitting continuous readings to the City's Water Treatment Plant. The Customer shall prepare the design for the proposed service connection, submit it to, and receive the approval of the City prior to its installation. The City shall own the meter and be responsible for maintaining it in good repair.

3 Quality of Water

The City shall operate and maintain its Water Supply System in order to supply water for municipal and industrial purposes that meets the water quality standards of the Washington State Department of Health and the U.S. Environmental Protection Agency, including periodic revisions to these standards. The City shall employ the normal care and practices of water utilities with respect to meeting water quality standards.

The City shall not be liable to the Customer for failure to meet the water quality standards for reasons that are outside the control of the City. The Customer shall hold the City harmless from any water quality related claim for damages by third parties served by the Customer, to the extent that the claim arises out of Customer's negligence.

4 Rates and Charges

The City has established the following rates and charges and billing procedures for customers of its Water Supply System, which apply to this agreement.

4.1 Rate Structure The City has defined the following costs associated with the facilities, operation and maintenance of its water supply system:

Capital Cost Those costs incurred for the betterment and rehabilitation of the Water Supply System. Includes amounts paid from revenues, water system funds, and debt service on bonds issued for the betterment or rehabilitation of the system.

Fixed Operating Cost The cost of labor, supervision, supplies, utilities, services, taxes, insurance, and all other expenses required to operate and maintain the Water Supply System other than those items included under Variable Operating Cost.

Variable Operating Cost The cost of chemicals and electric power required to deliver water from the Water Supply System.

4.2 Cost Allocation The Customer shall pay its proportionate share of the Capital Cost, Fixed Operating Cost, and Variable Operating Cost. These costs shall be allocated as follows:

Capital Cost Allocated to all Water Supply System customers based on the Committed Volume of water to each customer in proportion to the total water supply requirements.

Fixed Operating Cost Allocated to all Water Supply System customers based on the metered water volume of each customer as a percentage of the total metered volume of all customers, with the following exceptions:

1) Administrative support services and all employee benefits shall be allocated to customers in the same proportions that the total cost of all other Personnel Services is divided among them.
2) The State Excise Tax shall be allocated based on actual (or projected) billings to each of the customers. In accordance with Washington State Law, no Excise Tax will be assessed to wholesale customers purchasing water for resale.

Variable Operating Cost Allocated to all Water Supply System customers in accordance with the metered water volume of each customer as a percentage of the total metered volume of all customers.

4.3 Billing Basis

1) The Capital Cost Allocation to customers is determined each time a water rate analysis is prepared by the City and is set for the ensuing rate period (usually 3 to 5 years). Each customer's "committed" volume used to calculate the Capital Cost for the rate period shall be agreed upon between the City and the Customer based upon current usage and estimated increased water requirements during the rate period. The current Capital Cost is shown in Exhibit B.
2) The Fixed and Variable Operating Costs shall be determined each year as part of the City's budgeting process. Rates current as of the date of this agreement are shown on Exhibit B and are used as the basis for the customer billings according to the volume of water used. The City will calculate the unit Fixed and Variable Operating Costs for the period based upon projected operating costs and projected water use and will notify the customers of these rates (Exhibit C). These revised costs will be used as the basis for billing customers over the billing period. Periodically, but not to exceed two years, the City will calculate and report actual costs and retroactively adjust each customer's charges (i.e., increase or decrease) to actual costs.

4.4 Billing The City shall read the Customer meters each month, calculate, and issue a bill to the Customer. The bill shall identify the Capital Cost, the Fixed Operating Cost, the volume of metered water delivered to the Customer during the month, and the corresponding Variable Operating Cost. The Capital Cost and Fixed Operating Cost are payable regardless of the volume of water consumed while the Variable Operating Costs shall be paid according to the volume of metered water delivered to the Customer. Payment by the Customer is due within 15 days of the receipt of the bill.

4.5 Late Payment If a bill remains unpaid after 30 days, the City will assess interest on the delinquent amount at the rate of 12% per annum. If a bill still is not paid after 90 days, the City may use other remedies legally available to is, including shutting off service to enforce payment.

4.6 Additional Charge During the rate period, the Customer is entitled to the quantity of water fixed as the basis for the capital charge (Committed Volume). Should the Customer use an annual volume greater than the Committed Volume shown on Exhibit B or as amended on Exhibit C, it shall pay the current Commercial rate (Outside of City water sales) for the quantity in excess of the Committed Volume.

5. Metering

The volume of water delivered to the Customer shall be measured by metering equipment installed in accordance with Article 2. The meter shall be maintained and read by the City. It shall be tested by the City periodically, but not less than once per year, to assure its continuing accuracy and conformance to the standards of measurement and service accepted in the water industry. The Customer has the right to be notified ahead of time and be present at any of the regularly scheduled tests. The cost of conducting such tests shall be borne by the City. These tests may also be conducted at other times at the request of the Customer and the Customer may elect to have a representative witness the meter test. If the meter is accurate, the Customer shall pay for the cost of the test; but if the test reveals an inaccuracy of more than 2 percent, the City shall pay for the test. If an inaccuracy of more than 2 percent is discovered, all billings for water furnished hereunder for one-half the time from the date of the preceding test shall be adjusted. The adjustment shall be for the full amount in excess of 2 percent.

6. Continuity of Service

The City shall use reasonable diligence to provide a regular and uninterrupted supply to the Customer's approved delivery point(s), but shall not be liable to the Customer for damages, breach of contract, or otherwise for interruption of service or curtailment of supply for any cause beyond the control of the City. These could include, but are not limited to, Acts of God, sabotage, war, fires, floods, earthquakes, power failure or other catastrophes, strikes, or failure or breakdown of the Water Supply System. The Customer shall hold the City harmless from any claim for damages related to continuity of service by third parties served by the Customer, to the extent that the claim arises out of Customer's negligence.

7. Conflicts

To the extent that there is any inconsistency between the provisions of this agreement, any exhibit incorporated as part of this agreement, or subsequent amendments and other rules and regulations of the City, the provisions of this agreement shall control.

8. Future Supply

8.1 Service Area This agreement between the City and the Customer is to supply water to the Customer's existing industrial operations and/or water service area. In this regard, the Customer agrees not to increase its industrial operations, to add new customers, or to expand its service area in a manner that would increase its water requirements by more than 10 percent without the prior approval of the City.

8.2 Water Supply Requirements The City operates its Water Supply System for the purpose of delivering an adequate supply of good quality water to all of its customers. The City agrees to maintain and to operate its system so as to meet the volumes contracted for by its customers and to supply additional volumes as may be required by the Customer in the future, consistent with the needs of all its customers.

8.3 Future Improvements The City will plan and develop water supply facilities that may become necessary in the future to replace existing facilities or to expand the capacity of its Water Supply System to meet growing demands. The City may require appropriate commitments from its customers prior to proceeding with system improvements.

9. Termination

Either the City or the Customer shall have the right to terminate this agreement by giving at least one year written notice of its desire to do so.

10. Term

Subject to the provisions of paragraph 9 of this Agreement, this agreement shall take effect on January 1, 2006 and remain in full force and effect until December 31, 2025. Either party can request amendment or renegotiation of this agreement not more frequently than on an annual basis.

11. Records Inspection

The City shall maintain and make available for inspection at reasonable times all records pertaining to the water system. These records shall be maintained for a minimum 3-year period.

12. Addresses

All notices and billing required hereunder shall be sent to the following addresses:

CITY OF ANACORTES
Mailing: PO Box 547
Anacortes, WA 98221
Physical: 904 6th Street
Anacortes, WA 98221

CUSTOMER
Notices and Billing:
865 SE Barrington Drive
Oak Harbor, WA 98277

13. Applicable Law

This Agreement and all disputes arising thereunder shall be governed by Washington State Law.

IN WITNESS WHEREOF, the parties hereto have executed this Contract as of the day and year first above written.

CITY OF ANACORTES

By: H. Dean Maxwell
H. Dean Maxwell, Mayor

ATTEST:

Wanda Johnson
Wanda Johnson, City Clerk

CITY OF OAK HARBOR

By: Patricia A. Cohen
Patricia A. Cohen, Mayor

ATTEST:

Connie Wheeler
Connie Wheeler, City Clerk

EXHIBIT A

Dated: January 1, 2006

Water Supply Agreement between the City of Anacortes and City of Oak Harbor.

Approved Metered Service Connections:

No.	Size	Brand	Type	Location	Reading System
1	10"	Rockwell		Deception Pass	Manual
2	12"	Panamet		Sharpe's Corner	Manual

EXHIBIT B

Dated: January 1, 2006

Water Supply Agreement between the City of Anacortes and City of Oak Harbor.

1. Water Charges:

Capital Cost	$ 31,200 / Month
Fixed Operating Cost (2005 Estimate)	$ 22,650 / Month
Variable Operating Cost (2005 Estimate)	$ 135.75 / Million Gallons

2. Committed Water Volume:

   Annual: 970 Million Gallons

3. Water Pressure: 120 psi

EXHIBIT C

AMENDMENT NO. 1

This Amendment, effective January 1, 2008, replaces and supersedes Exhibit B and prior amendments to the Water Supply Agreement entered into January 1, 2006, between the City of Anacortes and the City of Oak Harbor.

1. Water Charges for the period of 1/1/2008 to 12/31/2010:

Capital Cost	**$47,916/ month**
Fixed Operating Cost (estimate)	**$22,780/ month**
Variable Operating Cost (estimate)	**$152.42 / million gallons**

2. Committed Water Volume for the period 1/1/2008 to 12/31/2010:
Annual: 1,000 million gallons

3. Water Pressure:
Dependent on service location

All other terms and conditions of the original contract shall remain in effect.

IN WITNESS WHEREOF, the parties hereto executed this Contract Amendment as of the day and year above written.

CITY OF OAK HARBOR

Jim Slowik
Mayor

Dated: April 1, 2008

ATTEST:

Connie Wheeler
City Clerk

CITY OF ANACORTES

H. Dean Maxwell
Mayor

Dated: 4/3/08

ATTEST:

Steve Hoglund
City Clerk/Treasurer

EXHIBIT C

AMENDMENT NO. 1

This Amendment, effective January 1, 2008, replaces and supersedes Exhibit B and prior amendments to the Water Supply Agreement entered into January 1, 2006, between the City of Anacortes and the City of Oak Harbor.

1. **Water Charges for the period of 1/1/2008 to 12/31/2010:**

Capital Cost	**$47,916/ month**
Fixed Operating Cost (estimate)	**$22,780/ month**
Variable Operating Cost (estimate)	**$152.42 / million gallons**

2. **Committed Water Volume for the period 1/1/2008 to 12/31/2010:**
   Annual: 1,000 million gallons

3. **Water Pressure:**
   Dependent on service location

All other terms and conditions of the original contract shall remain in effect.

IN WITNESS WHEREOF, the parties hereto executed this Contract Amendment as of the day and year above written.

CITY OF OAK HARBOR

Jim Slowik
Mayor

Dated: April 1, 2008

ATTEST:

Connie Wheeler
City Clerk

CITY OF ANACORTES

H. Dean Maxwell
Mayor

Dated:

ATTEST:

Steve Hoglund
City Clerk/Treasurer

RSE:mc

Copy

Contract No.
N62474-71-C-3706

Complete revision 3/7/89 BW

DEPARTMENT OF THE NAVY

NEGOTIATED WATER SERVICE CONTRACT

Naval Air Station, Whidbey Island, Oak Harbor, Washington 98277
(Premises to be served) (City) (State)

City of Oak Harbor, 3075-300 West, Oak Harbor, Washington 98277
(Contractor) (Contractor's Address)

RECEIVED
JUL 12 1971
CITY OF OAK HARBOR

Premises are: (X) Government Owned
( ) Government Leased
Symbol No. of Lease:
Name of Lessor:

Estimated annual cost hereunder: $65,000

Connection Charge: $ 1,357,000

Bills will be rendered in quintuplicate to: Commanding Officer
Naval Air Station, Whidbey Island
Oak Harbor, Washington 98277

Payments will be made by: Commanding Officer
Naval Regional Finance Center Treasure Island
San Francisco, California 94130

Communications: All communications and modifications regarding this contract shall be addressed as follows:

Contractor: City of Oak Harbor
3075-300 West
Oak Harbor, Washington 98277

Government: Commanding Officer, Western Division (Code 113)
Naval Facilities Engineering Command
San Bruno, California 94066

This contract is negotiated pursuant to the authority of 10 USC 2304(a)(10)

Appropriations chargeable:
For Recurring Billing Charges: Applicable funds will be cited on invoices or delivery orders issued against this contract.

For Connection Charge: 17X1205.2511 032 12212 0 062474 2A
000000 000000D15603
(Include final data from MCON appropriation when available)

RSE:mc

Co. ract No.
N62474-71-C-3706

THIS CONTRACT is entered into as of 7 JUL 1971 by and between the UNITED STATES OF AMERICA, hereinafter called the Government, represented by the Contracting Officer executing this contract, and CITY OF OAK HARBOR, whose address is 3075-300 West, Oak Harbor, Washington 98277, hereinafter called the Contractor.

I. SCOPE. Subject to the terms and conditions hereinafter set forth, the Contractor shall sell and deliver to the Government and the Government shall purchase and receive from the Contractor potable water service (hereinafter called service) requested by the Government from the Contractor at the premises to be served hereunder (hereinafter called the service location), in accordance with the Technical and General provisions and the Water Service Specifications attached hereto and made a part hereof.

II. TERM. This contract shall continue in effect until terminated at the option of the Government by the giving of written notice not less than sixty (60) days in advance of the effective date of termination.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.

CITY OF OAK HARBOR

By R. O. Ellis, Mayor

THE UNITED STATES OF AMERICA

By D. A. Bartley

D. A. BARTLEY, CAPT, CEC, USN
For Commander, Naval Facilities Engineering Command, Contracting Officer

Attached to and made a
part of Contract No.
N62474-70-C-3706

EXHIBIT A

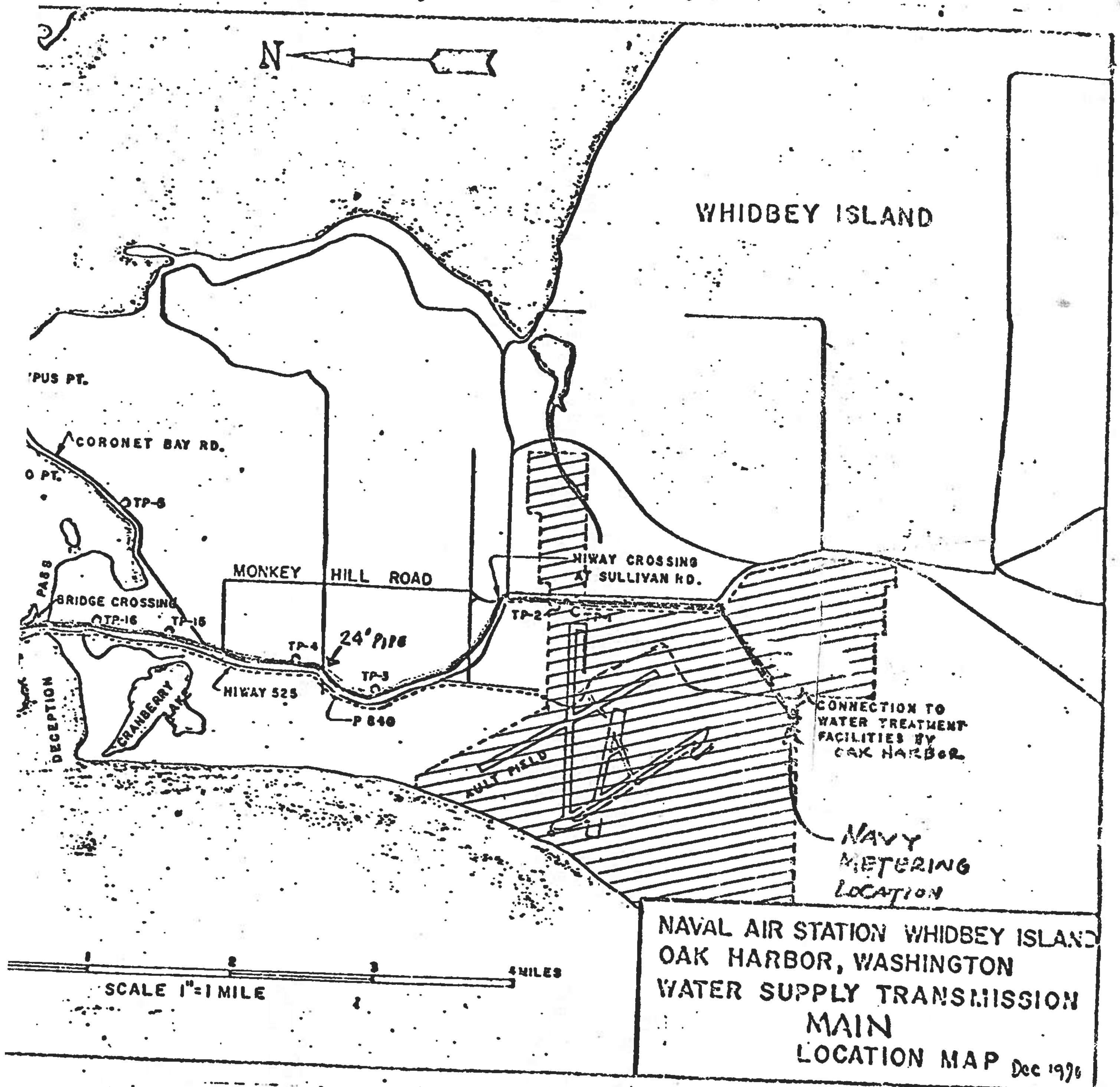
(4) In Exhibit "A" attached to and made a part of Contract N62474-71-C-3706:

a. Delete, effective April 1, 1974, the rate specified in Modification No. N62474-71-C-3706-P00001 and insert in lieu thereof:

1. RATE:

First	150,000 cu. ft. (or less) per month	$453.95
From	150,000 cu. ft. to 1,000,000 cu. ft. same month, per 100 cu. ft.	.22
From	1,000,000 cu. ft. to 10,000,000 cu. ft. same month per 100 cu. ft.	.11
Over	10,000,000 cu. ft. per month per 100 cu. ft.	.023

2. Determination of pro-rata billing to Navy: The City of Anacortes shall bill the Contractor monthly for all water registered by the 24-inch and 10-inch meters and the Contractor's meters on the basis of the rate in Exhibit "A" above. [redacted] To this amount shall be added the appropriate monthly charges for the business and occupation tax, maintenance,



NAVAL AIR STATION WHIDBEY ISLAND
OAK HARBOR, WASHINGTON
WATER SUPPLY TRANSMISSION
MAIN
LOCATION MAP Dec 1970

Exhibit "B", attached to and made a part of Contract No. N62474-70-C-3706-P00001.

DESCRIPTION OF FACILITIES

1. **The description of the facilities to be constructed by the Contractor indicating basis and amount of Government's share:**

EXHIBIT "B"

CONTRACTOR INSTALLED FACILITIES

1. Approximately 62,300 lineal feet of 24-inch ductile iron water pipe.
2. Approximately 295 lineal feet of 16-inch ductile iron water pipe.
3. Ductile or cast iron fittings.
4. 1. Connection to existing 24-inch Anacortes water line.
5. 1. Meter Station at Dean's Corner.
6. Bridge crossings.
7. Roadway crossings.
8. 14-16-inch gate valve assemblies.
9. 16-Blow-off assemblies.
10. 20-Air-Vac assemblies.
11. Necessary materials for foundations, back fill, surfacing and patching.

finance 4/2062.
LKB7h

CITY OF OAK HARBOR

865 S.E. Barrington Drive Oak Harbor, Washington 98277-4092
City Hall (360) 679-5551

W 27,513.50
S 4,695.90

WATER STATEMENT

Date: 7/7/2003

TO: Public Works Department
N68711-71-C3706/K006200202-P0004
1115 W Lexington Building 103
NAS Whidbey Island
Oak Harbor, Wa. 98278

Account: 21-000090-00

Key Numbers 6200202
6200301

BILLING PERIOD: June 1, 2003 through June 30, 2003

Account Description		Consumption In Gallons
Sharps Corner 12"		106,840,000
Deception Pass 10"		144,600
	TOTAL AMOUNT BILLED TO CITY IN GALLONS	106,984,600
21-002300-00	Pump Station Remote	42,910,000
21-002200-00	A.U.W. Weapons Bldg/NAS	10,473
21-002100-00	Runway NAS	-
	Total Navy Consumption	42,920,473
21-011000-00	Yacht Club	14,214
21-009125-00	City Park Launch Hydrant	-
21-007025-00	Marina Harbormaster	214,705
21-006095-00	Marina Irrigation	-
21-008025-00	Marina Bathhouse	17,206
21-009025-00	City Park Launch Pier	37,405
21-001000-00	Catalina Marina	2,992
	Total City Consumption	286,522
07-165000-00	Jack Truex	10,473
07-165600-00	Michael Christian	23,191
07-165200-00	Fred & Filomena Christian	1,496
07-165100-00	Ethel Sharp	-
07-165700-00	Hansen/Cascade Property	5,237
07-165300-01	April Lyn Whitlock	3,741
07-165400-03	Jason Leon Iron Moccasin	1,496
07-165510-05	Dummy Account/Vacant	-
07-165800-02	Dummy Account/Vacant	-
07-165910-01	Jason Hicks	748
	Total Consumption of City Customers on Navy Line	46,382
	TOTAL WATER USED BY NAS IN GALLONS	42,587,569

411.151.010
24" WL Maint fund
14,105.91

gallons

Total Cost per million gallons	\$ 65,251.32 /	106,984,600 X	1,000,000 =	\$ 609.91
Charges for water usage		42.587569 X	\$ 609.91 =	\$
Administrative costs		5.029% X	25,974.58 =	\$
Fire Sprinkler System at AUW Building				\$
Maintenance fund 24" Water Main			=	\$
Sewer Lagoon Charges			=	\$

TOTAL AMOUNT DUE FOR THE MONTH OF JUNE 2003 \$

141.50 per million gallons

CITY OF ANACORTES
P.O. BOX 410
ANACORTES, WA 98221-0410
(360) 293-1909

6/30/03

CITY OF OAK HARBOR
ATTN: ACCOUNTS PAYABLE
865 SE BARRINGTON DR
OAK HARBOR, WA 98277

ACCOUNT # 900-9080-00

FOR WATER DELIVERED BY THE CITY OF ANACORTES WATER DEPARTMENT FOR THE PERIOD OF: 5/29/03 TO 6/30/03 .

METER READINGS

12" METER	PRESENT READING	6,946,490,000	GALLONS
SHARPE'S CORNER	PREVIOUS READING	6,839,650,000	GALLONS
	WATER USED	106,840,000	GALLONS
10" ROCKWELL	PRESENT READING	11,363,800	GALLONS
DECEPTION PASS	PREVIOUS READING	11,219,200	GALLONS
	WATER USED	144,600	GALLONS
	TOTAL CONSUMPTION	106,984,600	GALLONS

CHARGES

CAPITAL COST (INCLUDING DEBT SERVICE)		$ 32,970.00
FIXED OPERATING EXPENSES		17,143.00
	TOTAL CHARGES	$ 50,113.00
VARIABLE (VOLUME) OPERATING EXPENSES: 106,984,600 GALLONS @ $141.50 / PER MILLION GALLONS		15,138.32
	TOTAL CHARGES THIS BILL	**$ 65,251.32**
	ADJUSTMENTS	
	PREVIOUS BALANCE	54,646.92
	TOTAL AMOUNT DUE	**$119,898.24**
	DUE DATE 7/20/2003	

NDF

ACCOUNTING CLERK, UTILITY BILLING
NIOMI FREDRICKSON

RSE:mc

Attached to and made a part of Contract No. N62474-71-C-3706

TECHNICAL AND GENERAL PROVISIONS FOR UTILITY SERVICE

I. TECHNICAL PROVISIONS

1. MEASUREMENT OF SERVICE

a. All service furnished by the Contractor shall be measured by metering equipment of standard manufacture, furnished, installed, maintained calibrated, and read by the Contractor at his expense. When more than a single meter is installed at the service location, the readings thereof shall be billed conjunctively. In the event that any meter fails to register or registers incorrectly, the quantity of service delivered through it during that period shall be determined and an equitable adjustment based thereon shall be made in the Government's bills (for this purpose any meter which registers not more than two (2) percent slow or fast shall be deemed correct). Failure to agree on any adjustment shall be a dispute concerning a question of fact within the meaning of the "Disputes" clause of this contract.

b. The Contractor guarantees and reserves to the Government at all times sufficient capacity to transmit not less than 4,500,000 gallons per day through the twenty-four inch main to the Government's water treatment facilities located at the Naval Air Station, Whidbey Island. [illegible]

Paragraph I.1.b. add, "The capacity of 4,500,000 gallons per day is the transmission capacity which represents Government share in the Contractor's twenty-four inch transmission water line. This capacity shall not be construed as the Government's firm contract demand."

its interest in the existing ten-inch water [illegible].

d. Meter Test. The Contractor, at its expense, shall periodically inspect and test the meters installed by it at intervals not exceeding five (5) years. At the written request of the Contracting Officer, the Contractor shall make additional tests of any or all of such meters in the presence of Government representatives. The cost of such additional tests shall be borne by the Government if the percentage of error is found to be not more than two (2) percent slow or fast. No meter shall be placed in service or allowed to remain in service which registers in excess of one hundred (100) percent under normal operating conditions.

e. The Contractor shall read all meters at periodic intervals of approximately thirty (30) days. All billings based on meter readings of less than twenty-seven (27) days or more than thirty-three (33) days shall be prorated accordingly.

II. GENERAL PROVISIONS

1. PAYMENT.

a. The Contractor shall be paid by the designated disbursing officer for service furnished hereunder at the rates specified; ~~provided~~,

RSE:mc

Attached to and made a part of Contract No. N62474-71-C-3706

~~that the Government shall be liable for the minimum monthly charge specified in this contract commencing with the billing period in which service is initially furnished and continuing until this contract is terminated, except that the minimum monthly charge shall be equitably prorated for the billing period in which commencement and termination of this contract shall become effective.~~

b. Payments hereunder shall be contingent upon the availability of appropriations therefor, and shall not be made in advance of the service rendered.

c. All bills for service shall be paid without penalty or interest and the Government shall be entitled to any discounts customarily applicable to payment of bills by all customers of the Contractor.

d. Invoices for service rendered hereunder shall contain statements of the meter readings at the beginning of the billing period, meter constants, consumption during the billing period, and such other pertinent data as shall be required by the Government.

e. The Contractor hereby declares that rates are not in excess of the lowest rates now available to any existing or prospective customer under like condtions of service, and agrees that during the life of this contract the Government shall continue to be billed at the lowest applicable rate for similar conditions of service.

2. <u>RATES AND CHARGES</u>.

a. For the service furnished under this contract to the service location, the Government shall pay the Contractor:

Paragraph II.2.a delete subparagraph (1) and insert, in lieu thereof the following: "The applicable rate for the commodity as set forth in paragraph 1. of Exhibit "A", attached hereto and made a part hereof.

(2) A charge for maintenance and operations costs of the twenty-four inch water main as set forth in paragraph 2. of Exhibit "A", attached hereto and made a part hereof.

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Attached to and made part of Contract No. N62474-71-C-3706

(a) The Contractor shall furnish the Government a detailed breakdown of all costs of under gravity flow conditions of operating and maintaining the twenty-four inch water main to determine the Government's proportionate share of costs of operation and maintenance of the water main. Operation and maintenance costs as used herein shall include all operating expenses for maintenance, repair and replacement of said water main except major repairs and replacements as hereinafter defined. Such costs shall be limited to include only direct labor, materials, engineering and supervisory overhead excluding engineering and overhead allocable to any other element of the Contractor's water system. The Government's proportionate share of the foregoing costs shall be one-half of these costs. The Government shall have the right at reasonable times to inspect the Contractor's records in respect of such costs and to obtain from the Contractor its caluclations upon which such charges are based. The above shall be the basis for setting or adjusting the rate set forth for prospective application in paragraph 2 of Exhibit A.

(3) Major Repairs and Replacements. The Contractor shall establish a special reserve fund for the accomplishment of major repairs and replacements to its twenty-four inch water main. Any major repair and replacement to the water facilities, the cost of which exceeds $5,000.00 shall be funded from this reserve. The Government as provided in paragraph 3 of Exhibit A and the Contractor shall each contribute an equal amount, initially established at $250.00 per month, to this reserve until such a time as the accumulated total thereof shall equal $20,000.00. The Contractor's expenditures for major repairs and replacements and the status of this reserve shall be reviewed five (5) years from the date hereof and every five (5) years thereafter during the life of this contract for the purpose of adjusting the amount of the monthly contribution to this reserve. The Contractor's liability for such repairs and replacements shall not, however, depend at any time on the sum then present in such reserve, but the Contractor shall be entitled to recover from subsequent accruals in such reserve any sums advanced for repairs and replacements for which it made proper expenditures from other sources at a time when the reserve was inadequate for the purpose. If in any one year a deficit in excess of $10,000 develops in the reserve fund, the Government, shall contribute within one year, one-half of the amount required to eliminate the deficit. Should the Government terminate this contract as provided herein, the accumulated monies in the reserve fund shall be returned to the contributing parties in proportion to each party's contribution to such reserve fund.

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Attached to and made a part of Contract No. N62474-71-C-3706

3. CHANGE OF RATES

a. The rate set forth in paragraph 1 of Exhibit A will only be changed if the rate under which the Contractor purchases water from the City of Anacortes is changed, in which case the Government will be given an opportunity to participate in the negotiations with the City of Anacortes.

b. The adjustment of paragraph 2 of Exhibit A will be in accordance with paragraph 2.(2)(a) above.

c. The adjustment of paragraph 3 of Exhibit A will be in accordance with paragraph 2.(3) above.

4. CHANGE IN VOLUME OR CHARACTER OF SERVICE. The Contracting Officer shall give reasonable notice to the Contractor respecting any material changes anticipated in the volume or characteristics of the utility service required at the service location.

5. CONNECTION CHARGE.

a. The Government, in consideration of the Contractor furnishing the service hereinbefore described and certain of the facilities necessary thereto consisting of approximately 66,000 feet of nominally twenty-four inch diameter main thereof, more particularly described in Exhibit B attached hereto and made a part hereof, adequately metered and sufficient to transmit the guaranteed volume of Government water to the metering location delineated in Exhibit "C" attached to and made a part hereof, shall pay to the Contractor a non-refundable connection charge in the amount of $1,357,000 provided, however, that such payment shall not become due until such time as the connection is made to the Government's water treatment facilities, Naval Air Station, Whidbey Island, Oak Harbor, Washington, provided, further, as a condition precedent to final payment, the Contractor shall, if required by the Contracting Officer, execute a release in terms acceptable to the Contracting Officer, of claims against the Government arising under or by virtue of such connection charge.

b. The Contractor's facilities including those as to which a connection charge is payable, notwithstanding the requirement of release, and the payment of a connection charge, shall be and remain the Contractor's property and not the Government's property. The Contractor may hereafter increase the capacity of its system provided that it does not interfere with the service guaranteed to the Government and without entitling the Government to any claims of reimbursement except as provided in paragraph 8.b. below.

c. The Government's share towards construction of the twenty-four inch water transmission main shall not be in excess of $1,357,000.00, and the Contractor's share shall be $528,000.00. If the total cost of construction is less than $1,885,000.00 such savings will accrue to the Government by decreasing the amount of the aforementioned connection charge.

6. CONTINUING RIGHTS OF SERVICE. In consideration of the payment of the connection charge as provided herein, the Contractor agrees to provide the Government's requirements for water services to Naval Air Station, Whidbey Island, Oak Harbor, Washington, as specified herein for a period of fifty (50) years, under the terms and conditions specified herein, provided that, no discontinuance of service by the Government at this service location shall effect a termination of the Contractor's obligation.

7. ADVANCE PAYMENTS.

a. Amount of Advance. At the request of the City of Oak Harbor, Oak Harbor, Washington and subject to the conditions hereinafter set forth, the Navy will make advance payments to the City of Oak Harbor (hereinafter referred to as the "Contractor"), not to exceed the amount of $1,357,000.00. The funds will be advanced by the Navy Regional Finance Center, Treasure Island, San Francisco, California in increments approximating the Contractor's monthly requirements. The Contractor will submit monthly invoices to the disbursing office, via the Commanding Officer, Western Division, Naval Facilities Engineering Command, San Bruno, California, approximately ten (10) days prior to the beginning of the month for which any advance payment cash requirement exists. No advance payment will be made in an amount which together with all advance payments theretofore made shall result in advances being in excess of $1,357,000.

b. Depository. The advance payment made hereunder shall be deposited in the City's depository, the Everett Trust & Savings Bank, Oak Harbor Branch, Oak Harbor, Washington and identified as "Navy Special Account Contract N62474-71-C-3706".

c. Use of Funds. The funds in the special account will be withdrawn by the Contractor solely for the purpose of making payments for items of allowable cost or to reimburse the Contractor for such items of allowable cost, incurred or to be incurred for performance of the work set forth in "Exhibit B" of the contract and for such other purposes as the Administering Office may approve in writing. Any interpretation required as to the proper use of funds shall be made in writing by the Administering Office (Office of the Comptroller, Department of the Navy).

d. Interest Charge. Interest will not be charged the Contractor on advance payments made hereunder.

e. Return of Funds. The Contractor may at any time repay all or any part of the funds advanced hereunder and shall at any time, if so requested in writing by the Administering Office, repay to the Navy such part of the unliquidated balance of advance payments as shall, in the opinion of the Administering Office be in excess of current requirements. If the amount of the costs set forth in "Exhibit B" of the contract is reduced the Contractor will immediately refund an amount of the advance payment equal to the reduction in the contract price.

f. Liquidation. If not otherwise liquidated, the advance payment made hereunder shall be liquidated as herein provided. When the work provided for under "Exhibit B" of this contract is completed, the Contractor shall submit an invoice for payment of the Connection Charge. The amount due the Contractor therefor will be applied in liquidation of the unliquidated advance payment. If, upon completion of such transaction the advance payment has not been fully liquidated, the balance thereof shall be deducted from any sums due or which may become due to the Contractor from the Government, and any deficiency shall be paid immediately by the Contractor to the Government upon demand.

g. Default. In the event that the contract is terminated by reason of fault of the Contractor, the full amount of the unliquidated advance payment shall be immediately repaid to the Government by the Contractor.

h. Authority. The incorporating of advance payment provisions in this contract is made under the authority of Title 10 U. S. C. 2307.

8. TERMINATION.

a. Termination Prior to Completion of Facilities. The Government reserves the right to terminate this contract at any time prior to completion of the facilities provided for herein with respect to which the Government is to pay a connection charge. In the event the Government exercises this right, the Contractor shall be paid fair compensation, exclusive of profit, with respect to those facilities, but not to exceed the amount of the connection charge.

b. Termination Subsequent to Completion of Facilities. In the event the Government so terminates subsequent to payment of the connection charge hereinbefore provided, it shall do so without liability further ~~therefor~~.

9. CONTINUITY OF SERVICE AND CONSUMPTION.

a. The Contractor shall use reasonable diligence to provide a regular and uninterrupted supply of service at the service location, but shall not be liable to the Government for damages, breach of contract, or otherwise, for failure, suspension, diminution, or other variations of service occasioned by any cause beyond the control and without the fault or negligence of the Contractor. Such causes may include, but are not restricted to, acts of God or of the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, or failure or breakdown of transmission or other facilities and availability of water from the City of Anacortes.

b. In the event the Government is unable to operate the service location in whole or in part for any cause beyond its control and without its fault or negligence, including but not limited to acts of God or of the public enemy, fires, floods, epidemics, quarantine restrictions, or strikes, and equitable adjustment shall be made in the monthly rates specified in this contract (including the minimum monthly charge) if the period during which the Government is unable to operate the service location in whole or in part shall exceed fifteen (15) days during any billing period hereunder.

10. CONTRACTOR'S FACILITIES

a. The Contractor, at his expense, shall furnish, install, operate, and maintain all facilities required to furnish service hereunder to, and to measure the service at, the point of delivery specified in the Utility Service Specifications, attached to and made a part hereof. Title to all of these facilities shall remain in the Contractor and he shall be responsible for all loss of or damage to those facilities except that arising out of the fult or negligence of the Government, its agents or its employees. Any future relocation of Contractor's facilities required by the Government shall be at the expense of the Government. All taxes and other charges in connection therewith, together with all liability arising out of the negligence of the Contractor in the construction, operation, or maintenance of these facilities, shall be assumed by the Contractor.

b, The Government hereby grants to the Contractor, free of any rental or similar charge, but subject to the limitations specified in this contract, a revocable permit to enter the service location for any proper purpose under this contract, including use of the site or sites agreed upon by the parties hereto for the installation, operation and maintenance of the facilities of the Contractor required to be located upon Government premises. Authorized representatives of the Contractor will be allowed access to the facilities of the Contractor at suitable times to perform the obligations of the Contractor with respect to these facilities. It is expressly understood that the Government may limit or restrict the right of access herein granted in any manner considered to be necessary for the national security.

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Attached to and made a part of Contract No. N62474-71-C-3706

c. Upon mutually agreed upon terms and conditions, the Government will initiate procedures to obtain requisite approvals to grant, an easement by separate agreement, to the Contractor the right to use Government land for the purpose of installing the water main described in Exhibit B and any extension thereof, to serve customers of the Contractor located off of the Naval Air Station, Whidbey Island, Oak Harbor, Washington.

d. In the event the Government should discontinue service and elects to exercise its option to take service at a later date, the Government shall pay a re-connection charge, the exact amount of which shall be negotiated at the time of re-connection. This would include costs imposed on the Contractor for relocation of the twenty-four inch water transmission main.

11. CONFLICTS. To the extent of any inconsistency between the provisions of this contract, and the provisions of any schedule, rider, or exhibit incorporated in this contract by reference or otherwise, the provisions of this contract shall control.

12. DEFINITIONS (1962 FEB). As used throughout this contract, the following terms shall have the meanings set forth below:

a. The term "Head of the Agency" or "Secretary" means the Secretary, the Under Secretary, any other head or assistant head of the executive or military department or other Federal agency: and the term "his duly authorized representative" means any person or persons or board (other than the Contracting Officer) authorized to act for the Head of the Agency or the Secretary.

b. The term "Contracting Officer" means the person executing this contract on behalf of the Government, and any other officer or civilian employee who is a properly designated Contracting Officer; and the term includes, except as otherwise provided in this contract, the authorized representative of a Contracting Officer acting within the limits of his authority.

c. Except as otherwise provided in this contract, the term "subcontracts" includes purchase orders under this contract.

13. ASSIGNMENT OF CLAIMS (1962 FEB)

a. Pursuant to the provisions of the Assignment of Claims Act of 1940, as amended (31 U.S.C. 203, 41 U.S.C. 15), if this contract provides for payments aggregating $1,000 or more, claims for monies due or to become due the Contractor from the Government under this contract may be assigned to a bank, trust company, or other financing institution, including any Federal lending agency, and may thereafter be further assigned and reassigned to any such institution. Any such assignment or reassignment shall cover all amounts payable under this contract and not already paid, and shall not be made to more than one party except that any such assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in such financing. Unless otherwise provided in this contract, payments to an assignee of any monies due or to become due under this contract shall not, to the extent provided in said Act, as amended, be subject to reduction or set-off.

b. In no event shall copies of this contract or of any plans, specifications, or other similar documents relating to work under this contract, if marked "Top Secret," "Secret" or "Confidential," be furnished to any assignee of any claim arising under this contract or to any other person not entitled to receive the same. However, a copy of any part or all of this contract so marked may be furnished, or any information contained therein may be disclosed, to such assignee upon the prior written authorization of the Contracting Officer.

14. DISPUTES (1958 JAN). a. Except as otherwise provided in this contract, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to the Contractor. The decision of the Contracting Officer shall be final and conclusive unless, within 30 days from the date of receipt of such copy, the Contractor mails or otherwise furnishes to the Contracting Officer a written appeal addressed to the Secretary. The decision of the Secretary or his duly authorized representative for the determination of such appeals shall be final and conclusive unless determined by a court of competent jurisdiction to have been fraudulent, or capricious, or arbitrary, or so grossly erroneous as necessarily to imply bad faith, or not supported by substantial evidence. In connection with any appeal proceeding under this clause, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of his appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision.

b. This "Disputes" clause does not preclude consideration of law questions in connection with decisions provided for in paragraph a. above: *provided*, that nothing in this contract shall be construed as making final the decision of any administrative official, representative, or board on a question of law.

c. The provisions of a. above shall not apply to disputes which are subject to the jurisdiction of a Federal, State, or other appropriate regulatory body. The provisions of a. above shall also be subject to the requirements of the law with respect to the rendering of utility services and the collection of regulated rates. (AMENDMENT OF 1968 SEP.)

15. OFFICIALS NOT TO BENEFIT (1949 JUL) No member of or delegate to Congress, or resident commissioner, shall be admitted to any share of or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

16. COVENANT AGAINST CONTINGENT FEES (1958 JAN). The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty the Government shall have the right to annul this contract without liability or in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage or contingent fee.

RECEIVED
JUL 12 1971
CITY OF OAK HARBOR

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Attached to and made a part of Contract No. N62474-71-C-3706

17. EXAMINATION OF RECORDS (1969 APR). a. The Contractor agrees that the Comptroller General of the United States or any of his duly authorized representatives shall, until expiration of three years after final payment under this contract or of the time periods specified in Appendix M of the Armed Services Procurement Regulation, whichever expires earlier, have access to and the right to examine any books, documents, papers, and records of the Contractor, that directly pertain to, and involve transactions relating to this contract or subcontracts hereunder.

b. The Contractor further agrees to include in all his subcontracts hereunder a provision to the effect that the subcontractor agrees that the Comptroller General of the United States or any of his duly authorized representatives shall, until expiration of three years after final payment under the subcontract or of the time periods specified in Appendix M of the Armed Services Procurement Regulation, whichever expires earlier, have access to and the right to examine any books, documents, papers, and records of such subcontractor that directly pertain to, and involve transactions relating to the subcontract. The term "subcontract" as used in the clause excludes: (i) purchase orders not exceeding $2,500 and (ii) subcontracts or purchase orders for public utility services at rates established for uniform applicability to the general public.

18. GRATUITIES (1952 MAR). a. The Government may, by written notice to the Contractor, terminate the right of the Contractor to proceed under this contract if it is found, after notice and hearing, by the Secretary or his duly authorized representative, that gratuities (in the form of entertainment, gifts, or otherwise) were offered or given by the Contractor, or any agent or representative of the Contractor, to any officer or employee of the Government with a view toward securing a contract or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performing of such contract; *provided*, that the existence of the facts upon which the Secretary or his duly authorized representative makes such findings shall be in issue and may be reviewed in any competent court.

b. In the event this contract is terminated as provided in paragraph a. hereof, the Government shall be entitled (i) to pursue the same remedies against the Contractor as it could pursue in the event of a breach of the contract by the Contractor, and (ii) as a penalty in addition to any other damages to which it may be entitled by law, to exemplary damages in an amount (as determined by the Secretary or his duly authorized representative) which shall be not less than three or more than ten times the cost incurred by the Contractor in providing any such gratuities to any such officer or employee.

c. The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

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Attached to and made a part of Contract No. N62474-71-C-3706

19. CONVICT LABOR (1949 MAR). In connection with the performance of work under this contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment at hard labor.

20. EQUAL OPPORTUNITY (1969 JAN). During the performance of this contract, the Contractor agrees as follows:

(1) The Contractor will not discriminate against any employee or applicant for employement because of race, color, religion, sec, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this nondiscrimination clause.

(2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

(3) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency Contracting Officer, advising the labor union or workers' representative of the contractor's commitments under Section 202 of Executive Order 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

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Attached to and made a part of Contract No. N62474-71-C-3706

(6) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part, and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Contractor will include the provisions of Paragraph (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions including such provisions including sanctions for non-compliance: *Provided*, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

21. AUDIT - PRICE ADJUSTMENTS (1970 JAN)

(a) This clause shall become operative only with respect to any modification of this contract which involves aggregate increses and/or decreases in costs plus applicable profits in excess of $100,000, unless the modification is priced on the basis of adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation.

(b) For purposes of evaluating the accuracy, completeness and currency of cost or pricing data required to be submitted in conjunction with such a contract modification, the Contracting Officer, the Comptroller General of the United States, or any authorized representatives who are employees of the United States Government, shall--until the expiration of three years from the date of final payment under this contract or for the time periods specified in Appendix M of the Armed Services Procurement Regulation, whichever expires earlier--have the right to examine all books, records, documents, and other data of the Contractor related to the negotiation, pricing or performance of this contract or which will permit adequate evaluation of the cost or pricing data submitted, along with the computations and projections used therein.

(c) The Contractor agrees to insert this clause, including this paragraph (c), in all subcontracts hereunder which when entered into exceed $100,000 so as to apply until the expiration of three years from the date of final payment under the subcontract or for the time periods specified in Appendix M of the Armed Services Procurement Regulation, whichever expires earlier. When so inserted, changes shall be made as follows: (i) in this paragraph (c), redesignate "The Contractor" as appropriate and (ii) in subparagraph (b) above add "of the Government prime contract" after "Contracting Officer"; and add, at the end of (a) above, the words, "*provided* that the modification to the subcontract results from a modification to the Government prime contract."

22. SUBCONTRACTOR COST OR PRICING DATA—PRICE ADJUSTMENTS(1970 JAN)

(a) Paragraphs (b) and (c) of this clause shall become operative only with respect to any modification made pursuant to one or more provisions of this contract which involves aggregate increases and/or decreases in costs plus applicable profits expected to exceed $100,000. The requirements of this clause shall be limited to such modifications.

(b) The Contractor shall require subcontractors hereunder to submit cost or pricing data under the following circumstances: (i) prior to the award of any subcontract the amount of which is expected to exceed $100,000 when entered into; (ii) prior to the pricing of any subcontract modification which involves aggregate increases and/or decreases in costs plus applicable profits expected to exceed $100,000, except where the price is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantitites to the general public, or prices set by law or regulation.

(c) The Contractor shall require subcontractors to certify that to the best of their knowledge and belief the cost and pricing data submitted under (b) above is accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract change or modification.

(d) The Contractor shall insert the substance of this clause including this paragraph (d) in each subcontract which exceeds $100,000.

RSE:mc

Attached to and made a part of Contract No. N62474-71-C-3706

23. PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--PRICE ADJUSTMENTS (1970 JAN)

(a) This clause shall become operative only with respect to any modification of this contract which involves aggregate increases and/or decreases in costs plus applicable profits in excess of $100,000 unless the modification is priced on the basis of adequate competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation. The right to price reduction under this clause is limited to defects in data relating to such modification.

(b) If any price, including profit, or fee, negotiated in connection with any price adjustment under this contract was increased by any significant sums because:

(i) the Contractor furnished cost or pricing data which was not complete, accurate and current as certified in the Contractor's Certificate of Current Cost or Pricing Data;

(ii) a subcontractor, pursuant to the clause of this contract entitled "Subcontractor Cost or Pricing Data" or "Subcontractor Cost or Pricing Data--Price Adjustments" or any subcontract clause therein required, furnished cost or pricing data which was not complete, accurate and current as certified in the subcontractor's Certificate of Current Cost or Pricing Data;

(iii) a subcontractor or prospective subcontractor furnished cost or pricing data which was required to be complete, accurate and current and to be submitted to support a subcontract cost estimate furnished by the Contractor but which was not complete accurate and current as of the date certified in the Contractor's Certificate of Current Cost or Pricing Data; or

(iv) the Contractor or a subcontractor or prospective subcontractor furnished any data, not within (i), (ii) or (iii) above, which was not accurate, as submitted;

the price shall be reduced accordingly and the contract shall be modified in writing as may be necessary to reflect such reduction. However, any reduction in the contract price due to defective subcontract data of a prospective subcontractor, when the subcontract was not subsequently awarded to such subcontractor, will be limited to the amount (plus applicable overhead and profit markup) by which the actual subcontract, or actual cost to the Contractor if there was no subcontract was less than the prospective subcontract cost estimate submitted by the Contractor, *provided* the actual subcontract price was not affected by defective cost or pricing data.

RSE:eg

Attached to and made a
part of Contract No.
N62474-71-C-3706

(NOTE: Since the contract is subject to reduction under this clause by reason of defective cost or pricing data submitted in connection with certain subcontracts, it is expected that the contractor may wish to include a clause in each such subcontract requiring the subcontractor to appropriately indemnify the contractor. However, the inclusion of such a clause and the terms thereof are matters for negotiation and agreement between the contractor and the subcontractor, provided that they are consistent with ASPR 23-203 relating to Disputes provisions in subcontracts. It is also expected that any subcontractor subject to such indemnification will generally require substantially similar indemnification for defective cost or pricing data required to be submitted by his lower tier subcontractors.)

(c) The requirement for inclusion of the above clauses in contracts with foreign governments or agencies thereof may be waived in exceptional cases by the Head of a Procuring Activity, stating in writing his reasons for such determinations.

24. <u>CONDITIONS PRECEDENT</u>.

a. If monies are received from any Federal agencies other than the Navy Department, Navy's connection charge of $1,357,000.00 shall be reduced by an amount then to be determined. This clause does not apply to contractor's facilities other than the twenty-four inch water main between Deans Corner and the Government's water treatment plant, which may be required to furnish water to customers of the contractor located off the station.

b. The Contractor agrees to attempt to rck DLB enter into a valid agreement with The City of Anacortes for the supply of water sufficient to serve all of its

to Paragraph 24.b add, the sentence, " The Contractor's construction contract will not be awarded by the Contractor until such written agreement is entered into with the City of Anacortes.

void, at the option of the Government if the following actions are not taken by the Contractor by the dates specified:

at a rate and at terms and conditions acceptable to the Government by ~~1 July~~ 17 Sept 1971

(1) Agreement with The City of Anacortes to furnish water ~~as provided in b. above by 15 May 1971~~ rck DLB rck DLB

(2) Obtaining of funds required for the construction of its share of the facilities described in Exhibit B by ~~15 April~~ 7 July 1971. rck DLB

(3) Receipt of an acceptable bid for construction of the facilities described in Exhibit B at a price which will not require a contribution by the Government in excess of $1,357,000 by ~~XXXXXXXXXXXX~~ 6 August 1971. rck DLB

d. Provision of water service to the Government not later than 31 October 1972.

RSE:mtb

Attached to and made a part of Contract No. N62474-71-C-3706

e. This contract is conditioned upon the Contractor obtaining all easements. Any costs therefor shall be computed in the Contractor's contract contribution of $528,000.

f. This contract shall be null and void at the option of the Contractor, if in the Contractor's opinion, after receipt of construction bids, that the twenty-four inch water transmission line cannot be constructed for $1,885,000 or if the Contractor's share exceeds $528,000.

g. The total cost to the Contractor for on-station easements referred to in paragraph 10. c. above, shall not exceed a total of $100.00.

[redacted]

"h. A Contingent Fund in the amount of $187,086.47 is hereby established. Of this amount $151,086.47 is to be held by the Government. The amount of $36,000.00 will be held by the Contractor. The Contractor shall make payment for all contingencies up to the amount of its share of $36,000.00 during construction of the twenty-four inch water transmission.line. If after depletion of the Contractor's portion of the fund the Contractor is unable to meet the full amount of any such additional justified change, the Government will make payment of such additional change. The Government's obligation for such purpose shall not exceed $151,086.47. All monies remaining the Contingent Fund shall be in the account of the Government for possible use in the construction, by the Contractor, of its construction Bid Item No. 6, Surge Protection Facility and Bid Item No. 8, Electrical, Control and Telephone Line Work."

(1) In Modification No. P00001, paragraph 12.(b)(5)a, subparagraph h, at the end of the paragraph, insert after the word "Work", "and water meters installed by the Contractor off of the 10-inch water line."

(b) The total cost of such installation shall not exceed $18,452.40.

(c) Modification of basic contract is necessary to make a change in paragraph 24.c to establish an anniversary date of basic contract effective 8 August 1974.

(d) Delete $100.00 and insert in lieu thereof $4,448.18.

RSE:mc

Attached to and made a part of Contract No. N62474-71-C-3706

WATER SERVICE SPECIFICATIONS

1. PREMISES TO BE SERVED: Naval Air Station, Whidbey Island Oak Harbor, Washington 98277

2. ESTIMATED SERVICE REQUIREMENTS:

Estimated ~~daily~~ monthly maximum demand:	~~4,500,000 gallons~~ 6 000 000 cubic feet
Estimated annual consumption:	408,000,000 gallons

"This amount shall be renegotiated annually as of the anniversary date of 1 August 1974."

3. POINT OF DELIVERY: The point shall be at the Government's treatment plant at the Naval Air Station, Whidbey Island (Ault Field), Oak Harbor, Washington.

4. DESCRIPTION OF WATER SERVICE: Contractor shall have water continuously available at the Navy's treatment facilities, Attachment 1, attached to and made a part hereof, at a pressure prevailing in the Contractor's main at such location. No pumping will be required of the Contractor.

5. QUALITY OF WATER: The water supplied under the terms of this contract shall be potable and suitable for domestic use and shall meet the requirements of the State of Washington Health and Safety Code with respect to public domestic supply and culinary water supplied by common carriers in interstate commerce, and such revisions thereof as may be made from time to time.

"6. Metering and Billing. Water shall be measured on the 24" line by a 12" Navy owned meter. Water on the 10" line shall be measured by City of Oak Harbor meters located at (1) The Fire School, (2) AUW Building and (3) Radar Site."

7. ALTERATIONS AND ADDITIONS: None

ORDINANCE NO. 1036

ORDINANCE DEFINING THE WATER SERVICE AREAS OF THE CITY OF OAK HARBOR

WHEREAS, in Oak Harbor Municipal Code Chapter 13.24 , it provides for establishment of City's water service area (being the area outside of the City of Oak Harbor wherein the City will supply water to others; now, therefore

THE CITY COUNCIL OF THE CITY OF OAK HARBOR do ordain as follows:

Section One. There is hereby added a new section 13.24.015 "Water Service Area" to the Oak Harbor Municipal Code which shall read as follows:

> Section 13.24.015 Water Service Area. The water service area of the City of Oak Harbor is defined by resolution.

Section Two. Severability. If any provision of this Ordinance or its application to any person or circumstance is held invalid, the remainder of the Ordinance or the application of the provision to other persons or circumstances is not affected.

Section Three. This Ordinance shall be in full force and effect five days after its passage and publication as required by law.

PASSED by the City Council and approved by its Mayor this 5th day of March, 1996

THE CITY OF OAK HARBOR

Mayor

Attest:

Denise Sols Cue

For City Clerk

Water Service
Area Ordinance - 1

Approved as to Form:

City Attorney

Published: April 13, 1996

C:\work\res-ord6\wtrarea2.ord

RESOLUTION NO. 96-08

RESOLUTION ADOPTING THE WATER SERVICE AREA FOR OAK HARBOR

BE IT RESOLVED by the City Council of the City of Oak Harbor as follows:

1. The water service area is set out in the map listed as Exhibit "A". The water service area is more particularly described in Exhibit "B".

2. Resolution 10-76 is hereby repealed.

PASSED and approved by the City Council this 5 day of March, 1996.

THE CITY OF OAK HARBOR

Mayor

Attest:

Denise Sobchuk

For City Clerk

Approved as to Form:

City Attorney

C:\work\res-ord6\wtr-serv.res

OAK HARBOR WATER SERVICE AREA
LEGAL DESCRIPTION

Beginning at point 200.0 feet East of Lot 1. Plat of Flowers Heights in the Southeast 1/4, Section 10. Township 32 North, Range 1 East of the Willamette Meridian; thence West along the South line of said plat to the East line of Balda Road; thence South along the East line of Balda Road 1324.0 feet, more or less; thence West 80.0 feet to the West line of Balda Road, said point also being the Southeast corner of the Plat of Walker's Heights; thence West along the South line of said plat to the Southwest corner of Lot 28, Plat of Walker's Heights; thence North along the West line of said plat 660.0 feet; thence West 390.0 feet, more or less to the centerline of SR 20; thence Northeast along the SR 20 centerline to the Southeast corner of the Northwest 1/4, Section 10, Township 32 North, Range 1 East; thence West along the South line of said Northwest 1/4 to the Southeast corner of the Northeast 1/4, Section 9, Township 32 North, Range 1 East; thence North along the East line of said Northeast 1/4, a distance of 1320.0 feet; thence West 1320.0 feet to the East margin of the Plat of Waterloo Acres Division #1; thence North along the East boundary of said plat to the South line of Fort Nugent Road; thence West along the South line of Fort Nugent Road to the Northwest corner of said plat; thence South along the West boundary of said plat 620.0 feet, more or less; thence West 825.0 feet; thence North 620.0 feet, more or less, to the South line of Fort Nugent Road; thence West along the South line of Fort Nugent Road 100.0 feet, more or less, thence North 680.0 feet; thence West 66.0 feet; thence North 660.0 feet to the South line of the North ½ of the Southwest 1/4, Section 4, Township 32 North, Range 1 East; thence West to the Southwest corner of the Northwest 1/4 of the Southwest 1/4, Section 4, Township 32 North, Range 1 East; thence North along the West line of said Southwest 1/4 to the Northwest corner of the Northwest 1/4 of the Southwest 1/4,

EXHIBIT B-1

Section 4; thence East along the North line of said Southwest 1/4 to the Northeast corner of the Northwest 1/4 of the Southwest 1/4, Section 4; thence North along the East line of the Southwest 1/4 of the Northwest 1/4, Section 4, Township 32 North, Range 1 East, to the Northeast corner of the Southwest 1/4 of the Northwest 1/4, Section 4; thence East along the North line of the Southeast 1/4 of the Northwest 1/4, Section 4, to the Southeast corner of Lot D, Island County Short Plat 72-082, said point also being on the North line of Fairway Lane; thence North 29° 31' 37" West along the East line of Lot D, 310.98 feet; thence North 0° 46' 10" East 292.0 feet, thence East 125.0 feet, more or less, to the East line of the Northeast 1/4 of the Northwest 1/4, Section 4, Township 32 North, Range 1 East; thence North to the Northwest corner of the Plat of Patton's Hillcrest Village Division #1; thence East along the North line of said plat to the West line of Highland Drive; thence Northeast along a curve to the right to the Southwest corner of Lot 1, Patton's Hillcrest Village, Division #2; thence North along the West line of said plat to the Northeast corner of the Southwest 1/4 of the Northeast 1/4, Section 33, Township 33 North, Range 1 East; thence East along the East and North line of Crosby Road to the intersection of the centerline of Heller Road; thence North along the centerline of Heller Road to the Northwest corner of the Northeast 1/4 of the Northwest 1/4, Section 34, Township 33 North, Range 1 East; thence East along the North line of said Northeast 1/4 to the North corner of the Northeast 1/4 of the Northwest 1/4, Section 34; thence North to the Northeast corner of the Northeast 1/4 of the Southwest 1/4, Section 27, Township 33 North, Range 1 East to the Northeast corner of the Northwest 1/4 of the Southeast 1/4, Section 27, Township 33 North, Range 1 East; thence North to the Northeast corner of Lot A, Island County Short Plat 78-141; thence West 660.0 feet to the Northwest corner Lot A of Short Plat 78-140; thence North to the Southeast corner of Lot 19, Plat of Pine Terrace, all in the Northeast 1/4, Section 27, Township 33 North, Range 1 East of the

Willamette Meridian; thence West along the South line of said plat to the Southwest corner, thence North along the West line of said plat to a point which lies 217.0 feet South of the Northeast corner of the Northeast 1/4 of the Northwest 1/4, Section 27, Township 33 North, Range 1 East; thence West 200.0 feet; thence North to the North line of Ault Field Road; thence East along the North line of Ault Field Road to its intersection with old County Road #301; thence Northeast along the North line of said County Road, having a curve to the left, to its intersection with Clover Valley Road; thence Northeast along the North line of Clover Valley Road, having a curve to the left, to a point which lies 90.0 feet, more or less, from the Northeast corner of the Southeast 1/4 of the Southwest 1/4, Section 23, Township 33 North, Range 1 East; thence East 660.0 feet; thence South 1320.0 feet, more or less, to the South line of Ault Field Road; thence East along the South line of Ault Field Road to the Northeast corner of the Northwest 1/4 of the Northeast 1/4, Section 26, Township 33 North, Range 1 East; thence South to a point which lies 660.0 feet North of the Southeast corner of the Northwest 1/4 of the Southeast 1/4, Section 26, Township 33 North, Range 1 East; thence East 660.0 feet; thence South 660.0 feet; thence East to the West line of SR 20; thence Northeast along the West line of SR 20 to a point which lies 620.0 feet East of the Northeast corner of the Northwest 1/4 of the Northwest 1/4, Section 25, Township 33 North, Range 1 East; thence East along the South line of Fakkema Road 700.0 feet to the Northeast corner of the Northwest 1/4, Section 25, Township 33 North, Range 1 East; thence South 1481.0 feet; thence West 267.0 feet, more or less, to the Northeast corner of Lot B, Island County Short Plat 79-102; thence South along the East line of Lots B and C of said short plat to the North line of Case Road; thence West along the North line of Case Road to a concrete monument which is the Northeast corner of Government Lot 2; thence South 2375.0 feet, more or less; thence West to the East line of Torpedo Road; thence

South along the East line of Torpedo Road 404.0 feet; thence East 825.0 feet, more or less, thence South to the South line of Crescent Harbor Road; thence West along the South line of Crescent Harbor Road to a point of curvature to the left and the intersection of the East line of 70 N E Street; thence Southwest along the East line of 70 N E Street to a point.which is 30.0 feet North of 875 Avenue East extended; thence East 529.0 feet, more or less; thence Southwest 1036.0 feet; thence West 529.0 feet, more or less, to the East line of 70 N E Street; thence Southwest and South along the East line of 70 N E Street to a point which lies 110.0 feet North of 300 Avenue East extended; thence South 52° 55' 00" East 844.72 feet;

Thence South 36° 08' 49" West 175.34 feet;

thence South 52° 42' 33" East 51.60 feet;

thence South 01° 19' 42" West 181.60 feet to the South line of E Pioneer Way;

thence South 80° 45' 00" East 76.19 feet;

thence South 09° 11' 01" West 179.71 feet;

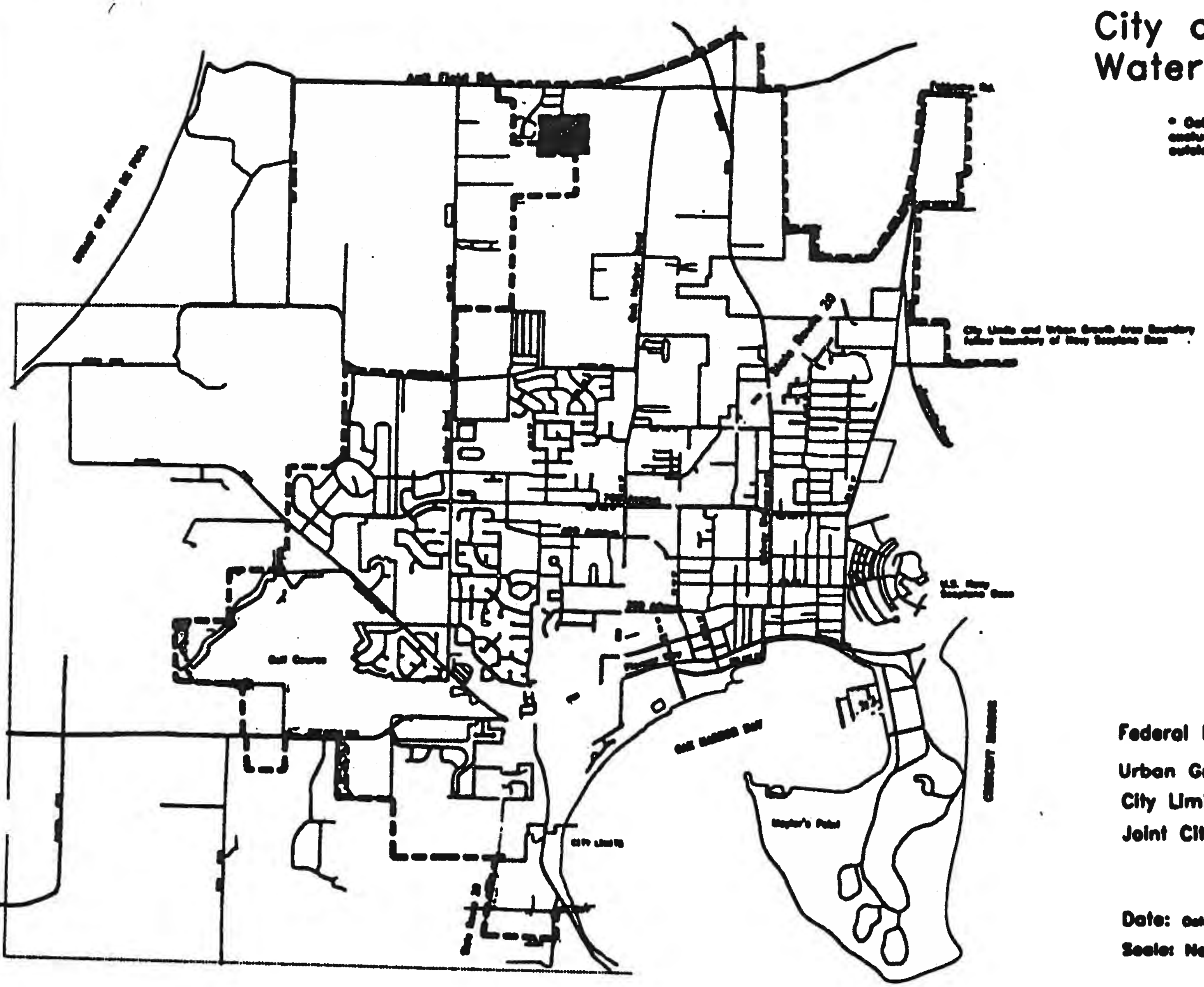
thence South 89° 27' 22" East 272.87 feet;

thence South 11° 31' 38" East 1574.27 feet;

thence South 78° 32' 45" West 268.0 feet, more or less, to the Oak Harbor Bay and the South line of the Oak Harbor Marina.

City of Oak H bor Water Service Area*

* Oak Harbor is not an exclusive water provider outside the city limits.



Federal Exempt Land

Urban Growth Area

City Limits

Joint City-County Planning Area

Date: October 1998

Scale: None

For locations of adjacent water systems see the City of Oak Harbor 1998 Comprehensive Water System Plan.

Prepared by City of Oak Harbor
Planning and Community Development Department

Exhibit "Ä"

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thence West 80.0 feet to the West line of Balda Road, said point also being the Southeast corner of the Plat of Walker's Heights; thence West along the South line of said plat to the Southwest corner of Lot 28, Plat of Walker's Heights; thence North along the West line of said plat 660.0 feet; thence West 390.0 feet, more or less to the centerline of SR20 - - - - - -

OAK HARBOR WATER SERVICE AREA
LEGAL DESCRIPTION

Beginning at a point 200.0 feet East of Lot 1, Plat of Flowers Heights in the Southeast 1/4, Section 10, Township 32 North, Range 1 East of the Willamette Meridian; thence West along the South line of said plat to the East line of Balda Road; thence South along the East line of Balda Road 1324.0 ~~885.0~~ feet, more or less; ~~thence West 1320.0 feet, more or less, to the centerline of SR20~~; thence Northeast along the SR20 centerline to the Southeast corner of the Northwest 1/4, Section 10, Township 32 North, Range 1 East; thence West along the South line of said Northwest 1/4 to the Southeast corner of the Northeast 1/4, Section 9, Township 32 North, Range 1 East; thence North along the East line of said Northeast 1/4, a distance of 1320.0 feet; thence West 1320.0 feet to the East margin of the Plat of Waterloo Acres Division #1; thence North along the East boundary of said plat to the South line of Fort Nugent Road; thence West along the South line of Fort Nugent Road to the Northwest corner of said plat; thence South along the West boundary of said plat 620.0 feet, more or less; thence West 825.0 feet; thence North 620.0 feet, more or less, to the South line of Fort Nugent Road; thence West along the South line of Fort Nugent Road 100.0 feet, more or less, thence North 680.0 feet; thence West 66.0 feet; thence North 660.0 feet to the South line of the North 1/2 of the Southwest 1/4, Section 4, Township 32 North, Range 1 East; thence West to the Southwest corner of the Northwest 1/4 of the Southwest 1/4, Section 4, Township 32 North, Range 1 East; thence

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EXHIBIT "B"

North along the West line of said Southwest 1/4 to the Northwest corner of the Northwest 1/4 of the Southwest 1/4, Section 4; thence East along the North line of said Southwest 1/4 to the Northeast corner of the Northwest 1/4 of the Southwest 1/4, Section 4; thence North along the East line of the Southwest 1/4 of the Northwest 1/4, Section 4, Township 32 North, Range 1 East, to the Northeast corner of the Southwest 1/4 of the Northwest 1/4, Section 4; thence East along the North line of the Southeast 1/4 of the Northwest 1/4, Section 4, to the Southeast corner of Lot D, Island County Short Plat 72-082, said point also being on the North line of Fairway Lane; thence North 29 31'37" West along the East line of Lot D, 310.98 feet; thence North 0 46'10" East 292.0 feet; thence East 125.0 feet, more or less, to the East line of the Northeast 1/4 of the Northwest 1/4, Section 4, Township 32 North, Range 1 East; thence North to the Northwest corner of the Plat of Pattons Hillcrest Village Division #1; thence East along the North line of said plat to the West line of Highland Drive; thence Northeast along a curve to the right to the Southwest corner of Lot 1, Pattons Hillcrest Village, Division #2; thence North along the West line of said plat to the Northeast corner of the Southwest 1/4 of the Northeast 1/4, Section 33, Township 33 North, Range 1 East; thence East along the East and North line of Crosby Road to the intersection of the centerline of Heller Road; thence North along the centerline of Heller Road to the Northwest corner of the Northeast 1/4 of the Northwest 61

1/4, Section 34, Township 33 North, Range 1 East; thence East along the North line of said Northeast 1/4 to the North corner of the Northeast 1/4 of the Northwest 1/4, Section 34; thence North to the Northeast corner of the Northeast 1/4 of the Southwest 1/4, Section 27, Township 33 North, Range 1 East to the Northeast corner of the Northwest 1/4 of the Southeast 1/4, Section 27, Township 33 North, Range 1 East; thence North to the Northeast corner of Lot A, Island County Short Plat 78-141; thence West 660.0 feet to the Northwest corner Lot A of Short Plat 78-140; thence North to the Southeast corner of Lot 19, Plat of Pine Terrace, all in the Northeast 1/4, Section 27, Township 33 North, Range 1 East of the Willamette Meridian; thence West along the South line of said plat to the Southwest corner; thence North along the West line of said plat to a point which lies 217.0 feet South of the Northeast corner of the Northeast 1/4 of the Northwest 1/4, Section 27, Township 33 North, Range 1 East; thence West 200.0 feet; thence North to the North line of Ault Field Road; thence East along the North line of Ault Field Road to its intersection with old County Road #301; thence Northeast along the North line of said County Road, having a curve to the left, to its intersection with Clover Valley Road; thence Northeast along the North line of Clover Valley Road, having a curve to the left, to a point which lies 90.0 feet, more or less, from the Northeast corner of the Southeast 1/4 of the Southwest 1/4, Section 23, Township 33 North, Range 1 East; thence

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East 660.0 feet; thence South 1320.0 feet, more or less, to the South line of Ault Field Road; thence East along the South line of Ault Field Road to the Northeast corner of the Northwest 1/4 of the Northeast 1/4, Section 26, Township 33 North, Range 1 East; thence South to a point which lies 660.0 feet North of the Southeast corner of the Northwest 1/4 of the Southeast 1/4, Section 26, Township 33 North, Range 1 East; thence East 660.0 feet; thence South 660.0 feet; thence East to the West line of SR20; thence Northeast along the West line of SR20 to a point which lies 620.0 feet East of the Northeast corner of the Northwest 1/4 of the Northwest 1/4, Section 25, Township 33 North, Range 1 East; thence East along the South line of Fakkema Road 700.0 feet to the Northeast corner of the Northwest 1/4, Section 25, Township 33 North, Range 1 East; thence South 1481.0 feet; thence West 267.0 feet, more or less, to the Northeast corner of Lot B, Island County Short Plat 79-102; thence South along the East line of Lots B and C of said short plat to the North line of Case Road; thence West along the North line of Case Road to a concrete monument which is the Northeast corner of Government Lot 2; thence South 2375.0 feet, more or less; thence West to the East line of Torpedo Road; thence South along the East line of Torpedo Road 404.0 feet; thence East 825.0 feet, more or less; thence South to the South line of Crescent Harbor Road; thence West along the South line of Crescent Harbor Road to a point of curvature to the left and the intersection of the East line 63 of 70 NE Street; thence Southwest along the East line of 70 NE Street to a point which is 30.0 feet North of 875 Avenue East extended; thence East 529.0 feet, more or less; thence Southwest 1036.0 feet; thence West 529.0 feet, more or less, to the East line of 70 NE Street; thence Southwest and South along the East line of 70 NE Street to a point which lies 110.0 feet North of 300 Avenue East extended;

thence South 52 55'00" East 844.72 feet;

thence South 36 08'49" West 175.34 feet;

thence South 52 42'33" East 51.60 feet;

thence South 01 19'42" West 181.60 feet to the South line of E. Pioneer Way;

thence South 80 45'00" East 76.19 feet;

thence South 09 11'01" West 179.71 feet;

thence South 89 27'22" East 272.87 feet;

thence South 11 31'38" East 1574.27 feet;

thence South 78 32'45" West 268.0 feet, more or less, to the Oak Harbor Bay and the South line of the Oak Harbor Marina.

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TB

RESOLUTION NO. 10-76

A resolution defining the water service areas of the City of Oak Harbor;

Whereas, in Ordinance No. 403, it is provided that the City Council from time to time establish the city's water service area, this being the primary area outside the City Limits wherein the City will supply water to other than another governmental unit;

IT IS HEREBY RESOLVED by the City Council of the City of Oak Harbor that the water service area of the City of Oak Harbor is described as follows:

Sections 3, 4, 9, 10, 14, and 15, Twp 32 North, Range 1, EWM and SEctions 25, 26, 27, 28, 33, 34, 35 and 36, Township 33 North Range 1, EWM, adjacent to the City of Oak Harbor within its Comprehensive Planning area, more particularly described as follows:

Beginning at the meander corner on the South line of Sec. 14 Twp 32 N, Rge 1, EWM, approximately 1375 feet easterly of the SW corner thereof; thence Westerly along said southerly line to the easterly margin of Scenic Heights Road; thence southerly along said margin to its intersection with the southerly margin of Balda Road; thence westerly along said southerly line and the South line of Sec. 15, T 32, Rge 1 EWM to the westerly margin of Monroe Landing Road; thence northerly along said westerly margin and the westerly line of said Sec. 15 to the Section corner common to Secs. 9, 10, 15 and 16, Twp 32 N, Rge 1, EWM; thence westerly along the South line of said Sec. 9 to the Southwest corner thereof; thence northerly along the westerly line of said Sec 9 and the westerly lines of Secs. 4, Twp 32N, Rge 1, EWM and 33, Twp 33N, Rge 1, EWM to the southerly margin of Crosby Road; thence westerly to the southerly production of the westerly margin of Crosby Road; thence northerly along said westerly margin to the north margin of Clover Valley Road thence easterly along said northerly margin and the northerly margin of Ault Field Road to the easterly margin of SR 20 in the SE1/4 of the SW1/4 of Sec. 24, T 33 N, Rge 1, EWM; thence southerly along the easterly margin of SR 20, through Sec. 24 and 25, T 33N, Rge 1, EWM to the easterly margin of Torpedo Road (Co. Rd. #288); thence continuing southerly along said easterly margin and the easterly margin of 70 NE St. (Auvil Rd. #288) to the southerly margin of Crescent Harbor Road, the existing City Limits.

A map showing the water service areas marked Schedule "A" is attached hereto and by reference made a part of this resolution.

PASSED by the Council and approved by its Mayor this 19 day of October 1976.

THE CITY OF OAK HARBOR

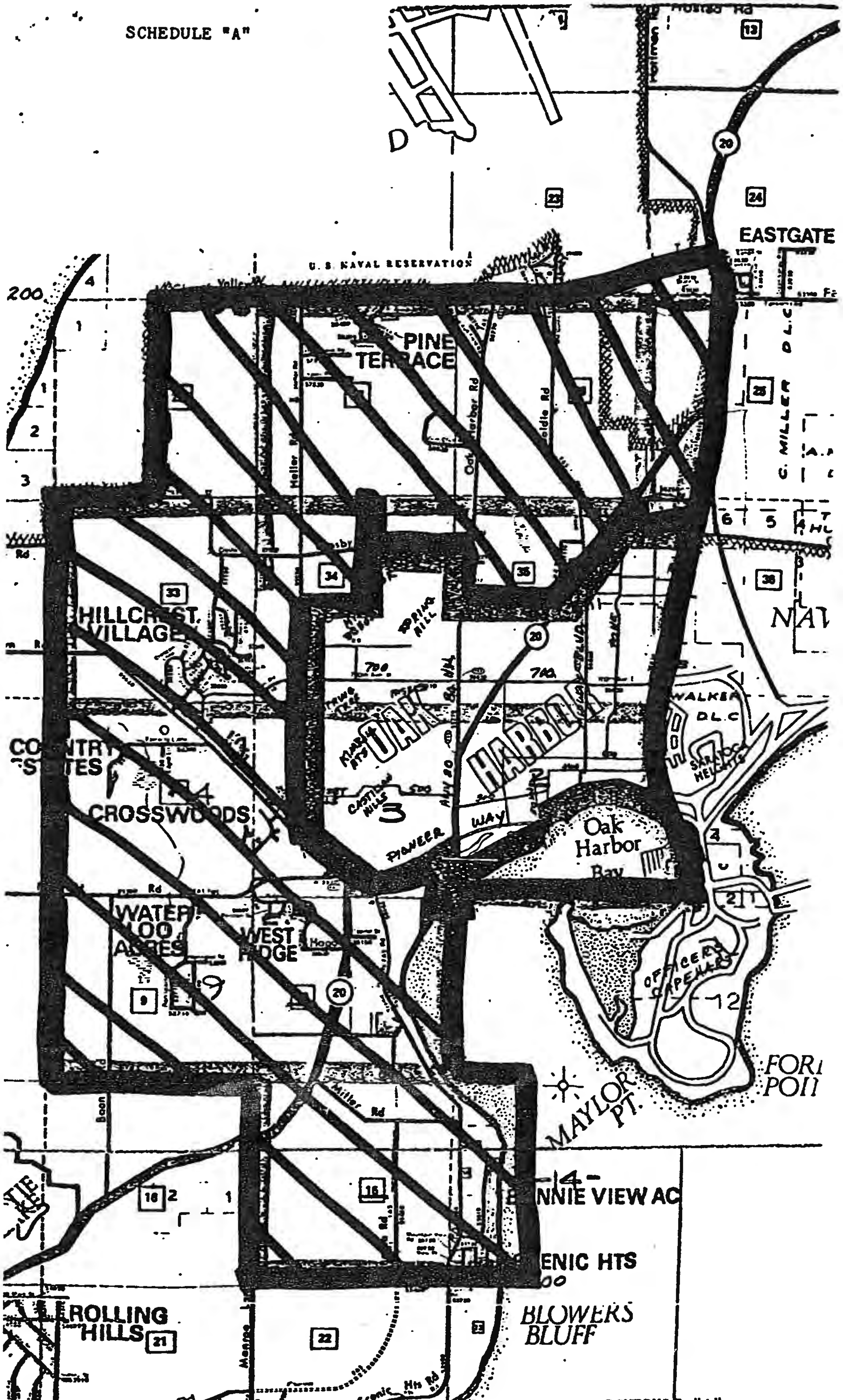
by [signature]
MAYOR

ATTEST:
[signature]
CITY CLERK

APPROVED:
[signature]
CITY ATTORNEY

JOHN W. WOLD
ATTORNEY AT LAW
OAK HARBOR, WASH.

SCHEDULE "A"



SCHEDULE "A"

~~FILED~~ RECORDED
VOL 439
PAGE 348
REQUEST OF
City of Oak Harbor
MAR 15 9 38 AM '79
E. DUANE KEMP, AUDITOR
ISLAND COUNTY, WASH.
[signature] DEPUTY

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348793

WATER AGREEMENT - OUTSIDE CITY LIMITS

THIS AGREEMENT is made and entered into this 14th day of March 1979, by and between the NORTH WHIDBEY WATER DISTRICT, hereinafter referred to as the "DISTRICT" and the CITY OF OAK HARBOR, a Municipal Corporation, hereinafter referred to as "CITY", WITNESSETH:

WHEREAS, the CITY OF OAK HARBOR is the owner of a ten inch water main located in SR 20, and

WHEREAS, the DISTRICT is desirous of obtaining a water supply for certain property located within said DISTRICT which property is described on the attached Schedule;

THE PARTIES ARE AGREED AS FOLLOWS:

1. The ordinances of the City of Oak Harbor as they now exist or may be amended so far as they pertain to the subject of this contract are a part of this contract and the district shall be subject to said ordinances.

2. Oak Harbor is purchasing water from the City of Anacortes and can only sell the water that it purchases from that source.

3. The primary function of the distribution and transmission system is to furnish water to the water service area of the City of Oak Harbor, as it may from time to time be defined. If at any time it is determined by the City Council that there is not surplus capacity in the transmission line then this contract may be terminated or modified.

4. The District is to only supply water to that property described in Schedule "A" which is attached hereto and by reference made a part of this contract. If any other property is served then the contract may be terminated by the City.

5. The hookup shall be to the ten (10) inch main and shall be at the expense of the District. The hookup shall be made by permit as provided by Ordinance of the City.

6. The City may require the District to install a rate of flow meter.

7. The District agrees to abide by all rules and regulations of the State Health Department and any other agency which may have regulatory power over the Oak Harbor system.

8. Because of the Anacortes water rate structure, the control of peak demand is very critical. The City has spent and will spend a great deal of money for extra storage and flow control. The District is located beyond the area where the water flow control efforts of the City can be effective. The District has no storage nor contemplates any storage at this time. The City reserves the right,

(1) To restrict the flow or the demand on the service.

(2) To set a rate to reflect the added cost to the City of the added demand upon the City system. This rate does not have to be an average rate but may be a specific rate adjusted to reflect those added costs to the City, generated by the District's usage of water and the demand upon the system. The rate will be set from time to time by ordinance.

JOHN W. WOLD
ATTORNEY AT LAW
OAK HARBOR, WASH.

9. The City will be the owner of the water meter and the demand meter.

10. The 10" line may be transferred to another agency who may assume the water services on North Whidbey Island. The City may transfer this contract along with the 10" line and upon doing so the City will have no further liability on this contract and this contract shall be modified in that the reference to "City" herein shall mean the new operator of the 10" line.

11. The City shall be under no obligation to the District to maintain or replace the 10" line if the same is deemed uneconomic by the council of the City.

APPROVED this 13th day of March 1979.

NORTH WHIDBEY WATER DISTRICT

by ______________________

by ______________________

by ______________________

APPROVED BY:

CITY OF OAK HARBOR City Council at a regular meeting held the 6th day of February 1979.

by ______________________
ALVIN B. KOETJE, MAYOR

DATE: March 14, 1979

ATTESTED TO:

____
CITY CLERK

also the following proposition:

"Shall North Whidbey Water District, if formed, be authorized to levy at the earliest time permitted by law on all property located in the District a general tax for one year, in excess of limitations provided by law, of not to exceed one dollar and twenty-five cents ($1.25) per thousand dollars of assessed value for general preliminary expenses of the District?"

One year one dollar and twenty-five cents per thousand dollars of assessed value tax YES

One year one dollar and twenty-five cents per thousand dollars of assessed value tax NO

(5) There shall also be elected at said election THREE water district Commissioners for said North Whidbey Water District to hold office respectively for the terms of two, four and six years, and until their respective successors are elected and qualified, the terms of each to be expressed on the ballot.

(6) That the notices of said election shall be published and posted as required by law.

PASSED this 11th day of April, 1977.

BOARD OF COUNTY COMMISSIONERS
ISLAND COUNTY, WASHINGTON

Chairman

Commissioner

Commissioner

ATTEST:
Clerk of the Board

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT			1. CONTRACT ID CODE J	PAGE OF PAGES 1 4
2. AMENDMENT/MODIFICATION NO. P00008	3. EFFECTIVE DATE See Block 16c	4. REQUISITION/PURCHASE REQ. NO. N0062097RCPC151		5. PROJECT NO. *(If applicable)* 970077

6. ISSUED BY CODE 613	7. ADMINISTERED BY *(If other than Item 6)* CODE
SOUTHWEST DIVISION NAVAL FACILITIES ENGINEERING COMMAND CONTRACTS DEPARTMENT, CODE 611MD 1220 PACIFIC HIGHWAY, ROOM 135 SAN DIEGO, CA 92132-5187	DUPLICATE ORIGINAL

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*			
CITY OF OAK HARBOR ATTN: MR. SCOTT BARNEY 865 S.E. BARRINGTON DRIVE OAK HARBOR, WA 98277			9A. AMENDMENT OF SOLICITATION NO.
			9B. DATED (SEE ITEM 11)
			10A. MODIFICATION OF CONTRACT/ORDER NO. N68711-71-C-3706
CODE 0T089	FACILITY CODE		10B. DATED (SEE ITEM 13) 7 JUL 71

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning ____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference of to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*
17 97971804 70AA 0000 00620 0 068688 2D CPC151 006207XE102Q $13,556.09

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIED THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDERED IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation date, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
XX	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: Terms of the Basic Contract
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☒ is required to sign this document and return 2 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION *(Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

(a) THE PURPOSE OF THIS MODIFICATION IS TO PROVIDE INTERTIES TO THE WATER SYSTEM AT NAS WHIDBEY ISLAND.

SEE PAGE 2

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
Stephen A. Dernbach		H. D. Powell Contracting Officer	
15B. CONTRACTOR/OFFEROR BY [signature] *(Signature of Person Authorized to Sign)*	15C. DATE SIGNED 9-18-97	16B. UNITED STATES OF AMERICA BY [signature] *(Signature of Contracting Officer)*	16C. DATE SIGNED 9/24/97

STANDARD FORM 30 (REV. 10-83)

(b) **PERMISSION TO ENTER SERVICE LOCATION** - The Government hereby grants to the City of Oak Harbor (Contractor) its agents, servants, and employees, free of any rental or similar charge, but subject to the limitations specified in this contract, a revocable permit to enter the service location for any proper purpose under this contract, including use of site or sites agreed upon by the parties hereto for the installation, operation and maintenance of the facilities of the Contractor required to be located upon Government premises. The Contractor is authorized to perform the above mentioned services up to the point of each individual meter. The Government will be responsible for the water system downstream of the interties. Authorized representatives of the Contractor will be allowed access to the facilities of the Contractor at suitable times to perform the obligations of the Contractor with respect to these facilities.

It is expressly understood that the Government may limit or restrict the right of access herein granted in any manner considered to be necessary for the national security. However, the Contractor shall not be held in breach or default of this contract or be penalized for failure to provide service hereunder should this right of access be so limited or restricted by the Government to the extent that the Contractor cannot perform.

(c) **TERM OF SERVICE:** Indefinite or until terminated at the option of the Government by giving written notice not less than 30 days in advance of the effective date of termination.

(d) **CONNECTION CHARGE**: In consideration of furnishing and installation by the Contractor at their expense of the interties described in water service specification the Government shall pay the Contractor as a connection charge, after receipt of satisfactory evidence of completion of facilities, a non-recurring not to exceed charge of **$13,556.09** The Contractor will sign the attached release form upon receipt of payment of the connection charge.

(e) Submit **CONNECTION CHARGE** invoice to the following address:

Commanding Officer
Southwest Division, Code 611.MD
Naval Facilities Engineering Command
1220 Pacific Highway, Bldg. 110
San Diego, CA 92132

(f) Submit any invoices for emergency water service to the following address:

NAS Whidbey Island
Attn: Code N4623
Oak Harbor, WA 98277

(g) The paying office address is as follows: **(DO NOT SEND INVOICES TO THIS ADDRESS)**

DFAS San Diego OPLOC (EFD)
P.O. Box 429100
San Diego, CA 92142-9100

(h) The following Federal Acquisition Regulation (FAR) clauses are incorporated into this contract with the full force and effect of law:

52.203-3	Gratuities (APR 84)
52.209.6	Protecting the Government's Interest when Subcontracting with Contractors Debarred, Suspended, or Proposed for Debarment (JUL 95)
52.232-1	Payments (APR 84)
52.232-25	Prompt Payment (MAR 94)
52.233-1	Disputes (OCT 95)
52.236-2	Differing Site Conditions (APR 84)
52.241-7	Change in rates or terms and conditions of service for regulated services (FEB 95)

Attached to and made a part of
N68711-71-C-3706

WATER SERVICE SPECIFICATIONS
FOR EMERGENCY WATER SERVICE ONLY

1. **SPECIFIC PREMISES TO BE SERVED**: NAS Whidbey Island, WA

Intertie Locations:

a. South of the corner of E. Whidbey Ave/SE Regatta Drive
b. Goldie Street north of NE 16th Ave

2. **NATURE OF SERVICE OR CHANGE**:

__✓__ Connection
______ Change
______ Disconnect

3. **DESCRIPTION OF WATER SERVICE**: The interties will be configured to allow water to flow in either direction in the event of an emergency and shall be used only in the case of emergency or as agreed by the Government and City. Double valving shall be installed to prevent accidental intertie of the two systems. Both parties must be notified prior to opening any intertie. The interties do not place any encumbrance, implied or otherwise, on either the Contractor or Government's water storage.

4. **METERING AND BILLING**: The volume of water used through the interties shall be determined based on the deduction of average daily flows over an appropriate period of time prior to the intertie being opened from total metered usage during the time the intertie is used.

5. **SIZE OF CONTRACTOR'S PIPELINE TO POINT OF DELIVERY**: Not less than 8 inches

6. **RATE SCHEDULE:** If the Government requires usage of emergency water through the interties, the Government shall pay the City of Oak Harbor in accordance with the approved applicable water rates.

7. **OPERATION AND MAINTENANCE**: Operation and Maintenance of the intertie and valving will be provided by the City of Oak Harbor. The City will maintain its half of the intertie and the connecting pipe up to the Government's intertie valve. The Government will maintain its intertie valve.

Attached to and made a part of
N68711-71-C-3706

CONTRACTOR'S RELEASE UNDER N68711-71-C-3706
WATER INTERTIE SYSTEM
NAS WHIDBEY ISLAND

KNOW ALL MEN BY THESE PRESENTS: In consideration of the premise and the sum of $ ____________ lawful money of the Unites States of America (hereinafter called the Government) $____________________ of which has already been paid and ______________________________ which is to be paid by the Government under the above mentioned contract; the contractor, for itself, its successors and assigns, hereby remises, releases and forever discharges the United States, its officers, agents and employees, of and from all manner of debts, dues, liabilities, obligations, accounts, claims, and demands whatsoever, in law and in equity, under or by virtue of the said contract except:

IN WITNESS WHEREOF, this contractor has executed this release 18th day of Sept. 19 97

City of Oak Harbor
Contractor

865 S.E. Barrington Drive
Street Number or R.F.D

Oak Harbor, WA 9B277
City State Zip Code

By [signature]
Signature

Stephen A. Dernbach
Name - Type or Print

Mayor
Title

COMPLETE ONLY IF CONTRACTOR IS A CORPORATION

I, Rosemary Morrison CERTIFY that I am the City Clerk City of Oak Harbor of the corporation herein; that Stephen A. Dernbach, who signed this release on behalf of the corporation, was then Mayor of said corporation; and that said release was duly signed for and on behalf of said corporation by authority of its governing body.

(SEAL)

Rosemary Morrison
Signature

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
	1 | 1

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
P00009	See Block 16c	N0062097RCPC151	970077

6. ISSUED BY CODE 613

SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CONTRACTS DEPARTMENT, CODE 613MD
1220 PACIFIC HIGHWAY, ROOM 135
SAN DIEGO, CA 92132-5187

7. ADMINISTERED BY (If other than Item 6) CODE

DUPLICATE ORIGINAL

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)

CITY OF OAK HARBOR
ATTN: MR. SCOTT BARNEY
865 S.E. BARRINGTON DRIVE
OAK HARBOR, WA 98277
(360) 679-6302

CODE 0T089 FACILITY CODE

9A. AMENDMENT OF SOLICITATION NO.

9B. DATED (SEE ITEM 11)

10A. MODIFICATION OF CONTRACT/ORDER NO.
N68711-71-C-3706

10B. DATED (SEE ITEM 13) 7 JUL 71

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning ____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference of to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)
17 97971804 70AA 0000 00620 0 068688 2D CPC151 006207XE102Q $3,079.85

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIED THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDERED IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
XX	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: Terms of the Basic Contract
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☒ is required to sign this document and return 2 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

(a) THE PURPOSE OF THIS MODIFICATION IS TO INCREASE FUNDING FOR THE WATER INTERTIES PROJECT AT NAS WHIDBEY ISLAND, WA, DUE TO THE FOLLOWING UNFORESEEN SITE CONDITIONS:

(1) THE PIPES WERE DEEPER THAN ANTICIPATED, REQUIRING MORE EXCAVATION AND SHORING, AND (2) THERE WAS MORE ROAD WORK THAN ANTICIPATED. THIS SLOWED CONSTRUCTION AND REQUIRED MORE ROAD REPAIR.

(b) WATER INTERTIE PROJECT IS INCREASED FROM: $13,556.09 BY: $3,079.85 TO: $16,635.94

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
Stephen A. Dernbach, Mayor of Oak Harbor		H. D. Powell, Contracting Officer	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
BY [signature] (Signature of Person Authorized to Sign)	9-23-97	BY [signature] (Signature of Contracting Officer)	9/24/97

STANDARD FORM 30 (REV 10-83)

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
1511 Third Ave., Suite 719 • Seattle, Washington 98101-1632

January 26, 1998

RYAN GOODMAN, P.E.
CITY OF OAK HARBOR
865 SE BARRINGTON DR
OAK HARBOR WA 98277

KEITH KEUNZI
NAS WHIDBEY
441100 W LEXINGTON ST BLDG 1190
OAK HARBOR WA 98278-3800

Subject: City of Oak Harbor Water System (ID#62650C) Island County
NAS Whidbey Water System (ID#034207) Island County
Acknowledgment of Completion of Construction for:
City / Navy Emergency Intertie

Dear Mr. Goodman and Mr. Keunzi:

This letter acknowledges receipt of the Construction Report (received on January 23, 1998) for the City / Navy Intertie Project. It is understood that the project was constructed in accordance with the City's and Navy's standard watermain construction specifications. It is further understood that this intertie will be used in emergency conditions only and that it is not intended to support future growth in either service area.

Please include a brief hydraulic evaluation and operating details in each of your future water system plan updates.

Sincerely,

Derek M. Pell

Derek M. Pell, P.E.
District Engineer
N.W. Drinking Water Operations

Enclosures

cc: Island County Health Department

CITY OF OAK HARBOR

865 S.E. Barrington Drive   Oak Harbor, Washington 98277-4092
City Hall (360) 679-5551

January 5, 1998

Derek Pell, Regional Engineer
Washington State Department of Health
1511 - 3rd Avenue, Suite 719
Seattle, WA 98101

Re: Waterline Inter-ties

Dear Mr. Pell:

On October 17, 1997, a meeting was held to discuss the impact to the water systems of operating the inter-ties between the City of Oak Harbor (ID#62650C) and the Naval Air Station (ID#034207) waterlines, which are located in Island County. In attendance at this meeting were: Dave Krause, NAS Whidbey Utility Engineer; Dave Dlugosh, Facilities Management Specialist; Rich Tyhuis, Oak Harbor Streets/Water Field Supervisor; and myself.

It was agreed that, depending on the severity of the incident and the vast number of situations requiring us to operate the inter-ties, it would be impossible to record all of the different effects it may have. Therefore, we came to the conclusion that the inter-ties would not be operated unless the specified representative from both parties were present and agreed to operate them. In the event the inter-ties must be operated, the two points of contact will be:

> Naval Air Station Whidbey Island - Base Operating Support Contractors Trouble Desk
> City of Oak Harbor - Public Works Manager of the Water Department

I hope this satisfies this portion of the Department of Health requirement. If you have any questions, please contact my office at 679-5551, extension 302. Thank you.

Sincerely,

Scott Barney
City of Oak Harbor Public Works Manager
Streets/Water/Equipment Rental

Dave Krause
NAS Whidbey Utility Engineer

CITY OF OAK HARBOR

865 S.E. [illegible]gton Drive Oak Harbor, Washington 98277-4092
City Hall (360) 679-5551

WATERLINE INTER-TIE ACTIVATION

The waterline inter-ties between the City of Oak Harbor (ID#62650C) and NAS Whidbey's (ID#034207) water systems will be activated only in the event of an emergency.

If either inter-tie were to be activated, it would be crucial to closely monitor both system's water storage tanks. In either case, the supplying system would be capable of providing water only for a short period of time (approximately 48 to 72 hours) before both systems would require implementation of water usage restrictions.

If either system required a large amount of water, and providing that the main water supply lines between Anacortes and Whidbey Island (rendered from the Skagit River) are completely operational, the system supplying the water may be required to activate booster pumps to the demanding system.

If a power failure were to occur at either facility, water flow would be gravity fed from the Navy's system into the City's system, as the Navy's system is located on higher ground.

In the event that the main water supply lines between Anacortes and Whidbey Island were to experience a interruption in service and could not provide water, both the City of Oak Harbor and NAS Whidbey water systems would be required to immediately commence strict water rationing, until it was determined how and when the water supply from Anacortes would be restored.

Once per year the City of Oak Harbor will flush the inter-ties, with a representative from NAS Whidbey on site to access the Navy side of the inter-tie.

The inter-ties will not be operated except in the event of an emergency and unless the specified representative from both parties agrees to operate them. In the event the inter-ties must be operated, the two points of contact will be:

Naval Air Station Whidbey Island
  Base Operating Support – Contractor's Trouble Desk - 257-3358
City of Oak Harbor Public Works
  Water Division Supervisor - through ICOM - 679-9567

NOTES

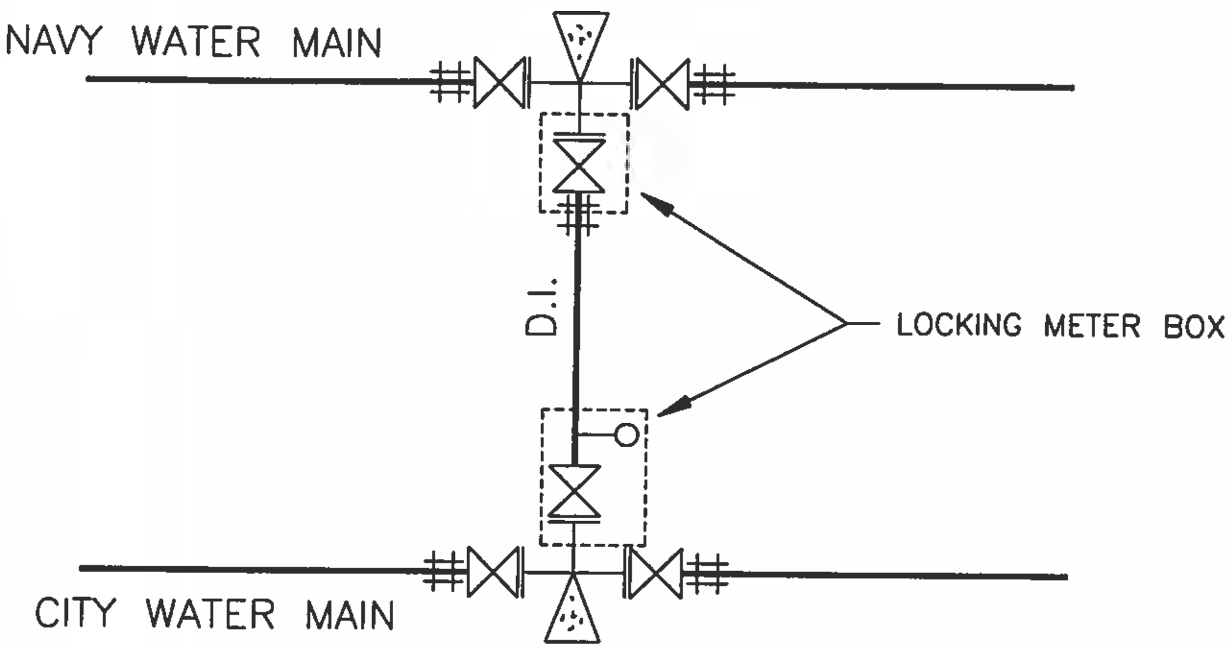
- The location of the two Navy/City waterline inter-ties are on Regatta Drive, south of Whidbey Avenue, and Goldie Street, at approximately 1751.
- The Navy and City water bypass lines are each 10" lines.
- Both sides of the inter-tie are valved.
- There are 2" blow-off valves on each inter-tie, located on the east side of Goldie Street and the east side of Regatta Drive.
- Because water within the inter-tie may be stagnate, it must be blown out so as not to enter either system.

PROCEDURE FOR OPERATION OF WATERLINE INTER-TIE

- Open blow-off valve.
- Open one side of the inter-tie, farthest from the blow-off, and run the water through until you get chlorine residual. Close that side.
- Then open the other side of the inter-tie and flush through the blow-off until you get chlorine residual. Close the inter-tie.
- Close the blow-off valve.
- Re-open the first side of the inter-tie, then the other.

NOTE: At this point the blow-off should not show water and both sides of the inter-tie should be open.

- Closely monitor both system's water storage tanks.



NOTES

1. Interties to be size of smaller line but no less than 8".
2. All gate valves to be FLxMJ, tees to be FLxFLxFL.
3. Field verify main materials and sizes prior to construction.

City of Oak Harbor

865 SE Barrington Drive
Oak Harbor, WA 98277

REVISIONS

MARK	DATE	DESCRIPTION	BY

APPROVAL:

DATE

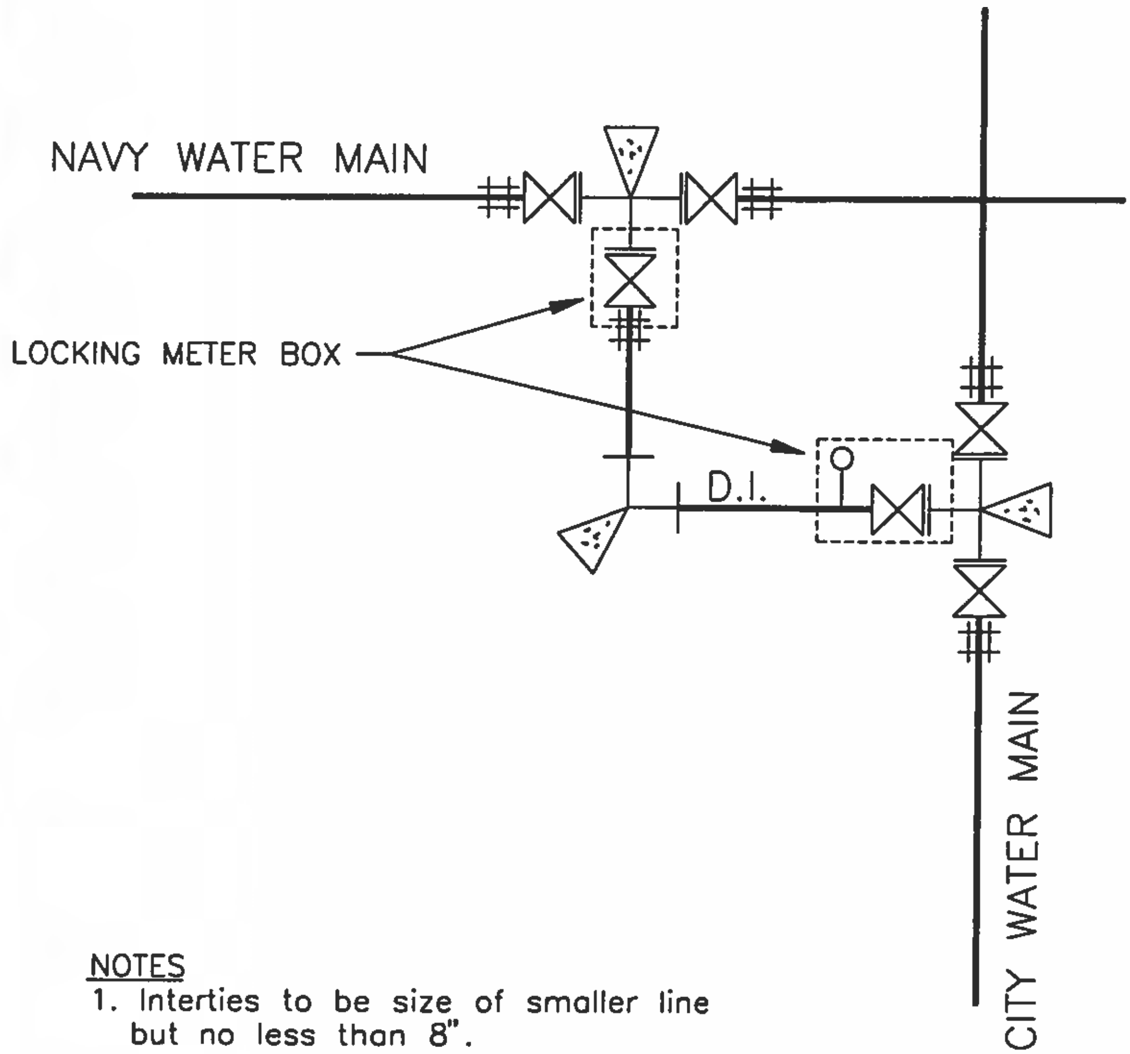
CITY OF OAK HARBOR
NAS WHIDBEY ISLAND
WATER SYSTEM INTERTIES
TYPICAL DETAIL
PARALLEL MAINS

SCALE HORIZ. NONE VERT. ——

SHEET NO. 1 OF 1

DRAWN BY RAK
CHECKED BY RG

DRAWING NUMBER



NOTES
1. Interties to be size of smaller line but no less than 8".
2. All gate valves to be FLxMJ, tees to be FLxFLxFL.
3. Field verify main materials and sizes prior to construction.

THRUST BLOCK
BLOWOFF
GATE VALVE
TEE
COUPLING
90° BEND

REVISIONS

MARK	DATE	DESCRIPTION	BY

APPROVAL:

City of
Oak Harbor

865 SE Barrington Drive
Oak Harbor, WA 98277

CITY OF OAK HARBOR
NAS WHIDBEY ISLAND
WATER SYSTEM INTERTIES
TYPICAL DETAIL
CROSSING MAINS

SCALE HORIZ. NONE VERT. ____
SHEET NO. 1 OF 1
DRAWN BY RAK
CHECKED BY RC
DRAWING NUMBER

F:\WATER\PERPINTR 02/12/97 F1t

01/06/2009 10:31:09 AM 4242310
Recording Fee $50.00 Page 1 of 9
Franchise
Island County Washington

After Recording Return to:
Island County Engineer

FRANCHISE

**ISLAND COUNTY
WASHINGTON**

Franchise No. 18(7)
Balda Road
Sec. 10, Twp. 32N, Rge. 1E

In the Matter of the Application of

City of Oak Harbor, for a franchise to construct, operate and maintain an extension to an existing water distribution system (hereinafter referred to as FACILITY) in, along, under and/or across the County road known as Balda Road located outside the City of Oak Harbor's Urban Growth Area located within the South East Quarter (SE¼) of Section 10, Township 32 North, Range 1 East, W.M., Island County, Washington, (hereinafter known as FRANCHISE AREA).

The application of City of Oak Harbor, its successors and assigns, for a franchise to construct, operate, and maintain the FACILITY in, along, under and/or across the FRANCHISE AREA having come on regularly for hearing on the 15th day of September, 2008. before the County Commissioners of Island County, Washington under the provisions of Chapter 36.55 RCW Franchises on Roads and Bridges as now in effect or as hereafter amended, and it appearing to the County Commissioners that notice of said hearing, as required by law, has been duly given and that it is for the public interest to grant the franchise herein granted; it is

ORDERED that a franchise be and the same hereby is given and granted to City of Oak Harbor, its successors and assigns (hereinafter referred to as the "HOLDER") to construct, operate and maintain the FACILITY, together with the necessary laterals and service connections in, along, under and/or across the FRANCHISE AREA for a period of time to expire on the 24th day of February, 2022 subject to the terms and conditions hereinafter enumerated.

INDEX

Section One – Definitions

1. When used in this franchise, unless otherwise indicated:

   a. "HOLDER" means City of Oak Harbor, its successors and assigns.

   b. "COUNTY" means Island County, Washington

   c. "FACILITIES" means all components of the water distribution system located within County road right-of-way.

   d. "FRANCHISE AREA" means the County road known as Balda Road located outside the City of Oak Harbor's Urban Growth Area located within the South East Quarter (SE¼) of Section 10, Township 32 North, Range 1 East, W.M., Island County, Washington

Section Two – Facilities within Franchise Area

1. Under the provisions of Chapter 36.55 RCW Franchises on Roads and Bridges and the Island County Code, the COUNTY hereby grants to the HOLDER subject to the terms and conditions set forth hereinafter, a Franchise for twenty-five (25) years, commencing upon the effective date of this Franchise.

2. In constructing, operating, maintaining and repairing said Facilities the HOLDER shall conform to applicable ordinances and to policies or requirements made by the Island County Engineer, or any County department or officers authorized to supervise and regulate such work and utility for the protection and safety of the public.

3. Requirements as established by individual departments of Island County shall become part of this franchise.

4. The COUNTY does hereby grant to the HOLDER the right, privilege, and authority to construct, maintain, repair and replace Facilities in, upon, over, under, along, under, and/or across FRANCHISE AREA.

Section Three – Non-Interference of Facilities

1. Said Facilities shall at all times be constructed and maintained so as not to interfere with the use of the County road for travel or maintenance.

2. Any and all damage or injury done or caused to said County road right-of-way or any portion thereof in the construction, operation, maintenance or repair of said FACILITY shall be immediately repaired and reconstructed under the supervision and to the satisfaction of the Island County Engineer; and in the event the HOLDER shall fail, neglect or refuse to immediately repair and reconstruct said damage, or injury to said County road right-of-way, the same may be done by the COUNTY and the expense and cost thereof shall immediately be repaid by the HOLDER to the COUNTY. In performing any such repairs, neither the COUNTY nor any of its employees, agents or subcontractors shall be deemed to be an employee, agent, or subcontractor of the HOLDER.

3. The HOLDER of this franchise, when contemplating work upon, along, over, under or across County right-of-way, shall first file with the Island County Engineer its application for permits to do such work. Such applications shall be accompanied by drawings and information as required by the Island County Engineer. Plans, drawings, and specifications for all utility lines lying within the County right-of-way shall be prepared and approved by a licensed engineer at the expense of the HOLDER. One copy of plans for constructed work, including as-built construction changes and notations, shall be on file with the office of the County Engineer. No application for work shall be approved without this requirement being met.

4. A copy of the permit and franchise must be on the job site, and protected from the elements, at all times during any of the construction authorized by said permit and franchise.

5. All slopes must be seeded and protected from erosion until the vegetation is reestablished.

6. All trenches, boring or jacking pits, etc. shall be backfilled as soon as possible and not left open during non-working hours unless covered with material of sufficient strength to withstand traffic loads or a method of protection approved by the Island County Engineer.

7. All slopes, slope treatment, topsoil, ditches, pipes, etc., disturbed by this operation shall be restored to their original cross-section and condition. All open trenches shall be marked by warning signs, barricades, lights, and if necessary, flagmen shall be employed for the purpose of protecting the traveling public. Roadside operations may be specified by the Island County Engineer's representative.

8. During the construction and/or maintenance of this FACILITY, the HOLDER shall comply with the *Manual on Uniform Traffic Control Devices for Streets and Highways (Federal Highway Administration)* and Washington modifications thereto. If determined necessary by the Island County Engineer, the HOLDER shall submit a signing and traffic control plan to the Island County Engineer's representative for approval prior to construction or maintenance operations. No lane closures shall be allowed except as approved by the Island County Engineer's representative. Approvals may cause revision of special provisions, including hours of operation.

9. Whenever deemed necessary by the Washington State Department of Labor and Industries and/or the Island County Public Works Department for the safety of the

workers and the protection of the highway pavement, the sides of the trench (or excavation) shall be adequately supported to reduce the hazard to workers and prevent any damage by cracks, settlement, etc., to the pavement. No other work in the trench or excavation area will be allowed until this requirement is met.

10. The HOLDER shall provide emergency call out response 24 hours a day, seven days a week. The response time shall be one hour. If the HOLDER does not respond in one hour, the Island County Engineer will bill the HOLDER for costs of additional flagging or traffic control, if deemed necessary, caused by the delay in response beyond one hour.

11. In the event any right-of-way marker, fence or guardrail is located within the limits of this project and will be disturbed during construction, these items will be carefully removed prior to construction and reset or replaced at the conclusion of construction to the satisfaction of the Island County Engineer or his representative. All signs and traffic control devices must be maintained in operation during construction.

Section Four – Relocation of Facilities

1. Whenever necessary for the construction, repair, improvement, alteration or relocation of all or any portion of said County road right-of-way as determined by the Island County Engineer, any or all of said Facilities shall be removed and relocated within sixty (60) days of notification by the Island County Engineer.

2. Upon failure, neglect or refusal of the HOLDER to perform any change, removal, relaying or relocating of said FACILITY or any repairs or reconstruction of said County road right-of-way within sixty (60) days of notification by the Island County Engineer, the COUNTY may undertake and perform such requirement and the cost and expense thereof shall be immediately repaid to the COUNTY by the HOLDER.

3. If the HOLDER fails to relocate water distribution lines within sixty (60) day notification period, the HOLDER shall be responsible for any project delay claims resulting from their failure to relocate.

4. The work of constructing, removing and relocating any and all of said existing and/or future Facilities shall be done at the expense of the HOLDER, and with the least possible interference with travel upon the said County road, and to the entire satisfaction and under the supervision of the Island County Engineer and none of such work shall be undertaken or carried on without ten days written notice having been first given to the Island County Engineer.

Section Five – Maintenance and Construction of Facilities

1. Prior to any construction and/or upgrade of the water line, plans and specifications and documentation from the appropriate public health authority confirming the approval of the water system, its proposed construction and/or upgrade must be presented to the Island County Public Works Department.

2. Prior to the beginning of construction, a pre-construction conference shall be held at which the Island County Engineer or his representative and the HOLDER and HOLDER'S engineer, contractor, and inspector shall be present.

3. The HOLDER is responsible for properly marking all structures in the County right-of-way owned by the HOLDER. In compliance with the COUNTY'S

continuing road maintenance activity. Structures shall be cleared, by the HOLDER, of tall grass, brush and/or other obstacles within a five (5)-foot radius at all times so County employees in maintenance equipment may easily see said structures. Damage to County equipment due to undisclosed fixtures, non-cleared pedestals, or facilities will be charged to the HOLDER. Failure by the HOLDER to comply with the clearing requirements of this paragraph on any occasion with respect to any structure owned by the HOLDER in the County road right-of-way will eliminate the fiscal responsibility of the COUNTY to replace such undisclosed, non-cleared structure damaged due to maintenance on that occasion.

4. Work within the right-of-way shall be restricted to between the hours of 8:00 a.m. and 3:00 p.m., and no work shall be allowed on the right-of-way Saturday, Sunday, or holidays, unless authorized by the Island County Engineer or his representative. Any lane closures must be submitted for approval in advance of use. The hours of permitted closure may differ from the above noted hours.

5. The construction that is authorized through the granting of this franchise shall be commenced within one year from the date hereof; otherwise the franchise shall be null and void and terminated upon notice as provided by law. Time is the essence of this provision.

6. Upon completion of any new construction and/or upgrade to the FACILITY, a stamped as-built plan and a letter of certification verifying the project was constructed according to plans and specifications must be completed by the responsible party and submitted to the Island County Public Works Department.

Section Six - Indemnification

1. The HOLDER shall indemnify and save harmless and defend the COUNTY agencies of Island County and its appointed and elected officers and employees from and against any and all claims, liability, losses, costs (including attorney's fees), and/or causes of action, which may arise from any act or omission of the HOLDER, its agents, subcontractors, servants or employees in the performance of services under this franchise. The HOLDER further agrees to indemnify, save harmless and defend the COUNTY, its agents, servants, and employees from and against any claim, demand or cause of action, in connection with or incident to the work performed under this franchise, of whatsoever kind or nature arising out of any conduct or misconduct of the HOLDER, its agents, subcontractors, servants or employees for which the COUNTY, its appointed officers, or elected officers, or employees are alleged to be liable. Provided further that if the claims or suits are caused by or result from the concurrent negligence of (a) the HOLDER, its agents, subcontractors, servants or employees and (b) the COUNTY, its appointed or elected officers or employees, this indemnity provision, with respect to claims or suits based upon such negligence, shall be valid and enforceable only to the extent of the HOLDER'S negligence or the negligence of the contractor's agents, subcontractors, servants or employees. This requirement of the HOLDER to indemnify and defend the COUNTY, its appointed and elected officers and employees shall not apply when the damages are caused by or result from the sole negligence of the COUNTY, its appointed or elected officers or employees. In the event of litigation between the parties to enforce the rights under this paragraph, reasonable attorney's fees shall be allowed to the prevailing party.

2. The HOLDER shall maintain liability insurance in the amount of $1,000,000.00 by a company authorized to do business under the laws of the State of Washington. All insurance required by this franchise to be maintained by the HOLDER shall specifically include the COUNTY as an additional insured and

shall not be canceled or reduced below the amounts required by this franchise without forty-five (45) days written prior notice to the COUNTY.

3. Neither the application by the HOLDER for any permit or authorization pertaining to the use or occupancy by the HOLDER of any County road or other County right-of-way or pertaining to the performance on any County road or other County right-of-way of any work by the HOLDER or by any of its agents, subcontractors, servants or employees, nor the acceptance by the HOLDER of any such permit or authorization, nor the performance of any activity by the HOLDER or any of its agents, subcontractors, servants or employees pursuant to any such permit or authorization, nor the acceptance or enjoyment by the HOLDER of any benefit or privilege arising under any such permit or authorization shall be effective to enlarge or diminish the HOLDER'S obligation or liability to indemnify or hold harmless the COUNTY or any of its appointed or elected officers and employees.

<u>Section Seven – Compliance with Federal, State and Local Regulations</u>

1. The granting of this franchise shall place no obligation upon the Island County Engineer and/or the County Commissioners to warrant or defend the rights hereby granted.

2. The franchise HOLDER must comply with the "Accommodations of Utilities on County Road Right-of-Way for Island County" policy that was accepted and approved by the Board of County Commissioners May 15, 1996, which is by this reference incorporated herein and made a part hereof.

3. The HOLDER must comply with the Recommended Standards for Water Works (1997 Edition, Great Lakes - Upper Mississippi River Board of State Sanitary Engineers), the Criteria for Sewage Works Design (State of Washington, Department of Ecology, December 1998) and/or other requirements of the Island County Health Department.

4. The HOLDER, as an owner of an underground utility facility, is required to subscribe to the statewide toll-free telephone one-number locator service, a service through which a person can notify utilities and request field-marking of underground facilities prior to the commencement of excavation, in accordance with the provisions of chapter 19.122 RCW – Underground Utilities.

5. The HOLDER shall install detector tape or cable approximately twelve (12) inches above the underground facility. The tape shall conform to the standards of the *American Public Works Association Uniform Color Code*.

6. All material and workmanship shall conform to the Washington State Department of Transportation *Standard Specifications for Road, Bridge and Municipal Construction*, current edition, and amendments thereto, and may be subject to inspection by the Island County Engineer or his representative.

7. The HOLDER of this franchise should remove any asbestos pipe from the County right-of-way. However, it may be abandoned in place subject to the responsibility to remove and dispose of said asbestos pipe at some future date as may be required by the COUNTY should future road maintenance constructions or improvement so dictate.

Section Eight – Annexations and Vacations

1. Whenever any of the streets, avenues, alleys, roads, highways, rights-of-way or public places designated in such franchise shall be eliminated from the COUNTY jurisdiction by reason of the incorporation or annexation to a city, then all the rights, privileges and franchises so granted shall terminate in respect to the streets, avenues, alleys, roads, highways, rights-of-way, and public places so eliminated.

2. If at any time the COUNTY vacates any County street, avenue, alley, road, highway, right-of-way, or other County property which is subject to rights granted by the franchise and the vacation is for the purpose of acquiring the fee or other property interest in the road, right-of-way, or other property interest in the road, right-of-way, or other County property for the use of the COUNTY, in either its proprietary or governmental capacity, then the Board of County Commissioners may, at its option, by giving ninety days' written notice to the grantee and after granting an alternate route, terminate this franchise with reference to such County road, right-of-way, or other County property so vacated, and the COUNTY shall not be liable for any damages or losses to the grantee by reason of such termination and the grantee shall move its franchise at its own cost.

3. In the event the COUNTY vacates any portion of the FRANCHISE AREA during the term of this Franchise, and the COUNTY does not grant an alternate route under No. 2, above, the COUNTY shall, in its vacation procedure, reserve a public utility easement for the HOLDER'S Facilities, unless it is determined by the Board of County Commissioners not to do so for good and/or lawful cause.

Section Nine – Default and Revocation

Any breach of any of the conditions and requirements herein made, or failure on the part of the HOLDER of this franchise to proceed with due diligence and in good faith after its acceptance, with construction work hereunder, shall subject this franchise to cancellation after a hearing before the County Commissioners, of which said hearing the HOLDER shall be given at least ten (10) days written notice, if at that time the HOLDER is a resident and doing business in the State of Washington. Said written notice shall be by certified mail, return receipt requested, if at the time the HOLDER is a resident or a corporation and doing business in the State of Washington. Otherwise said notice shall be by publishing a notice of said hearing once a week for two consecutive weeks in a newspaper of general circulation in Island County, Washington, the last publication to be at least ten days before the date fixed for said hearing.

Section Ten – Non-exclusive Franchise

This franchise is non-exclusive and the COUNTY reserves the right to grant franchises to other persons or companies to use the County road right-of-ways or any part thereof covered by this franchise for the same purposes authorized by law.

Section Eleven – Franchise Term

This franchise is and shall remain in full force and effect for a period of fourteen (14) years and after the effective date of the executed Franchise; provided, however, the HOLDER shall have no rights under this Franchise nor shall the HOLDER be bound by the terms and conditions of the Franchise unless the HOLDER shall, within twenty (20) days after the effective date of the Franchise, file with the COUNTY its written acceptance of the Franchise.

Section Twelve - Assignment

1. No assignment or transfer of this franchise in any manner whatsoever shall be valid nor vest any rights hereby granted until the Island County Engineer shall have been furnished with written evidence of such transfer or certified copies thereof, together with written acceptance of the terms of the franchise by the Assignee, and unless and until the County Commissioners shall have granted their consent in writing to such assignment or transfer. Failure to comply with this provision shall be cause for cancellation as herein provided.

2. The HOLDER shall, within twenty (20) days from receipt of a copy of this order, file with the Island County Engineer at Coupeville its written acceptance of the terms and conditions of this franchise.

Section Thirteen - Subletting

The HOLDER shall not sublet use of its Facilities within the FRANCHISE AREA without the prior written consent of the COUNTY. Such consent shall not be unreasonably withheld. Prior to the date of any sublet, the sublettee shall file written notice with the COUNTY of the proposed sublet and shall apply for all applicable permits and franchises together with its written acceptance of all terms and conditions of this Franchise. The sublettee may not use the Facilities until all approvals, permits, and franchises are granted and in effect.

Section Fourteen – Severability

If any term, provision, condition or portion of this Franchise shall be held to be invalid, such invalidity shall not affect the validity of the remaining portions of this Franchise, which shall continue in full force and effect. The headings of sections and paragraphs of this Franchise are for convenience of reference only and are not intended to restrict, affect or be of any weight in the interpretation or construction of the provisions of such sections or paragraphs.

Section Fifteen – Modification and Amendment

1. This Franchise may be amended only by written instrument, signed by both parties, which specifically states that it is an amendment to this Franchise and is approved and executed in accordance with the laws of Washington State.

2. If, during the term of this Franchise, there becomes effective any change in federal or state law including changes approved by the Washington Utilities Transportation Commission which:

    a. affords either party the opportunity to negotiate in good faith a term or condition of this Franchise which term or condition would not have, prior to such change, been consistent with federal or state law; or

    b. pre-empts or otherwise renders null and void any term or condition on this Franchise which has theretofore been negotiated in good faith;

    then, in such event, either party may, within one hundred and eighty (180) days of the effective date of such change, notify the other party in writing that such party desires to commence negotiations to amend this Franchise. Such negotiations shall encompass only the specific term or condition affected by such change in federal or state law and neither party shall be obligated to re-open negotiations on any other term or condition of this Franchise. Within thirty (30) days from and

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Franchise
Island County Washington

4242310

after the other party's receipt of such written notice, the parties shall, at a mutually agreeable time and place, commence such negotiations. Pending completion of such negotiations resulting in mutually agreeable amendment of this Franchise, adoption of such amendment by the Board of County Commissioners and accepted by the HOLDER, and except as to any portion thereof which has been pre-empted or otherwise rendered null and void by such change in federal or state law, the Franchise shall remain in full force and effect.

Section Sixteen – Miscellaneous

1. The HOLDER will be subject to any future charge as may be authorized by the Board of County Commissioners through a public process for ordinance adoption that may be required of the franchise holders for their use of County right-of-way.

2. This franchise is granted under the provisions and subject to the conditions and requirements of Chapter 36.55 RCW Franchises on Roads and Bridges as now in effect or as hereinafter amended.

DATED at Coupeville, Washington this 15 day of SEPTEMBER, 2008.

John Dean
JOHN DEAN, Chairman
Board of County Commissioners

ATTEST: Elaine Marlow
ELAINE MARLOW
Clerk of the Board

BOARD OF CO. COMMISSIONERS
EST ISLAND COUNTY 1853
WASHINGTON

APPENDIX C

AULT FIELD BOOSTER STATION TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

TO:	Mr. Arnie Peterschmidt
FROM:	Russ Porter, P.E.
	Steve Clarke, P.E.
	Adam Miller, P.E.
DATE:	April 5, 2011
SUBJECT:	Ault Field Pump Station

This memorandum is a description of pump tests performed at the City of Oak Harbor Ault Field Pump Station by City staff and Gray & Osborne personnel on December 9, 2010. This memorandum also contains a discussion of current operational issues and a recommendation for improvements to the facility.

December 9, 2010 Pump Test

On December 9, 2010, personnel from the City of Oak Harbor and Gray & Osborne met at the Ault Field Booster Station to conduct a pump test. The first pump test was performed on Pump 1. Pump 1 is equipped with a 125 horsepower motor and VFD and is operated frequently by the City. The pump was operated in its normal fashion and the following data was recorded.

TABLE 1
Pump 1 Test

Parameter	Value
Flow	2,500 gpm
Inlet Gauge Pressure	106 psi
Outlet Gauge Pressure	140 psi
Inlet SCADA Pressure	97 psi
Outlet SCADA Pressure	128 psi
Motor Frequency (Digital Readout)	52 Hz
Motor Frequency (Gauge)	57 Hz
Amperage	140 Amps
Typical Full Load Amps – 125 hp	145 Amps

Pump 2 was not operated because it was assumed that its operation would be similar to Pump 1 per City staff experience.

The second pump test was performed on Pump 4. Pump 3 and Pump 4 are 75 horsepower, constant speed pumps that the City rarely uses due to problems with over current operation. As with the Pump 1 test, the Pump 4 test is intended to represent either Pump 3 or 4 since both pumps are the same model. For the pump test, both inlet and outlet gauge pressure and flow were recorded while the outlet valve downstream of the outlet gauge was throttled to record multiple points along the pump curve. The results of the test are shown below.

TABLE 2
Results of Pump 4 Test

Flow, gpm	Inlet Gauge Pressure, psi	Outlet Gauge Pressure, psi	Amperage (Full Load Amps = 89)
0	112	114	0
1500	106	114	104.5
1400	104	130	102.5
1176	108	161	96.8
785	111	188	80.2
0	112	118	0

The data in Table 2 indicate that Pump 4 (and Pump 3) is oversized for the facility. Under normal, unthrottled conditions, the pump provides 1,500 gpm but operates out on its curve and draws almost 105 amps, well above the full load amperage of 89 amps. The pump must be throttled back to almost half of its capacity to bring the amperage below the full load. This confirms City staff suspicions and their reluctance to operate Pumps 3 and 4.

A comparison of the pump data in Table 2 and the manufacturer's pump curve is shown as Figure 1. Information available for the pump indicates that it was supplied with a 14.5 inch impeller but the pump curve data matches the performance of an approximately 13.75 inch impeller. The unthrottled operation point for Pumps 3 and 4 appears to be 1,500 gpm, a value that is in the far right portion of the pump curve, well off the normal operating range.

The pump data was used to develop a system curve for Ault Field Booster Station. Both pump tests indicate that most of the system losses at Ault Field occur on the inlet side of the pump station. The inlet pressure dropped during the Pump 4 test from 112 psi down to 104 psi when 1,400 gpm was flowing. For Pump Test 1, inlet pressure (recorded from SCADA) dropped from 117 psi down to 97 psi (20 psi drop) while 2,500 gpm was pumped. In contrast, during the Pump 1 test, the outlet pressure change was only 9 psi and a maximum pressure of 128 psi.

Because of the apparent discrepancy between the Pump 1 test gauge pressures and the SCADA pressures recorded from a pressure transducer, the SCADA data will be used for this analysis.

Discussion

Oak Harbor currently transfers water from Anacortes via the Ault Field Booster Station to the 405 pressure zone. The hydraulic grade from Anacortes varies from 402 to 423 feet. Essentially, the Ault Field Booster station is used to overcome headlosses in the line from Anacortes.

As demonstrated in the pump test described above, Pumps 3 and 4 are oversized for the low head experienced at the Ault Field facility. Consequently, City staff operate Pumps 1 and 2 using VFDs to provide flow at a suitable pressure and can only use Pumps 3 and 4 by throttling them back on their curves using manual valves.

Our recommendation would be to modify or replace one or both of Pumps 3 and 4 to provide a unit properly sized for the flow and head conditions experienced at Ault Field. Having a properly sized pump at the Ault Field facility will allow City staff to use the constant speed pump(s) as the primary pumps and to retain the use of existing Pumps 1 and 2 for backup. As an alternative, Pumps 1 and 2 could still be used as primary but properly sized Pumps 3 and 4 would provide usable redundancy.

There are two options for Pumps 3 and 4. One option would be to replace the entire pump with a pump designed for the flow and head condition. The second option would be to replace the existing motor with a slower speed motor. Both options are discussed below.

The first option would be to install new constant speed pumps. Because of the high flow, low head condition, the new pumps would likely be slower speed pumps and there are limited options that could easily be used. One possible unit would be a Peerless 10AE operated at 900 rpm. Because the pump will be sized for a lower head condition, the pump motor horsepower will be lower than the existing pump. It is anticipated that the existing motor starter and the conductors to the pump motor can be reused with no modification. Depending upon the actual replacement pump configuration, it is anticipated that the pump pedestals and inlet and outlet fittings may need to be modified.

Consequently, the scope of the project could be limited to the mechanical installation of the pump only.

The second option for providing a better pump condition would be to replace the existing 1,770 rpm motor with a slower speed motor. Two options for this would be 1,170 rpm and 900 rpm, two commercially available motors.

Figure 2 presents an analysis of the existing and proposed pump options with predicted system curves for conditions present after the construction of the new reservoir. Two system curves are presented; one for an HGL of 402 from Anacortes and one for an HGL of 423 to demonstrate the extent of inlet system pressure anticipated by the agreement with Anacortes. The two curves represented the upper and lower boundaries of the anticipated hydraulic conditions. City staff have indicated that the inlet pressure in practice does not vary much and is generally near the upper 423 limit. The system curves on the figure include the differential between the inlet HGL and the anticipated 425 overflow of the proposed new reservoir. The curves also include a headloss component based on flow that is calculated from the flow test data.

As Figure 2 indicates, the existing pump is anticipated to produce approximately 1,430 to 1,470 gpm under the new conditions if it remains unchanged. This is slightly lower than the 1,500 gpm recorded during the pump test but the pump was pumping to an HGL of 405 feet during the test rather than the 425 HGL of the system curves on the figure.

If a 1,170 rpm motor is installed on the existing pump, the expected output is 880 to 970 gpm for system described by the two system curves. If a 900 rpm motor is installed, the anticipated output is between 620 and 740 gpm. The expected horsepowers for 1170 and 900 rpm are approximately 30 and 15 horsepower, respectively, as calculated from the measured amperage during the pump test using similitude calculations. The final horsepower recommendation will be determined after consulting the manufacturer. As with the pump replacement option, it is anticipated that the existing motor starters and conductors can be reused. In contrast to pump replacement, however, only the motor mounts on the pump pedestal will require modification while the pump and piping can remain unchanged.

The Anacortes transmission main provides water at a hydraulic grade line between 402 and 423 feet, usually closer to the 423 foot upper limit. Since the Ault Field Booster Station will eventually pump to the new 430 Zone when the new reservoir is constructed, the new head condition used for this analysis assumes all the water coming in to Oak Harbor at Ault Station will be pumped from 405 to 430 hydraulic grade. For this analysis, and average day flow of 1,000 gpm pumped 25 feet will be used to determine the operating cost of a new pump versus motor replacement for the existing pump. The work required for this is 55,400 HP hours per year. Table 3 presents a 10 year cost analysis for the options discussed above.

TABLE 3
Comparison of Operating and Capital Costs for Pump Replacement versus Slow Speed Motor

Parameter	New Peerless 10 AE, 900 RPM Pumps 3 and 4 (Pumps 1 and 2 Secondary)	Existing Pumps 3 and 4 with New 900 rpm Motor (Pumps 1 and 2 Secondary)	Existing Pumps 3 and 4 with New 1,170 rpm Motor (Pumps 1 and 2 Secondary)	Existing Pump 1 with VFD Primary – Pumps 3 and 4 Secondary with New 1,170 rpm Motors
Pump Capacity at 10 psi	1,200 gpm	750 gpm	1000 gpm	~2,500 gpm
Pump Efficiency	80 %	45% (1)	35% (1)	NA
Motor Efficiency	90 %	90 %	93 %	NA
Motor Power Factor	0.62	0.69	0.79	NA
Total Pump and Motor Efficiency	45 %	28 %	26 %	35% (2)
Total Work Required	55,400 HP hrs/yr	55,400 HP hrs/yr	55,400 HP hrs/yr	55,400 HP hrs/yr
Total Electrical Power (Work/Total Eff.)	91,800 kWhr	148,000 kWhr	159,000 kWhr	118,000 kWhr
Annual Power Cost ($0.1045/kWhr)	$9,620	$15,500	$16,700	$12,400
Capital Cost for Upgrade (2 Pumps)	$60,000	$14,000	$14,000	$14,000
10 Year Life Cycle Cost – Present Value(3)	$155,000	$166,000	$178,000	$84,000

(1) Calculated from Pump 4 pump test data.

(2) Calculated from Pump 1 pump test data.
(3) Calculated using 3% inflation and 3.5% interest.

Given the information in the table above, the best option over the 10 year period if the City desires to operate Pumps 1 and 2 as primary is to completely replace Pumps 3 and 4 with 900 rpm pumps designed for the head condition. The most significant factor appears to be the low efficiency of the existing pump; the measured value was well below the manufacturer's value even at higher heads for which the pump was designed. If the pump followed the manufacturer's curve, its efficiency would have been significantly higher and the 10 year present value calculation would likely have favored replacing only the motors on Pumps 3 and 4.

A third option in Table 3 that the City may wish to pursue is to continue to primarily operate Pumps 1 and 2 with VFDs and exchange the motors for Pumps 3 and 4 with slower speed motors. With this strategy, Pumps 3 and 4 would provide redundancy for Pumps 1 and 2. The City has been operating Pumps 1 and 2 for the last several years using the VFDs with no issues. Using the annual power cost from the table above and the capital cost for replacing motors on Pumps 3 and 4, the present value for the 10-year analysis is $84,000.

Recommendation

It is our recommendation that the City replace the motors for Pumps 3 and 4 with 1,170 rpm motors. During this operation, it is also recommended that the split case pumps be disassembled to investigate possible causes of the noted inefficiency such as impeller issues or bearing wear. Depending upon the final efficiencies of Pumps 3 and 4, the City can decide whether it wants to continue operating Pumps 1 and 2 as lead pumps with Pumps 3 and 4 serving as redundant or operating Pumps 3 and 4 as lead pumps.

APPENDIX D

UNINTENDED DISCOVERY PROTOCOL

CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

Building Permit # ______________________

Property Address: ______________________________________

I have read the attached document labeled "Unanticipated Discovery Protocol (UDP)" and in the event that the ground-disturbing activities or other activities related to development on the above referenced permit uncover protected cultural materials, I will follow the actions in the UDP.

______________________________ ______________

Signature Date

____

Print name

Note: The City highly recommends that an Archeologist be present on site monitoring the construction activities. It is also the responsibility of the applicant to contact the State Department of Archaeology and Historic Preservation to determine if there are additional requirements.

Contact: Gretchen Kaehler, Assistant State Archeologist, Local Governments, at DAHP at (360)-586-3088.

CITY OF OAK HARBOR

Unanticipated Discovery Protocol (UDP)
CITY PROJECTS

In the event that ground-disturbing activities or other activities related to development uncover protected cultural material (e.g., bones, shell, antler, horn or stone tools), the following actions will be taken:

1. When an unanticipated discovery of protected cultural material (see definitions below) occurs, the crew lead or contractor will completely secure the location and immediately contact:
    a. For contractors working on City Projects, the foreman will contact the City Project Manager, Project Engineer or Inspector as appropriate;
    b. On projects being performed by City crew, the crew lead will contact his or her Division Manager or the Department Head to report the discovery;
    c. If the discovery consists of possible human remains, the contractor or crew lead will stop all work in and adjacent to the discovery and move all equipment to a reasonable distance.

2. For all reports of unanticipated discoveries of protected cultural material, the Project Manager, Division Manager or Department Head will confirm that the location has been secured and contact:
    a. The Washington State Department of Archaeology and Historic Preservation (DAHP) (Gretchen Kaehler);
    b. The Swinomish Indian Tribal Community (Larry Campbell);
    c. The Tulalip Tribes (Hank Gobin and Richard Young); and
    d. City of Oak Harbor Mayor and City Administrator;

3. If the reported discovery consists of possible human remains, the Project Manager, Division Manager or Department Head will confirm that all work has ceased in the immediate vicinity of the discovery, that all equipment has been moved a reasonable distance away and contact:
    a. The Oak Harbor Police Department and the Island County Coroner Robert Bishop to determine if the remains are forensic in nature;
    b. If the remains are not forensic in nature, the Department of Archaeology and Historic Preservation (DAHP) (Gretchen Kaehler and Guy Tasa); will take the lead on determining the appropriate method of treatment for the remains and will consult with the affected tribes;
    c. A professional archaeologist.

Cultural material that may be protected by law could include but not be limited to:

- Logging, mining, or agriculture equipment older than 50 years;
- Historic bottles and soldered dot cans;
- Buried layers of black soil with layers of shell, charcoal, and fish and mammal bones. Buried cobbles that may indicate a hearth feature (Figure 1 and Figure 2);
- Non natural sediment or stone deposits that may be related to activity areas of people;
- Stone, bone, shell, horn, or antler tools that may include projectile points (arrowheads), scrapers, cutting tools, wood working wedges or axes, and grinding stones (Figure 3-Figure 9);
- Stone tools or stone flakes;
- Perennially damp areas may have preservation conditions that allow for remnants of wood and other plant fibers; in these locations there may be remains including fragments of basketry, weaving, wood tools, or carved pieces; and

- Human remains.

Project Contact List (fill in as appropriate)

Name	Affiliation	Numbers
	Oak Harbor Project Manager	
	Oak Harbor Division Manager	
Lt. Tim Sterkel Sgt. Teri Gardner	Oak Harbor Police Department	360-914-7267 360-914-7245
Robert Bishop	Island County Coroner's Office	360-679-7358
Richard Young	Tulalip Tribe of Indians	360-716-4635
Hank Gobin	Tulalip Tribe of Indians	360-716-2636
Larry Campbell	Swinomish Indian Tribal Community	360-840-4127
Gretchen Kaehler	Assistant State Archaeologist (DAHP)	360-586-3088
Guy Tasa	Physical Anthropologist (DAHP)	360-586-3534
	Professional Archaeologist	

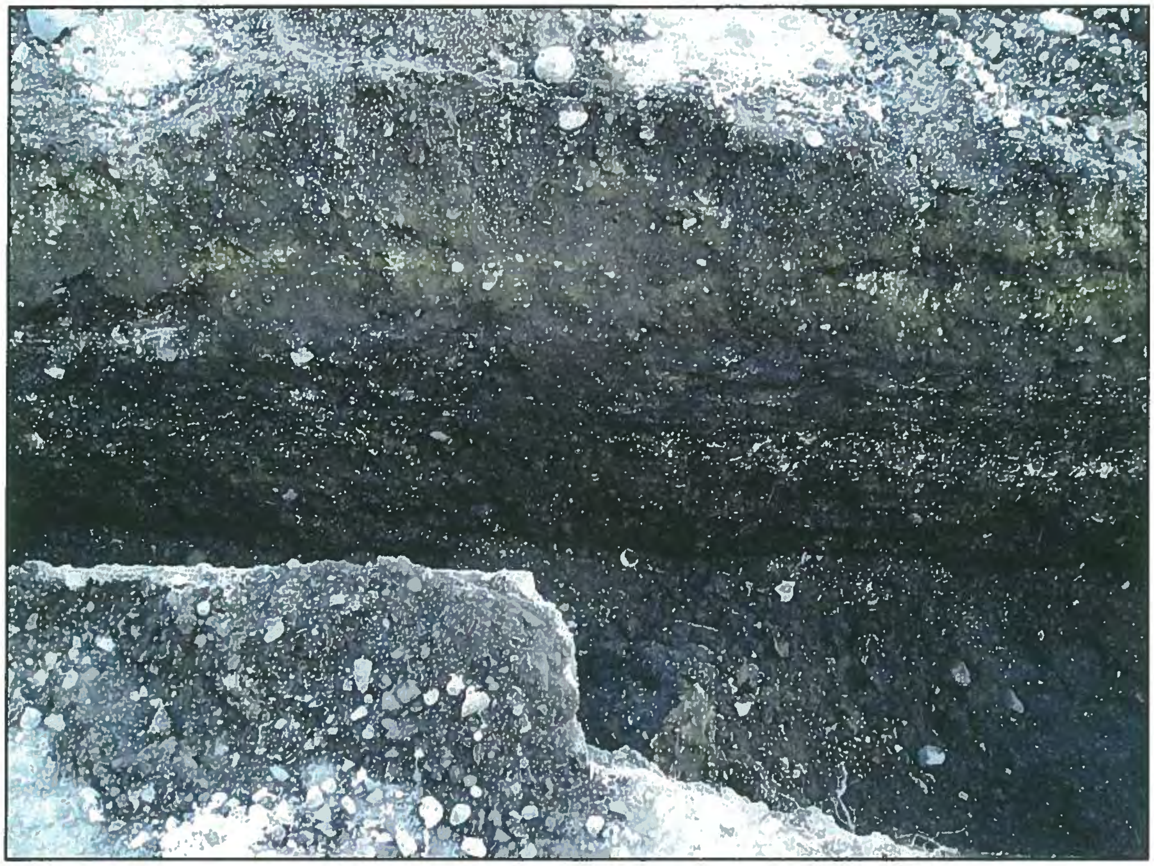

Figure 1: Example of shell midden in profile for the UDP.

Figure 2: Example of protected rock lined hearth feature for UDP.

Figure 3: Example of worked bone and spines for UDP.

Figure 4: Example of adze blade for UDP.

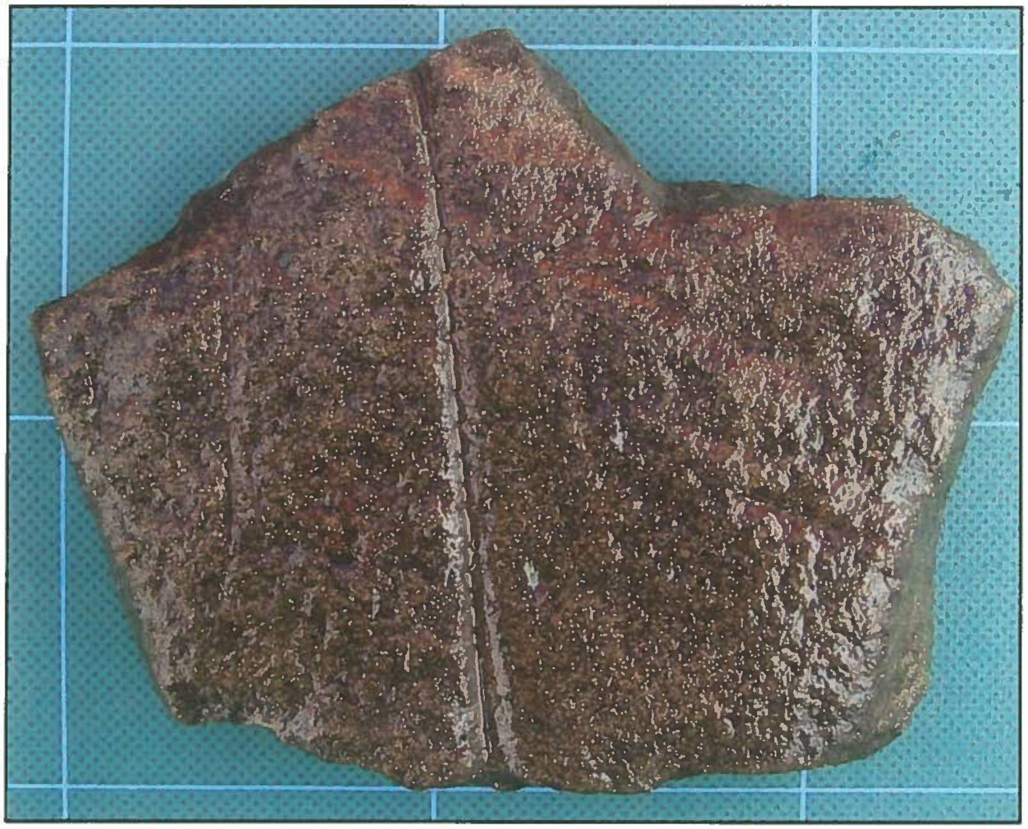

Figure 5: Example of sandstone abrader for UDP.

Figure 6: Example of Flaked Cobble tool for UDP.

Figure 7: Example of ground stone point for UDP.

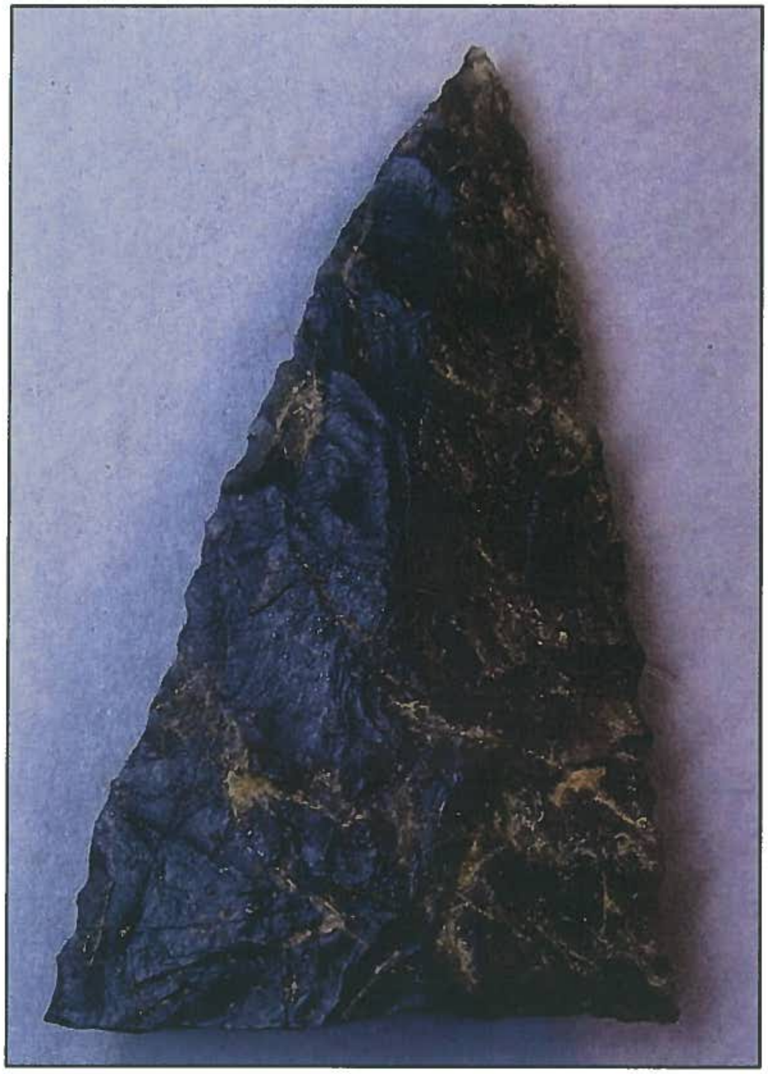

Figure 8: Example of dacite projectile point fragment for UDP.

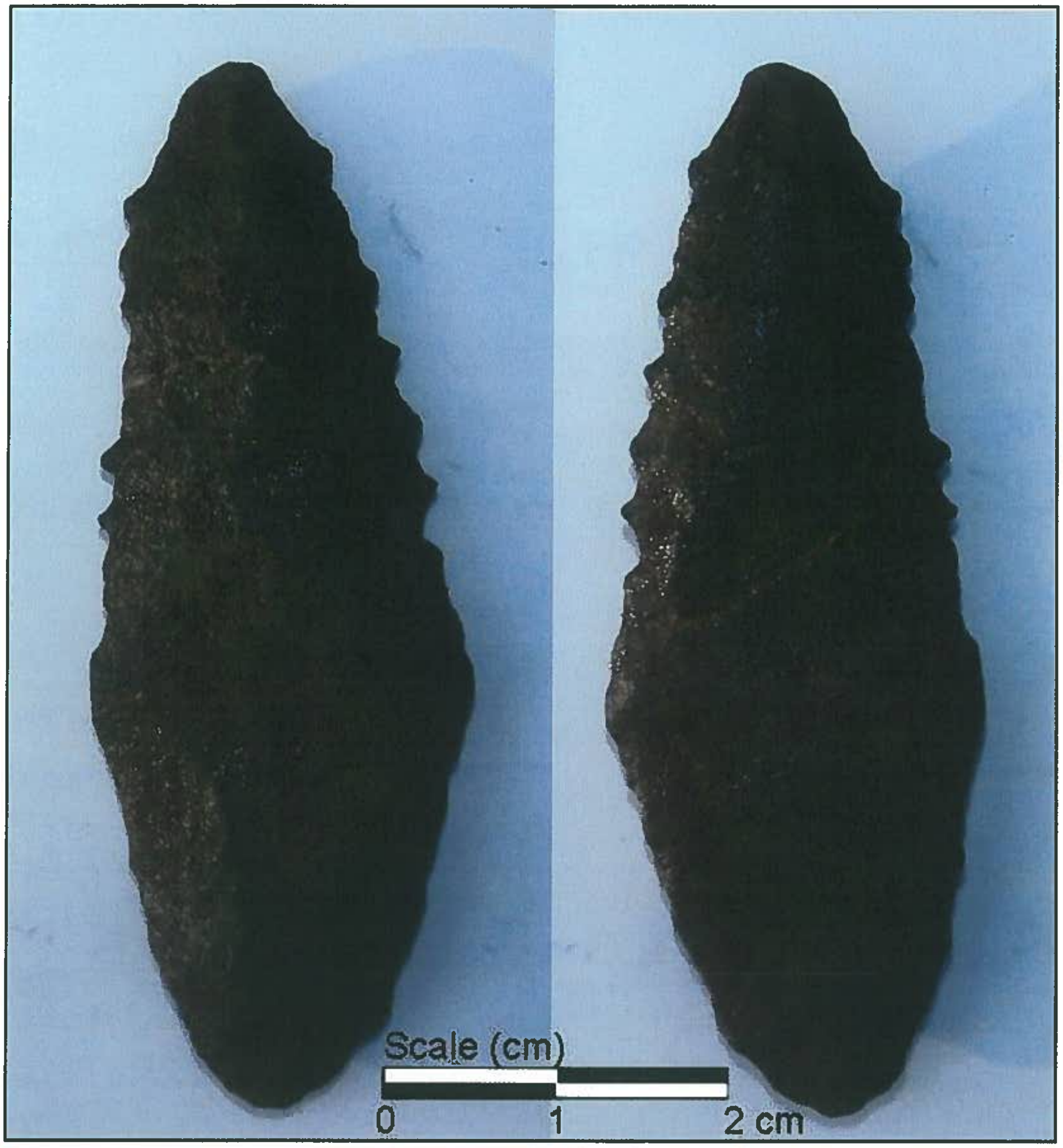

Figure 9: Example of igneous projectile point for UDP.

APPENDIX E

OAK HARBOR MUNICIPAL CODE TITLE 13

Title 13
WATER

Chapters:

Chapter 13.04
DEFINITIONS

Sections:

13.04.010 Generally.

For purposes of this title, the words or phrases defined in this chapter shall have the meanings set out in this chapter. (Ord. 438 § 1, 1976; Ord. 403 § 1, 1975).

13.04.020 City.

"City" means the city of Oak Harbor, Washington, or as indicated by the context, it may mean the water department, public works superintendent, clerk, treasurer, city supervisor, or other city employee or agent representing the city in the discharge of his duties. (Ord. 438 § 1, 1976; Ord. 403 § 1(a), 1975).

13.04.025 City water system.

"City water system" is the interconnected wells, reservoirs, pipes, mains, pump stations, pressure pump stations, monitoring gauges, valves, water gates and other appurtenances which are owned by the city of Oak Harbor and used or capable of being used for the collection, treatment and transmission of water for human use and for fire suppression or irrigation purposes or part thereof. (Ord. 1393 § 9, 2004).

13.04.030 Council.

"Council" means the city council of the city of Oak Harbor. (Ord. 438 § 1, 1976; Ord. 403 § 1(b), 1975).

13.04.040 Facilities tap fee.

"Facilities tap fee" means a connection fee for customers beyond the city limits of Oak Harbor, based on the size of meter requested, is established, and is intended to represent the benefited property's proportionate share of the net value of the city's water system. (Ord. 438 § 1, 1976; Ord. 403 § 1, 1975).

13.04.050 Mains.

"Mains" means water lines designed or used to serve more than one premises. (Ord. 438 § 1, 1976; Ord. 403 § 1(g), 1975).

13.04.060 Mains, standard or permanent.

"Standard or permanent mains" means mains conforming to the standard specifications of the city of Oak Harbor with respect to materials and minimum diameter. (Ord. 438 § 1, 1976; Ord. 403 § 1(h), 1975).

13.04.070 Mains, substandard or temporary.

"Substandard or temporary mains" means water mains which do not conform to the minimum standards as defined in this chapter. (Ord. 438 § 1, 1976; Ord. 403 § 1(i), 1975).

13.04.080 Meter, master.

"Master meter" means a meter installed to supply an area outside the city's water service limits. (Ord. 438 § 1, 1976; Ord. 403 § 1(l), 1975).

13.04.090 Peak daily demand.

"Peak daily demand," for the purposes of this title, shall be determined by multiplying the estimated maximum population to be served in an area by 300 gallons. (Ord. 438 § 1, 1976; Ord. 403 § 1(n), 1975).

13.04.100 Person, customer, owner, occupant, and agent.

"Person," "customer," "owner," "occupant," and "agent," wherever used in this title, include natural persons of either sex, associations, copartnerships and corporations whether acting by themselves or by a servant, agent or employee. The singular number includes the plural and the masculine pronoun includes the feminine. (Ord. 438 § 1, 1976; Ord. 403 § 1(f), 1975).

13.04.110 Premises.

"Premises" means a continuous tract of land, building or group of adjacent buildings under a single control with respect to use of water and responsibility for payment therefor. Subdivisions of such use or responsibility constitute a division into separate premises as defined in this section. (Ord. 438 § 1, 1976; Ord. 403 § 1(e), 1975).

13.04.120 Service connection.

"Service connection" means that portion of the city water system connecting the water supply system on a premises to the city water main. This includes the tap into the main, the water meter, the service line from the main to the meter and from the meter to the property line. Service connections include connections for fire protection. (Ord. 438 § 1, 1976; Ord. 403 § 1(k), 1975).

13.04.130 Standard specifications.

"Standard specifications" means those standard specifications for public works construction as prepared by the Washington Chapter of the American Public Works Association which have been adopted by the city council of the city of Oak Harbor. (Ord. 438 § 1, 1976; Ord. 403 § 1(j), 1975).

13.04.140 Superintendent.

"Superintendent" means the public works superintendent of the city of Oak Harbor. Any act in this title required or authorized to be done by the superintendent may be done on behalf of the superintendent by an authorized employee of the public works department. (Ord. 438 § 1, 1976; Ord. 403 § 1(d), 1975).

13.04.150 Supervisor, city.

The "city supervisor" means the supervisor of the city of Oak Harbor. Any act in this title required or authorized to be done by the city supervisor may be done on behalf of the city supervisor by an authorized employee. (Ord. 438 § 1, 1976; Ord. 403 § 1(c), 1975).

13.04.160 Water service limits.

"Water service limits" means an area comprising the existing city limits of Oak Harbor plus adjacent county area as may be designated by the city council by resolution. (Ord. 403 § 1(m), 1975).

Chapter 13.08
GENERAL PROVISIONS

Sections:

13.08.020 Comprehensive water system plan.

The city supervisor is directed to prepare a comprehensive plan for the city of Oak Harbor water supply and distribution system. A copy of the plan shall be available to the public at the utility office. The plan shall include:

(1) Minimum main sizes allowable on all city streets;

(2) Minimum main sizes and the planned distribution system in the water service area;

(3) The location of all existing facilities;

(4) Such other information as the council may require. (Ord. 403 § 3, 1975).

13.08.030 Displacement of waterworks appurtenances – Notice – Liability.

Any person, contractor, corporation, or any municipal department performing construction work in or on any street or utility right-of-way shall give the superintendent two days' written notice in the event it becomes necessary to remove or change any water mains, pipes or appurtenances. Damage to any part of the water system shall make such person, contractor, corporation, or agency liable to the water department for the cost of necessary repairs and replacements. (Ord. 403 § 11, 1975).

13.08.040 Access to premises for inspection.

Authorized employees of the water department, properly identified, shall have access at reasonable hours of the day to all premises and parts thereof to which water is served from the city water system.

If an authorized city employee is refused admittance to make an inspection, water service may be discontinued immediately. (Ord. 403 § 12, 1975).

13.08.050 Addition of fluoride – Administration.

A source of fluoridation approved by the State Department of Health shall be added to the water supply of the city of Oak Harbor under the rules and regulations of the Washington State Board of Health, such addition to be administered in a manner approved by the State Director of Public Health. (Ord. 403 § 27, 1975).

Chapter 13.10
WATER CONSERVATION

Sections:

13.10.010 Findings and purpose.

(1) The city's water supply is subject to weather conditions, water contamination, interruption of supply and other emergencies and, therefore, usage reductions may be required to assure an adequate supply for essential needs; and

(2) The city is supplied water in part by the city of Anacortes water department, and this water supplier has requested that the city of Oak Harbor provide for measures and authority to impose emergency water restrictions and sanctions to conserve water consumption during such emergency in accordance with a water shortage response plan; and

(3) The unrestricted water use for non-essential purposes during water emergencies will endanger the adequacy of the water supply for essential needs; and

(4) Compliance with said restrictions will be encouraged by imposition of additional charges for water usage in excess of authorized usage during an emergency; and

(5) The city council recognizes the critical importance of an immediate response by the city in the event of any water supply emergency; and to provide this response, the mayor or his/her designee, shall be granted authority to implement the water shortage response plan, hereinafter referred to as the plan; and

(6) This chapter is necessary for the health, safety and welfare of the city of Oak Harbor. (Ord. 1263 § 2, 2001).

13.10.020 Limitation on water use.

In the event that a supplier notifies the city of a shortage of water or the mayor reasonably determines such a shortage or emergency to be imminent, the mayor or his/her designee is authorized to implement the plan, according to drought condition levels identified in the plan, in order to efficiently safeguard the safety and health of the general public or to provide for the public convenience. The use of water in the city or in any portion thereof, for irrigation, cooling, sprinkling, washing of motor vehicles or outdoor surfaces, or other uses may be forbidden, restricted, or regulated and such regulations may be made effective as to all customers or as to particular classes of customers. Rationing may be imposed during any shortage of water, either in lieu of or in addition to other measures hereby authorized.

(1) Upon receiving notification from a water supplier of an impending water emergency or in the event of transmission and/or distribution system failure, the water division will notify the mayor within 24 hours or on the next business day that a water emergency/shortage will be or has been declared.

(2) The mayor or his/her designee will issue a public notification of the declaration of water emergency and imposition of restrictions.

(3) Restrictions will be in effect immediately upon issuance of the public notification. Restrictions and the amount of surcharge for violations of mandatory restrictions will be posted and published as outlined in the plan.

(4) Notice of emergency rationing shall be delivered in whatever means available to inform both residents and businesses. Delivery could include posting at businesses, library, newspapers, radio, television, or door-to-door. However, lack of said personal notice shall not relieve a water customer from the duty to abide by the emergency regulation. (Ord. 1263 § 3, 2001).

13.10.030 Water restrictions – Powers of the city.

The mayor or his/her designee shall conduct public education efforts regarding the benefits and necessity of conservation by the public, and is authorized, to promulgate such rules and regulations as may be necessary to implement water use restriction. The regulations will be on file with the city clerk, and the rules and regulations and any amendment thereto shall be effective five days after said filing with the city clerk. The mayor or his/her designee is further authorized to make exceptions to such restrictions in specific cases as he/she finds reasonable which may in the mayor’s discretion include, but not be limited to, watering newly seeded or sodded lawns, food sources, landscape ornamental plantings required by the city, when necessary to alleviate unnecessary economic hardship to commercial or industrial activities, or to prevent possible damage to health, safety or welfare. (Ord. 1263 § 4, 2001).

13.10.040 Water restrictions – Surcharge.

It is unlawful for any person to violate water use and restrictions and violation of these provisions shall be a misdemeanor punishable under the general penalty provisions of this code. In addition to other lawful remedies, the mayor or his/her designee is authorized to impose a surcharge for the first occurrence after a documented warning notice and each subsequent violation in which a customer’s water usage practices exceed water conservation restrictions as provided for in this chapter. Said surcharge will be added to and become a part of the water bill for the customer in addition to any service rate amounts. Prior to the imposition of the first surcharge, a public works department representative shall deliver in person or post a notice at the service address advising of the customer’s water usage practices in excess of mandatory water shortage restrictions and advising that a surcharge may be imposed for any further violations. A copy of the violation notice shall also be mailed to the owner and/or occupant. The mayor shall promulgate regulations providing for appeal of any notice of violation. Appeals must be received within five working days of delivery of notice of violation.

(1) Surcharges for violations of water restrictions in effect until thereafter adjusted shall be $25.00 for first violation, $50.00 for a second violation, and $250.00 for a third or subsequent violation.

(2) Surcharges for all customer classes will be reviewed annually based on actual or projected expenses of the water division necessary to maintain a water supply during an emergency. (Ord. 1263 § 5, 2001).

13.10.050 Enforcement.

(1) The mayor or his/her designee, including any employee of the city of Oak Harbor public works division, or field personnel, or police officer of the city, shall have the authority to enforce the provisions of this chapter.

(2) In addition to the surcharges provided, the mayor or his/her designee may cause water service to be terminated for subsequent or continuing violation of water conservation restrictions. (Ord. 1263 § 6, 2001).

13.10.060 Severability clause.

If any section, subsection, sentence, clause, phrase, part or portion of this chapter is for any reason held to be invalid or unconstitutional by any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this chapter. (Ord. 1263 § 7, 2001).

Chapter 13.12
PROHIBITED USE OF WATER SYSTEM

Sections:

13.12.010 Unlawful water use.

It is unlawful for any person supplied with water from the city water system to use the water for any other purpose than those named in the application for service, or to use the water in violation of any of the provisions of this title. (Ord. 1393 § 2, 2004; Ord. 438 § 3, 1976; Ord. 403 § 5, 1975).

13.12.020 Damaging or interfering with water system prohibited.

(1) It is unlawful for any person to willfully disturb, break, deface, or damage any portion of the city water system including, but not limited to, any fire hydrant, water meter, gate valve, water pipe, water main, pump station, holding tank or other waterworks appurtenances including buildings, grounds and improvements belonging to or part of the city's water system.

(2) It is unlawful for any person to open, close, turn or interfere with, or connect to any fire hydrant, valve, or pipe belonging to the city unless authorized by the superintendent or his/her designee in writing. This section shall not apply to members of a fire department acting in their official capacity. (Ord. 1393 § 3, 2004; Ord. 403 § 6, 1975).

13.12.030 Electrical grounding.

It is unlawful to connect or attach any wire conveying ground current or other electrical current to any water pipe, or water main attached to or forming a part of the city water system. (Ord. 1393 § 4, 2004; Ord. 438 § 4, 1976; Ord. 403 § 7, 1975).

13.12.040 Sprinkling during fire prohibited.

It is unlawful for any person to knowingly use water from the city water system for lawn or garden sprinkling or irrigating purposes on any premises when instructed to cease such use because the water is needed to fight a fire or when a conservation directive has been put into effect by directive of the city council. (Ord. 1393 § 5, 2004; Ord. 403 § 8, 1975).

13.12.060 Unauthorized connection and turning off prohibited.

It is unlawful for any person to connect any pipe to the city mains or to turn water on or off at any premises without the consent of the superintendent or his/her designee. (Ord. 1393 § 6, 2004; Ord. 403 § 26, 1975).

Chapter 13.13
CROSS-CONNECTIONS

Sections:

13.13.001 Findings.

(1) It is a requirement of the Washington State Department of Health (WA DOH) for the city to establish a cross-connection control program satisfactory to the Department of Health; and

(2) Cross-connections within the customer’s plumbing system pose a potential source for the contamination of the public water supply system; and

(3) A safe supply of drinking water is of the highest health, welfare and safety concern for the city. (Ord. 1456 § 1, 2006).

13.13.005 Definitions.

(1) "Administrator" means the public works superintendent or such other person designated to administer the cross-connection program adopted and/or authorized by this chapter.

(2) "Backflow" means the flow other than the intended direction of flow of any foreign liquids, gases or substances into the distribution system of a public water supply.

(3) "Backflow prevention device" means a WA DOH-approved device to counteract back pressure or prevent back-siphonage.

(4) "Cross-connection" means any physical arrangement whereby a public water supply is connected, directly or indirectly, with any other water supply system, sewer drain, conduit, pool, storage reservoir, plumbing fixture or other device which contains or may contain contaminated water, sewage, or other waste or liquids of unknown or unsafe quality which may be capable of imparting contamination to the public water supply as a result of backflow.

(5) "Purveyor" means the city of Oak Harbor water division. (Ord. 1456 § 2, 2006; Ord. 579 § 1, 1981).

13.13.010 Cross-connections – Prohibitions.

The installation or maintenance of a cross-connection which in the opinion of the administrator will endanger the water quality of the potable water supply of the city is unlawful. (Ord. 1456 § 3, 2006; Ord. 579 § 1, 1981).

13.13.020 Backflow prevention device.

Backflow prevention devices shall be required to be installed and maintained by the service customer on any service connection to the Oak Harbor water supply system where, in the opinion of the administrator, the backflow prevention devices are necessary for the protection of the city water supply from backflow. (Ord. 1456 § 4, 2006; Ord. 579 § 1, 1981).

13.13.030 Compliance required.

Use or operating of a private water supply system contrary to the provisions of the ordinances of the city or the laws of the state or the rules and regulations of the State Board of Health regarding public water supplies, where the private system is served by the city public water supply, is unlawful. (Ord. 1456 § 5, 2006; Ord. 579 § 1, 1981).

13.13.040 Backflow prevention devices – Testing.

All backflow prevention devices including reduced pressure backflow devices and factory-assembled double check-valve assemblies installed under this chapter shall be inspected and tested after installation and annually, or more often where successive inspections indicate repeated failure. The devices shall be repaired, overhauled or replaced whenever they are found to be defective. Inspections, tests, and repairs and records thereof shall be certified in writing to the administrator. The administrator shall maintain a list of certified backflow prevention device testing personnel qualified to do testing. The city shall maintain copies of all testing required. (Ord. 1456 § 6, 2006; Ord. 579 § 1, 1981).

13.13.050 Regulations.

Rules and regulations of the State Board of Health identified as Definitions and Cross Connection Control regulation in Washington State under WAC 246-290-010 and 246-290-490 are adopted by reference as now or hereafter amended, deleted from or added to. A current copy of such regulations will be on file with the city clerk's office. (Ord. 1456 § 7, 2006; Ord. 579 § 1, 1981).

13.13.055 Prevention of contamination.

The customer's plumbing system, starting from the termination of the city's water service pipe, shall be considered a potential high health hazard requiring the isolation of the customer's premises by a city/WA DOH-approved, customer-installed and -maintained air gap (AG), reduced pressure backflow assembly (RPBA) or detector derivative thereof. The RPBA shall be located at the end of the city's water service pipe (i.e., immediately downstream of the meter). Water shall only be supplied to the customer through a city-approved and customer-installed and -maintained RPBA. The purveyor will require premises isolation for a customer that is of the high-hazard type or category requiring "mandatory premises isolation" established by the WA DOH regulations (Table 9, WAC 246-290-490).

It is provided, however, the city, upon an assessment of the risk of contamination posed by the customer's plumbing system and use of water, may allow:

(1) A single-family or multiresidential customer to connect directly to the water service pipe, i.e., without a city-approved DCVA or RPBA.

(2) Any customer other than a single-family or multiresidential customer, as a minimum, to be supplied through a city/WA DOH-approved, customer-installed and -maintained double check valve assembly (DCVA) or double check detector assembly (DCDA).

(3) Any customer, other than a single-family or duplex residential customer, to connect directly to the water service pipe (i.e., without a purveyor-approved DCVA or RPBA); provided, that the customer installs and maintains backflow preventers, at the point of hazard, that are commensurate with the degree of hazard assessed by the purveyor. (Ord. 1456 § 8, 2006).

13.13.056 Conditions for providing service.

Water service is provided based on the following terms and conditions:

(1) The customer shall take all measures necessary to prevent the contamination of the plumbing system within his/her premises and the city's distribution system that may occur from backflow through a cross-connection. These measures shall include the prevention of backflow under any back pressure or back siphonage condition, including the disruption of supply from the city's system that may occur by reason of routine system maintenance or during emergency conditions, such as a water main break.

(2) The customer shall install, operate and maintain at all times his/her plumbing system in compliance with the current edition of the plumbing code having jurisdiction as it pertains to the prevention of

contamination and protection from thermal expansion due to a closed system that could occur with the present or future installation of backflow preventers on the customer’s service and/or at plumbing fixtures.

(3) Where a city/WA DOH-approved reduced pressure backflow assembly is not provided, and for cross-connection control or other public health related surveys, the customer shall provide access for the employees or agents of the city to all parts of the premises during reasonable working hours of the day for routine surveys, and at all times during emergencies unless the provisions of subsection (4) of this section are followed.

(4) Where agreement for access for the city’s survey is denied, water service may be supplied by the city, provided premises isolation is provided through a city/WA DOH-approved RPBA.

(5) The customer shall:

> (a) Have tested upon installation, annually thereafter or when requested by the city, after repair and after relocation his/her RPBA or DCVA installed to protect the city’s distribution system;
>
> (b) Have all testing done by a city-approved backflow assembly tester (BAT) currently certified by WA DOH;
>
> (c) Have the RPBA or DCVA tested following the procedures approved by WA DOH with the recommended additional procedures in the “Cross Connection Control Manual, Accepted Procedures and Practice,” Sixth Edition, December 1995, or latest edition thereof (a copy of which is on file with the city clerk and by this reference is made a part of this chapter); and
>
> (d) Submit to the city the results of the test(s) on the city-supplied test report form within the time period specified by the city.

The customer shall bear all costs for the installation, testing, repair, maintenance and replacement of the RPBA, DCVA or derivative thereof installed to protect the city’s distribution system.

(6) At the time of application for service, if required, the customer shall submit plumbing plans and/or a cross-connection control survey of the premises by a city-approved and WA DOH-certified cross-connection control specialist (CCS).

The survey shall assess the cross-connection hazards and list the backflow prevention provided within the premises. The results of the survey shall be submitted prior to the city turning on water service to a new customer. The cost of the survey shall be borne by the customer.

(7) For classes of customers other than single-family residential, when required by the city, the customer shall submit a cross-connection control resurvey of the premises by the persons described above. The city may require the resurvey to be performed in response to changes in customer’s plumbing, or performed periodically (annual or less frequent) where the city considers the customer’s plumbing system

to be complex or subject to frequent changes in water use. The cost of the resurvey shall be borne by the customer.

(8) Within 30 days of a request by the city, a residential customer shall complete and submit to the city a “Water Use Questionnaire” for the purpose of surveying the health hazard posed by the customer’s plumbing system on the city’s distribution system. Further, the residential customer agrees to provide within 30 days of a request by the city a cross-connection control survey of the premises by a city-approved and WA DOH-certified cross-connection control specialist (CCS).

(9) The customer shall obtain the prior approval from the city for all changes in water use, and alterations and additions to the plumbing system, and shall comply with any additional requirements imposed by the city for cross-connection control.

(10) The customer shall immediately notify the city and the local public health inspection jurisdiction of any backflow incident occurring within the premises (i.e., entry into the potable water of any contaminant or pollutant), and shall cooperate fully with the city to determine the reason for the incident.

(11) As a condition of service, the customer shall agree to indemnify and hold harmless the city for all contamination of the customer’s plumbing system or the city’s distribution system that results from an unprotected or inadequately protected cross-connection within his/her premises. This indemnification shall pertain to all backflow conditions that may arise from the city’s suspension of water supply or reduction of water pressure, recognizing that the air gap separation otherwise required would require the customer to provide adequate facilities to collect, store and pump water for his/her premises.

(12) The customer shall agree that, in the event legal action is required and commenced between the city and the customer to enforce the terms and conditions herein, the substantially prevailing party shall be entitled to reimbursement of all its costs and expenses including, but not limited to, reasonable attorney’s fees as determined by the court.

(13) The city’s survey of a customer’s premises is for the sole purpose of establishing the city’s minimum requirements for the protection of the public water supply system, commensurate with the city’s assessment of the degree of hazard.

(14) The city, in keeping with changes to state regulations, industry standards, or the city’s risk management policies, may impose retroactive requirements for additional cross-connection control measures.

(15) Where the purveyor imposes mandatory premises isolation in compliance with WA DOH regulations, or agrees to the customer’s voluntary premises isolation through the installation of an AG or RPBA immediately downstream of the purveyor’s water meter and before any branch connection, the customer acknowledges his obligation to comply with the other cross-connection control regulations having jurisdiction (i.e., Uniform Plumbing Code). Although the purveyor’s requirements for installation, testing, and repair or backflow assemblies may be limited to the RPBAs used for premises isolation, the customer

agrees to the other terms herein as a condition of allowing a direct connection to the purveyor's service pipe.

(16) It shall not be assumed by the customer or any regulatory agency that the purveyor's survey, requirements for the installation of backflow prevention assemblies, lack of requirements for the installation of backflow prevention assemblies, or other actions by the purveyor's personnel constitute an approval of the customer's plumbing system or an assurance to the customer of the absence of cross-connections therein.

The conditions of this section shall be included in any agreement with the customer for water utility service. (Ord. 1456 § 9, 2006).

13.13.057 Enforcement measures.

(1) The city may discontinue water supply within 72 hours of giving notice, or a lesser period of time if required to protect the public health, if the customers fail to cooperate with the city in the survey of premises, in the installation, maintenance, repair, inspection or testing of backflow prevention assemblies or air gaps required by the city, or in the city's effort to contain a contaminant or pollutant that is detected in the customer's system.

(2) Without limiting the generality of the foregoing, in lieu of discontinuing water service, the city may install a reduced pressure backflow assembly (RPBA) on its service pipe to provide premises isolation, and recover all of its costs for the installation and subsequent maintenance and repair of the assembly, appurtenances and enclosure from the customer as fees and charges for water. The failure of the customer to pay these fees and charges may result in termination of service in accordance with the city's water billing policies. There shall be a five percent surcharge on all water usage billings after city installation for maintenance and monitoring the same. (Ord. 1456 § 10, 2006).

13.13.060 Nuisances declared – Abatement.

Unlawful cross-connections now existing or hereafter installed, services requiring backflow prevention devices and unlawful use or operation of a private water supply system served by the city public water supply system are declared to be a public nuisance, and any measures authorized by law for the abatement of nuisances may be taken at the direction of the administrator. (Ord. 1456 § 11, 2006; Ord. 579 § 1, 1981).

Chapter 13.16
MAINS AND SERVICE GENERALLY

Sections:

13.16.010 Application for service.

All applications for water service shall be made at the office of the utility department or such other place designated by the city supervisor. The application shall be made by the owner or an agent of the owner of the property to be served. The applicant shall state the purposes for which the water is to be used. The applicant must agree to abide by the rules and regulations which may be established from time to time. The applicant must agree that the city shall have the right at any time, without notice, to shut off the water supply for repairs, extension, or nonpayment of rates, and the city shall not be responsible for any damage whatever resulting directly or indirectly from the shutting off of the water. (Ord. 403 § 4, 1975).

13.16.020 Emergency interruption of service.

In case of an emergency, or whenever the public health, safety or equitable distribution of water so demands, the superintendent may reduce or limit the time for, or temporarily discontinue, the use of water. Water service may be temporarily discontinued for purposes of making repairs, extensions, or doing other necessary work. Before so changing, reducing, limiting, or discontinuing the use of water, the superintendent shall notify, insofar as practicable, all water consumers affected. The city shall not be responsible for any damage resulting from interruption, change, or failure of the water supply. (Ord. 403 § 10, 1975).

13.16.030 Mains and service connections – Work by authorized personnel only.

Only employees of the water department or contractors authorized by the superintendent or the city supervisor shall be allowed to do any work on the city mains or service connections. (Ord. 403 § 13, 1975).

13.16.040 Mains and services – Distance from sanitary sewers.

All water mains, service lines and other waterworks appurtenances which carry water shall be located a sufficient distance to prevent contamination, both horizontally and vertically, from any sanitary sewer. All water installations are subject to the approval of the superintendent. (Ord. 403 § 14, 1975).

13.16.050 Mains and service connections – Ownership.

The ownership of all water mains, and all appurtenances thereto located within the city of Oak Harbor's water service area must be vested in the city's water department. Any developer, person, firm or corporation who has constructed any water mains because of platting and/or other requirements must relinquish all ownership interest in that part of the system that he has constructed before any water service connection will be supplied water from the city mains. (Ord. 403 § 15, 1975)

Chapter 13.20
SERVICE CONNECTIONS

Sections:

13.20.010 Adjacent main required.

Except as provided in OHMC 13.24.030, a premises shall not be connected to the water system of the city unless there is adjacent to the property a main owned by and under the exclusive control of the city. (Ord. 438 § 6, 1976; Ord. 403 § 16, 1975).

13.20.020 When made – Ownership and maintenance.

When a permit has been issued for the installation of a water service, the superintendent shall cause the premises to be connected with the water system. The service connection shall be the property of the city and maintained by the city. (Ord. 438 § 6, 1976; Ord. 403 § 16, 1975).

13.20.030 Separate meter required.

Except as provided in OHMC 13.24.030, every premises supplied with city water must have its own separate meter. Premises so supplied will not be allowed to supply water to any other premises. The city supervisor may require individual buildings on any premises to be separately metered. This applies to existing as well as new installations. (Ord. 438 § 6, 1976; Ord. 403 § 16, 1975).

13.20.040 Additional connections – Installation and billing.

When additional water service connections are required for any premises, all water service to such premises shall be metered, installed, and billed at the applicable rate. (Ord. 438 § 6, 1976; Ord. 403 § 16, 1975).

13.20.050 Materials and plumbing.

All persons connecting to the city's water system may only use materials conforming to the standard specifications. Plumbing on premises shall conform to the uniform plumbing code of the city of Oak Harbor. (Ord. 438 § 6, 1976; Ord. 403 § 16, 1975).

13.20.060 Temporary connections for construction and earth settling – Rates.

(1) The use of water for construction purposes or earth settling may be allowed. Application shall be made to the water department, and a cash deposit shall be made in an amount so determined by the superintendent. Water used as set forth in this section or for any other temporary use, if it is impracticable in the opinion of the superintendent to meter the water, shall be charged for at a rate fixed by the superintendent.

(2) The charge for earthwork settling for each lineal foot of trench shall be two cents. (Ord. 403 § 17, 1975).

13.20.070 Use of water from fire hydrants – Equipment – Charge.

When water service is supplied for any purpose through the fire hydrants, other than to the city, the water department will furnish the necessary equipment required for such service. A charge computed on the full cost of the service including maintenance, operating and testing, together with the cost of the rental of the equipment furnished by the water department, shall be calculated and collected by the water department. The minimum charge shall not be less than $10.00. This shall be in addition to any charge for water. (Ord. 403 § 17, 1975).

Chapter 13.24
SERVICE BEYOND CITY LIMITS[1]

Sections:

13.24.005 Preannexation agreements.

(1) The city council establishes as a policy and directs that within the currently established zone of influence and the urban growth area no water connection to or expansion of a water connection already existing to the Oak Harbor water system shall be allowed unless the property owners and the underlying lien holders agree that the city is authorized to proceed with annexation of the property and further agree not to contest the annexation of the property.

(2) If water is to be supplied to a new subdivision or development within the urban growth area, all new or subsequent water systems development within that subdivision or development shall be to city standards.

(3) If any person claims that this condition for water connection is unduly burdensome or that there is no likelihood that the property will be annexed within 10 years after connection, they may petition the council to be relieved of this obligation. The council in reaching its decision on this issue shall take into consideration the burdens created, the need to promote orderly growth, land use and the likelihood that

the property will be annexed to the city within 10 years of the date of the agreement. (Ord. 1252 § 1, 2001; Ord. 954 § 1, 1993).

13.24.010 Categories.

(1) Water service beyond the city limits shall fall into two categories:

(a) Outside the city limits but within the city's water service area;

(b) Outside the city limits and beyond the city's water service area.

(2) OHMC 13.24.050 through 13.24.100 shall apply to both categories. (Ord. 879 § 1, 1991).

13.24.015 Water service area.

The water service area of the city of Oak Harbor is defined by resolution. (Ord. 1036 § 1, 1996).

13.24.020 Within water service area – Terms and conditions.

Water service to premises shall be subject to the following terms and conditions:

(1) Water service to premises within the city's water service area will be subject to all the rules and regulations of this title that pertain to premises within the city limits.

(2) All rates for water service beyond the city limits, but within the city's water service area, will be established by ordinance for this class of service.

(3) System development charges in the water service area outside city limits shall be at the same rate as the system development charge for three-quarter-inch meters times the maximum number of expected equivalent residential units to be provided from the system. It is further provided that this fee may be reduced by agreement when the applicant installs system improvements as specified under Chapter 13.48 OHMC as now in effect or hereafter amended.

(4) Plans for water systems must be approved by the city engineer and the public works superintendent or his or her designee.

(5) The city shall own all lines and systems up to and including the meter. Such lines and system elements shall be located in easements given to the city or in public rights-of-way. (Ord. 1166 § 8, 1999; Ord. 879 § 1, 1991).

13.24.030 Beyond water service area – Conditions.

The city council may, at its discretion, supply water to areas beyond the city's water service limits on the following conditions:

(1) All sales of water beyond the water service limits of the city will be made only to another municipal or governmental unit such as Island County, a water district organized according to state law, another city, etc.

(2) There must be a finding by the city council that the city has an excess water supply available for the service requested.

(3) Sales, at the discretion of the city, will be through a master meter.

(4) Meters will be allowed only at points and of sizes approved by the public works superintendent or other person designated by the public works superintendent to be in charge of the water utility. The applicant will pay full costs of providing services to the designated area. Master meters shall be a minimum of two inches in diameter.

(5) System development charges for areas outside the water service area shall be at the same rate as the system development charge for three-quarter-inch meters times the maximum number of expected equivalent residential units consumption to be provided by the water services; provided, that this fee may be reduced by agreement when the applicant installs storage capacity which significantly reduces the impact on peak demand times.

(6) Adequate storage at least equal to the estimated peak daily demand for the area to be served shall be provided by the applicant. The method for meeting this requirement shall be established in the agreement authorizing the connection to the Oak Harbor water system.

(7) Ownership of the water system beyond the meter shall be vested in the applicant and the operation, repair, expansion and renewal of the system beyond this point shall be the responsibility of the applicant. The city's responsibility shall terminate at the master meter.

(8) Each system served by a master meter shall have a licensed system operator.

(9) All costs associated with connecting to the city's system shall be paid by the applicant. (Ord. 1166 § 9, 1999; Ord. 879 § 1, 1991).

13.24.040 Beyond water service area – Application.

Application for water service, as in OHMC 13.24.030, shall be made to the city council. The application shall include a detailed description of the area to be served, the name of the body which will be responsible for the service charges, the estimated maximum daily amount of water required, an estimate of system development charges and such other information as the council may deem necessary. Service to additional areas not included in the original application shall require a separate application and approval. Each year after acceptance, an update of the information shall be provided to the city engineer. (Ord. 879 § 1, 1991).

13.24.050 Consideration of NAS Whidbey Island Air Installation Compatible Use Zones latest edition.

NAS Whidbey Island Air Installation Compatible Use Zones shall be considered by the council in making its decision on the granting or denying of water service beyond the water service area. If amelioration measures are required to bring the development in compliance, the applicant shall pay for all costs to assure such compliance. (Ord. 879 § 1, 1991).

13.24.060 Fire hydrant.

The charge for connecting a fire hydrant to a city line outside city limits shall be $1,500. (Ord. 879 § 1, 1991).

13.24.070 Interruptability.

The city may sever connection to a water service customer when:

(1) Supplies of water are inadequate to handle the city requirements of customers inside the city limits or U.S. Navy;

(2) Temporary water shortage; and

(3) Emergency conditions requiring full water supply to the city of Oak Harbor. (Ord. 879 § 1, 1991).

13.24.080 Draw down.

A customer outside the city limits may not draw water out of the mains in such a way as to impair water service to the city of Oak Harbor. (Ord. 879 § 1, 1991).

13.24.090 Design standards – Backflow prevention.

(1)(a) The design standards for any water system beyond a master meter shall meet or exceed the Washington State Department of Health's minimum standards for public water supplies. All materials used in the system shall be AWWA approved.

(b) A backflow prevention valve shall be required in conjunction with each master meter.

(c) Current systems using master meters shall install backflow prevention valves within one year from the date of the ordinance codified in this chapter.

(2) Applicant and their successor's interest shall be responsible to assure that all systems are in compliance with county and state standards. (Ord. 879 § 1, 1991).

13.24.100 Disconnection.

Any violation of the requirements of this chapter may be cause for discontinuance of service to the system by the city council. Unless an emergency condition exists, any such action would be taken only after the customer had been advised in writing of the violation before hearing on the matter. (Ord. 879 § 1, 1991).

13.24.110 Penalty.

It is hereby declared a gross misdemeanor punishable by a fine of up to $5,000 or one year in jail or both such fine and jail time to make an unpermitted connection to the city water system. (Ord. 879 § 1, 1991).

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Prior legislation: Ords. 403 and 438.

Chapter 13.28
MAIN CONSTRUCTION

Sections:

13.28.010 Charge – Assessment.

Each parcel of property to be served within the water service limits shall be assessed its proportionate share of the cost of construction of a standard main abutting or serving the property. Prior to approval of an application for water service, the city supervisor shall ascertain if the property in question has previously contributed or been assessed its proportionate share of the construction costs. Property abutting a standard main, but not previously assessed or not having previously contributed its proportionate share of construction costs for such standard main may be connected to such standard main upon payment of a special construction charge as described in OHMC 13.28.030. The special construction charge is in addition to any other charges levied by this title. (Ord. 403 § 22, 1975).

13.28.020 Service connection – No main in street.

(1) Whenever an applicant requests water service to premises that do not have a standard main adjacent to the premises, a standard main must be installed as a prerequisite to connection to the city water system. The standard main must conform with the comprehensive water system plan of the city water system and must be installed along the complete street frontage of the premises to be served.

(2) A standard main may be installed by any of the following methods:

(a) The main may be installed at the property owner's expense by a contractor under the supervision and approval of the city supervisor. The city may contract with the owner to provide for the reimbursement of such owner and his assigns for return of construction expense for a period of up to 10 years. The city will agree to charge any person who subsequently taps on to the main for service a pro rata share of the cost of construction of the main and will reimburse the property owner. Assessments after the expiration of contract period shall revert directly to the city.

(b) If the premises lies within the corporate limits of the city of Oak Harbor, the owner may elect to have the main installed by making payment to the city of the main assessment as provided in OHMC 13.28.030(2); provided, however, that the availability of this option is contingent upon whether or not, in the opinion of a majority of the city council, sufficient money is available in the current water department budget to provide the necessary funds for the extension. Upon payment of the assessments designated in this section, the city will undertake to have the main installed. There will be no reimbursement to the original applicant for subsequent connection to the main.

(c) If the premises lies within the water service area of the city of Oak Harbor, the owner may also petition to have the main installed by the formation of a local improvement district as prescribed by state law and the ordinances of the city.

(d) If adequate money is available in the water department fund, the city shall pay the material cost difference in cases where the comprehensive water plan calls for a main size larger than eight inches. (Ord. 438 § 10, 1976; Ord. 403 § 23, 1975).

13.28.030 Special charge – Property not previously assessed or costs unpaid.

For owners of property not previously assessed or not having contributed their proportionate share of construction costs for the water main, a special construction charge will be paid as follows:

(1) If the property in question abuts a main covered by a "late-comer's agreement" as provided for in OHMC 13.28.020(2)(a), the special construction charge will be as provided in said agreement.

(2) If a standard main does not exist across the frontage of the premises requesting a service connection, the superintendent may prepare an estimate of the cost to install the required standard main to serve said premises. Payment of this estimate will exempt the property for which such payment was made from a subsequent local improvement district assessment for the installation of a standard main.

(3) If the property in question is not covered by a "late-comer's agreement" then the special connection charge will be computed as follows:

(a) The number of units of property frontage to be served by the water main, determined in the manner prescribed in RCW 35.44.030 and 35.44.040 for determining assessable units of frontage or by such other method or combination of methods of computing assessments which may be deemed to more fairly reflect the special benefits to the property being assessed as authorized by RCW 35.44.047, shall be multiplied by the local improvement assessment per unit of frontage or developer extension construction costs for the water main involved.

(b) If construction costs are not available for the specific water line for which the connection is being requested, the city engineer is authorized to compute and establish the average local improvement assessment cost paid by property owners or average costs for developer extensions for water mains completed and accepted by the city during that year, which average assessment or developer extension cost shall be used by him in computing the special connection charge imposed by OHMC 13.28.010. (Ord. 599 § 1, 1981; Ord. 403 § 24, 1975).

13.28.040 Specifications for standard water mains.

(1) Standard water mains shall not be less than six-inch diameter pipe. Pipes of smaller size may be used when the city supervisor determines that maximum fire rating could be maintained and the line in question cannot be extended.

(2) All pipe shall be designed to withstand a minimum internal water pressure of 150 pounds per square inch and shall conform to the latest adopted standards of the American Water Works Association. All design standards, quality standards and pipe sizes shall conform to the latest Fire Underwriters Standards and requirements.

(3) Water mains shall be asbestos cement, cast iron, ductile iron or approved equivalent material. (Ord. 403 § 25, 1975).

Chapter 13.32
RATES AND CHARGES*

Sections:

*Prior legislation: Ords. 403, 495, 515, 522, 570, 622, 721, 803, 812 and 941.

13.32.005 Water utility fund.

Fund #401, Water Fund, is hereby denominated the water utility fund, which is to be used in the operation of the water utility. All water service and water connection charges shall be deposited in this fund, to be used only for the purpose of paying all or any part of the cost and expense of providing water utility services, or to pay or secure the payment of all or any portion of any issue of general obligation or revenue bond issued for such purpose. The water service charges shall be established by ordinance. (Ord. 1584 § 1, 2010).

13.32.010 Connection charge.

(1) 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 his or her 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.

(2) For water connections outside the city limits of Oak Harbor, a surcharge of 50 percent will be added to the charges specified above for the extra costs involved in working beyond the normal service area. (Ord. 1584 § 1, 2010; Ord. 973 § 1, 1994).

13.32.025 Water rate – Inside the city limits and state park facilities.

(1) Water Service Charge. A water service charge shall be levied on all water customers. The water service charge shall consist of an administrative charge for service, also termed a "monthly ready to serve charge," a consumption charge for actual use, and a monthly charge for sprinkler systems, if any.

(a) Administrative Charge. The administrative charge for water supplied by the city to single-family residential, commercial and industrial customers inside the city limits and state park facilities shall be based on the number and size of the meter(s) serving the customer. A multifamily residential administrative charge shall apply to each meter serving a premises authorized for two or more dwelling units pursuant to a certificate of occupancy. The administrative charge for service to a multifamily residential meter shall be based upon the number of dwelling units served by the meter less a factor reflecting administrative savings due to single meter usage.

(b) Consumption Charge. The consumption charge shall be based on the quantity of water used and shall increase according to a schedule established by the utility rate ordinance.

(c) Sprinkler System Charge. The monthly charge for sprinkler systems, if any, shall be a flat rate based upon the cost of service of sprinkler systems to the water utility.

(2) Rates to Be Set in the Utility Rate Ordinance. The water service charge shall be set in accordance with the policies and requirements of this chapter in the utility rate ordinance. The utility rate ordinance should be reviewed annually to ensure that it properly reflects the costs of service, operation, maintenance and construction of the water utility services. (Ord. 1584 § 1, 2010; Ord. 1529 § 1, 2008; Ord. 1492 § 1, 2007; Ord. 1452 § 1, 2006; Ord. 1418 § 1, 2005; Ord. 1306 § 1, 2002; Ord. 1292 § 1, 2001; Ord. 1258 § 1, 2001; Ord. 1240 § 1, 2000; Ord. 1228 § 1, 2000; Ord. 1201 § 1, 1999; Ord. 1192 § 1, 1999; Ord. 1130 § 1, 1998).

13.32.030 Billing and collection procedures.

Billing and collection procedures for the utility shall be as provided in this title and OHMC Title 3 and under state law as now in effect or hereafter amended. (Ord. 1584 § 1, 2010; Ord. 1348 § 21, 2003).

13.32.060 Monthly rate – Naval Air Station.

(1) The charge for water consumed by the Naval Air Station shall be determined by agreement between the city and the U.S. Navy and shall be reflected in the utility rate ordinance. (Ord. 1584 § 1, 2010; Ord. 973 § 1, 1994).

13.32.075 Water rate – Premises beyond city limits.

The water service charge for customers residing outside the city limits shall be one and one-half times the rate charged for the similar water service established by the utility rate ordinance. (Ord. 1584 § 1, 2010; Ord. 1130 § 2, 1998).

13.32.083 Master meter connections (water utility district charges).

(1) The administrative charge for master meter connections (water service connections to water districts) shall be based upon meter size.

(2) The administrative charge and water usage will be charged at one and one-half times the rate for in-city non-single-family residential customers for equivalent water usage. (Ord. 1584 § 1, 2010; Ord. 1130 § 3, 1998).

13.32.085 Construction.

During the construction of any building and before water is installed as provided in this title, as amended, the contractor so constructing such building may be permitted to use the city water supply by making application therefor pursuant to OHMC 3.95.040 and paying the charges prescribed by the utility rate ordinance. (Ord. 1584 § 1, 2010; Ord. 1130 § 6, 1998; Ord. 973 § 1, 1994).

13.32.115 Certificate of occupancy.

No water shall be turned on for service in any premises for which a certificate of occupancy has not been obtained, in advance, from the city building department; provided, that water may be turned on for construction work in unfinished buildings, subject to the provisions of OHMC 13.32.085. (Ord. 1584 § 1, 2010; Ord. 973 § 1, 1994).

Chapter 13.36
FIRE PROTECTION SYSTEMS

Sections:

13.36.010 Installation permitted – Rate – Billings.

Fire protection systems may be installed in the city of Oak Harbor. The rate therefor shall be $12.72 per month, plus $1.79 per inch of the diameter of the fire service pipe over eight inches in diameter at the city main. Billings shall be part of the water utility bill. (Ord. 1306 § 3, 2002; Ord. 1292 § 3, 2001; Ord. 1258 § 3, 2001; Ord. 1240 § 1, 2000; Ord. 1228 § 3, 2000; Ord. 1201 § 3, 1999; Ord. 1192 § 4, 1999; Ord. 1130 § 4, 1998; Ord. 403 § 36(a), 1975).

13.36.020 Private systems – Approval required – Standards – Application.

Private fire protection systems must be approved by the city supervisor. They may include automatic sprinkler heads, standpipes, hose racks and connections, inside and outside fire hose outlets, hydrants and such other appurtenances. Automatic sprinkler system installations shall comply with the 1972 Edition of the National Fire Protection Association Pamphlet No. 13. Before any system is installed, application shall be made to the city supervisor and a diagram of the installation shall be submitted. The diagram shall contain a list of all material to be used, valve locations and service line pipe size. (Ord. 403 § 36(b), 1975).

13.36.030 Connection lines – Separation from water supply – Prohibited acts.

Fire connection lines shall be separate from the regular water supply. No water may be withdrawn from the lines except for fire. It is unlawful for any person or firm who has a water connection for fire protection purposes to add any other connection or let water be used off the premises for which the connection is made. (Ord. 403 § 36(c), 1975).

13.36.040 Installation – Permit required – Requirements.

No installation may be made until a permit has been issued and the installation shall only be done according to plans approved by the city supervisor. The city of Oak Harbor must be notified before any work is done in the street right-of-way or on the water use detection system. The city of Oak Harbor will have an inspector on the site while work is being done in the city street or where the water main is being tapped. The applicant will pay all installation costs of the fire protection system, including all costs of inspection. (Ord. 403 § 36(d), 1975).

13.36.050 Damage liability.

The city will not be responsible nor liable for any personal injury or property damage or any loss due to fire or otherwise by reason of an insufficient quantity of water and/or insufficient water pressure for any reason whatsoever. Rates established for service connections of this type are conditioned upon the premise that no liability of any nature whatsoever shall attach to the water department by reason of failure of water quantity or water pressure. (Ord. 403 § 36(e), 1975).

Chapter 13.40
VIOLATIONS

Sections:

13.40.010 Penalty.

(1) Any person, firm, association or corporation found guilty of violating OHMC 13.12.020, Damaging or interfering with water system prohibited, or OHMC 13.12.060, Unauthorized connection and turning off prohibited, shall be punishable as a gross misdemeanor and may be fined up to $5,000 or imprisoned up to 365 days in jail or both such fine and jail time.

(2) Reckless or intentional interruption of service to a customer of the water utility which is the result of a prohibited act under Chapter 13.12 OHMC shall be a gross misdemeanor punishable by a fine of up to $5,000 or a year in jail or both such fine and jail time. Interruption of service to each customer affected by an interruption, in violation of Chapter 13.12 OHMC, shall be a separate offense.

(3) Any person, firm or corporation found guilty of intentionally or recklessly violating the terms of this title (except as specified in subsections (1) and (2) of this section) shall be guilty of a misdemeanor and may be fined up to a sum of $1,000 or imprisoned up to 90 days in jail, or both such fine and jail time.

(4) Other violations of this chapter are civil infractions punishable by a fine of up to $250.00 under procedures set out in Chapter 1.20 OHMC, as now in effect or hereafter amended.

(5) Each day of continued violation shall be a separate offense. (Ord. 1393 § 8, 2004; Ord. 1014 § 10, 1995; Ord. 403 § 41, 1975).

APPENDIX F

2009 NEW RESERVOIR PROJECT PREDESIGN REPORT

CITY OF OAK HARBOR

ISLAND COUNTY **WASHINGTON**

CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

NEW RESERVOIR PROJECT
PREDESIGN REPORT

G&O NO. 08426
AUGUST 2009

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF OAK HARBOR

ISLAND COUNTY **WASHINGTON**

CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

NEW RESERVOIR PROJECT
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EXECUTIVE SUMMARY

The City of Oak Harbor (City) engaged Gray & Osborne, Inc. (G&O) to provide engineering services to assist in determining the best location for a new reservoir and to provide the design for a new reservoir on the selected site. The scope of work included updating the computerized water system model developed by the engineering fire that wrote the City's 2003 Water System Plan, and an independent analysis of the total reservoir capacity needed by the City.

RESERVOIR SITING ANALYSIS AND SYSTEM MODELING RESULTS

The City desired that five pre-identified sites be considered in the siting analysis, as each of the sites is either owned by, or readily available to, the City. Gray & Osborne reviewed the identified sites that were under consideration with regard to their attributes, relationships to the existing pressure zones, and distribution system transmission capability. This process showed that: 1) The lack of transmission capacity within the distribution system was a major factor in siting of the reservoir; and 2) one or more new, higher hydraulic grade line (HGL) pressure zone(s) would be required to address identified low pressure areas within the system. The following comments summarize Gray & Osborne's findings.

- The Ft. Nugent Park site in the southwest corner initially appeared to be the logical location, since the future growth is anticipated to be to the southwest. The limited capacity to move incoming water to the southwest, the need for a higher local HGL to improve local system pressures, and the inability to address pressure issues in other portions of the system ultimately ruled this site out.

- The Eastside Reservoir site is not large enough for the size of reservoir needed. It would also require pumping all of the water delivered from it, and would require significant transmission line construction throughout the City to deliver water to the future growth areas. This site was ruled out based on the size of the site, even before the transmission issues were considered.

- The SR 20 site in the northeast section of the system is large, but would require pumping of all water delivered from the reservoir, as well as significant transmission line construction to deliver water to the southwest.

- The Heller Road site is not large enough for the sizes of reservoirs needed, unless the existing reservoirs were removed, which would mean paying for the replacement volume as well. If taller reservoirs were used, the height would require that all incoming water be pumped into the reservoirs, and the water at the lower levels of the reservoirs would need to be pumped out as well. Transmission capacity to deliver water to the reservoirs and from the reservoirs to the areas of higher elevation in the southwest and northeast areas would need to be provided. This site was thus eliminated from consideration for additional storage.

- The Gun Club Road Site initially appeared to be far from the anticipated growth area, although its location and elevation were both favorable to receiving incoming water form Anacortes and for delivery of water by gravity to a large portion of the existing system. Since a booster pump station (BPS) will be needed to deliver water to the west and southwest at a higher hydraulic grade line (HGL), this station could also provide higher pressure to the current low pressure area in the northeast, if transmission capacity were built to serve that area. Installing the transmission line to the east from the reservoir to serve the northeast area will also eliminate the need to build a much longer, and thus more expensive, line that was planned to move water into the area. With facilities at the Gun Club Road site, the high areas near the Heller Road Reservoirs and Redwing Park area in the northwest could also be served at the higher HGL, allowing removal of the two existing booster pump stations that serve them, thus concentrating essentially all of the new storage and pumping functions for the system into a single facility. And from this location, much of the transmission line construction to the southwest area can be built over time through developer extensions as growth occurs, or constructed by the City through connection fees collected as development occurs.

- Other Sites – With the Gun Club Road site being City property located on one of the highest points in the local area, relatively near the incoming supply line from Anacortes, and recognizing the size of parcel that might be needed for multiple reservoirs and a booster pump station, no other sites were sought out.

RESERVOIR CAPACITY ANALYSIS RESULTS

Gray & Osborne prepared an analysis of the overall system storage needs based on Washington State Department of Health guidelines. While the project originally envisioned a 3.0 MG of additional storage, Gray & Osborne found the long-term built out system will need a total of approximately 7.0 MG of additional storage, including replacement of the storage volume provided by existing 0.54-MG Eastside Reservoir, recommended for replacement due to its age and lack of a proper foundation. The available system storage capacity is marginally adequate for only the very near-term. Even minor growth will cause the system to become storage deficit. In addition, the planned system improvements to address pressure and fire flow issues by creation of new pressures zones will cause the system be become storage deficient. With these changes and anticipated growth, the system will require an additional 4.0 MG of storage by 2029.

EXISTING STORAGE FACILITIES

Three storage reservoirs, two at the Heller Road Reservoir site, and one at the East Side Reservoir site located at Regatta Drive and NE 5th, serve the City's water system.

THE HELLER ROAD FACILITY

The primary storage facility is the Heller Road Storage Facility has two reservoirs with a total capacity of 2.54 MG. The large reservoir was constructed in 1976. The smaller was constructed in 1963. These reservoirs are in generally good condition. Both reservoirs "float" on the distribution system, meaning that water moves into and out of the reservoirs as needed, in combination with incoming flow from Anacortes, to meet the demands within the system. These reservoirs also supply water to the Downtown Zone, the Heller Booster Zone and the Redwing Pressure Zone.

THE EASTSIDE RESERVOIR

The Eastside Reservoir is constructed of steel and provides approximately 540,000 gallons of storage. The Reservoir was originally constructed in 1949 and expanded in 1959. This Reservoir is located on Regatta Drive, and is fed from the Mainland Zone distribution system. The water level in the Reservoir is controlled by an inlet altitude valve, which opens to allow water to enter the Reservoir when the level drops below an established level. The discharge line allows water in the Reservoir to float on the Downtown Zone to establish the HGL for the Zone.

The Downtown Zone is also served by five pressure-reducing valves (PRVs). These PRVs begin opening when the Reservoir level drops a few feet below the overflow level and, as a result, the lower three quarters of the storage volume provided by the Reservoir is essentially unused. The combination of these PRVs has more than adequate flow capacity to serve all the needs in the downtown Zone.

This reservoir has no foundation and rests directly upon the soil beneath it. With no foundation, the seismic stability of the reservoir is highly suspect. The investment needed to retrofit the reservoir for seismic stability, combined with the cost of recoating both the interior and exterior of the reservoir, would be substantial. A seismic retrofit would also call for a reduced maximum operating level that would reduce the effective storage volume provided by this reservoir. This combination of costs versus benefits has lead Gray & Osborne to recommend to City staff that this reservoir be considered for abandonment.

COORDINATION WITH NAVAL AIR STATION WHIDBEY ISLAND

The staff at Naval Air Station Whidbey Island (NAS) has been planning to install a transmission main from the NAS base to the existing school and a proposed future housing development of 300 to 400 housing units to be located east of the City. The required fire flow was indicated as being 3,500 gpm. Addressing the low-pressure issues in the northeast portion of the system with the reservoirs and booster pump station at the Gun Club Road site by installing the needed transmission line to the east, also provides the opportunity to coordinate with NAS to serve their needs. This proposed new alignment would result in substantial savings to both NAS and the City when compared to previous plans. City staff has contacted NAS and there is interest in partnering on the project to both eliminate a duplication of facilities and realize these potential savings.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the system analyses performed using the updated computer model, Gray & Osborne's reviews of each of the pre-identified reservoir sites, the updated reservoir capacity analysis, and the recently identified coordination potential for serving the NAS school east of the City, Gray & Osborne drew the following conclusions:

- The Oak Harbor water system currently lacks the transmission capacity to adequately deliver high flow rates to the future growth area southwest and west of the City and still maintain the minimum required system pressures.

- Any of the preidentified sites considered for locating one or more reservoirs will require construction of at least one additional booster pump station to facilitate the movement of the required fire flows within the system, and one additional booster pump station to address the low pressure area in the northeast portion of the City. With the recommended location and system reconfiguration, one booster pump station can serve both purposes, as well as eliminate two existing small booster pump stations used to boost pressures for small areas.

- The current total reservoir capacity in the system will be deficient in storage volume under DOH guidelines when the needed system reconfiguration is undertaken to address system pressure and fire flow issues. The needed additional storage capacity, including replacing the Eastside Reservoir capacity, is approximately 4.0 MG to address projected growth over the next 20 years. The exact time at which a second reservoir will be needed for build out is dependent upon the rate of growth in the area.

- Even the projected volume of needed additional storage does not relieve the City's vulnerability to a potential longer-term interruption of the incoming supply line from the City of Anacortes system, as it provides such a high proportion of the total system supply. There are few opportunities for development of sufficient local supply to offset this vulnerability unless consideration is given to a very expensive backup capacity that might be provided from a desalination plant.

- By establishing the firm, schematic concept for development of the ultimate transmission conveyance system to serve the southwest portion of the City and its future growth area, and then managing the development of that area in relation to the provision of water service, the City should have the capability to develop sufficient financial capacity to develop the needed system through connection charges and requiring developers to participate in, or install, segments of the new pipe lines. This may present some limitations on the sequence of areas that can be developed and served; however, the orderly development of the various areas may also be enhanced.

Gray & Osborne recommends the City of Oak Harbor proceed with the overall program of system upgrades in the following manner:

- Project No. 1 – Construct the 18-inch inflow and outflow lines between the point of connection to the existing system in Oak Harbor Road and the Gun Club Road Reservoir Site, a total of approximately 5,800 LF of pipe line, and install the PRV station at Oak Harbor Road to allow readjustment of the incoming line pressure to meet the current Mainland Zone HGL. **Estimated Cost - $2,306,000**.

- Project No. 2 – Construct a new 4.0-MG reservoir at the Gun Club Road Site. The size will be approximately 150 feet in diameter and 30-feet high with a high water operating elevation of 425 feet. **Estimated Cost - $3,100,000**.

- Project No. 3 – Modify the pumping configuration of the Ault Field facility to boost the incoming HGL from Anacortes in order to allow filling of the new reservoir. This would be an interim step that could be omitted if either the booster pump station at the Gun Club Road Site or the new station at Sharps Corner were built first. **Estimated Cost- $300,000**.

- Project No. 4 – Construct the new booster pump station at the new reservoir site in preparation for extension of the west to east transmission line to serve the NAS need for fire flow supply at the east edge of the City. This station will include the capability to boost incoming water to the overflow elevation of the reservoir, so, if the Ault Field facility was modified, it could be taken off line when this is complete. **Estimated Cost - $1,900,000**.

- Project No. 5 – Construct the west to east transmission line to create the new 480 East Zone and raise the HGL for the low pressure areas in the northeast portion of the City. **Estimated Cost - $3,160,000**

- Project No. 6 – Construct the remaining portion of the needed transmission improvements, PRV stations and isolation valving, to extend the extent of the 480 East Zone and deliver 3,500 gpm to NAS. **Estimated Cost - $852,000**.

- Project No. 7 – Construct the dedicated line between the Heller Road Reservoir site and the mainland Zone to allow it to be isolated from the new 480 West Zone. **Estimated Cost - $780,000**.

- Project Nos. 8 thru 12 – Construct the various segments of 16-inch transmission lines in sequence to extend the new 480 West Zone to the southwest portion of the system. **Combined Estimated Cost - $9,615,000**.

PROJECT DESCRIPTION AND OBJECTIVES

The City of Oak Harbor (City) engaged Gray & Osborne, Inc. (G&O) to provide engineering services to assist in selecting the location for a new reservoir and to provide the design for a new reservoir on the selected site. The scope of work included updating the computerized water system model developed by Earth Tech, Inc., the engineering firm that prepared the City's 2003 Water System Plan (03-WSP), and provided to Gray & Osborne by the City, and an independent analysis of the total reservoir capacity needed by the City.

The first phase of the project scope of work was to update the computer model and reestablish calibration of the model. Following that, an analysis of the system was to be undertaken to assist in determining the most advantageous location for the reservoir. Factors considered in reviewing reservoir locations included: Current system operations; future system expansion; the capability to allow phased installation of future improvements in a coordinated manner; and the water transmission capabilities within the distribution system. The City had preidentified five potential sites for the reservoir facility, and desired that each site be considered and evaluated during the site selection process. Special consideration was to be given to the fact that each of these sites is either owned by the City or readily available to the City.

The third portion of the project was to provide an independent analysis of the near-term and long-term system storage capacity needs. The objective of this analysis was to verify that the size of the reservoir being considered would be adequate to serve the City for a reasonable period of time before additional capacity might be needed.

The last portion of the first phase of the project is to provide 30 percent design documents for the reservoir project.

GENERALIZED DESCRIPTION OF THE OAK HARBOR WATER SYSTEM

The City of Oak Harbor owns and operates the water system that serves the community and also provides water to the Naval Air Station – Whidbey Island (NAS) facility located to the north of the City. The following sections provide a general description of the system and those components that influence the location and sizing of the proposed reservoir. The system, its zones, the pre-identified potential reservoir sites and existing distribution lines larger than 10-inch diameter are shown in Figure 1.

Information upon which the descriptions below are based include the 2003 Water System Plan (03-WSP), prepared by Earth Tech, Inc., discussion with City staff, and discussions with City of Anacortes staff pertaining to operational characteristics of the Anacortes system.

SOURCES OF SUPPLY

The City's primary water source is a wholesale purchase agreement with the City of Anacortes. Under this agreement, Anacortes delivers treated water to the City at Sharpe's Corner, located approximately 12 miles north of the City on US Highway 20. The quantity of water available from Anacortes is open to periodic renegotiation when the City needs additional water. The water supply agreement specifies that the minimum hydraulic grade line (HGL) at Sharpe's Corner will be at elevation 302, although the normal operating HGL is on the order of 323 feet.

> NOTE: The HGL elevations stated in the supply agreement are based upon NGVD '29 elevations. The City's datum is based upon NGVD '29 plus 100 feet. The corresponding HGL at Sharpe's Corner are approximately 402 and 423 feet, respectively when referring to the City datum. All references to elevation in the remainder of this Report are based upon the City's datum.

In addition to the Anacortes supply, the City has three operating well sources, Wells 8, 9 and 11, with a combined production capacity of 430 gpm. These wells are located within the City just east of Heller Road. (See Figure 1.)

TRANSMISSION MAINS

The City owns a 24-inch waterline that runs approximately 12 miles from the metering station at Sharpe's Corner south, across the Deception Pass Bridge, to the Ault Field Pump Station (Ault Field) facility in the northerly portion of the City's service area. The City also owns a 10-inch waterline from a metering station near the north end of the

Deception Pass Bridge, across the Bridge, to the Ault Field facility. The 10-inch line is fed from the Anacortes distribution system that serves portions of the Fidalgo Island community north of Deception Pass.

The only current limitation to the Anacortes supply is related to low pressure in the 24-inch transmission line at the high points in the transmission line between Sharpe’s Corner and the Ault Field facility. Low pressure can be the result of either head losses (hydraulic friction losses) during periods of high flow or low supply HGL from Anacortes, or a combination of the two factors. Under current normal operating conditions, the incoming HGL is more than sufficient to allow flow directly into the distribution system. The Ault Field facility allows water to bypass the pumping facilities and flow directly to the distribution system under most operating conditions. This facility was intended to boost the incoming HGL to move water into the distribution system during periods of reduced supply HGL. This has rarely been needed, however. It is anticipated that future system demands will require the City to invest in a pumping station at Sharpe’s Corner to boost the supply HGL sufficiently to avoid the low transmission line pressures and overcome the head losses in the transmission line as the demand grows. This facility is not part of the proposed Reservoir project, and the cost of the facility is not included in the later listing of proposed system improvements.

From the Ault Field facility south into the distribution system, the only large diameter line that would be considered a transmission main runs within Oak Harbor Road from the Ault Field facility to approximately Gun Club Road. The remainder of the “transmission” function through the system is in the distribution system, which has a few 12-inch mains along major corridors and smaller diameter distribution piping of primarily 8-inch pipes. See Figure 1.)

DISTRIBUTION SYSTEM

The City’s distribution system is currently composed of four pressure zones, referred to as the Mainland Zone (into which the incoming water from Anacortes flows), the Downtown Zone, the Heller Booster Zone to the west, and the Redwing Pressure Zone in the northwest portion of the City. Figures 1, 2 and 3 show the City’s service area and the existing pressure zones within it, with Figure 3 providing a three dimensional perspective of the system.

The Mainland Zone – HGL 405

The Mainland Zone serves the major portion of the City’s service area. The 03-WSP indicates this zone had approximately 5,790 services in 2003, which correlates to an average daily demand (ADD) of approximately 1.17 million gallons per day (mgd). The HGL in the zone is established by the combination of the water surface in the Heller Road Reservoirs and the incoming flow from Anacortes through the Ault Field facility. Under normal operation, the inflow from Anacortes flows directly into the Mainland Zone distribution system and fills the two Heller Road Reservoirs. The HGL in the

Mainland Zone is impacted slightly during periods when the NAS system is drawing water from the City's system near the Ault Field facility. This impact causes water to be drawn from the Heller Road Reservoirs. During periods when the NAS is not drawing water, the HGL in the system again rises to fill the Heller Road Reservoirs. Observations of system time-lapse records of this inflow/outflow situation indicate this cyclical pattern, and Staff has discussed the need to close or partially close some valves near the Heller Road facilities in order to induce some head losses to prevent overflowing the Reservoirs.

The Downtown Zone – HGL 335

The Downtown Zone serves the lower portions of the City that are a combination of the older residential neighborhoods and the original business district that is known as being the downtown area. The southerly portion of this area is along the shore of the body of water known as Oak Harbor. The 03-WSP indicates this zone had approximately 1,450 services in 2003, which correlates to an average daily demand (ADD) of approximately 0.29 million gallons per day (mgd). The HGL for the Downtown Zone is established by the East Side Reservoir and a combination of five reducing valve (PRV) stations. The PRVs are set to become active when the Reservoir is drawn down approximately 11 feet.

The Heller Booster Zone – HGL 440

The Heller Booster Zone is a "closed" pressure zone (meaning that it has no reservoir open to the atmosphere) that is fed by a booster pump station located at the Heller Road Reservoir facility. The Zone encompasses the high ground surrounding the facility.

The Redwing Pressure Zone – HGL 433

Similar to the Heller Booster Zone, the Redwing Pressure Zone is a closed zone fed by a booster pump station, including a fire flow pump, that draws water from the distribution system and raises the HGL sufficiently to serve a limited area in the northwest portion of the City.

STORAGE FACILITIES

Three storage reservoirs, two at the Heller Road Reservoir site, and one at the East Side Reservoir site, serve the City's water system.

As a point of clarification, the term "reservoir" is used both as a generic, all-inclusive term referring to water storage facilities of any type or configuration. When referring to steel reservoirs, those that are taller than their diameters are typically referred to as standpipes. This distinction will be observed when appropriate in this Report. In addition, the heights of reservoirs are typically referring to the height of the overflow level above the reservoir base.

The Heller Road Facility

The primary storage facility is the Heller Road Storage Facility with one reservoir and one standpipe. The large reservoir at this site, a 2.0-million gallon (MG) steel reservoir, is approximately 78 feet in diameter, 56.5 feet high and was constructed in 1976. The smaller, a 585,000 gallon steel standpipe is approximately 42 feet in diameter, 56.5 feet high and was constructed in 1963. These reservoirs are in generally good condition. Both reservoirs "float" on the distribution system, meaning that water moves into and out of the reservoirs as needed, in combination with incoming flow from Anacortes, to meet the demands within the zone. These reservoirs also supply water to the Downtown Zone, the Heller Booster Zone and the Redwing Pressure Zone.

The East Side Standpipe

The East Side Standpipe is constructed of steel and provides approximately 540,000 gallons of storage. The Standpipe is approximately 41.5 feet in diameter, 53 feet in height and was constructed in 1949 and expanded in 1959. This Standpipe is located just west of Regatta Drive, and is fed from the Mainland Zone distribution system. The water level in the Standpipe is controlled by an inlet altitude valve, which opens to allow water to enter the Standpipe when the level drops below an established level. The discharge line allows water in the Standpipe to float on the Downtown Zone to establish the HGL for the Zone.

The Downtown Zone is also served by five PRVs with ample flow capacity to serve the Zone. In order to ensure sufficient pressure to the Downtown Zone, these PRVs begin opening within a few feet (indicated to be 11 feet) below the overflow level of the Standpipe in order to have the full capacity of each be effective when needed. As a result, the lower three quarters of the storage volume provided by the Standpipe is essentially unusable in coordination with the PRVs feeding into the Zone because they provide more than adequate capacity to supply the highest fire flow in the Zone, and then refill the reservoir to the HGL corresponding with their corresponding closing set points.

This reservoir has no foundation and rests directly upon the soil beneath it. With no foundation, the seismic stability of the reservoir is highly suspect. The investment needed to retrofit the reservoir for seismic stability, combined with the cost of recoating both the interior and exterior of the reservoir, would be substantial. A seismic retrofit would also call for a reduced maximum operating level that would reduce the effective storage volume provided by this reservoir. This combination of costs versus benefits has lead Gray & Osborne to recommend to City staff that this reservoir be considered for abandonment whenever an investment in prolonging its life, such as recoating, is considered necessary.

RESERVOIR SITING ANALYSIS

The City identified five locations it had considered as potential sites for a new reservoir facility. Each site was reviewed preliminarily during a drive-by orientation to the City's system. City staff provided a brief discussion of each site. Discussions also covered future growth potential over the mid-term (10 to 15 years) and long-term (build out). It was understood that a large portion of the system growth (65%+) would be served by system extensions to the southwest of the City, beyond the existing service area.

Initially City staff indicated that a 1,000-gpm to 1,500-gpm fire flow should be considered in the growth areas. After further discussions, a 2,500-gpm fire flow was adopted for use in the analysis in anticipation of potentially larger homes (the International Fire Code requires single or two family residential structures of 3,600 sq. ft. or more to have a minimum of 1,500-gpm fire flow available) and small community type commercial developments such as convenience stores, churches and schools.

An important set of factors to understand are the requirements for service pressures that must be considered in siting and designing water system improvements. The applicable pressure criteria are established by Washington State Department of Health (DOH) standards contained in WAC 246-290-230, which states in Sections (5) and (6) that:

> "New public water systems or additions to existing systems shall be designed with the capacity to deliver the design (peak hour demand) PHD quantity of water at 30 psi (210 kPa) under PHD flow conditions measured at all existing and proposed service water meters or along property lines adjacent to mains if no meter exists, and under the condition where all equalizing storage has been depleted."
>
> ***"If fire flow is to be provided, the distribution system shall also provide maximum day demand (MDD) plus the required fire flow at a pressure of at least 20 psi (140 kPa) at all points throughout the distribution system and under the condition where the designed volume of fire suppression and equalizing storage has been depleted."***

As points of reference regarding the pressures stated above, the 30 psi requirement means that any water stored less than 69 feet (30 psi X 2.31 ft/psi) above the highest water service, or potential service, cannot be considered to be available to serve the domestic demands in the system unless the pressure is reliably boosted to the appropriate HGL corresponding to that service pressure and elevation. To the 69 feet, additional consideration must be given to any head losses within the system leading to that service. Similarly, any water stored less than 46 feet (20 psi X 2.31 ft/psi) plus an additional height to reflect any head losses within the system, above the highest service cannot be considered to be available to provide emergency water supply during system outages, or for fire suppression purposes. These criteria can be met through the placement of the reservoir(s) at elevations that provide the needed height above the service(s), or by using pumping systems, with the proviso that redundant pumping capacity and power supply must be available to ensure availability of the required flows and pressures under the specified conditions.

INITIAL MODEL ANALYSIS – FOCUS AND FINDINGS

The distribution system expansion referred to in the 03-WSP was reflected in the original model as a skeletal system beyond the existing distribution system. Most of the future system growth was projected to be to the southwest. This assumption was therefore used as the starting point for our analysis.

Initial consideration focused on the Ft. Nugent Park site for the proposed reservoir and a booster pump station (BPS). With the 03-WSP recommendations focused on this site and the knowledge that most of the future growth would be in this general area and to the west of this site, this became the "obvious choice" for siting the proposed reservoir. One of the limitations for the Ft. Nugent Site discussed during our orientation tour was the height of a reservoir that could be built there: A tall standpipe would not be acceptable on this site, as it was an important recreational resource for the community. This limitation would therefore require the installation of a BPS to pump water from a low level, or even underground, reservoir on this site to an HGL high enough to provide sufficient pressures within the southwest growth area to be served by the reservoir, as well as PRVs to drop water from this new zone back into the 405 Zone.

A fixed head reservoir was used in the model to represent a reservoir and BPS at the Ft. Nugent Park site to serve the southwest growth area and supplement the supply to the 405 Zone in that area. The intent was that flow into the new reservoir would occur during off-peak periods of normal operating conditions, and flow would be restricted when pressures in the 405 Zone could not be sustained by the existing system and required water to be supplied by the new BPS. With this basic assumption on supplying water to the new reservoir, the analysis of the capability of the existing water system to serve both the existing system and the future growth expected in the southwest portions of the service area was begun. The initial findings were surprising, showing that even under normal MDD operating conditions, the 405 Zone could not supply flow to replenish a new reservoir at the Ft. Nugent site while also serving those portions of the southwest service area that were developing and not intended to be in the new, higher HGL zone. The result was unacceptable reductions in pressures in the areas south of and around the Heller Road storage facilities that were not in the Heller Booster Zone.

The observed results were a demonstration of the insufficient transmission capacity into the southwest area. One solution would be for the size of the new reservoir and the capacity of the new BPS to be sufficient to provide the total fire flow plus MDD flow needs of the areas to be served, and a dedicated supply line added from the Heller Road Storage to reduce the influence the added flow was having on the 405 Zone. The alternative was to pursue a significant amount of water main replacement to improve hydraulic characteristics in the area.

This inability to move water to the southwest portion of the existing distribution system proved to be the "tip of the iceberg" as it led to looking at the overall system capability to move water to meet high demands. During the model calibration process, it had been noted both in the field and in the modeling process that there were other relatively high elevation areas within the distribution system that were affected by high flows placed almost anywhere in the system. For example, during the hydrant testing process, a data logger was placed at a high point in the system on NE 11th Avenue near Ridgewood Park in the northeast portion of the system. The residual pressure at this hydrant dropped to just over 20 psi on a number of occasions, even with the Heller Road Reservoirs nearly full and water coming in from Anacortes. So this area and a few others were of concern from the beginning of the modeling process. Model runs to determine available fire flows under the assumption of the reservoirs being depleted of fire suppression storage volumes showed that a few high points imposed limitations to available fire flows in most areas of the City.

With these added observations as background, the concern regarding the limited "transmission" capability – or the ability to move large quantities of water - in the distribution system became a major factor in the evaluation of the identified potential reservoir sites and system improvements. The major challenge became moving water to the combination of the southwestern, the western and the northeastern portions of the system. The desirable solution was to place of a new reservoir in a central location where all three areas could be served with the addition of a single BPS and a "minimal" network of additional transmission capability having to be added to the system. In addition to these, the "normal" considerations regarding system redundancies and providing the required flows and service pressures under emergency situations must be considered.

The combination of these considerations raised a number of questions regarding the system, its capabilities and the siting of the proposed new reservoir. These included:

- Is there sufficient storage volume within the system under normal DOH criteria, and, more specifically, considering the potential for an interruption to the supply of Anacortes water from either a reduced HGL or damage to the 24-inch waterline?
- If additional storage volume is added to the system, where should it be placed, and can one reservoir serve the multiple needs of the system?
- How can the transmission capacity of the system be improved, and if additional new transmission capacity is required, how can it be physically and cost effectively provided?
- Recognizing that a new BPS would be required, and that its size would be essentially the same wherever it was located, would it also be possible to eliminate the existing BPSs serving the Heller Booster Pump Zone and the Redwing Park Pressure Zone while also eliminating the need for other BPSs to serve both the southwest area and the northeast area if the new BPS were installed in one location versus another?

RESERVOIR CAPACITY ANALYSES

The scope of the project was to prepare the design for a 3.0 MG reservoir, with selection of the site to be determined based upon analyses of available sites and considerations of the benefits available from siting of the facilities. The 03-WSP discussion on reservoir capacity was reviewed and found to indicate that approximately 3 MG of additional storage is needed by 2023. The analysis presented did not consider the future needs at build out, nor did it identify the dead storage component of the Heller Road Reservoirs. With this as background, the independent storage volume analysis under current, 2029 and build out scenarios began. While the recommended volume of the storage components differ somewhat, the dead storage component (omitted in the 03-WSP document) in the existing reservoirs must be considered due to the local topography.

Dead storage is the volume of storage below the level that can provide 20 psi throughout the distribution system. The 03-WSP (p 1-4) indicates the Mainland Zone serves elevations up to 340 ft. City staff has provided a correction to this elevation with the highest service being at 310 ft. elevation. The theoretical minimum usable elevation in the Heller Road Reservoirs is therefore 310+(20 X 2.31) = 356 ft. As a result, the lower 7 feet of these reservoirs would be considered as dead storage, which represents a volume of 0.32 MG. In practical terms, this volume is actually larger, as there are always some head losses within the distribution system that would reduce the available pressure at any given service by some amount.

Since the 03-WSP is now dated, population projections and system production and usage data were updated to reflect 2009 as the base year and 2029 as the end of the typical 20-year planning period. Tables 1 through 4 present our storage analyses based on the last five years of system data from 2004 through 2008 that was provided by the City, with projections extrapolated to the near-term future (2029) and long-term future (build-out) projection time frames assuming the system zone configuration as it exists now. (Appendix B contains the City provided data.) The system projections based upon the recommended system reconfigured pressure zones with the new reservoir(s) and BPS as developed through the modeling process, are shown in Tables 5 through 8, and the physical configuration is shown in Figures 4 and Figure 5. All of these tables assume:

- The Anacortes supply is interrupted for two days duration of the standby period;
- The recommended abandonment of the East Side Reservoir has taken place;
- All three wells are functional with standby power at each;
- The fire suppression storage volume for the Mainland and Downtown Zones will be provided or supplemented by the new reservoir(s); and

- The fire suppression storage volume is “nested” with the standby storage in the new reservoirs.

The analyses use a **1.77 peaking factor** (based on system data for 2004 through 2008) for calculation of the MDD, the 160.3 gpd/equivalent residential unit (ERU) (based on system data for 2004 through 2008) adjusted to include system water losses in order to reflect the actual system demand per ERU value rather than the consumption value. This results in a system demand of <u>170.5 gpd/ERU</u> [Calculated as (160.3 gpd/ERU) X (1.0597 to represent 5.97% losses based on 2004 through 2008 system data)].

Please note that in each case the volume of standby storage reflects the DOH design criteria of at least two days of average daily demand to allow component replacement and power restoration. For the 2029 period, it also includes an additional volume to provide a minimum of 3.5 MG of standby storage. This volume assumes the Anacortes supply is interrupted, but does not begin to fully address vulnerability to a longer-term interruption of the Anacortes supply, such as a failure of the pipeline at the Deception Pass Bridge. Also, the fire flow durations under future conditions has been adjusted to three hours to reflect the current International Fire Code Requirement.

TABLE 1

Current (2009) and Future Build-Out ERUs and System Demands by Existing Zones - Based on Demand

Zone	Existing Connections (ERUs)	Potential Additional Connections At Build Out (ERUs)	Total Potential Connections (ERUs)	Existing $ADD_{(SD)}$ (gpd)	Potential Additional $ADD_{(SD)}$ (gpd)	Total Potential $ADD_{(SD)}$ (gpd)
Mainland Zone	7212	14036	21,248	1,229,484	2,392,822	3,622,306
Downtown Zone	1802	350	2,152	307,200	59,667	366,868
Total	**9,014**	**14,386**	**23,400**	**1,536,684**	**2,452,489**	**3,989,174**

TABLE 2

Future (2029) ERUs and System Demands by Existing Zones

Zone	2029 Connections (ERUs)	Potential Additional Navy Housing Connections (ERUs)	Total Potential Connections (ERUs)	Existing $ADD_{(SD)}$ (gpd)	Potential Additional $ADD_{(SD)}$ (gpd)	Total Potential $ADD_{(SD)}$ (gpd)
Mainland Zone	12646	400	13,046	2,155,859	68,191	2,224,050
Downtown Zone	3161		3,161	538,879	0	538,879
Total	**15,807**	**400**	**16,207**	**2,694,738**	**68,191**	**2,762,929**

TABLE 3

Current (2009) System Storage Analysis By Current Zones

Storage Component (gallon)	Mainland Zone	Downtown Zone	System As a Whole	
Diam/Equiv Diam of Res	90.35	42.00	99.64	90.35 is equivalent diameter for the 80 ft. and 42 ft. Reservoirs
Feet of OS	5	5	5	
Operational Storage (OS)(1)	239,900	51,900	291,700	
No. ERUs	7,212	1,802	9,014	Inflow from Anacortes w/ 423 HGL @ Sharps Corner, Res @ 398
Normal Inflow	2,150	250	2,400	
Equalizing Storage (ES)	30,700	50,800	81,500	
Reliable Inflow	265	165	430	Assume Anacortes out & 3 wells function - 165 flows to downtown from PRVs
Standby Storage (SB) - Flows	1,695,800	139,300	1,835,000	
Standby Storage (SB) - 200 G/ERU	1,442,400	360,400	1,802,800	
Standby Storage (SB) -	1,695,800	360,400	1,835,000	
Reqd Fire Flow - GPM	3,500	3,500	3,500	
Fire Flow Duration - Hrs	3	3	3	Duration reflect IFC
Fire Suppression Storage (FSS)	630,000	0	630,000	All Fire Suppression from Mainland Zone
Total Required Storage	1,966,400	463,100	2,838,200	
Existing Storage Volume	2,565,950	549,245	3,115,195	
Dead Storage (DS)	326,200	20,800	347,000	
Total Available Storage	2,239,750	528,445	2,768,195	
Storage Surplus (Deficit)	**273,350**	**65,345**	**338,695**	

TABLE 4

Future (2029) System Storage Analysis by Current Zones

Storage Component (gallon)	Mainland Zone	Downtown Zone	System As a Whole	
Diam/Equiv Diam of Res	90.35	0.00	90.35	Assume Downtown served by PRVs and East Res. Abandoned
Feet of OS	5	5	5	
Operational Storage (OS)(1)	239,900	0	239,900	
No. ERUs	16,207	0	16,207	
Normal Inflow	2,400	0	2,400	
Equalizing Storage (ES)(2)	421,900	0	421,900	Flow from Mainland Zone
Reliable Inflow	430	0	430	
Standby Storage (SB) - Flows	4,287,500	0	4,287,500	
Standby Storage (SB) - 200 G/ERU	3,241,400	0	3,241,400	
Standby Storage (SB) -	4,287,500	0	4,287,500	
Reqd Fire Flow - gpm	3,500	3,500	3,500	
Fire Flow Duration - Hrs	3	0	3	Duration changed to reflect IFC
Fire Suppression Storage (FSS)	630,000	0	630,000	
Total Required Storage	5,579,300	0	5,579,300	
Storage Volume	2,565,950	0	2,565,950	
Dead Storage (DS)(6)	326,200	0	326,200	
Total Available Storage(7)	2,239,750	0	2,239,750	
Storage Surplus (Deficit)(8)	**(3,339,550)**	**0**	(3,339,550)	**System Requires Additional Storage Volume**

TABLE 5

Future (2029) ERUs and System Demands by Future Zones

Zone	2029 Connections (ERUs)	Potential Additional Navy Housing Connections (ERUs)	Total Potential Connections (ERUs)	Existing $ADD_{(SD)}$ (gpd)	Potential Additional $ADD_{(SD)}$ (gpd)	Total Potential $ADD_{(SD)}$ (gpd)
Mainland & Downtown Zones	5350		5,350	912,055	0	912,055
480 Zone – Incl. New 420 Zone	10857	400	11,257	1,850,874	68,191	1,919,065
Total	**16,207**	**400**	**16,607**	**2,762,929**	**68,191**	**2,831,120**

TABLE 6

Future (Build-Out) ERUs and System Demands by Future Zones

Zone	Build Out Connections (ERUs)	Potential Additional Navy Housing Connections (ERUs)	Total Potential Connections (ERUs)	Existing $ADD_{(SD)}$ (gpd)	Potential Additional $ADD_{(SD)}$ (gpd)	Total Potential $ADD_{(SD)}$ (gpd)
Mainland & Downtown Zones	6065		6,065	1,033,946	0	1,033,946
480 Zone – Incl. New 420 Zone	16935	400	17,335	2,887,037	68,191	2,955,228
Total	**23,000**	**400**	**23,400**	**3,920,983**	**68,191**	**3,989,174**

TABLE 7

Future (2029) System Storage Analysis by Future Zones

Storage Component (gallon)	Mainland & Downtown Zones	480 & 420 Zones	System As a Whole	
Diam/Equiv Diam of Res	90.35	150.00	175.11	**Includes New 4.0 MG Reservoir In 480 Zone**
Feet of OS	4	6	2	
Operational Storage (OS)(1)	191,900	793,100	360,300	
No. ERUs	5,350	11,657	17,007	
Normal Inflow	0	5,400	5,400	Inflow of 5,400 gpm from Anacortes as 2023 approaches will require boosting delivery pressure at Sharp's Corner
Equalizing Storage (ES)	257,900	0	257,900	
Reliable Inflow	35	395	430	Assume Anacortes out & 3 wells function and pump into 480 Zone
Standby Storage (SB) - Flows	1,723,400	2,837,000	4,560,400	
Standby Storage (SB) - 200 G/ERU	1,070,000	2,331,400	3,401,400	
Standby Storage (SB)	1,723,400	2,837,000	4,560,400	
Reqd Fire Flow - gpm	3,500	3,500	3,500	
Fire Flow Duration - Hrs	3	3	3	Revised to reflect latest IFC duration
Fire Suppression Storage (FSS)	630,000	630,000	1,260,000	Fire Flow for Mainland also available in new Reservoirs @ Gun Club Rd. Site
Total Required Storage	2,173,200	3,630,100	5,803,300	
Existing Storage Volume	2,565,950	3,965,475	6,531,426	
Dead Storage (DS)	326,200	264,400	590,600	
Total Available Storage	2,239,750	3,701,075	5,940,826	
Storage Surplus (Deficit)	**66,550**	**70,975**	**137,526**	**Allows For Limited Additional Growth**

TABLE 8

Future (Build-Out) System Storage Analysis by New Zones

Storage Component (gallon)	Mainland & Downtown Zones	480 & 420 Zones	System As a Whole	
Diam/Equiv Diam of Res	90.35	199.15	218.69	**Includes 2 Reservoirs w/7 MG In 480 Zone**
Feet of OS	8	4.5	2	
Operational Storage (OS)(1)	383,700	1,048,500	562,000	
No. ERUs	6,065	17,735	23,800	
Normal Inflow	1,950	2,850	4,800	Inflow of 4,800 gpm from Anacortes will require boosting delivery pressure at Sharp’s Corner
Equalizing Storage (ES)	0	422,600	422,600	
Reliable Inflow	75	355	430	Assume Anacortes out & 3 wells function and pump into 480 Zone
Standby Storage (SB) - Flows	1,851,900	5,024,500	6,876,400	
Standby Storage (SB) - 200 G/ERU	1,213,000	3,547,000	4,760,000	
Standby Storage (SB) -	1,851,900	5,024,500	6,876,400	
Reqd Fire Flow - gpm	3,500	3,500	3,500	
Fire Flow Duration - Hrs	3	3	3	Revised to reflect latest IFC duration
Fire Suppression Storage (FSS)	630,000	630,000	1,260,000	Fire Flow for Mainland also available in new Reservoirs @ Gun Club Rd. Site
Total Required Storage	2,235,600	6,495,600	8,731,200	
Existing Storage Volume	2,565,950	6,989,987	9,555,938	Assumes new reservoirs provide all fire suppression storage .
Dead Storage (DS)	326,200	466,000	792,200	
Total Available Storage	2,239,750	6,523,987	8,763,738	
Storage Surplus (Deficit)	**4,150**	**28,387**	**32,538**	**Storage Adequate for Projected Growth**

Based upon these analyses, constructing a 4.0-MG reservoir at this time, would meet projected needs until 2029.

LOCATION SITE SELECTION CONSIDERATIONS FOR THE NEW RESERVOIRS

Based upon the results of the initial system and fire flow analyses, it became apparent that addressing the distribution system transmission capability alone would not help address the low pressure issues in the higher portions of the distribution system. The incoming Anacortes HGL currently sets the Mainland Zone HGL, with the exception of those periods during which NAS is filling its reservoirs at a high flow rate. At those times, if the Heller Road Reservoirs are full, they will set the HGL for at least the southern portion of the Mainland Zone until they are drawn down a few feet, at which time a match is achieved between the Heller Road HGL and the Anacortes supply HGL at some point in the system, and that point would slowly shift to the south as the reservoir levels drop.

The Mainland Zone HGL could be altered at the Ault Field facility; however, this would introduce other issues, such as making the Heller Road facilities virtually unusable for normal operations without adding the capacity to pump out of the reservoirs. Raising the HGL in the Mainland Zone would also increase service pressures in areas that are now served at pressures that are higher than desirable, and could create a liability for the City for those homes that did not previously require PRVs on service lines but would under an increased HGL. So it is desirable to work toward maintaining at least the lower portions in the Mainland Zone at the same, or possibly lower, HGL. And without raising the local HGL in the northeast portion of the system, the low-pressure issues in that portion of the system cannot be addressed.

As a result of these preliminary findings, the goal of finding a location that would provide the opportunity to move water at the HGL needed to address all of the pressure issues with one storage/BPS facility was highly desirable, if it was possible.

The basic concept settled upon was to provide a storage facility that could be fed from the Anacortes system under moderately high flow conditions. It was also recognized that a BPS would need to be provided at Sharpe’s Corner in the future to boost the Anacortes transmission line pressures, and thus the incoming HGL, although an interim supply BPS might be needed to boost water into the new reservoir(s) under certain conditions. It was also recognized that this storage facility could be at almost any elevation that was compatible with the incoming HGL, as a higher HGL would reduce the head against which the new discharge BPS would have to pump to the new higher HGL zone, thus reducing pumping costs.

Another factor considered was the transmission capacity and sizing of the new lines needed to deliver incoming Anacortes water to the new reservoir(s), and deliver the pumped discharge water to the areas in the new HGL zone that would improve system pressures in these higher areas and also deliver water effectively to the future growth area in the southwest. Recognizing the need for additional storage capacity in the future, locating the future storage facility on the same site as the first new reservoir would allow a single BPS to serve both current and future needs.

With these factors in mind, each of the five locations, preidentified by the City, were reviewed to judge how each would fit into the “ideal” mold of the desirable site. The following comments summarize the findings.

FT. NUGENT PARK SITE

The Ft. Nugent Park site initially looked like the obvious place upon which to focus. The realities associated with this site quickly came to light, however, and led a shift of focus away from this site. Table 9 presents the pros and cons that apply to the Ft. Nugent Park site.

TABLE 9

Ft. Nugent Park Site Pros and Cons

Pros	Cons
Serves the projected primary growth area.	Does not directly address or improve transmission capacity of the system either locally or system wide.
Site is owned by the City and available to use.	Without addressing transmission capacity, this site creates low-pressure issues along the Heller Road ridge area during high flows to the southwest area.
	Cannot provide flow to any other portion of the system.
	Site development would be restricted in terms of reservoir size, and BPS siting.
	Would not readily facilitate installation of additional future storage, as water could not be delivered to other portions of the City.

Based on these factors, the Ft. Nugent Park site was discounted from further consideration.

HELLER ROAD SITE

The Heller Road site has an advantage over the Ft. Nugent Park site based upon its higher elevation, and the co-location with the existing reservoirs. Table 10 presents the pros and cons that apply to the Heller Road site.

TABLE 10

Heller Road Site Pros and Cons

Pros	Cons
Could serve the projected growth area to the southwest.	Does not directly address or improve transmission capacity of the system.
Site is owned by the City and available to use.	The site is too small to allow construction of a suitably large reservoir for the current project, and cannot accommodate an additional future reservoir. A new facility would require removal of the existing reservoirs and incurring the replacement cost to regain that needed volume of storage.
	This site does not address low-pressure issues in the northeast portion of the service area.
	This site would require retaining the present Heller BPS to serve the immediate area, as well as the Redwing BPS to serve the northwest area.
	Usability of water within the reservoirs on this site would remain the same as presently occurs due to the small normal HGL fluctuation in the Anacortes supply.
	The effectiveness of a BPS at this site to address the above issues would require replacements of long segments of smaller lines, or parallel lines running at a higher HGL to move water from east to west, from west to east, and to the northeast.

Based upon these findings, the Heller Road site was eliminated from further consideration.

EAST SIDE RESERVOIR SITE

The East Side Reservoir site was considered only briefly due to its size, location and elevation. Table 11 presents the pros and cons that apply to the East Side Reservoir site.

TABLE 11

East Side Reservoir Site Pros and Cons

Pros	Cons
The city owns the property.	Does not directly address or improve transmission capacity of the system. To the contrary, moving high flows into a reservoir at this site would exacerbate existing issues.
	Could not serve the projected growth area to the southwest.
	Would require major transmission main construction and a BPS to deliver water to any point in the current Mainland Zone of the distribution system, and direct transmission capacity to any other zones, unless additional BPSs were installed.
	The site is too small for the currently needed reservoir, and there is no room for additional facilities in the future.

Based upon these findings, the East Side Reservoir site was eliminated from further consideration.

THE HIGHWAY 20 SITE

The Highway 20 Site (the former Boyer property located at Highway 20 and Fakkema Road) is located well north of the distribution system and at an elevation below that which could be designed to “float on the existing system at the incoming Anacortes HGL. Table 12 presents the pros and cons that apply to the Highway 20 site.

TABLE 12

Highway 20 Site Pros and Cons

Pros	Cons
The city owns the property, outright or in conjunction with Island County.	Does not directly address or improve transmission capacity within the distribution system, most of which is well south of the site.
The site is quite large and could handle future installation of additional storage facilities.	Would require a new BPS facility and transmission main to deliver water back into the Mainland Zone, and the existing BPS facilities to remain as well as the construction of an additional BPS to serve the northeast area, although the latter could be incorporated into this site with the addition of a substantial length of additional transmission main.
	Could not serve the projected growth area to the southwest directly.
	The property cannot be developed for other uses due to the use restrictions associated with NAS flight patterns.

Based upon the above analysis, the Highway 20 Site was dropped from further consideration.

GUN CLUB ROAD SITE

Initial thoughts on the Gun Club Road site were mixed. The area was not well defined initially, so any advantages of the site were not obvious. Additional information obtained from the City and outside sources quickly added to the credibility of the site, particularly when considering the multiple factors identified during the initial analyses. It was also found that by creating a new, higher, 480 feet HGL pressure zone in the northwest portion of the system and along the Heller Road ridge with a BPS at this site, the bulk of the low pressure issues along the ridge can be eliminated, the two existing BPS facilities can be eliminated, and the extension of a transmission line to the southwest area would allow serving the primary growth area as well. This same HGL could be used to serve the northeast area by adding a west to east transmission line to deliver water to the area and isolating that area from the Mainland Zone. This meant that a single BPS at this site could be used to address all of identified deficiencies once the new transmission lines were constructed, and each of the transmission lines would also serve multiple purposes and areas.

After initial discussions with City staff regarding serving the northeast portion of the system from this site, staff asked if it would be possible to serve the NAS need for 3,500 gpm at a location and HGL that would allow delivering that flow to an existing school and future housing area east of the City. This possibility was reviewed and it was found that with the extension of the 480 East Zone to the south along the east edge of the

City, delivery of this flow was, indeed, possible, although it will require extending a 12-inch line along the western edge of the new Zone to isolate it from the Mainland Zone and allow taking advantage of the multiple existing smaller lines in the local distribution system to deliver water from west to east while also maintaining fire flows along those residential streets. Based on this finding, direction was received to include this extension in the planning process.

Table 13 presents the pros and cons that apply to the Gun Club Road site:

TABLE 13

Gun Club Road Site Pros and Cons

Pros	Cons
The City owns the 5-acre parcel, large enough for two reservoirs, and the BPS .	Transmission lines will be required to move water around and through the proposed new higher pressure zone and to the southwest.
The elevation allows placement of the reservoirs and BPS without substantial excavation quantities.	Sizes of proposed transmission lines need to be large enough to minimize head losses over the long distances involved. The total length needed is minimized by locating facilities at this site.
The site is "relatively" close to the existing transmission line between the Ault Field facility and the distribution system.	Creating a higher-pressure zone along the Heller Road ridge will require construction of a new 12-inch waterline to link the Heller Road Reservoirs directly to the Mainland Zone in order to allow it to float on the zone. Without this line, water would have to be pumped out of the reservoirs.
The site can accommodate the incoming Anacortes HGL and the reservoir(s) could "float" partially full on the Mainland Zone.	
The new, higher HGL pressure zone would be sufficiently high to serve the northeast portion of the service area at less cost than currently planned.	
The request from the NAS to provide 3,500 gpm to the east boundary of the service area becomes feasible with the addition of a 12-inch line extension to help move water to that area.	

TABLE 13 – (continued)

Gun Club Road Site Pros and Cons

Pros	Cons
Once the reservoir is built on this site and linked to the incoming main in Oak Harbor Street, the other facilities could be phased to meet the needs of the City and developers.	
The construction of portions of the lines to serve the southwest area can be passed on to developers, since that specific need is based upon future growth in that area and directly to the west, as well.	

THE RECOMMENDED SITE

Based upon the above findings, the Gun Club Road site is recommended as the preferred site. It meets all of the needs of the project and affords the City the basis for improvements in water service pressures to major portions of the system as well as allowing the provision of service to the remaining growth areas.

DISTRIBUTION SYSTEM TRANSMISSION CAPACITY IMPROVEMENTS

Having identified the water system's limited distribution capability to deliver water from north to south, from east to west and from west to east, the challenge became one of identifying what was needed to improve the capacity of the system and a strategy to accomplish the improvements. The keys to the solution were the identification of the Gun Club Road Reservoir Site as the selected alternative, and the understanding of the deficiencies that was developed during the system analysis modeling.

DELIVERY TO THE GUN CLUB ROAD SITE

The Gun Club Road Site is currently not served with water. The City owned property is adjacent to a proposed development that is currently under review by the City. The final routing of the transmission lines to and from the reservoirs will be within the existing easements that are an extension of the Gun Club Road to the west side of the "namesake" Gun Club site adjacent to the property and will ultimately become a right-of-way, and it could either turn north along in the easement adjacent to the west edge of the Gun Club property, or enter the proposed development and run within the proposed roadways to the actual reservoir site. Final routing will be determined at the time of final design and will depend upon the status of the proposed development. Either routing can be accommodated, although initial planning has focused on utilizing the easement route. The locations of these lines and the other proposed transmission improvements are shown in Figure 6.

The flows to be accommodated by the transmission mains that deliver water to and from the reservoir and BPS site must consider the delivery of maximum day demand (MDD) into, and the larger of peak hour demand (PHD) or MDD plus fire flows out of the site. The projected MDD inflow is anticipated to be approximately 4,800 gpm. This rate of flow will require development of a source BPS in the Sharp's Corner area to boost the pressure under high flow conditions to maintain transmission line pressure above the applicable lower pressure limit. In the interim the Ault Field facility will be modified to boost water to the 425-foot HGL of the new reservoir(s). When the new BPS is built at the Gun Club Site, the Ault Field facility may not be needed. Once the Sharp's Corner BPS comes on line to boost the incoming HGL, water will flow directly into the reservoir(s) without further boosting. It is anticipated that boosting the HGL of the incoming water may not be needed under winter operating conditions if the head losses between Oak Harbor Road and the reservoir(s) can be held to a minimum.

The design outflow between the BPS and the end of the combined outflow line delivering water to both the 480 West Zone (which includes supplying the new 420 Zone) and 480 East Zones plus 400 NAS units will be the worst-case combination of the PHD for both areas or the combined MDDs plus the 3,500-gpm fire flow. In this case, the worst case demand would be the total of the system wide MDDs plus the 3,500-gpm fire flow, or 8,400 gpm, based upon the assumption that the new facilities are serving the entire system with the Heller Road facilities off line for some reason. The highest flow to the 480 East Zone plus 400 NAS units is the MDD of approximately 450 gpm plus 3,500-gpm fire flow, or approximately 4,000 gpm. For the 480 West Zone, the maximum flow is approximately 3,300 gpm plus 2,500 gpm fire flow, or 5,800 gpm.

With this in mind, the proposed sizes of the incoming line is 18-inches, with class 52 ductile iron pipe. The outlet line between the BPS and the last common point of the lines to the 480 West and East Zones will be 24-inch to reduce the pipeline velocity to approximately 6.0 feet per second. The pipe line to the West 480 Zone, with a flow of 5,800 gpm, will be 18-inch down to a point just north of the Heller Road Site in order to reduce head losses and maintain the HGL of the 480 West Zone under higher flows. The line to the 480 East Zone will be 18-inch out to the Oak Harbor Road PRV Station, recognizing that this line is pumped from the reservoirs and additional head could be provided, if necessary. Beyond the Oak Harbor Road PRV Station, this line will be 16 inch.

The installation of the new line to the Gun Club Site will include cutting in tees to the 16-inch line in Oak Harbor Road, and installation of a PRV station on the outlet line. The PRV Station will have two PRVs on the 16-inch Oak Harbor Road line to reduce pressure to the Mainland Zone, and one from the outlet line to the Oak Harbor Road line to allow the 480 Zone to supply water to the Mainland Zone under normal operation, but also to allow serving it by gravity from the new reservoir in the interim period until the new BPS is installed.

THE EXTENSION TO THE 480 WEST ZONE

The extension to the 480 West Zone will cross the proposed development in which the new reservoirs are to be located either in new rights-of-way, or in the existing easements along the periphery of the property, to the point that the future lines are installed in existing rights-of-way to reach the intersection of Heller Road and NW 2nd Avenue. Once the connection to the 12-inch line in Heller Road can be made, the initial portion of the new 480 West Zone will be created by isolating it from the Mainland Zone by closing valves and the installation of PRV stations in strategic locations to supplement fire flows in neighborhood areas.

With this initial creation of the 480 West Zone, operation of the two existing BPSs can be discontinued. It will also be possible to begin creating the new 420 Zone, located south of the 480 West Zone and fed from it, by closing valves and installation of PRV stations to isolate it from the Mainland Zone that feeds it now. The PRV stations that intersect with Mainland Zone pipes will be set to allow backflow into the 420 Zone in case of fire flows for the interim period until the full length of the 16-inch transmission line in the 480 West Zone is completed. The proposed location of the new 16-inch line and the 420 Zone are shown schematically in Figure 2.

The major portion of the 480 West Zone transmission line from Heller Road and NW 2nd Avenue will be installed under developer extension agreements as future development occurs. The capacity of the 12-inch line in Heller Road to deliver flow to the southern portion of the 480 West Zone is limited, so even a relatively small level of development will begin taxing its capacity. And since placing the 16-inch line parallel to the existing 12-inch line in Heller Road would not address the projected growth to the west, and is not needed or necessarily desirable when the future 16-inch is installed to the west, the installation of this line will become one of the controlling factors on the order of development to the west and southwest of the City.

THE EXTENSION TO THE 480 EAST ZONE

The extension to the 480 East Zone will be 16-inch beyond the Oak Harbor Road PRV station and will cross from west to the east on the extension of Gun Club Road. An alternative routing is possible, however, this is the favored routing as part of the purpose of the new zone is to address the low-pressure issues in the northeast portion of the City. Once this line is installed, the northeast portion of the City, and the area along the eastern portion of the City will be isolated from the Mainland Zone with the extension of a 12-inch line along the east side of NE O'Leary Street to deliver water to the east-west lines in the residential streets, addressing both the fire flows on those streets and developing the distributed transmission capacity to deliver water to the NAS connection that will allow delivery of fire flows to the school and housing units east of the City. The locations of these lines are shown in Figure 2.

OVERALL PROGRAM OF IMPROVEMENTS

The series of individual projects included in the program of system improvements to ultimately create the new system configuration is shown under the following section, CONCLUSIONS AND RECOMMENDATIONS. The project prioritization has been established by City staff. The linear foot cost for various pipe sizes were established for purposes of creating this estimated total program cost through a process of estimating the cost of design, construction, sales tax, and contingency for 1,000-linear foot segments of ductile iron pipe of each size. The bases of the cost estimates for the various pipe line sizes is provided in Appendix C. The cost of the reservoir, BPS and PRV stations have been based on recent experience on bids received. These costs do not, however, attempt to quantify or adjust for the very recent bidding climate that has resulted from the current economic downturn, as this is likely a short term phenomenon, and to plan based on these results is not considered prudent.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the system analyses performed using the updated computer model, our reviews of each of the pre-identified reservoir sites, the updated reservoir capacity analysis, and the recently identified coordination potential for serving the NAS school and community east of the City, the following conclusions are drawn:

- The Oak Harbor water system currently lacks the transmission capacity to adequately deliver high flow rates to the future growth areas southwest and west of the City and still maintain the minimum required system pressures.

- Any of the preidentified sites considered for locating one or more reservoirs will require construction of at least one additional booster pump station to facilitate the movement of the required fire flows within the system, and one additional booster pump station to address the low pressure area in the northeast portion of the City. With the recommended location and system reconfiguration, one booster pump station can serve both purposes, as well as eliminate two small booster pump stations used to boost pressures for small areas.

- The current total reservoir capacity in the system is marginally sufficient in under DOH guidelines. With the reconfiguration of the system to create higher HGL zones in the west and east, the existing capacity will be deficient. The needed additional storage capacity, including replacing the Eastside Reservoir capacity, is approximately 4.0 MG over the period through 2029 and 7.0 MG at build out. The exact time at which the second reservoir will be needed is dependent upon the rate of growth in the area. Even this volume of additional storage does not relieve the City's vulnerability to a potential longer term interruption of the incoming supply line from the City of Anacortes system, as it provides such a high proportion of the total system demand, and there are few opportunities for development of sufficient local supply to offset this vulnerability unless consideration is given to a very expensive backup capacity that might be provided from a desalination plant.

- By establishing the firm, schematic concept for development of the ultimate transmission conveyance system to serve the southwest portion of the City and its future growth area, and then managing the development of that area in relation to the provision of water service, the City should have the capability to develop sufficient financial capacity to develop the needed system through connection charges and requiring developers to participate in, or install, segments of the new pipe lines. This may present some limitations on the sequence of areas that can be developed and served, however, the orderly development of the various areas may also be enhanced.

It is recommended that the City of Oak Harbor proceed with the overall program of system upgrades in the following manner:

- Project No. 1 – Construct the 18-inch inflow and outflow lines between the point of connection to the existing system in Oak Harbor Road and the Gun Club Road Reservoir Site, a total of approximately 5,800 LF of pipe line, and install the PRV station at Oak Harbor Road to allow readjustment of the incoming line pressure to meet the current Mainland Zone HGL. **Estimated Cost - $2,306,000**.

- Project No. 2 – Construct a new 4.0-MG reservoir at the Gun Club Road Site. The size will be approximately 150 feet in diameter and 30-feet high with a high water operating elevation of 425 feet. **Estimated Cost - $3,100,000**.

- Project No. 3 – Modify the pumping configuration of the Ault Field facility to boost the incoming HGL from Anacortes in order to allow filling of the new reservoir. This would be an interim step that could be omitted if either the booster pump station at the Gun Club Road Site or the new station at Sharps Corner were built first. **Estimated Cost- $300,000**.

- Project No. 4 – Construct the new booster pump station at the new reservoir site in preparation for extension of the west to east transmission line to serve the NAS needs for domestic and fire flow supply at the east edge of the City. This station will include the capability to boost incoming water to the overflow elevation of the reservoir, so, if the Ault Field facility was modified, it could be taken off line when this is complete. **Estimated Cost - $1,900,000**.

- Project No. 5 – Construct the west to east transmission line to create the new 480 East Zone and raise the HGL for the low pressure areas in the northeast portion of the City. **Estimated Cost - $3,160,000**

- Project No. 6 – Construct the remaining portion of the needed transmission improvements, PRV stations and isolation valving, to extend the extent of the 480 East Zone and deliver 3,500 gpm to NAS. **Estimated Cost - $852,000**.

- Project No. 7 – Construct the dedicated line between the Heller Road Reservoir site and the mainland Zone to allow it to be isolated from the new 480 West Zone. **Estimated Cost - $780,000**.

- Project Nos. 8 thru 12 – Construct the various segments of 16-inch transmission lines in sequence to extend the new 480 West Zone to the southwest portion of the system. **Combined Estimated Cost - $9,615,000**.

APPENDIX A

SYSTEM MODELING, CALIBRATION, AND INITIAL ANALYSIS

APPENDIX A

SYSTEM MODELING, CALIBRATION, AND INITIAL ANALYSIS

In order to determine the preferred location for the proposed reservoir, an analysis of the City's water system was necessary to identify the overall capabilities of the system to effectively utilize the additional storage under both current and future demands. This effort was comprised of a series of analyses performed using a computerized model of the system, with individual system components identified and represented by salient characteristics, such as sizes and lengths of pipes, locations and types of control valves, sizes and configuration of reservoirs, and pump characteristics. The City's engineer of record for the 03-WSP, Earth Tech, Inc. had utilized a model using WaterCAD software to analyze the system's capabilities and forecast needed system improvements as part of the process of preparing the 03-WSP. The model used by Earth Tech contained a number of scenarios representing the system at various stages of build out from the current (2003) system to ultimate build out. The need for additional storage was identified in the WSP, and the recommended location was in the south end of the City at Ft. Nugent Park.

WATER MODEL USED AND CONVERSION BETWEEN SOFTWARE SYSTEMS

The City supplied G&O with the electronic files of the computer model used by Earth Tech. The current modeling was performed using H2Onet software, and G&O selected Earth Tech's ultimate build out scenario as the basis for converting the water system model from WaterCAD to H2Onet software. The actual conversion was performed by MWH Soft, Inc., the developers of H2Onet software. The build out scenario was selected for the conversion because it included the future waterlines envisioned by Earth Tech to serve future growth of the system, and distributed future growth in system demands to reflect the City's vision of future growth. With this as a base scenario, the model was easily reconfigured to represent the current system by closure of proposed future lines and elimination of future demands within a new scenario reflective of current conditions.

UPDATING AND CALIBRATING THE MODEL

Once the model conversion was completed, the model was reviewed to compare the model content to information provided by the City, including system maps, updates of system improvements, and sizes and dimensions of reservoirs and major water mains. Once the model was believed to substantially represent the system, model calibration was undertaken.

Model calibration is a process designed to ensure the computer model reflects the actual operating characteristics of the system in the field. This is typically accomplished by releasing large flows from fire hydrants while simultaneously measuring the hydrant flow rate, the residual water pressure at an adjacent point in the system, the current reservoir levels and all incoming flows, in this case the flow coming in from Anacortes. This real world data was then used to make adjustments to the model to cause the model results to reflect the conditions measured in the field under the numerous flow tests that are run as part of the calibration runs. Once the model is calibrated to yield acceptable results, the model can be used to predict how the water system will function at other locations and under other conditions. These results can be based upon the current system, or, with the addition of information on future improvements and demands, the future system.

In order to attain model calibration with reliable results and to ease inputs, a few modifications to the model input were necessary.

REDWING PARK PRESSURE ZONE

The Redwing Park Pressure Zone was originally modeled as a high pressure zone with what appeared to be a fire flow pump pumping into this zone. A PRV with pressures sustaining feature drops water from this pressure zone into the Mainland Zone, however, the PRV was not set to function. The model did not have a jockey pump to feed the zone, and there were no demands in the model in this zone. The fire flow pump was on and operating at 1,219 gpm. We turned the fire flow pump off and substituted a fixed head reservoir with a 1,000-gpm pump that feeds into the zone in order to ensure that adequate residential fire flow will be available in the zone. The model settings and levels for the Redwing Park Booster Station are as follows;

TABLE A-1

Redwing Park Pressure Zone Supply – Model Settings

Reservoir 898	
Type	Fixed Head Reservoir
Hydraulic Grade Line	366 – This setting was in the original model, however this reservoir was inactive.
Pump 905	
Design Flow	1,000 gpm @ 67' Head
Actual Flow	1,219 gpm @ 56' Head
Downstream elev	325'
Downstream HGL	420'
Downstream pressure	41 psi

HELLER ROAD RESERVOIRS

The Heller Road Reservoirs had been modeled as one reservoir instead of two. The reservoir volume and levels appeared to be accurate, and were accepted as adequately representing the facility. The model settings and levels for the Heller Road Reservoir are as follows;

TABLE A-2

Heller Road Reservoirs – Model Settings

Tank 902	
Max. Level	56.5
Min. Level	0
Initial Level	46.5
Base Elev.	349.2
Diameter	88.25
Max Volume	2,585,052
Max Water Elevation	406
Initial Volume	2,127,521
Initial Water Elevation	395.7

HELLER BOOSTER ZONE

The Heller booster zone is modeled as a small pressure zone that is served by a jockey pump outside of the Heller Road Reservoirs. The booster zone has a check valve that allows flow into the booster zone from just outside of the reservoir if the pressure in the zone drops. The model settings and operating conditions of the Heller Booster Station are as follows;

TABLE A-3

Heller Pressure Zone Supply – Model Settings

Pump 904	
Flow	75 gpm @ 101.5' Head

EAST SIDE RESERVOIR

The East Side Reservoir was originally modeled as a reservoir that feeds the downtown pressure zone. The reservoir is filled from the Mainland Zone, with water flowing into the reservoir through a PRV that keeps it from overflowing. The PRV was not active in the original model, so we set the PRV level to 1 foot below the tank overflow level. The tank size was corrected to reflect the actual tank diameter and levels. The revised model settings and levels for the East Side Reservoir are as follows;

TABLE A-4

Eastside Reservoir – Model Settings

Tank 901	
Max. Level	53
Min. Level	0
Initial Level	48.7
Base Elev.	288.5
Diameter	41.5
Max Volume	536,245
Max Water Elevation	342
Initial Volume	492,739
Initial Water Elevation	337.2

CITY OF ANACORTES CONNECTION

The City of Anacortes connection is modeled as a fixed head reservoir with reservoir, HGL levels and water mains as follows:

TABLE A-5

Anacortes Connection "Reservoir" and Supply Line – Model Settings

Reservoir 899	
Fixed Head Reservoir	
Water Surface HGL	404' – This is intended to provide simulation at near the lower limit of the guaranteed HGL at Sharp's Corner.
16" Pipe Length	100'
24" Pipe Length	30,110'
16" Pipe Length	1,760'
24" Pipe Length	31,275'
18" Pipe Length	150'

DOWNTOWN PRESSURE ZONE

The Downtown Pressure Zone is fed through 5 PRV stations, each with a smaller PRV for average demands and a larger PRV for fire flows or high demands. The PRV settings were input to the model to reflect information received from City staff. This included adding the PRV and associated piping at the intersection of SW Barrington Drive and SW Fleet Street, and closing the three additional PRVs on SE O'Leary Street, SE Pasek Street, and SE Quaker Street that were in the model. The settings for the PRVs feeding into the Downtown Pressure Zone are as follows:

Table A-6 – Downtown Zone PRV Supplies - Model Settings

PRV Location	PRV Size (in)	Elev.	Upstream Pressure (psi)	Upstream HGL (ft)	Downstream Pressure (psi)	Downstream HGL (ft)
SE Midway/SE 4th Avenue	8	196	88	399	53	318
SE Midway/SE 4th Avenue	3	196	88	399	58	330
SE Cabot Drive/SR 20	8	145	109	397	75	318
SE Cabot Drive/SR 20	4	145	109	397	80	330
South Oak Harbor Street/SW 3rd Avenue	8	156	105	398	69	315
South Oak Harbor Street/SW 3rd Avenue	3	156	105	398	74	327
SW Barrington Drive/SW Fleet Street	8	188	91	398	54	313
SW Barrington Drive/SW Fleet Street	2	188	91	398	59	324
SR 20/SW Scenic Heights	8	167	96	389	68	324
SR 20/SW Scenic Heights	3	167	96	389	73	335

DISTRIBUTION SYSTEM UPDATES AND MODIFICATIONS

We updated the system piping in the model to reflect information from City staff and the water system base map. These changes include the piping for the Home Depot development off of SE Atlas Street, closing a portion of the failing water main on Oak Harbor Street, adding the piping for the Fairway Point PRD and the Fireside Developments on the SW side of the water system. We did not incorporate any specific additional demands from these new developments, however, as they are assumed to be reflected in the "gross" added demands utilized to project future demands on the system.

APPENDIX B

UPDATED SYSTEM DATA FOR 2001 – 2008
FROM CITY RECORDS

APPENDIX B

UPDATED SYSTEM DATA FOR 2001 – 2008
FROM CITY RECORDS

The following data was received from the City of Oak Harbor. The information was used to update information on the value of the ERU and to establish the total ERU demand for the system, the percentage of water losses and to then make projections of future use. The Value of the ERU has dropped from that established in the 03-WSP, and the reduction in consumption has reduced the size of the required reservoir sizes.

City of Oak Harbor: Water System Profile For The Year 2001

A	SERVICE CHARACTERISTICS	Number		
1	Estimated service population	16,698		
2	Estimated service area (square miles)	4.8 square miles		
3	Miles of mains	87.75 miles		
4	Fire Hydrants	655		
5	Water Storage	3,125,000 gallons		
6	Number of separate water systems serving	3		
7	Interconnection with other systems	3		
B	**ANNUAL WATER SUPPLY**	**Annual volume Gallons**	**Number of intakes or source points**	**Percent metered**
7	Groundwater	1,594,900	3	100%
8	Purchased: treated	823,420,100	2	100%
9	Total annual water supply	825,015,000		
C	**SERVICE CONNECTIONS**	**Connections**		**Percent metered**
10	Residential, single-family	3418		100%
11	Residential, multi-family	603		100%
12	Commercial	530		100%
13	Multi-commercial	97		100%
14	Schools	25		100%
15	Hotel/Motel	11		100%
16	Ind/Church	20		100%
17	Com/Res	14		100%
18	Irrigation	79		100%
19	Fire Sprinkler	81		
20	Navy	6		100%
21	Total connections	4884		98%
D	**WATER DEMAND**	**Annual volume Gallons**	**Percent of total**	**Gallons per connection**
19	Residential sales	231,853,396	47%	6,783
20	Multi-residential sales	137,848,647	28%	22,860
21	Commercial	55,296,560	11%	104,333
22	Multi-commercial	16,604,080	3%	171,176
23	Schools	10,082,892	2%	403,315
24	Hotel/Motel	9,242,776	2%	840,252
25	Ind/Church	2,426,836	.02%	121,341

26	Com/Res	598,480	.01%	42,748
27	Irrigation	22,574,666	5%	285,755
29	**UNACCOUNTED WATER**	**20,061,117**	**2.01%**	
30	City total system demand (total use)	490,806,715	59.49%	
31	Navy total system demand (total use)	314,147,168	38.36%	
32	Navy and City total system demand (total use) including Navy	825,015,000		
E	**AVERAGE & PEAK DEMAND**	**Volume**	**Total supply capacity**	**Percent of total capacity**
33	City average-day demand	1,399,638	3,000,000	47%
34	Average-day demand including Navy	2,260,315		
35	City highest daily use (August 11)	2,127,000	3000,000	71%
36	City average-day demand per capita	60		

City of Oak Harbor: Water System Profile For The Year 2002

A	SERVICE CHARACTERISTICS	Number		
1	Estimated service population	18,880		
2	Estimated service area (square miles)	4.8 square miles		
3	Miles of mains	89.75 miles		
4	Fire Hydrants	683		
5	Water Storage	3,125,000 gallons		
6	Number of separate water systems serving	3		
7	Interconnection with other systems	3		
B	**ANNUAL WATER SUPPLY**	**Annual volume Gallons**	**Number of intakes or source points**	**Percent metered**
7	Groundwater	1,116,500	3	100%
8	Purchased: treated	839,867,100	2	100%
9	Total annual water supply	840,983,600		
C	**SERVICE CONNECTIONS**	**Connections**		**Percent metered**
10	Residential, single-family	3567		100%
11	Residential, multi-family	617		100%
12	Commercial	624		100%
13	Multi-commercial	96		100%
14	Schools	23		100%
15	Hotel/Motel	11		100%
16	Ind/Church	20		100%
17	Com/Res	14		100%
18	Irrigation	81		100%
19	Fire Sprinkler	85		
20	Navy	6		100%
21	Total connections	5144		100%
D	**WATER DEMAND**	**Annual volume Gallons**	**Percent of total**	**Gallons per connection**
19	Residential sales	235,678,432	46%	68,421
20	Multi-residential sales	136,152,704	26%	220,679
21	Commercial	55,610,762	11%	891,209
22	Multi-commercial	17,566,884	3%	182,988
23	Schools	1,487,824	2%	499,471
24	Hotel/Motel	11,086,094	2%	1,007,827
25	Ind/Church	2,212,880	.02%	110,644

26	Com/Res	4,744,450	.01%	338,889
27	Irrigation	25,591,753	5%	315,948
29	**UNACCOUNTED WATER**	**37,289,870**	**4.3%**	
30	City total system demand (total use)	515,867,000	59.49%	
31	Navy total system demand (total use)	339,331,200	39.7%	
32	Navy and City total system demand (total use) including Navy	855,198,200	100%	
E	**AVERAGE & PEAK DEMAND**	**Volume**	**Total supply capacity**	**Percent of total capacity**
33	City average-day demand	1,366,000	3,125,000	44%
34	Average-day demand including Navy	2,295,845		
35	City highest daily use (June 14)	2,540,000	3,125,000	81%
36	Residential City gpcd	64		
37	Commercial City gped	52		

City of Oak Harbor: Water System Profile for the Year 2003

A	SERVICE CHARACTERISTICS	Number		
1	Estimated population	20,570		
2	Estimated Navy population	3,229		
3	Estimated City population	17,341		
4	Estimated service area (square miles)	4.8 square miles		
5	Miles of mains	90.23 miles		
6	Fire Hydrants	721		
7	Approved backflow prevention device	474		
8	Water valves	2,139		
9	Water Storage	3,125,000 gallons		
10	Number of separate water systems serving	3		
11	Interconnection with other systems	3		
B	**ANNUAL WATER SUPPLY**	**Annual volume gallons**	**Number of intakes or source points**	**Percent metered**
12	Groundwater	1,815,500	3	100%
13	Purchased: treated	930,335,456	2	100%
14	Total annual water supply	932,150,956		
15	Total annual metered consumption	901,327,371		
16	Total gallons loss	30,823,585		
17	Unaccounted water	3.3%		
C	**SERVICE CONNECTIONS**	**Connections**		**Percent metered**
18	Residential, single-family	3709		100%
19	Residential, multi-family	623		100%
20	**Total residential connections**	**4332**		
21	Commercial	760		100%
22	Multi-commercial	95		100%
23	Schools	23		100%
24	Hotel/Motel	11		100%
25	Ind/Church	20		100%
26	Com/Res	14		100%
27	Irrigation	81		100%
28	Fire Sprinkler	85		
29	Navy	6		100%
30	**Total commercial connection**	**1095**		

31	Total connections	5427		100%
D	**WATER DEMAND**	**Annual volume gallons**	**Percent of total**	
32	Residential demand	253,774,223	47.9%	
33	Multi-residential demand	132,985,997	25.1%	
34	**Total residential demand**	**386,760,220**	**73%**	
35	Commercial	60,281,150	11.4%	
36	Multi-commercial	17,118,772	3.2%	
37	Schools	12,745,380	2.4%	
38	Hotel/Motel	10,284,131	1.9%	
39	Ind/Church	2,415,615	.05%	
40	Com/Res	5,285,327	.01%	
41	Irrigation	34,613,091	6.5%	
42	**Total commercial demand**	**142,743,466**	**25.5%**	
43	City total system demand (total use)	529,503,684	56.9%	
44	Navy total system demand (total use)	384,059,000	41.3%	
45	Navy and City total system demand (total use)	930,721,700	100%	
E	**AVERAGE & PEAK DEMAND**	**Volume gallons**	**Total supply capacity**	**Percent of total capacity**
46	City average-day demand	1,450,695	3,125,000	46%
47	Average-day demand including Navy	2,549,922		
48	City highest daily use (July 21,2003)	2,900,000	3,125,000	93%
49	Residential City gpcd	61		
50	Commercial City gped (population/employees 7,260)	54		

City of Oak Harbor: Water System Profile for the Year 2004

A	**SERVICE CHARACTERISTICS**	**Number**		
1	Estimated population	20,890		
2	Estimated Navy population	4,827		
3	Estimated City population	17,341		
4	Estimated service area (square miles)	4.8 square miles		
5	Miles of mains	90.23 miles		
6	Fire Hydrants	721		
7	Approved backflow prevention device	540		
8	Water valves	2,139		
9	Water Storage	3,125,000 gallons		
10	Number of separate water systems serving	3		
11	Interconnection with other systems	3		
B	**ANNUAL WATER SUPPLY**	**Annual volume gallons**	**Number of intakes or source points**	**Percent metered**
12	Groundwater	1,621,500	3	100%
13	Purchased: treated	907,106,400	2	100%
14	Total annual water supply	908,727,900		
15	Total annual metered consumption	881,977,788		
16	Total gallons loss	26,750,112		
17	Unaccounted water	3%		
C	**SERVICE CONNECTIONS**	**Connections**		**Percent metered**
18	Residential, single-family	3854		100%
19	Residential, multi-family	683		100%
20	**Total residential connections**	**4537**		
21	Commercial	717		100%
22	Multi-commercial	97		100%
23	Schools	23		100%
24	Hotel/Motel	11		100%
25	Ind/Church	22		100%
26	Com/Res	14		100%
27	Irrigation	88		100%
28	Fire Sprinkler	90		
29	Navy	6		100%
30	**Total commercial connection**	**1068**		

31	Total connections	5605		100%
D	**WATER DEMAND**	**Annual volume gallons**	**Percent of total**	
32	Residential demand	266,348,287	50.3%	
33	Multi-residential demand	129,673,410	24.4%	
34	**Total residential demand**	**396,021,697**	**74.7%**	
35	Commercial	62,696,017	11.8 %	
36	Multi-commercial	17,018,527	3.2%	
37	Schools	10,780,869	2.4%	
38	Hotel/Motel	9,332,548	1.9%	
39	Ind/Church	2,565,983	.05%	
40	Com/Res	4,842,451	.01%	
41	Irrigation	30,764,116	6.5%	
42	**Total commercial demand**	**142,141,994**	**26.9%**	
43	City total system demand (total use)	535,750,296	56.9%	
44	Navy total system demand (total use)	346,205,787	41.3%	
45	Navy and City total system demand (total use)	881,956,083	100%	
E	**AVERAGE & PEAK DEMAND**	**Volume gallons**	**Total supply capacity**	**Percent of total capacity**
46	City average-day demand	1,450,695	3,125,000	46%
47	Average-day demand including Navy	2,549,922		
48	City highest daily use (July 21,2003)	2,900,000	3,125,000	93%
49	Residential City gpcd	61		
50	Commercial City gped (population/employees 7,260)	54		

City of Oak Harbor: Water System Profile for the Year 2005

A	SERVICE CHARACTERISTICS	Number		
1	Estimated population	21,720		
2	Estimated Navy population	4,827		
3	Estimated City population	17,341		
4	Estimated service area (square miles)	4.851 square miles		
5	Miles of mains	94.70 miles		
6	Fire Hydrants	755		
7	Approved backflow prevention device	600		
8	Water valves	2,239		
9	Water Storage	3,150,000 gallons		
10	Number of separate water systems serving	3		
11	Interconnection with other systems	3		
B	**ANNUAL WATER SUPPLY**	**Annual volume gallons**	**Number of intakes or source points**	**Percent metered**
12	Groundwater	1,987,378	3	100%
13	Purchased: treated	860,793,958	2	100%
14	Total annual water supply	862,781,336		
15	Total annual metered consumption	872,413,374		
16	Total gallons loss	-9,632,038		
17	Unaccounted water	-1.12%		
C	**SERVICE CONNECTIONS**	**Connections**		**Percent metered**
18	Residential, single-family	4030		100%
19	Residential, multi-family	784		100%
20	**Total residential connections**	**4814**		
21	Commercial	567		100%
22	Multi-commercial	95		100%
23	Schools	23		100%
24	Hotel/Motel	11		100%
25	Ind/Church	22		100%
26	Com/Res	14		100%
27	Irrigation	95		100%
28	Fire Sprinkler	91		
29	Navy	6		100%
30	**Total commercial connection**	**920**		

31	Total connections	5738		100%
D	**WATER DEMAND**	**Annual volume gallons**		
32	Residential demand	249,374,646		
33	Multi-residential demand	152,169,525		
34	**Total residential demand**	**401,544,171**		
35	Commercial	75,585,780		
36	Multi-commercial	18,998,748		
37	Schools	12,562,095		
38	Hotel/Motel	9,420,823		
39	Ind/Church	2,609,373		
40	Com/Res	4,671,885		
41	Irrigation	30,945,905		
42	**Total commercial demand**	**154,794,609**		
43	City total system demand (total use)	556,471,828		
44	Navy total system demand (total use)	315,941,546		
45	Navy and City total system demand (total use)	872,413,374		
E	**AVERAGE & PEAK DEMAND**	**Volume gallons**	**Total supply capacity**	**Percent of total capacity**
46	City average-day demand	1,528,410	3,150,000	46%
47	Average-day demand including Navy	2,628,410		
48	City highest daily use (July 21,2003)	2,665,564	3,150,000	93%
49	Residential City gpcd	61		
50	Commercial City gped (population/employees 7,260)	54		

City of Oak Harbor: Water System Profile for the Year 2006

A	SERVICE CHARACTERISTICS	Number		
1	Estimated population	22,309		
2	Estimated Navy population	4,900		
3	Estimated City population	17,390		
4	Estimated service area (square miles)	4.874 square miles		
5	Miles of mains	98.73 miles		
6	Fire Hydrants	791		
7	Approved backflow prevention device	717		
8	Water valves	2,239		
9	Water Storage	3,150,000 gallons		
10	Number of separate water systems serving	3		
11	Interconnection with other systems	3		
B	**ANNUAL WATER SUPPLY**	**Annual volume gallons**	**Number of intakes or source points**	**Percent metered**
12	Groundwater	4,328,349	3	100%
13	Purchased: treated	868,328,688	2	100%
14	Total annual water supply	872,657,037		
15	Total annual metered consumption	761,613,841		
16	Total gallons loss	111,043,196		
17	Unaccounted water	12.72%		
C	**SERVICE CONNECTIONS**	**Connections**		**Percent metered**
18	Residential, single-family	4100		100%
19	Residential, multi-family	724		100%
20	**Total residential connections**	**4824**		
21	Commercial	474		100%
22	Multi-commercial	97		100%
23	Schools	24		100%
24	Hotel/Motel	11		100%
25	Ind/Church	23		100%
26	Com/Res	14		100%
27	Irrigation	99		100%
28	Fire Sprinkler	94		
29	Navy			100%

30	**Total commercial connection**	**842**		
31	Total connections	5,666		100%
D	**WATER DEMAND**	**Annual volume gallons**		
32	Residential demand	212,402,048		
33	Multi-residential demand	120,233,884		
34	**Total residential demand**	**332,635,932**		
35	Commercial	60,468,923		
36	Multi-commercial	18,036,691		
37	Schools	8,661,502		
38	Hotel/Motel	10,203,336		
39	Ind/Church	3,061,973		
40	Com/Res	5,110,271		
41	Irrigation	33,870,228		
42	**Total commercial demand**	**139,412,924**		
43	City total system demand (total use)	477,539,311		
44	Navy total system demand (total use)	284,074,530		
45	Navy and City total system demand (total use)	761,613,841		
E	**AVERAGE & PEAK DEMAND**	**Volume gallons**	**Total supply capacity**	**Percent of total capacity**
46	City average-day demand	1,566,677	3,150,000	46%
47	Average-day demand including Navy	2,390,841		
48	City highest daily use (July 21,2003)	2,869,733	3,150,000	93%
49	Residential City gpcd	61		
50	Commercial City gped (population/employees 7,260)	54		

City of Oak Harbor: Water System Profile for the Year 2007

A	SERVICE CHARACTERISTICS	Number		
1	Estimated population	22,290		
2	Estimated Navy population	4,900		
3	Estimated City population	17,390		
4	Estimated service area (square miles)	4.874 square miles		
5	Miles of mains	97.98 miles		
6	Fire Hydrants	807		
7	Approved backflow prevention device	749		
8	Water valves	2,239		
9	Water Storage	3,150,000 gallons		
10	Number of separate water systems serving	3		
11	Interconnection with other systems	3		
B	**ANNUAL WATER SUPPLY**	**Annual volume gallons**	**Number of intakes or source points**	**Percent metered**
12	Groundwater	3,013,797	3	100%
13	Purchased: treated	877,027,880	2	100%
14	Total annual water supply	880,041,677		
15	Total annual metered consumption	895,467,867		
16	Total gallons loss	-15,426,120		
17	Unaccounted water	-1.75%		
C	**SERVICE CONNECTIONS**	**Connections**		**Percent metered**
18	Residential, single-family	4204		100%
19	Residential, multi-family	734		100%
20	**Total residential connections**	**4938**		
21	Commercial	407		100%
22	Multi-commercial	97		100%
23	Schools	24		100%
24	Hotel/Motel	10		100%
25	Ind/Church	24		100%
26	Com/Res	13		100%
27	Irrigation	102		100%
28	Fire Sprinkler	103		
29	Navy	1		100%

30	**Total commercial connection**	**781**		
31	Total connections	5,719		100%
D	**WATER DEMAND**	**Annual volume gallons**		
32	Residential demand	232,089,048		
33	Multi-residential demand	121,225,116		
34	**Total residential demand**	**353,314,164**		
35	Commercial	68,273,102		
36	Multi-commercial	18,794,516		
37	Schools	19,575,533		
38	Hotel/Motel	10,634,242		
39	Ind/Church	2,728,321		
40	Com/Res	4,838,711		
41	Irrigation	36,495,310		
42	**Total commercial demand**	**161,339,735**		
43	City total system demand (total use)	613,470,428		
44	Navy total system demand (total use)	281,997,439		
45	Navy and City total system demand (total use)	895,467,867		
E	**AVERAGE & PEAK DEMAND**	**Volume gallons**	**Total supply capacity**	**Percent of total capacity**
46	City average-day demand	1,680,741	3,150,000	
47	Average-day demand including Navy	2,453,337		
48	City highest daily use (July 12,2007)	2,753,858	3,150,000	
49	Residential City gpcd	61		
50	Commercial City gped (population/employees 7,260)	54		

City of Oak Harbor: Water System Profile for the Year 2008

A	SERVICE CHARACTERISTICS	Number		
1	Estimated population	22,980		
2	Estimated Navy population	4,900		
3	Estimated City population	18,080		
4	Estimated service area (square miles)	4.889 square miles		
5	Miles of mains	99.44 miles		
6	Fire Hydrants	836		
7	Approved backflow prevention device	820		
8	Water valves	2,239		
9	Water Storage	3,150,000 gallons		
10	Number of separate water systems serving	3		
11	Interconnection with other systems	3		
B	**ANNUAL WATER SUPPLY**	**Annual volume gallons**	**Number of intakes or source points**	**Percent metered**
12	Groundwater	3,251,138	3	100%
13	Purchased: treated	806,231,456	2	100%
14	Total annual water supply	809,482,594		
15	Total annual metered consumption	752,827,466		
16	Total gallons loss	56,655,128		
17	Unaccounted water	7.00%		
C	**SERVICE CONNECTIONS**	**Connections**		**Percent metered**
18	Residential, single-family	4160		100%
19	Residential, multi-family	752		100%
20	**Total residential connections**	**4,912**		
21	Commercial	367		100%
22	Multi-commercial	96		100%
23	Schools	24		100%
24	Hotel/Motel	10		100%
25	Ind/Church	23		100%
26	Com/Res	14		100%
27	Irrigation	107		100%
28	Fire Sprinkler	107		
29	Navy	1		100%

30	**Total commercial connection**	**749**		
31	Total connections	5,661		100%
D	**WATER DEMAND**	**Annual volume gallons**		
32	Residential demand	228,038,086		
33	Multi-residential demand	118,202,044		
34	**Total residential demand**	**346,240,130**		
35	Commercial	56,196,524		
36	Multi-commercial	18,178,830		
37	Schools	12,794,006		
38	Hotel/Motel	10,367,170		
39	Ind/Church	2,350,530		
40	Com/Res	4,805,046		
41	Irrigation	27,675,211		
	Hydrant Meters			
42	**Total commercial demand**	**133,519,297**		
43	City total system demand (total use)	479,759,428		
44	Navy total system demand (total use)	275,404,400		
45	Navy and City total system demand (total use)	755,163,828		
E	**AVERAGE & PEAK DEMAND**	**Volume gallons**	**Total supply capacity**	**Percent of total capacity**
46	City average-day demand	1,470,937	3,150,000	46.69%
47	Average-day demand including Navy	2,217,761		
48	City highest daily use (8/16/08)	2,400,056	3,150,000	76.19%
49	Residential City gpcd	61		
50	Commercial City gped (population/employees 7,260)	54		

City of Oak Harbor Water System ERU Calculations and Demand Growth Projections

Year	2001	2002	2003	2004	2005	2006	2007	2008
Number Of Days In Year	365	365	365	366	365	365	365	366
Water Produced / Purchased - Gal.	825,015,000	840,983,600	932,150,956	908,727,900	862,781,336	872,657,037	880,041,677	809,482,594
Number of SFR Connections	3,418	3,567	3,709	3,854	4,030	4,100	4,204	4,160
SFR Consumption - Gal.	231,853,396	235,678,432	253,774,223	266,348,287	249,374,646	212,402,048	232,089,048	228,038,086
Total Unaccounted Water - Gal	20,061,117	37,289,870	30,823,585	26,750,112	(9,632,038)	111,043,196	(15,426,120)	56,655,128
Total City Demand - Gal	490,806,715	515,867,000	529,503,684	535,750,296	556,471,828	477,539,311	613,470,428	479,759,428
Total Navy Demand - Gal	314,147,168	339,331,200	384,059,000	346,205,787	315,941,546	284,074,530	281,997,439	275,404,400
City ADD - Incl Losses	1,399,368	1,366,000	1,450,695	1,450,695	1,528,410	1,566,677	1,680,741	1,470,937
City MDD - Incl Losses	2,127,000	254,000	2,900,000	2,900,000	2,665,564	2,869,733	2,753,858	2,400,056
ERU Value - GPD/ERU	186	181	187	189	170	142	151	150
Total City Non-SFR Consumption - Gal.	258,953,319	280,188,568	275,729,461	269,402,009	307,097,182	265,137,263	381,381,380	251,721,342
Total City Non-SFR ERUs	3,818	4,241	4,030	3,898	4,963	5,118	6,908	4,592
Total ERUs	7,236	7,808	7,739	7,752	8,993	9,218	11,112	8,752
% Unmetered/ Unaccounted For	3.9%	6.7%	5.5%	4.8%	-1.8%	18.9%	-2.6%	10.6%
Ratio MDD/ADD	1.52	0.19	2.00	2.00	1.74	1.83	1.64	1.63
Rolling 5-Yr Ave of ERU					182.5	173.8	167.8	160.3
Rolling 5-Yr Ave of MDD/ADD					1.49	1.55	1.84	1.77

Year	2001	2002	2003	2004	2005	2006	2007	2008
Rolling 5-Yr Ave of % Losses					3.8%	6.8%	5.0%	5.97%
Annual % Increase In ERUs		7.9%	-0.9%	0.2%	16.0%	2.5%	20.6%	-21.2%
Rolling 5-Yr Ave. Incr In ERUs						5.1%	7.7%	3.6%
Total Growth Over last 7 Years								21.0%
Ave Growth over last 7 Years								3.0%

APPENDIX C

PIPELINE COST ESTIMATES

APPENDIX C

PIPELINE COST ESTIMATES

The following tables present the cost estimating basis for various sizes of ductile iron pipe.

APPENDIX G

CROSS-CONNECTION CONTROL PLAN

CITY OF
Oak Harbor
WHIDBEY ISLAND, WASHINGTON

Cross Connection Control Program Summary

The City of Oak Harbor has the responsibility to protect the public water system from contamination due to cross connections. A cross connection may be defined as *"any actual or potential connection between a potable water line and any pipe, vessel, or machine that contains or has the probability of containing a non-potable gas or liquid, such that it is possible for a non-potable gas or liquid to enter the potable water system by backflow."*

All public water systems are required to develop and implement CCC programs. The CCC requirements are contained in Washington Administrative Code 246-290-490 of the Group A Drinking Water Regulations. The minimum required elements of a CCC program are:

1. Establishment of a legal authority and program policies;
2. Evaluation of premises for cross-connection hazards;
3. Elimination and/or control of cross connections;
4. Provision of qualified staff;
5. Inspection and testing of backflow preventers;
6. Quality control of testing process;
7. Response to backflow incidents;
8. Public education for consumers;
9. Record keeping for CCC program; and
10. Special requirements for reclaimed water use.

The Oak Harbor City Council on April 4, 2006 adopted Ordinance No. 1456 amending Chapter 13.13 of the Oak Harbor Municipal Code, reproduced as Appendix A, which authorizes the Purveyor to implement a CCC Program. This Code also authorizes the Purveyor to terminate water service to consumers who do not comply with the ordinance. However, the primary method for protection of the public water system will be the installation of a backflow preventer by the customer at the customer's expense.

Cross Connection Control Program Activities

The following items are activities that have been conducted by the City of Oak Harbor's CCC Program since 2009:

- The program monitors approximately 1,000 backflow assemblies per year. Monitoring includes mailing letters to customers requiring an annual test of the backflow assembly and then entering data into our backflow software (Tokay) to track results, failures, and upkeep of each of the assemblies. Also, second and third notices are sent to customers who do not comply with the first letter.

- 2009 – The CCC program staff conducted re-evaluations of all Table 9 facilities (Table 9 is a Department of Health list of high hazard facilities requiring mandatory premise isolation).
- 2009 – The program, in conjunction with meter readers, evaluated residential properties for irrigation systems.
- 2010 – The program implemented a CCC backflow software program (Tokay) to streamline our backflow tracking. We also linked our backflow software (Tokay) to our billing software (Eden) for active mailing address updating. This dramatically cut down on returned mail and increased our response to letters.
- 2011 – The program conducted an educational workshop for property managers and landscapers.
- 2012 – The program conducted a presentation on local Channel 10 educating customers on the water system and CCC Program.
- 2012 – The program started to re-evaluate commercial facilities with no premise isolation and get the facility evaluations into the Tokay software program so that we can track re-evaluations into the future.
- 2013 – The program sent letters and started to re-evaluate existing Table 9 exceptions and renew the exceptions as deemed appropriate.

Cross Connection Control Program Goals

The following items are future goals of the Cross Connection Control Program:

2015

- Inspect and reevaluate all assemblies not tested since 2009 and remove inactive assemblies.
- Re-evaluate all Table #9 facilities.
- Implement a *"written"* agreement between the City of Oak Harbor Building Division, as the authority having jurisdiction, and the City of Oak Harbor Water Division CCC Program.

2016 (NW Quadrant)

- Evaluate commercial properties without premise isolation and place them on a CCC survey schedule through the CCC Tokay software program. If high hazard exists, require owner to install appropriate Cross Connection Control.
- Evaluate residential systems with special plumbing and premise isolation.
- Send out questionnaires to residential customers with no known special plumbing.

2017 (SE Quadrant)

- Evaluate commercial properties without premise isolation and place them on a CCC survey schedule through the CCC Tokay software program. If high hazard exists, require owner to install appropriate Cross Connection Control.
- Evaluate residential systems with special plumbing and premise isolation.
- Send out questionnaires to residential customers with no known special plumbing.

2018 (SW Quadrant)

- Evaluate commercial properties without premise isolation and place them on a CCC survey schedule through the CCC Tokay software program. If high hazard exists, require owner to install appropriate Cross Connection Control.
- Evaluate residential systems with special plumbing and premise isolation.
- Send out questionnaires to residential customers with no known special plumbing.
- Evaluate the current Cross Connection Control Plan.

2019 (NE Quadrant)

- Evaluate commercial properties without premise isolation and place them on a CCC survey schedule through the CCC Tokay software program. If high hazard exists, require owner to install appropriate Cross Connection Control.
- Evaluate residential systems with special plumbing and premise isolation.
- Send out questionnaires to residential customers with no known special plumbing.

2020 (NW Quadrant)

- Evaluate commercial properties without premise isolation and place them on a CCC survey schedule through the CCC Tokay software program. If high hazard exists, require owner to install appropriate Cross Connection Control.
- Evaluate residential systems with special plumbing and premise isolation.
- Send out questionnaires to residential customers with no known special plumbing.

Every Year

- Complete CCC surveys for new construction/new occupancy accounts as well as scheduled surveys.
- Continue to implement Cross Connection Control public education.
- Re-evaluate Table 9 exceptions.

CROSS CONNECTION CONTROL

PROGRAM, ORDINANCE AND APPENDICES

865 S.E. Barrington Drive ● Oak Harbor, Washington 98277-4092 ● City Hall (360) 279-4500

CITY OF OAK HARBOR
CROSS CONNECTION CONTROL PROGRAM PLAN

TABLE OF CONTENTS

CROSS CONNECTION CONTROL PROGRAM PLAN

Cross-Connection Control Program Plan
For City of Oak Harbor Water System

A. Requirement for Program

<u>City of Oak Harbor, 62650-C</u>, hereinafter referred to as "the Purveyor", has the responsibility to protect the public water system from contamination due to cross connections. A cross connection may be defined as *"any actual or potential physical connection between a potable water line and any pipe, vessel, or machine that contains or has a probability of containing a non-potable gas or liquid, such that it is possible for a non-potable gas or liquid to enter the potable water system by backflow."*

All public water systems are required to develop and implement cross-connection control (CCC) programs. The CCC requirements are contained in Washington Administrative Code (WAC) 246-290-490 of the Group A Drinking Water Regulations. The minimum required elements of a CCC program are:

1. Establishment of legal authority and program policies;
2. Evaluation of premises for cross-connection hazards;
3. Elimination and/or control of cross connections;
4. Provision of qualified personnel;
5. Inspection and testing of backflow preventers;
6. Quality control of testing process;
7. Response to backflow incidents;
8. Public education for consumers;
9. Record keeping for CCC program; and
10. Special requirements for reclaimed water use.

Other CCC program requirements include:

1. Coordination with the Local Administrative Authority (LAA), i.e., the local building or plumbing official regarding CCC activities;
2. Prohibition of the return of used water into the public water system (PWS) distribution system; and
3. Inclusion of a written CCC program in a Water System Plan (WSP) or a Small Water System Management Program (SWSMP).

Note: Throughout the CCC program plan the term *customer* is used. *Customer* as used herein means the property owner and/or occupant of the premises served by the PWS (i.e., whoever interfaces with the PWS regarding water service). Also, unless otherwise defined, all CCC-related terms used in this program have the same definitions as those contained in WAC 246-290-010 of the Washington State Drinking Water Regulations.

B. Program Objectives

The objectives of the CCC program are to:

1. Reasonably reduce the risk of contamination of the public water distribution system;
2. Reasonably reduce the Purveyor's exposure to legal liability arising from the backflow of any contaminant originating from the customer's plumbing system and then supplied to other customers; and
3. Cooperate with the LAA by joint operation of program administrative tasks.

C. Summary of Program Decisions

The following table summarizes the major policy and program decisions adopted for the **City of Oak Harbor** water system. The items in the table represent CCC program areas that have more than one acceptable approach or option.

CCC Program Decision Summary Table for the City of Oak Harbor

Decision Item	Decision
1. Type of Program [General, WAC 246-290-490(2)(e)]	
a. Premises isolation only	
b. Premises isolation and in-premises protection (combination program)	X
2. Extent of Coordination with LAA [WAC 246-290-490(2)(d)]	
a. Information exchange	
b. Interaction	
c. Joint program	X
3. Relationship with Customer [Element 1]	
a. Signed service agreement or contract	
b. Ordinance/resolution; implied service agreement	X
4. Enforcement of Corrective Action [Element 1]	
a. Rely upon shut-off of water service	X
b. Rely upon Purveyor-installed premises isolation	
5. Assessment and Re-assessment of Hazard [Element 2]	
a. By Purveyor's staff or equivalent	X
b. By cross-connection control specialist (CCS) employed by customer; report reviewed by Purveyor's CCS	X
6. Location and Ownership of Premises Isolation Assembly [Element 3]	
a. On Purveyor's service line	
b. On customer's service line	X
7. CCS Option – Purveyor's Program Management [Element 4]	
a. Purveyor's staff member certified	X
b. Inter-agency agreement or use other agency's CCS	
c. Contract with consultant CCS	
8. Testing of Assemblies [Element 5]	
a. By Purveyor's staff or Purveyor-employed backflow assembly tester (BAT)	
b. By customer-employed (contractor – BAT)	X
9. Cost Recovery [WAC 246-290-100(4)(h) and –105(4)(p)]	
a. Borne by all customers (general water rates)	X
b. Assessed to specific class (commercial meters)	
c. Each customer directly bears cost	

D. Required Elements of Program

The drinking water regulations for Group A public water systems in Washington, WAC 246-290, require CCC programs to include certain minimum elements. The elements are listed in WAC 246-290-490(3). This section describes how the water system intends to comply with each of the required program elements. Elements are numbered the same as they appear in the WAC.

Element 1: *Adoption of a written legal instrument authorizing the establishment and implementation of a CCC program.*

The **City of Oak Harbor** water system has amended Ordinance No. 1456 (Chapter 13.13 of the Oak Harbor Municipal Code), reproduced as (Appendix A), which authorizes the Purveyor to implement a CCC program. The ordinance also authorizes the system to terminate water service to consumers who do not comply with the ordinance. However, the primary method for protection of the distribution system will be the installation of a backflow preventer by the customer, at the customer's expense.

For customers supplied prior to the adoption of the attached Ordinance, an implied service contract allows the Purveyor to protect the distribution system from contamination through a Purveyor-installed backflow preventer on a customer's service, at the customer's expense.

The written and implied contract terms are discussed further under Element 3.

Element 2: *Development and implementation of procedures and schedules for evaluating new and existing service connections to assess the degree of hazard.*

Initial Cross-Connection Hazard Surveys

The procedures for evaluating the backflow prevention requirements for new and existing customers are as follows:

1. For all ***new non-residential services***, the Purveyor will require that the customer submit with the application for water service an evaluation (appendix B) (performed at customer's expense) by a DOH-certified cross-connection control specialist (CCS) of the hazard posed by the proposed plumbing system, with recommendations for the installation at the meter of either a double-check valve assembly (DCVA) or a reduced-pressure principle backflow assembly (RPBA), or commensurate in-premises backflow preventers. The Purveyor may accept the recommendations or submit the recommendations to a CCS employed by the PWS for peer review and concurrence, before acceptance.

   As an alternative to the above requirement for a survey by a DOH-certified CCS, the Purveyor, at his/her discretion may specify the backflow preventer required to be installed as a condition of service.

   As an alternative to the above requirement for a survey by a DOH-certified CCS, the customer may agree to install an approved air gap (AG) or RPBA for premises isolation as a condition of service.

2. For all ***new residential services***, the Purveyor will require that the customer submit with the application for water service a completed "Water Use Questionnaire". If the customer's questionnaire indicates special plumbing, such as a lawn sprinkler system, or hazardous water use on the premises, the customer shall submit to the Purveyor an evaluation by a DOH-certified CCS of the hazard posed by the proposed special plumbing system, with recommendations for the installation at the meter of either a DCVA or an RPBA or commensurate in-premises protection.

   As an alternative to the above requirement for a survey by a DOH-certified CCS, the Purveyor, at his/her discretion may specify the backflow preventer required to be installed as a condition of service.

   As an alternative to the above requirement for a survey by a CCS, the customer may agree to install an approved air gap (AG) or RPBA for premises isolation as a condition of service.

3. For all ***existing non-residential services***, the Purveyor will require the customer to submit to the Purveyor, within nine months of notification, an evaluation by a DOH-certified CCS, of the hazard posed by the plumbing system, with recommendations for the installation at the meter of either a DCVA, an RPBA or commensurate in-premises backflow preventers. The Purveyor may accept the recommendations or submit the recommendations to a CCS employed by the Purveyor for peer review and concurrence, before acceptance.

   As an alternative to the above requirement for a survey by a DOH-certified CCS, the Purveyor, at his/her discretion may specify the backflow preventer required to be installed as a condition of service.

   As an alternative to the above requirement for a survey by a DOH-certified CCS, the customer may agree to install an AG or RPBA for premises isolation within 90 days of notification by the Purveyor or an alternate time period acceptable to the Purveyor.

4. For all ***existing residential services***, the Purveyor will require the customer to submit to the Purveyor, within four months of notification, a completed "Water Use Questionnaire." If the customer's reply indicates special plumbing or water use on the premises, the customer shall submit an evaluation by a DOH-certified CCS of the hazard posed to the water system by the customer's plumbing system, with recommendations for the installation at the meter of either a DCVA or an RPBA or commensurate in-premises backflow preventers.

   As an alternative to the above requirement for a survey by a CCS, the Purveyor may specify the backflow preventer required to be installed as a condition of service. The Purveyor's CCS will provide guidance on the type of backflow preventer to be installed.

5. For all existing services, should the customer fail to supply the required information for a hazard assessment or fail to submit a completed "Water Use Questionnaire," (Appendix B) the Purveyor may have the assessment made by a CCS employed by the Purveyor, require the installation of an RPBA for premises isolation, or take other such actions consistent with the previously stated policies and bill the customer for the associated costs.

Cross-Connection Hazard Survey Schedule for Initial Hazard Assessments

The schedule for initial hazard assessment is outlined in the following table. The schedule starts from the date the CCC program is established.

Initial Assessment Task	Schedule
Assessment of all new connections	At time of application for water service
Identification and assessment of high-hazard premises which are listed on Table 9 of Washington Administrative Code (WAC) 246-290-490	Within nine months
Identification and assessment of hazardous premises supplemental to Table 9 of WAC 246-290-490	Within 12 months
Identification of residential connections with special plumbing facilities and/or water use on the premises	Within 15 months

Cross-Connection Hazard Survey Schedule for Subsequent Hazard Re-Assessments

For subsequent cross-connection hazard surveys, procedures for evaluating the backflow prevention requirements are:

1. For **residential services,** the Purveyor will require the customer to submit to the Purveyor, within two months of Purveyor notification, a completed "Water Use Questionnaire." The procedure used for evaluating the hazard re-assessment and the potential change in the required backflow prevention will be the same as used for the initial hazard assessment.

2. For all **non-residential services**, the Purveyor will require the customer to submit to the Purveyor, within two months of Purveyor notification, a hazard re-assessment (at the customer's expense) by a DOH-certified CCS.

3. As an alternative to the above requirement for a survey by a DOH-certified CCS, the Purveyor, at his/her discretion, may conduct the evaluation and specify the backflow preventer required to be installed as a condition of service.

The frequency of hazard re-assessments will be as shown in the table below:

Type of Service	Frequency of Re-Evaluation
Any services with reduced-pressure principle backflow assembly (RPBA) installed for premises isolation	None required as long as the RPBA passes annual tests and inspections
Commercial services with double-check valve assembly (DCVA) installed for premises isolation	Every two years and upon change in use or ownership
Commercial services when Purveyor relies upon in-premises protection	Every two years and upon change in use, ownership, or plumbing system
Residential services with special plumbing where the Purveyor relies upon compliance with Uniform Plumbing Code (UPC)	Every 2-3 years (questionnaire)
Residential services with DCVA installed for premises isolation	Every 4-5 years (questionnaire)
Residential services with no known special plumbing or water use on the premises	Every 4-5 years and upon change in use, ownership, or plumbing system (questionnaire)

The Purveyor will inform the customer that the survey of a customer's premises (whether by a representative of the Purveyor or through the evaluation of a questionnaire completed by the customer) is for the sole purpose of establishing the Purveyor's minimum requirements for the protection of the public water supply system, and that the required backflow protection will be commensurate with the Purveyor's assessment of the degree of hazard.

The Purveyor will also inform the customer or any regulatory agencies that the Purveyor's survey, requirements for the installation of backflow prevention assemblies, lack of requirements for the installation of backflow prevention assemblies or other actions by the Purveyor's personnel or agent do not constitute an approval of the customer's plumbing system or an assurance to the customer or any regulatory agency of the absence of cross connections.

Element 3: *Development and implementation of procedures and schedules for elimination and/or control of cross-connections.*

Backflow Preventer Requirements

The following service policy shall apply to all new and existing customers:

1. The Purveyor will require that water service to all **non-residential customers** be isolated immediately downstream of the meter or connection prior to any branch connections by a DOH-approved AIRGAP, DCVA or RPBA acceptable to the Purveyor. All high-hazard connections of the type described under WAC 246-290-490(4)(b)(i)(ii)(iii)(table 9) shall be isolated with an AIR GAP or RPBA. All other non-residential customers shall be isolated with a DCVA. In lieu of isolation with a DCVA, other non-residential customers, with the concurrence of the Purveyor's CCS, may install in-premises protection commensurate with the degree of hazard, as determined by the Purveyor's CCS.

2. The Purveyor will require all **residential customers** with facilities of the type described under WAC 246-290-490(4)(b)(i)(ii)(iii)(table 9) to be isolated immediately downstream of the meter or connection prior to any branch connections with an AIRGAP or RPBA. All other residential customers with special plumbing or water use on the premises will be isolated with a DCVA or in-premise protection at the point of the hazard in accordance with the Uniform Plumbing Code (UPC). "Special plumbing" includes, but is not limited to, the following:

   - A lawn irrigation system;
   - A solar heating system;
   - An auxiliary source of supply, e.g., a well or creek;
   - Piping for livestock watering, hobby farming, etc.;
   - Residential fire sprinkler system; and
   - Property containing a small boat moorage.

3. **Additional premises requiring premises isolation.** The Purveyor has chosen to supplement Table 9 of WAC 246-290-490(4) by identifying additional premises or premises types for which premises isolation is mandated to be commensurate with the degree of hazard, as determined by the Purveyor's CCS. Such premises will include:

   - Military bases;
   - Tall buildings (over 30 feet);
   - Premises with complex plumbing;
   - Premises with multiple in-premise backflow preventers;
   - Premises with restricted, secured or denied access;
   - Premises with plumbing subject to frequent changes(shopping malls or strip malls);
   - Premises with a repeat history of cross-connections being established or reestablished;
   - Premises with public swimming pools;
   - Dedicated Fire systems; and
   - Premises outside of the City of Oak Harbor administrative authority but within the City's Water Service Area.

4. **All remaining residential customers** will be isolated at the meter by a Purveyor-installed meter check valve (single or dual). Residential customers not required to be isolated with an RPBA may install in-premises protection in accordance with the Uniform Plumbing Code (UPC) in lieu of isolation with a DCVA.

5. **For all customers that have a written service contract with the Purveyor**, the required premises isolation DCVA or RPBA shall be:

   - Purchased and installed by the customer (at the customer's expense) immediately downstream of the water meter in accordance with the Purveyor's standards described hereinafter; and
   - Maintained, tested, and inspected in accordance with the Purveyor's standards described hereinafter.

For new customers, the Purveyor will not turn on water (except for testing purposes) at the meter until the customer complies with the above requirements.

The failure of the customer to comply with the Purveyor’s installation and maintenance requirements shall constitute a breach of contract by the customer. The Purveyor may then proceed with corrective action provisions stipulated in the contract.

6. **Customers without written contracts** are considered to have an implied contract that requires the customer to bear all reasonable costs of service. The Purveyor will install the required DCVA or RPBA on the service, upstream of the meter, and charge the customer for the cost of the initial installation, and all future maintenance, testing, and repair, as set forth in the Purveyor's schedule of rates and charges. The failure of the customer to pay these costs shall constitute a breach of contract by the customer, and the Purveyor will proceed with the established delinquency of payment procedures. As an alternative, the customer may sign a service contract and install the required backflow preventer downstream of the meter in accordance with the Purveyor’s installation standards described hereinafter.

7. **Approved Backflow Preventers and Installation.** All backflow preventers relied upon by the Purveyor to protect the public water system shall meet the definition of “approved backflow preventer” as contained in WAC 246-290-010. The Purveyor will obtain and maintain a current list of assemblies approved for installation in Washington State from the DOH Office of Drinking Water.

   All backflow preventers will be installed in:

   - The orientation for which they are approved;
   - A manner and location that facilitates their proper operation, maintenance, and testing or inspection;
   - A manner that will protect them from weather-related conditions such as flooding and freezing; and
   - Compliance with applicable safety regulations.

   Installation standards contained in the most recently published edition of the Pacific Northwest Section, American Water Works Association (PNWS-AWWA) *CCC Manual* or the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USCFCCCHR) *CCC Manual* shall be followed unless the manufacturer’s requirements are more stringent. Installation shall conform to standard construction drawings and specifications of the Purveyor.

   The Purveyor has no regulatory responsibility or authority over the installation and operation of the customer's plumbing system. The customer is solely responsible for compliance with all applicable regulations and for prevention of contamination of his plumbing system from sources within his/her premises. Any action taken by the Purveyor to survey plumbing, inspect or test backflow prevention assemblies, or to require premises isolation (installation of DCVA or RPBA on service) is solely for the purposes of reducing the risk of contamination of the Purveyor's distribution system.

The Purveyor will inform the customer that any action taken by the Purveyor shall not be construed by the customer as guidance on the safety or reliability of the customer's plumbing system. The Purveyor will not provide advice to the customer on the design and installation of plumbing other than through the general public education program discussed in Element 8.

Except for easements containing the Purveyor's distribution system, the Purveyor will not undertake work on the customer's premises.

8. **Schedule for Installation of Backflow Preventers.** The following table shows the schedule that the Purveyor will follow for installation of backflow preventers when they are required (based on the hazard evaluation).

Type of Service	Schedule
New connections with cross-connection hazards	Before service is initiated
Existing connections with Table 9-type hazards and other high cross-connection hazards	Within 90 days after notification
Existing connections with other than Table 9 of WAC 246-290-490 or high cross-connection hazards	Within 180 days after notification (suggested)
Existing fire protection systems using chemicals or supplied by unapproved auxiliary water source	Within 90 days after notification
Existing fire protection systems not using chemicals and supplied by Purveyor's water	Within 1 year after notification (suggested)

The Purveyor may consider granting an extension of time for installation of backflow preventer for an existing connection if requested by the premises owner.

Element 4: *Provision of qualified personnel, including at least one person certified as a CCS, to develop and implement the CCC program.*

1. **Program Administration.** The responsibility for administration of the CCC Program rests with the Purveyor. General policy direction and risk management decisions are established by the Mayor and City Council. By an inter-agency agreement, the Local Administrative Authority (LAA) may undertake certain administrative tasks, and the Purveyor may undertake additional tasks to assist the LAA.

2. The Purveyor will employ or have on staff at least one person certified by DOH as a CCS to develop and implement the CCC program. As an alternative, or when no staff or employees are properly qualified, the Purveyor may retain a DOH-certified CCS on contract to provide the necessary expertise and services.

3. The following cross-connection related tasks will be performed by or under the direction of the Purveyor's certified CCS (on staff or under contract):

- Preparation of and recommendations regarding changes to the CCC program;
- Performance of and/or reviews of CCC hazard evaluations;
- Recommendations on the type of backflow preventer to be installed;
- Recommendations on schedules for retrofitting of backflow preventers;
- Inspections of backflow preventers for proper application and installation;

- Reviews of backflow preventer inspection and test reports;
- Reviews of backflow testing quality control information;
- Recommendations and/or the granting of exceptions to mandatory premises isolation;
- Participation in or cooperation with other water utility staff in the investigation of backflow incidents and other water quality problems;
- Completion of Backflow Incident Reports; and
- Completion of CCC Activity and Program Summary Reports.

4. The Purveyor may delegate other CCC program activities to other personnel who are not certified CCSs, including clerical support staff. These activities include:

- Administration of paperwork associated with service agreements;
- Mailing, collecting, and initial screening of hazard evaluation/water use questionnaires;
- Mailing of assembly testing notices;
- Receiving and screening of assembly testing reports;
- CCC program database administration and record keeping;
- Dissemination of public education material; and
- Assisting tasks associated with coordination with the LAA.

5. The following table identifies the current CCS employed or retained on contract by the Purveyor to manage the Purveyor's CCC program and/or act as the CCC technical resource for the Purveyor:

Name of CCS	Rich Tyhuis
Address	865 SE Barrington Drive
City, State, Zip	Oak Harbor, Washington
Telephone Number	360-279-4753
CCS Certification Number	1726

Element 5: *Development and implementation of procedures to ensure that approved backflow preventers are inspected and/or tested (as applicable).*

1. **Inspection and Testing of Backflow Preventers.** All backflow preventers that the Purveyor relies upon for protection of the water system will be subject to inspection and, if applicable, testing. This includes backflow preventers installed for in-premises protection that the Purveyor relies upon for protection of the water systems.

   Inspection and testing of backflow preventers will be as follows:

- The Purveyor's DOH-certified CCS will inspect backflow preventers for proper application (i.e., to ensure that the preventer installed is commensurate with the assessed degree of hazard);
- Either a DOH-certified CCS or backflow assembly tester (BAT) will perform inspections of backflow preventers for correct installation; and
- A DOH-certified backflow assembly tester will test all assemblies relied upon by the Purveyor to protect the public water system.

2. **Frequency of Inspection and Testing.** Inspection and testing of backflow preventers will be conducted:

   - At the time of installation;
   - Annually after installation;
   - After a backflow incident; and
   - After repair, reinstallation, relocation, or re-plumbing.

   The Purveyor may require a backflow preventer to be inspected and/or tested more frequently than once a year, when it protects against a high-health hazard or when it repeatedly fails tests or inspections.

3. **Responsibility for Inspection and Testing.** The Purveyor will be responsible for inspection and testing of all Purveyor-owned backflow preventers.

   The Purveyor will require the customer to be responsible for inspection and testing of backflow preventers owned by the customer. The customer shall employ, at customer expense, a DOH-certified BAT pre-approved by the Purveyor to conduct the inspection and test within the time period specified in the testing notice sent by the Purveyor. The test report shall be completed and signed by the BAT, then countersigned and returned by the customer to the Purveyor, before the due date specified by the Purveyor. The customer may request an extension of the due date for returning a test report by submitting a written request to the Purveyor. The Purveyor may grant one extension up to 90 days.

4. **Approved Test Procedures.** The Purveyor will require that all assemblies relied upon to protect the public water system be tested in accordance with DOH-approved test procedures as specified in WAC 246-290-490(7)(d). Any proposal to use alternate test procedures must be approved by the Purveyor's CCS.

5. **Notification of Inspection and/or Testing.** The Purveyor will notify in writing all customers who own backflow preventers that are relied upon to protect the public water system to have their backflow preventer(s) inspected and/or tested. Notices will be sent out not less than 30 days before the due date of the inspection and/or test. The notice will also specify the date (up to 30 days after the due date of the inspection and/or test date) by which the inspection/test report must be received by the Purveyor. (Appendix B)

6. **Enforcement.** When a customer fails to send in the inspection/test report within 15 days after the due date specified, and the Purveyor has not approved an extension to the due date, the Purveyor will take the following enforcement action:

   - The Purveyor will send a second notice giving the customer an additional 15 days to send in the inspection/test report;
   - If the customer has not sent in the inspection/test report within 10 days of the due date given in the second notice, the Purveyor will send a third notice, by certified mail, giving the customer an additional 15 days to send in the report. The notice will also inform the customer that failure to satisfactorily respond to this notice will result in water service shut-off;
   - The Purveyor will send copies of the third notice to the owner and occupants of the premises (if different from the customer) and to the LAA;

- If the owner and/or occupants have not responded satisfactorily to the Purveyor within 10 days of the due date specified in the third notice, the Purveyor will implement water service shut-off procedures; and
- The Purveyor will offer to arrange for the inspection and/or testing of the customer-owned backflow preventers by a certified BAT and will bill the customer the actual or typical cost of inspection and/or testing in the service area plus reasonable administrative costs. Collection and enforcement procedures for such charges will be the same as for other water utility charges.

Element 6: *Development and implementation of a backflow prevention assembly testing quality assurance/quality control program.*

1. **List of Pre-Approved BATs.** The Purveyor will maintain a list of local, DOH-certified BATs (Appendix C) that are pre-approved by the Purveyor to perform the following activities:

   - Backflow preventer inspection for proper installation; and
   - Backflow assembly testing.

   The Purveyor will also maintain a list of local DOH-certified CCSs that are pre-approved by the Purveyor to perform the following activities:

   - Cross-connection hazard evaluations;
   - Backflow preventer inspection for proper application; and
   - Backflow preventer inspection for proper installation**.**

   The list(s) will be revised annually or more frequently if necessary.

2. **Pre-Approval Qualifications.** BATs and CCSs who wish to be included on the Purveyor's pre-approved list and/or provide testing in the Purveyor's service area must apply to the Purveyor and furnish the following information:

   - Evidence of current DOH certification in good standing;
   - Make and model of testing equipment (BAT listing only);
   - Evidence of test equipment verification of accuracy and/or calibration within the past 12 months (BAT listing only); and
   - Evidence showing possession of a license to operate a business in the City of Oak Harbor.

3. **Quality Assurance.** The Purveyor's CCS will review within 30 days of receipt the backflow preventer inspection/test report forms submitted by the customer. The Purveyor's CCS may accept reports that are signed by a CCS or BAT not on the pre-approved CCS or BAT list provided that the same information as listed in "Pre-Approval Qualifications" is also submitted to the Purveyor.

   The Purveyor's CCS will provide follow up on test reports that are deficient in any way.

   The Purveyor's CCS will report incidences of fraud or gross incompetence on the part of any BAT or CCS to DOH Operator Certification program staff.

The Purveyor in addition, and not limited to the above requirements for quality assurance and quality control, shall reference the proposed supplement to the 6^{th} edition of the PNWS-AWWA CCC Manual titled Quality Assurance and Quality Control for Testing of Backflow Prevention Assemblies (Appendix J).

<u>Element 7:</u> *Development and implementation (when appropriate) of procedures for responding to backflow incidents.*

1. **Backflow Incident Response Plan.** The Purveyor's CCS will participate in developing a backflow incident response plan that will be part of the water system’s emergency response program as required by WAC 246-290-415(2). (Appendix D) The incident response plan will include, but will not be limited to:

   - Notification of affected population;
   - Notification and coordination with other agencies, such as DOH, the LAA, and the local health jurisdiction;
   - Identification of the source of contamination;
   - Isolation of the source of contamination and the affected area(s);
   - Cleaning, flushing, and other measures to mitigate and correct the problem; and
   - Apply corrective action to prevent future backflow occurrences.

2. **Technical Resources.** The Purveyor will use the most recently published edition of the manual, *Backflow Incident Investigation Procedures*, published by the PNWS-AWWA as a supplement to the Backflow Incident Response Plan for the City of Oak Harbor.

<u>Element 8:</u> *Development and implementation of a cross-connection control public education program.*

1. **Customer Education.** The Purveyor will distribute with water bills or some other means, at regular intervals, public education brochures to system customers. For residential customers, such brochures will describe the cross-connection hazards in homes and the recommended assemblies or devices that should be installed by the homeowner to reduce the hazard to the public water system. The education program will emphasize the responsibility of the customer in preventing the contamination of the public water supply. The Purveyor’s staff will produce the public education brochures (Appendix E) or the Purveyor will obtain brochures from:

   - PNWS-AWWA;
   - Spokane Regional Cross-Connection Control Committee (SRC4);
   - Western Washington Cross-Connection Prevention Professionals Group (The Group);
   - USC FCCCHR;
   - Other national backflow prevention associations, such as the American Backflow Prevention Association (ABPA); and/or
   - Other water utilities.

   The information distributed by the Purveyor will include, but not be limited to, the following subjects:

- Cross-connection hazards in general;
- Irrigation system hazards and corrective actions;
- Fire sprinkler cross-connection hazards;
- Importance of annual inspection and/or testing of backflow preventers; and
- Thermal expansion in hot water systems when backflow preventers are installed for premises isolation.

The Purveyor will distribute information brochures to all customers every two to three years, and to every new customer at the time the service agreement is signed.

2. **Public Outreach.** In cooperation with other water utilities, the Purveyor will participate in an outreach program consisting of:

- Distribution of cross-connection control information to hardware and plumbing stores serving the area;
- Participation in fairs, exhibits, and other events; and
- Special education sessions for irrigation contractors, fire sprinkler contractors, local backflow assembly testers, etc.

Element 9: *Development and maintenance of cross-connection control records.*

1. **Types of Records and Data to be Maintained.** The Purveyor will maintain records of the following types of information required by WAC 246-290-490:

- Service connections/customer premises information including:
  - Assessed degree of hazard; and
  - Required backflow preventer to protect the public water system.
- Backflow preventer inventory and information including:
  - Air gap (AG) location, installation and inspection dates, inspection results and person conducting inspection;
  - Backflow assembly location, assembly description (type, manufacturer, make, model, size, and serial number), installation, inspection and test dates, test results and data, and person performing test; and
  - Information on atmospheric vacuum breakers used for irrigation system applications, including manufacturer, make, model, size, dates of installation and inspections, and person performing inspections.

The Purveyor will maintain records on all assemblies that protect the public water system from contamination. At a minimum, the Purveyor will maintain records on all premises isolation assemblies required to protect the public water system. Where applicable, the above information will also be maintained for backflow preventers installed for in-premises protection that is relied upon by the Purveyor to protect the public water system.

By inter-agency agreement, the Purveyor will also maintain the above information for LAA required backflow preventers that are **not** relied upon by the Purveyor to protect the public water system.

2. **Reports to be Prepared and Submitted to DOH.** The Purveyor will prepare the following

reports required by WAC 246-290-490 (Appendix F) including:

- Cross-connection control program activities report for the calendar year, to be sent to DOH when requested;
- Cross-connection control program summary information, when required, or when there are significant policy changes;
- Backflow incident reports to DOH (and voluntarily to the PNWS-AWWA CCC Committee); and
- Documentation when exceptions to mandatory premises isolation are granted.

At a minimum, the Purveyor’s CCS will prepare and sign the exceptions reports.
The Purveyor’s CCS will prepare and sign all CCC-related reports required by WAC 246-290-490.

<u>Element 10:</u> *Additional cross-connection control requirements for reclaimed water.*

At this time the City of Oak Harbor does not receive or distribute reclaimed water. In the event that reclaimed water use is proposed within the PWS’s service area, the Purveyor will make all cross-connection control requirements mandated by the Permitting Authority in accordance with Chapter 90.46 RCW part of the written CCC program plan and comply with such additional requirements.

E. Other Provisions

1. **Coordination with Local Administrative Authority.** Both WAC 246-290-490 and the Uniform Plumbing Code amended for Washington require coordination between the water Purveyor and the Local Administrative Authority (LAA) in all matters pertaining to cross-connection control.

   The Purveyor will provide a copy of this CCC program to the City of Oak Harbor Development Services Department via a copy of the Purveyor's water system plan or in a separate document. The Purveyor will inform the LAA of any changes in policy or procedure that may impact the LAA.

   The Purveyor will provide information to the LAA in a timely manner regarding any:

   - Requirement imposed on a residential customer for the installation of a DCVA or an RPBA on the service, with a description of the cross-connection hazard identified;
   - Upgrade of the premises isolation backflow preventer, i.e., from a DCVA to an RPBA;
   - Action taken to discontinue water service to a customer; and
   - Backflow incident known by the Purveyor to have contaminated the public water system or a customer’s plumbing system.

2. **Written Agreement with Local Administrative Authority.** The Purveyor will pursue development of a written agreement with the Local Administrative Authority regarding the details of the coordination on CCC issues between the two parties. The agreement will include, but not be limited to, the following items:

   - The purpose of the written agreement;
   - Identification of the parties and other interested agencies;

- Delineation of responsibilities;
- Procedures regarding new service connections;
- Procedures regarding existing and changes to existing services;
- Special policies and procedures, such as for fire protection and irrigation services;
- Procedures regarding water service shut-offs, backflow incidents, and other events;
- Communications between parties; and
- Other contingencies.

3. **Prohibition of Return of Used Water**. The PWS must prohibit the intentional return of used water to the Purveyor's distribution system per WAC 246-290-490 (2)(l).

   Used water is defined as water that has left the control of the Purveyor. This includes water used for heating and cooling purposes and water that may flow back into the distribution system from customers with multiple connections.
   It is the policy of the City of Oak Harbor water system to:

   - Prohibit the intentional return of used water to the distribution system by any customer served by the public water system; and
   - Require that all customers with multiple connections, where the hydraulics permit the potential return of used water, to install a backflow preventer (DCVA or RPBA) commensurate with the degree of hazard at <u>each</u> point of connection.

4. **Unapproved Auxiliary Supplies.** All water supplies other than those owned by the Purveyor are considered unapproved auxiliary supplies as defined in WAC 246-290-010. The Purveyor will require backflow protection for customers with auxiliary supplies on their premises as follows:

   - Per Table 9 of WAC 246-290-490, the Purveyor will require the installation of an RPBA for premises isolation at the service connection to any customer having an unapproved auxiliary supply on the premises that is interconnected with the Purveyor's water system. The Purveyor will require the installation of a DCVA for premises isolation at the service connection to any customer with an unapproved auxiliary water supply not interconnected with the Purveyor's water system.

5. **Tanker Trucks.** The Purveyor may allow tanker trucks to obtain water from the Purveyor's water system under the following conditions:

   - The tanker truck is equipped with an approved AG or an approved RPBA with a current satisfactory inspection or test report; and
   - The tanker truck will obtain water from Purveyor-designated watering points only. These watering points are equipped with Purveyor-installed backflow preventers.

6. **Temporary Water Connections.** The Purveyor will not supply water through temporary connections, such as those used for construction projects or main disinfection, except through a backflow preventer arrangement approved by the Purveyor. The applicant for the temporary connection shall document that the backflow preventer is a DOH-approved model and has passed an inspection and/or test within the past 12 months and/or upon relocation, whichever is more recent.

7. **Interties and Wholesale Water Customers.** The Purveyor will require that interties with other public water systems or wholesale customers (such as mobile home parks) be isolated at the point of delivery by:

   - A minimum of a DCVA; and
   - A minimum of an RPBA if the Purveyor considers the purchasing system or wholesale customer to pose a high-health hazard to the Purveyor's system.

   The Purveyor may waive or reduce the level of protection at the intertie, if the purchasing public water system or wholesale customer:

   - Is a Group A public water system **not** exempt from DOH regulation as per WAC 246-290-020(2);

   - Has a CCC program that complies with WAC 246-290-490 and which has been approved by DOH; and
   - Implements the CCC program at a level satisfactory to the Purveyor.

F. Relationship to Other Planning and Operations Program Requirements

The Purveyor will consider the requirements and consequences of the CCC program on the utility's planning and operations requirements. Such considerations include, but are not limited to ensuring:

- And promoting adequate communication between CCC program personnel and other water utility staff;
- That adequate training is provided to all staff to recognize potential cross-connection control problems;
- That cross-connection issues be considered in water quality investigations;
- That the design of the water distribution system makes adequate provisions for expected head losses incurred through the installation of experienced by backflow assemblies;
- That CCC program personnel be consulted in the design of water and wastewater treatment facilities and when proposals are made to receive or distribute reclaimed water;
- That operations under normal and abnormal conditions do not result in excessive pressure losses; and
- That adequate financial and administrative resources are available to carry out the CCC program.

APPENDIX A

ORDINANCE 1456
OHMC CHAPTER 13.13

ORDINANCE NO. 1456

AN ORDINANCE AMENDING AND READOPTING OAK HARBOR MUNICIPAL CODE CHAPTER 13.13 CONCERNING CROSS CONNECTIONS TO THE OAK HARBOR WATER UTILITY 13.13.005, 13.13.010, 13.13.020, 13.13.040, 13.13.050, 13.13.060 AND ADDING SECTIONS 13.13.001, 13.13.055, 13.13.056, 13.13.057 AND READOPTING SECTION 13.13.030 ALL CONCERNED WITH CROSS CONNECTION IN THE WATER SYSTEM PROHIBITING CROSS CONNECTION AND SETTING STANDARDS FOR PROTECTING THE WATER SYSTEM FROM CROSS CONNECTION AND SETTING PENALTIES; ADMINISTRATIVE PROCEDURES AND REMEDIES TO PREVENT CROSS CONNECTION

THE CITY COUNCIL OF THE CITY OF OAK HARBOR do ordain as follows:

Section One. There is hereby added a new Section 13.13.001 entitled "Findings" to Chapter 13.13 of the Oak Harbor Municipal Code which shall read as follows:

13.13.001 Findings.

(1) It is a requirement of the Washington State Department of Health (WA DOH) for the City to establish a cross connection control program satisfactory to the Department of Health; and

(2) Cross connections within the customer's plumbing system pose a potential source for the contamination of the public water supply system; and

(3) A safe supply of drinking water is of the highest health, welfare and safety concern for the City.

Section Two. Oak Harbor Municipal Code Section 13.13.005 entitled "Definitions" is hereby amended and readopted to read as follows:

13.13.005 Definitions.

(1) "Administrator" is the Public Works Superintendent or such other person designated to administer the cross connection program adopted and/or authorized by OHMC 13.13.

(2) "Backflow" means the flow other than the intended direction of flow of any foreign liquids, gases or substances into the distribution system of a public water supply.

(3) "Backflow prevention device" means a WA DOH approved device to counteract back pressure or prevent back siphonage.

(4) "Cross connection" means any physical arrangement whereby a public water supply is connected, directly or indirectly, with any other water supply system, sewer drain, conduit, pool, storage reservoir, plumbing fixture or other device which contains or may

contain contaminated water, sewage, or other waste or liquids of unknown or unsafe quality which may be capable of imparting contamination to the public water supply as a result of backflow.

(5) "Purveyor" is the City of Oak Harbor Water Division.

Section Three. Oak Harbor Municipal Code Section 13.13.010 entitled "Cross connections -- Prohibitions" is hereby amended and readopted to read as follows:

13.13.010 Cross connections -- Prohibitions. The installation or maintenance of a cross connection which in the opinion of the administrator will endanger the water quality of the potable water supply of the city is unlawful.

Section Four. Oak Harbor Municipal Code Section 13.13.020 entitled "Backflow prevention device" is hereby amended and readopted to read as follows:

13.13.020 Backflow prevention device. Backflow prevention devices shall be required to be installed and maintained by the service customer on any service connection to the Oak Harbor water supply system where, in the opinion of the administrator, the backflow prevention devices are necessary for the protection of the city water supply from backflow.

Section Five. Oak Harbor Municipal Code Section 13.13.030 entitled "Compliance required" is hereby amended and readopted to read as follows:

13.13.030 Compliance required. Use or operating of a private water supply system contrary to the provisions of the ordinances of the city or the laws of the state or the rules and regulations of the State Board of Health regarding public water supplies, where the private system is served by the city public water supply, is unlawful.

Section Six. Oak Harbor Municipal Code Section 13.13.040 entitled "Backflow prevention devices -- Testing" is hereby amended and readopted to read as follows:

13.13.040 Backflow prevention devices -- Testing. All backflow prevention devices including reduced pressure backflow devices and factory assembled double check-valve assemblies installed under this section shall be inspected and tested after installation and annually, or more often where successive inspections indicate repeated failure. The devices shall be repaired, overhauled or replaced whenever they are found to be defective. Inspections, tests, and repairs and records thereof shall be certified in writing to the administrator. The administrator shall maintain a list of certified backflow prevention device testing personnel qualified to do testing. The City shall maintain copies of all testing required.

Section Seven. Oak Harbor Municipal Code Section 13.13.050 entitled "Regulations" is hereby amended and adopted to read as follows:

13.13.050 Regulations. Rules and regulations of the State Board of Health identified as Definitions and Cross Connection Control regulation in Washington State under WAC 246-290-

010 and WAC 246-290-490 are adopted by reference as now or hereafter amended, deleted from or added to. A current copy of such regulations will be on file with the city clerk's office.

Section Eight. There is hereby added a new Section 13.13.055 entitled "Prevention of contamination" to Chapter 13.13 of the Oak Harbor Municipal Code to read as follows:

13.13.055 Prevention of contamination. The customer's plumbing system, starting from the termination of the City's water service pipe, shall be considered a potential high health hazard requiring the isolation of the customer's premises by a City WA DOH approved, customer installed and maintained Air Gap (AG), Reduced Pressure Backflow Assembly (RPBA) or detector derivative thereof. The RPBA shall be located at the end of the City's water service pipe (i.e., immediately downstream of the meter). Water shall only be supplied to the customer through a City approved and customer installed and maintained RPBA. The Purveyor will require premises isolation for a customer that is of the high-hazard type or category requiring "Mandatory Premises Isolation" established by the WA DOH regulations (Table 9, WAC 246-290-490).

It is provided, however, the City, upon an assessment of the risk of contamination posed by the customer's plumbing system and use of water, may allow:

(1) a single family or multi residential customer to connect directly to the water service pipe, i.e., without a City approved DCVA or RPBA.

(2) any customer other than a single family or multi residential customer, as a minimum, to be supplied through a City/WA DOH approved, customer installed and maintained double check valve assembly (DCVA) or double check detector assembly (DCDA).

(3) any customer, other than a single-family or duplex residential customer, to connect directly to the water service pipe (i.e., without a Purveyor-approved DCVA or RPBA), PROVIDED THAT the customer installs and maintains backflow preventers, at the point of hazard, that are commensurate with the degree of hazard assessed by the Purveyor.

Section Nine. There is hereby added a new Section 13.13.056 entitled "Conditions for providing service" to Chapter 13.13 of the Oak Harbor Municipal Code to read as follows:

13.13.056 Conditions for providing service. Water service is provided based on the following terms and conditions:

(1) The customer shall take all measures necessary to prevent the contamination of the plumbing system within his/her premises and the City's distribution system that may occur from backflow through a cross connection. These measures shall include the prevention of backflow under any back pressure or back siphonage condition, including the disruption of supply from the City's system that may occur by reason of routine system maintenance or during emergency conditions, such as a water main break.

(2) The customer shall install, operate and maintain at all times his/her plumbing system in compliance with the current edition of the Plumbing Code having jurisdiction as it pertains to the prevention of contamination, and protection from thermal expansion due to a closed system that could occur with the present or future installation of backflow preventers on the customer's service and/or at plumbing fixtures.

(3) Where a City/WA DOH approved reduced pressure backflow assembly is not provided, and for cross connection control or other public health related surveys, the customer shall provide access for the employees or agents of the City to all parts of the premises during reasonable working hours of the day for routine surveys, and at all times during emergencies unless provisions of subsection (4) are followed.

(4) Where agreement for access for the City's survey is denied, water service may be supplied by the City, provided premises isolation is provided through a City/WA DOH approved RPBA.

(5) The customer shall:

(a) have tested upon installation, annually thereafter or when requested by the City, after repair and after relocation his/her RPBA or DCVA installed to protect the City's distribution system;

(b) have all testing done by a City approved Backflow Assembly Tester (BAT) currently certified by WA DOH;

(c) have the RPBA or DCVA tested following the procedures approved by WA DOH with the recommended additional procedures in the "Cross Connection Control Manual, Accepted Procedures and Practice", Sixth Edition, December 1995, or latest edition thereof (a copy of which is on file with the City Clerk and by this reference is made a part of this ordinance); and

(d) submit to the City the results of the test(s) on the City supplied test report form within the time period specified by the City.

The customer shall bear all costs for the installation, testing, repair, maintenance and replacement of the RPBA, DCVA or derivative thereof installed to protect the City's distribution system.

(6) At the time of application for service, if required, the customer shall submit plumbing plans and/or a cross connection control survey of the premises by a City approved and WA DOH certified Cross Connection Control Specialist (CCS).

The survey shall assess the cross connection hazards and list the backflow prevention provided within the premises. The results of the survey shall be submitted prior to the City turning on water service to a new customer. The cost of the survey shall be borne by the customer.

(7) For classes of customers other than single family residential, when required by the City, the customer shall submit a cross connection control re-survey of the premises by the persons described above. The City may require the re-survey to be performed in response to changes in customer's plumbing, or performed periodically (annual or less frequent) where the City considers the customer's plumbing system to be complex or subject to frequent changes in water use. The cost of the re-survey shall be borne by the customer.

(8) Within thirty (30) days of a request by the City, a residential customer shall complete and submit to the City a "Water Use Questionnaire" for the purpose of surveying the health hazard posed by the customer's plumbing system on the City's distribution system. Further the residential customer agrees to provide with thirty (30) days of a request by the City a cross connection control survey of the premises by a City approved and WA DOH certified Cross Connection Control Specialist (CCS).

(9) The customer shall obtain the prior approval from the City for all changes in water use, and alterations and additions to the plumbing system, and shall comply with any additional requirements imposed by the City for cross connection control.

(10) The customer shall immediately notify the City and the local public health inspection jurisdiction of any backflow incident occurring within the premises, (i.e., entry into the potable water of any contaminant or pollutant) and shall cooperate fully with the City to determine the reason for the incident.

(11) As a condition of service, the customer shall agree to indemnify and hold harmless the City for all contamination of the customer's plumbing system or the City's distribution system that results from an unprotected or inadequately protected cross connection within his/her premises. This indemnification shall pertain to all backflow conditions that may arise from the City's suspension of water supply or reduction of water pressure, recognizing that the air gap separation otherwise required would require the customer to provide adequate facilities to collect, store and pump water for his/her premises.

(12) The customer shall agree that, in the event legal action is required and commenced between the City and the customer to enforce the terms and conditions herein, the substantially prevailing party shall be entitled to reimbursement of all its costs and expenses including, but not limited to, reasonable attorney's fees as determined by the Court.

(13) The City's survey of a customer's premises is for the sole purpose of establishing the City's minimum requirements for the protection of the public water supply system, commensurate with the City's assessment of the degree of hazard.

(14) The City, in keeping with changes to State regulations, industry standards, or the City's risk management policies, may impose retroactive requirements for additional cross connection control measures.

(15) Where the Purveyor imposes mandatory premises isolation in compliance with WA DOH regulations, or agrees to the customer's voluntary premises isolation through the installation of an AG or RPBA immediately downstream of the Purveyor's water meter and before any branch connection, the customer acknowledges his obligation to comply with the other cross connection control regulations having jurisdiction (i.e., Uniform Plumbing Code). Although the Purveyor's requirements for installation, testing, and repair or backflow assemblies may be limited to the RPBAs used for premises isolation, the customer agrees to the other terms herein as a condition of allowing a direct connection to the Purveyor's service pipe.

(16) It shall not be assumed by the customer or any regulatory agency that the Purveyor's survey, requirements for the installation of backflow prevention assemblies, lack of requirements for the installation of backflow prevention assemblies, or other actions by the Purveyor's personnel constitute an approval of the customer's plumbing system or an assurance to the customer of the absence of cross connections therein.

The conditions of this section shall be included in any agreement with the customer for water utility service.

Section Ten. There is hereby added a new Section 13.13.057 entitled "Enforcement measures" to Chapter 13.13 of the Oak Harbor Municipal Code to read as follows:

13.13.057 Enforcement measures.

(1) The City may discontinue water supply within seventy-two (72) hours of giving notice, or a lesser period of time if required to protect the public health, if the customers fail to cooperate with the City in the survey of premises, in the installation, maintenance, repair, inspection or testing of backflow prevention assemblies or air gaps required by the City, or in the City's effort to contain a contaminant or pollutant that is detected in the customer's system.

(2) Without limiting the generality of the foregoing, in lieu of discontinuing water service, the City may install a reduced pressure backflow assembly (RPBA) on its service pipe to provide premises isolation, and recover all of its costs for the installation and subsequent maintenance and repair of the assembly, appurtenances and enclosure from the customer as fees and charges for water. The failure of the customer to pay these fees and charges may result in termination of service in accordance with the City's water billing policies. There shall be a five percent (5%) surcharge on all water usage billings after City installation for maintenance and monitoring the same.

Section Eleven. Oak Harbor Municipal Code Section 13.13.060 entitled "Nuisances declared -- Abatement" is hereby amended and readopted to read as follows:

13.13.060 Nuisances declared -- Abatement. Unlawful cross connections now existing or hereafter installed, services requiring backflow prevention devices and unlawful use or operation of a private water supply system served by the City public water supply system are declared to be a public nuisance, and any measures authorized by law for the abatement of nuisances may be taken at the direction of the administrator.

Section Twelve. Severability. If any provision of this Ordinance or its application to any person or circumstance is held invalid, the remainder of the Ordinance or the application of the provision to other persons or circumstances is not affected.

Section Thirteen. Effective Date. This Ordinance shall be in full force and effect five days after its passage and publication as required by law.

PASSED by the City Council and approved by its Mayor this 4th day of April, 2006.

THE CITY OF OAK HARBOR

Mayor

Attest:

City Clerk

Approved as to Form:

City Attorney

Published: APRIL 8, 2006

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APPENDIX B

PROGRAM ADMINISTRATION DOCUMENTS LIST

Appendix B
Program Administration Documents List

Sample Forms

The first section of Appendix B contains the following forms:

- Application for Water Service (Service Agreement);
- Backflow Assembly Test/AG Inspection Report - File Record;
- Cross-Connection Control Hazard Survey Report - Non-Residential Customers;
- Water Use Questionnaire - Residential Customers; and
- Backflow Incident Report Form.

Sample Letters

- Request to Complete Water Use Questionnaire;
- Notice of Survey of Premises;
- Request to Install Backflow Prevention Assembly;
- Request to Submit Test of Backflow Prevention Assembly; and
- Second Notice to Test Backflow Prevention Assembly.

Appendix C contains the following forms:

- Backflow Assembly Testers - Pre-Approved for Submitting Test Reports; and
- Commercial Cross Connection Questionnaire - Non-Residential Customers.

Application for Water Service (Service Agreement)

Owner's Name: ____ **Phone:** __________________________

Mailing Address: ____

Location Address: ____

Legal Description: ____

1. The undersigned applicant hereby applies for a water connection to the above-described property.
2. The applicant is the owner of the described property or the authorized agent of the owner.
3. As a condition of the City of Oak Harbor, hereinafter referred to as the Purveyor, providing and continuing service to the above described property, the property owner, by signing this application, agrees to comply with:
   a. All provisions of the attached current Ordinance, Resolution and/or By-laws of the Purveyor, or latest revision thereof; and
   b. Other such current (attached) and future rules and regulations that govern the Purveyor's water system.
4. The property owner specifically agrees:
   a. To install and maintain at all times his plumbing system in compliance with the most current edition of the Uniform Plumbing Code as it pertains to the prevention of potable water system contamination and prevention of pressure surges and thermal expansion in his water piping (for thermal expansion, it shall be assumed that a check valve is installed by the Purveyor on the water service pipe);
   b. Within 30 days of the Purveyor's request (or alternate schedule acceptable to the Purveyor):
      i) To install, maintain, test and repair in accordance with the Purveyor's cross-connection control standards all premises isolation backflow prevention assemblies required by the Purveyor to be installed to protect the public water system from contamination; and
      ii) To report to the Purveyor the results of all assembly tests and/or repairs to the premises isolation backflow prevention assemblies.
   c. As a condition of the Purveyor waiving the requirement for premises isolation by a reduced pressure backflow assembly on the property owner's service pipe:
      i) To authorize the Purveyor to make periodic water use surveys of the premises;
      ii) Within 30 days of the Purveyor's request, to install, test, maintain, and repair in accordance with the Purveyor's cross connection control standards (copy received with this application) all in-premises backflow prevention assemblies that provide equivalent protection for the Purveyor's distribution system;
      iii) To report to the Purveyor within 30 days of obtaining the results of all tests and repairs to the aforementioned backflow prevention assemblies; and
      iv) To report to the Purveyor any change to the plumbing system.
   d. Not to make a claim against the Purveyor or its agents or employees for damages and/or loss of production, sales or service, in case of water pressure variations, or the disruption of the water supply for water system repair, routine maintenance, power outages, and other conditions normally expected in the operation of a water system.
   e. To pay his water bill within 30 days from the date of billing.

After 30 days of the Purveyor mailing a written notice to the property owner of his breach of this agreement, the Purveyor may terminate water service. In the event legal action is required and commenced between the parties to this agreement to enforce the terms and conditions herein, the substantially prevailing party shall be entitled to reimbursement of all its costs and expenses including but not limited to reasonable attorney's fees as determined by the Court.

Applicant's Signature ______________________________Date __________________

Attachments received (have customer initial):

> **Water Rates/Charges _____________**
> **Service Connection Information ___________**
> **Water Service Policy _______________**

For Purveyor Use Only

_____/______/____ Date connection fee received

_____/_____/____ Date Water Use Survey questionnaire received

_____/_____/____ Date risk assessment completed; by ______________
{Insert Name of CCS}

_____/_____/____ Date customer notified of requirement for BPA

_____/_____/____ Date BPA installation approved

_____/_____/____ Date BPA test report accepted

_____/_____/____ Date BPA information entered into database

CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

BACKFLOW PREVENTION ASSEMBLY TEST REPORT

ACCOUNT NO. ________________

NAME OF PREMISE ____ Commercial ☐ Residential ☐

SERVICE ADDRESS ______________________________ CITY _________________ ZIP ____________

CONTACT PERSON _________________________ PHONE ( ) ____________ FAX ( ) _____________

LOCATION OF ASSEMBLY ____

DOWNSTREAM PROCESS __________________________ DCVA ☐ RPBA ☐ PVBA ☐ OTHER _______________

NEW INSTALL ☐ EXISTING ☐ REPLACEMENT ☐ OLD SERIAL NO. ___________ PROPER INSTALLATION? YES ☐ NO ☐

MAKE OF ASSEMBLY ______________ MODEL ___________ SERIAL NO. ______________ SIZE ____________

INITIAL TEST	DCVA / RPBA CHECK VALVE NO. 1	DCVA / RPBA CHECK VALVE NO. 2	RPBA	PVBA / SVBA AIR INLET
PASSED ☐ FAILED ☐	LEAKED ☐ __________ PSID	LEAKED ☐ __________ PSID	OPENED AT _____ PSID AIR GAP OK? ______.	OPENED AT _____ PSID DID NOT OPEN ☐
NEW PARTS & REPAIRS	CLEAN REPLACE PART ☐ ☐ ______. ☐ ☐ ______. ☐ ☐ ______. ☐ ☐ ______.	CLEAN REPLACE PART ☐ ☐ ______. ☐ ☐ ______. ☐ ☐ ______. ☐ ☐ ______.	CLEAN REPLACE PART ☐ ☐ ______. ☐ ☐ ______. ☐ ☐ ______. ☐ ☐ ______.	**CHECK VALVE** HELD AT ______ PSID LEAKED ☐ CLEANED ☐ REPAIRED ☐
TEST AFTER REPAIRS PASSED ☐ FAILED ☐	LEAKED ☐ __________ PSID	LEAKED ☐ __________ PSID	OPENED AT _____ PSID #1 CHECK ______ PSID	AIR INLET ______ PSID CHK VALVE _____ PSID

AIR GAP INSPECTION: Required minimum air gap separation provided? YES ☐ NO ☐ Detector Meter Reading _______________

REMARKS: ____ LINE PRESSURE ________ PSI

OWNER SIGNATURE: ____________________________________ CONFINED SPACE? ______________

TESTER'S SIGNATURE: ________________________________ CERT. NO. __________ DATE ____________

TESTER'S NAME PRINTED: _____________________________ TESTER'S PHONE NO. ________________

REPAIRED BY: ____ DATE ____________

FINAL TEST BY: _____________________________________ CERT. NO. __________ DATE ____________

CALIBRATION DATE __________ GAUGE NO. _________ MODEL ___________ SERVICE RESTORED? YES ☐ NO ☐

I certify that this report is accurate, and I have used WAC 246-290-490 approved test methods and test equipment.

COMMERCIAL CROSS-CONNECTION QUESTIONAIRE

Today's Date: ________________________ Account Number: ____________________

Project Name: ________________________ Permit Number #: ____________________

Business Name: ____

Business Type: ____

Physical Property Address: ____

City: _______________________________ State: _______ Zip: ______________

Property Owner: ____

Mailing Address: ____

Mailing City: _________________________ State: _______ Zip: ______________

Contact Person: ______________________ Phone Number: ______________________

1. Please indicate if your facility has, or will have, any of the following:

- ☐ Air conditioning system
- ☐ Air washer
- ☐ Aquarium make-up water
- ☐ Aspirator, chemical (herbicide, pesticide, weedicide)
- ☐ Aspirator, Medical / Lab
- ☐ Autoclave
- ☐ Autopsy table
- ☐ Auxiliary water system (well, pond, creek, other)
- ☐ Baptismal fountain
- ☐ Bathtub, below rim filler
- ☐ Bedpan washer
- ☐ Beverage dispenser (post-mix Co2)
- ☐ Boiler feed lines
- ☐ Bottle washing equipment
- ☐ Box hydrant (irrigation)
- ☐ Building three stories or more tall
- ☐ Car wash
- ☐ Chemical feed tank for industrial process
- ☐ Chemical feed (commercial cleaners)
- ☐ Chlorinators
- ☐ Computer cooling lines
- ☐ Condensate tanks
- ☐ Cooling towers
- ☐ Decorative ponds
- ☐ Degreasing equipment
- ☐ Dental equipment / cuspidors
- ☐ Dialysis equipment
- ☐ Dye vats and tanks
- ☐ Etching tanks
- ☐ Fermenting tanks
- ☐ Fertilizer injection
- ☐ Film processors
- ☐ Fire Department pumper connections
- ☐ Fire system (with booster pump)
- ☐ Fire system (without chemicals)
- ☐ Fire system (with antifreeze or chemicals)
- ☐ Fume hoods (lab)
- ☐ Garbage can washers
- ☐ Heat exchangers (other than double wall with leak path)
- ☐ Heat pumps
- ☐ High pressure washers
- ☐ Hot tubs (direct water connection)
- ☐ Hydrotherapy baths
- ☐ Ice makers
- ☐ Industrial fluid systems
- ☐ Irrigation system (no chemicals)
- ☐ Irrigation system (chemical)
- ☐ Laboratory equipment
- ☐ Laundry machines (commercial)
- ☐ Livestock drinking tanks
- ☐ Make-up tanks
- ☐ Photo developing sinks / tanks
- ☐ Pump prime lines
- ☐ Radiator flushing equipment
- ☐ Recreational vehicle sewage dump
- ☐ Sewer connected equipment
- ☐ Solar water heating system
- ☐ Spas
- ☐ Steam generating equipment
- ☐ Stills
- ☐ Swimming pools
- ☐ Trap primers
- ☐ Used, reclaimed or gray water systems
- ☐ X-ray equipment

2. Are you aware of any existing backflow protection located at this property?

   Please describe: ____

3. Please provide the name of all products or chemicals that are mixed with water at your location:

   ____

   ____

4. Please provide the name of all products or chemicals that are stored in bulk at your location:

   ____

   ____

Name of person completing this form: ______________________________

THIS SECTION TO BE COMPLETED BY THE WATER QUALITY DIVISION							
Type of water use	**Hazard Assessment**		**Backflow Protection Required**				
	Low	**High**	**None**	**DCVA**	**DCDA**	**RCBA**	**RPDA**
Domestic	☐	☐	☐	☐	☐	☐	☐
Irrigation	☐	☐	☐	☐	☐	☐	☐
Fire	☐	☐	☐	☐	☐	☐	☐
Status of meter	☐ Meter is set		☐ OK to install unlocked				
Certified by			☐ Locked per water quality				

Please return this questionnaire to the **City of Oak Harbor Water Division**:

Cross-Connection Control Hazard Survey Report

Non-Residential Customers

Survey date: ____________

Customer Information

Premises name: ____________________________________Telephone: ____________________

Address: ____ZIP: ___________

Contact person: ______________________________________Title: _______________________

Description of premises: ____

Description of water use: ____

Water Service and Backflow Prevention Assembly (BPA) Size/Type

Service Type	Service Size	Meter Size	BPA Size	BPA Type
Domestic				
Fire				
Irrigation				
Other				

Cross-Connection Control Specialist (CCS) Information

Name: _______________________________________ Telephone: _____________________

Company name: ____

Address: ____ZIP: __________

DOH CCS Certification #: ______________________ Year certified: __________________

Survey Results

Note: The CCS's survey shall include an inspection of the premises isolation assembly to verify that it is installed correctly and is a currently listed DOH-approved assembly.

Item	Location & Description of Cross Connection	Backflow Prevention Provided/Required

Attach additional sheets if needed.

Surveyor's Comments

Surveyor's Recommendations

I certify that this cross-connection hazard survey accurately reflects the overall risk posed by the customer's plumbing system to the Purveyor's distribution system. Based on the above survey, I certify that:

1. I found the following type(s) of premises isolation backflow preventer(s):

   Air Gap ____ RPBA/RPDA ____ DCVA/DCDA _____ None ____.

2. The existing backflow preventer(s) is/are properly installed.

   Yes ____ No ____ N/A ____.

3. The existing backflow preventer(s) is/are commensurate with the degree of hazard:.

   Yes ____ No ____ N/A ____.

4. Since no backflow preventer was installed for premises isolation, the premises owner should install a premises isolation backflow preventer of the following type:

   Air Gap ____ RPBA/RPDA ____ DCVA/DCDA ____ N/A ____.

5. The premises owner should replace the existing premises isolation backflow preventer(s) with the following:

   Air Gap ____ RPBA/RPDA ____ DCVA/DCDA ____ N/A ____.

The completed survey report shall be first signed by the CCS conducting the survey, and then counter-signed by the owner of the premises or the owner's authorized agent.

CCS Signature: _________________________________Date: ______________

As the Owner of the Premises (or Owner's authorized agent), I certify that I have received a copy of this completed Cross-Connection Control Hazard Survey Report.

Signature: ______________________________________**Date**: ____________

Note: Customers and regulatory agencies should be aware that the Purveyor's requirement for this cross-connection hazard survey and/or for the installation of a specific backflow prevention assembly on a service pipe ***do not*** constitute an approval of the customer's plumbing system, compliance of the customer's plumbing system with the Uniform Plumbing Code or an assurance of the absence of cross connections in the customer's plumbing system.

CITY OF Oak Harbor WHIDBEY ISLAND, WASHINGTON

Water Use Questionnaire
Residential Customers

Customer Account Number (optional)________________________ Permit Number____________________
Contact person______________________________ Property Owner_______________________________
Physical Address ____
Mailing Address ____
Phone Number_______________________________

Please indicate whether the special plumbing or activities listed below apply to your premises:

Yes	No	Plumbing or Activity Present on Customer's Premises*
		Underground sprinkler system
		Water treatment system (e.g., water softener)
		Solar heating system
		Residential fire sprinkler system
		Other water supply (whether or not connected to plumbing system)
		Sewage pumping facilities or grey water system
		Boat moorage with water supply
		Hobby farm
		Animal watering troughs
		Swimming pool or spa
		Greenhouse
		Decorative pond
		Photo lab or dark room
		Home-based business. If Yes, list type/describe (e.g., beauty salon, machine shop, etc.): ____________________ ____________________

* Based on their knowledge of residential connections served, public water systems may "customize" this list by adding or deleting plumbing categories or activities

Completed by (print name): ____________________________ Date: __________

Resident's Signature: ____

Please return this questionnaire to the **City of Oak Harbor Water Division**

CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

Backflow Incident Report Form

Many backflow incidents occur that are not reported. This is usually because:

- The incidents are of short duration;
- The incidents are not detected;
- Neither the customer nor the Purveyor realizes that a contamination was caused by a backflow incident;
- The customer is not aware the incident should be reported;
- Customers do not know who to report the incidents to; and/or
- Liability concerns on the part of either the customer or purveyor or both.

DOH and the PNWS-AWWA Cross-Connection Control Committee are making an effort to bring backflow incidents to the attention of water purveyors, Local Administrative Authorities, legislators, and the general public. If you have any knowledge of a backflow incident, please fill out a copy of the Backflow Incident Report Form and return it to DOH and the PNWS-AWWA CCC committee.

Cross-Connection Control Program
BACKFLOW INCIDENT REPORT FORM

Note: *use this form to comply with WAC 246-290-490(8)(g).*

Part 1: Public Water System (PWS) Information

PWS ID:	PWS Name:	County:

Part 2: Backflow Incident Information

A. Incident Identification

Incident date:	Time of incident:	Incident ID (DOH use):

B. Information on Premises where Backflow Originated

Name of premises:	
Premises physical address:	
City: ,WA	Zip:
Premises type: non-residential ☐ residential ☐	
Premises category/description (Table 9 category*, if applicable):	
Most recent hazard evaluation prior to incident (mm/dd/yyyy): None ☐	
PWS's assessed hazard level:	*Premises isolation* required by PWS? Yes ☐ No ☐
Type of backflow preventer required by PWS:	PWS relies on *in-premises protection*? Yes ☐ No ☐
Other hazard evaluation information:	

*See WAC 246-290-490(4)(b)(i).

C. Method of Discovery of Backflow

How the backflow was discovered (check all that apply):	Direct observation .... ☐ Meter running backwards .... ☐ Water use decrease .... ☐ Disinfectant residual monitoring ... ☐ Water quality monitoring .... ☐	Water quality complaint .... ☐ Illness/injury complaint .... ☐ Result of Investigation .... ☐ Other (Describe): ☐
Incident reported to the public water system by:	PWS Personnel ☐ Premises Owner/Occupant ☐ Other PWS Customer ☐ Backflow Assembly Tester ☐ Other (Specify):	

D. Contaminant Information

Contaminant type (check all that apply):	Microbiological ☐	Chemical ☐	Physical ☐

Describe contaminant (for example, the organism name, chemical, etc.). Please attach lab analysis or MSDS, if available.	

E. Extent and Effects of Contamination

Estimated extent of contamination:	Contained within premises ☐ Entered PWS distribution system ☐	
Estimated number of connections affected:	Residential	Non-residential
Estimated population affected or at risk:	Residential	Non-residential
Number water quality complaints:	Describe water quality complaints:	
Number illnesses reported:	Describe illnesses/irritation (specific illnesses, if known):	
Number physical injuries(e.g. burns) or irritation(e.g. rashes) cases reported:		

Part 3: Cross-Connection Control Information at Backflow Site

A. Source of Contaminant

Source of contaminant or fixture type (check all that apply):	Air conditioner/heat exchanger …..… ☐ Auxiliary water supply ……………... ☐ Beverage machine ……………..…… ☐ Boiler, hot water system ……..….…. ☐ Chemical injector/aspirator ………... ☐ Fire protection system …………..….. ☐ Irrigation system (PWS supplied) ….. ☐	Industrial/commercial process water/fluid………………………. ☐ Medical/dental fixture ………..…… ☐ Reclaimed water system………..….. ☐ Swimming pools, spa ….……..……. ☐ Wastewater (sewage) system …..….. ☐ Other (specify): ……….……. ☐ ……………………………..

B. Distribution System Pressure Conditions in the Vicinity of the Backflow Incident

Type of backflow:	Backsiphonage ☐ Backpressure ☐	**Typical distribution system pressure in vicinity of incident** (if range, enter lower end of range)**:** psi
Main/pressure status at time of incident (check all that apply):	Normal ……………………………... ☐ Main break ………………….............. ☐ Fire fighting ………………………… ☐ Other high usage ……………………. ☐ Power outage ………………………… ☐	Source/plant outage ………………… ☐ Scheduled water shutoff by PWS …... ☐ Unscheduled/emergency shutoff …… ☐ Unknown ...…………………….......... ☐ Other (specify) ☐

Describe causes and circumstances leading to backflow:

C. Backflow Preventer Information/Installation/Approval Status at Site of Backflow

Complete the tables in C and D for the ***premises isolation*** preventer for either of the following situations:

- If a premises isolation backflow preventer is installed ***and*** the contaminant entered the PWS distribution system.
- If the premises isolation assembly is the only backflow preventer at the site.

In all other cases, complete tables in C and D for the ***in-premises*** backflow preventer installed at the fixture. If more than one backflow preventer was involved in the backflow incident, copy tables C and D and complete them for the additional preventer(s).

If no backflow preventer was installed at the time the incident occurred, check this box ☐ and go directly to Part 4. Don't fill out the tables below (in C and D).

Backflow preventer information:	Type installed: Installed for: Make: Model: Size: Serial number: Date installed:	
Installation status (check all that apply):	Properly installed/plumbed ☐ Improperly installed/plumbed ☐	Improperly protected bypass present ☐ If so, explain:
Commensurate with assessed degree of hazard?	Yes ☐ No ☐	If not, explain:
DOH/USC-approved at time of backflow incident?	Yes ☐ No ☐	If not, approved when installed? Yes ☐ No ☐

D. Backflow Preventer Inspection/Testing Information at Site of Backflow

Most recent inspection/test information *prior* to backflow incident. Attach test report(s), if available.	No test report on record …………………………………………… ☐ Date tested/inspected: Passed test/inspection *without* repairs ………………… ☐ Failed initial test/inspection, passed *after* repair ……… ☐ Failed test/inspection, no repairs made ……………….. ☐	
Inspection/test information *after* backflow incident [per WAC 246-290-490(7)(b)]. Attach test report.	Not tested/inspected ……………………………………………. ☐ Date tested/inspected: Passed test/inspection *without* repairs ………………… ☐ Failed initial test/inspection, passed *after* repair……… ☐ Failed test/inspection, no repairs made……………….. ☐	
Preventer failure information , if applicable (check all that apply):	Fouled check ……………… ☐ Debris ……………………… ☐ Weather-related damage …... ☐	Damaged seat …. ☐ Other: ☐
If preventer failed inspection/test, did failure allow backflow?	Yes ☐ No ☐ If yes, explain:	

<u>Part 4: Corrective Action/Notifications</u>

Action *taken* by PWS to restore water quality (check all that apply):	None …………………….. ☐ Flushed/cleaned mains …… ☐ Flushed/cleaned plumbing… ☐ Disinfected mains ………… ☐ Disinfected plumbing ……... ☐	Other treatment (describe): ☐ Replaced mains ………… ☐ Replaced plumbing …….. ☐ Other: ☐
Action *ordered* by PWS to correct cross-connection (check all that apply):	None ……………………… ☐ Eliminate cross-connection... ☐ Remove by-pass …………... ☐ Install **new** preventer … ☐ For *premises isolation* ☐ For *fixture protection* ☐	Change **existing** preventer ☐ Repair/replumb …..…… ☐ Reinstall correctly …..... ☐ Replace with same type ☐ Upgrade type ....……. ☐ Other: ☐
Action ordered accomplished?	Yes ☐ Date: No ☐ If no, explain:	
Agency notifications per WAC 246-290-490(8)(f) (check all that apply):	DOH ☐ Local Health Agency ☐ Local Adm. Authority ☐ Issued by end of next business day:	
Notifications of consumers in area of incident (check all that apply):	Population at risk ☐ Boil Water Advisory ☐	Public notification (PN per DOH regs.) ☐ Other (describe):
Other enforcement/corrective actions (describe):		

Part 5: Cost of Backflow Incident (optional)

Item	PWS Personnel Hours Expended	Cost to PWS ($)	Cost to Premises Owner ($)
Investigation			
Restoration of water quality			
Correction of cross-connection situation			
Litigation and/or settlement			
Other not included in above			

Part 6: Further Information/Documentation

Additional information about this incident such as pictures, sketches, newspaper/journal articles, water quality analyses, epidemiological reports, etc. would be helpful. Information may be in electronic form or hard copy.

Part 7: Form Completion Information

Note: *Form should be completed by a person currently certified as a Cross-Connection Control Specialist.*

I certify that the information provided in this Backflow Incident Report is complete and accurate to the best of my knowledge.			
CCC Program Mgr. Name (print)**:**			Title:
Signature:		CCS Cert. Number:	Date:
Phone:	E-mail:		
I have reviewed this report and certify that the information is complete and accurate to the best of my knowledge.			
PWS Mgr./Representative Name (Print):			Title:
Signature:		Op. Cert. Number:	Date:

Please send completed backflow incident form:

By regular mail to:

Washington State Department of Health
Office of Drinking Water – CCC Program Manager
P O Box 47822
Olympia, WA 98504-7822

By email to: terri.notestine@doh.wa.gov or cccprogram@doh.wa.gov

For persons with disabilities, this document is available on request in other formats. To submit a request, please call 1-800-525-0127 (TTY 1-800-833-6388).

Please send questions, comments or suggestions about this form to DOH at the address above or e-mail them to cccprogram@doh.wa.gov

Letter Requesting Customer to Complete Water Use Questionnaire

Date

Customer Account Number (optional)
Customer
Customer Address Line 1
Customer Address Line 2

Dear ________ Water System Customer:

Washington State drinking water regulations, WAC 246-290-490, require public water systems to develop and implement cross-connection control programs. Cross-connection control programs help protect public health by preventing contamination of the drinking water as it is delivered to water system customers. The attached brochure explains what a cross connection is, describes typical household cross connections and what you can do to help protect your drinking water.

As part of our efforts to keep your drinking water safe, we are conducting a cross-connection control hazard survey of residential customers served by our system. The purpose of the survey is to help us determine if any of our residential customers have special plumbing or activities on their premises that could increase the risk of contamination to our water system.

For most residential customers, the cross-connection control hazard posed to the public water system is minimal. This is because your household plumbing was installed in compliance with the Uniform Plumbing Code. The Uniform Plumbing Code generally provides adequate protection of your water potable water piping and our public water distribution system from cross connections. However, a few customers with special plumbing or activities on their premises may pose an increased health risk to other customers served by our system. These customers may need to have a backflow preventer installed on their service lines or provide alternate protection to prevent contamination of the public water system.

Please complete the attached questionnaire by checking the applicable boxes on the table; and return the completed, signed questionnaire by {insert date} to the address shown below.

Thanks in advance for filling out the questionnaire. We appreciate your cooperation in helping us to protect the drinking water we deliver to our customers. If you have any questions about the survey or how to fill out the questionnaire, please contact me at **(360) 279-4753**. We will review your questionnaire and determine whether we need to contact your for further information.

Sincerely,

Rich Tyhuis
Operations Manager

Enclosures: CCC Brochure
Water Use Questionnaire

Notice of Survey of Premises (Non-Residential/Multi-Family Residential)
Customer-Employed Cross-Connection Control Specialist

Date

Customer Account Number (optional)
Customer Name
Customer Address Line 1
Customer Address Line 2

Dear ________ Water System Customer:

Washington State drinking water regulations, WAC 246-290-490, require public water systems to develop and implement cross-connection control programs. Cross-connection control programs protect public health by preventing contamination of the drinking water supply. The attached brochure explains what a cross connection is and what you can do to help protect your drinking water.

As part of the cross-connection control program, our system must assess the degree of hazard posed by each of our customer's plumbing systems upon the public water system. Non-residential customers and multi-family residential customers pose a special concern, because of the greater scope and complexity of their plumbing systems, special uses of water on the premises (e.g., manufacturing), fire protection systems, etc. Depending on the hazard assessment results, you may need to have a backflow preventer installed on your service line or provide alternate protection.

A cross-connection survey needs to be conducted in order for the City to complete the hazard assessment for your premises. The drinking water regulations require a person with special training, i.e., a Department of Health certified Cross-Connection Specialist (CCS), to conduct the surveys. Our system's policy is to have surveys of all non-residential premises and multi-family residential premises conducted by the City of Oak Harbor Water Division.

Please arrange for an appointment for the City to conduct the survey by {insert date}. We appreciate your cooperation in meeting this hazard survey requirement. If you have any questions, please contact me at **(360) 279-4753**.

Sincerely,

Rich Tyhuis
Operations Manager

Enclosures: CCC Brochure
Water Use Questionnaire
CCS List

Request to Install Backflow Prevention Assembly

Date

Customer Account Number (optional)
Customer Name
Customer Address Line 1
Customer Address Line 2

Dear ________ Water System Customer:

Washington State drinking water regulations, WAC 246-290-490, require public water systems to develop and implement cross-connection control programs. Cross-connection control programs protect public health by preventing contamination of the drinking water as it is delivered to people served by the water system. **The purpose of this letter is to inform you of a requirement to install a backflow assembly.**

Our water system's policy considers each of our customers's plumbing systems, starting from the termination of the service pipe downstream of the water meter, to pose a potential cross-connection hazard to the public water system. The policy requires a backflow prevention assembly commensurate with the degree of hazard to be installed on the service line. The purpose of this backflow prevention assembly is to isolate your plumbing system from the water distribution system. Attached is a copy of Ordinance 1456 (OHMC Chapter 13:13) describing the cross-connection control policy.

We have conducted the cross-connection control survey report submitted by the Cross-Connection Control Specialist (CCS). The survey assessed the overall public health hazard posed by your plumbing system (and water use) to the public water system. We agree with the assessment made by the CCS. **Based on the assessment, a Department of Health-approved {insert type of assembly} is required to be installed on your service line (at a location downstream of the water meter).**

Please make arrangements for the assembly to be installed by {**insert date**} or when your plumbing system is modified, whichever comes sooner. We realize that this expense was not anticipated, so if you are unable to comply with this deadline, please contact us to discuss an alternative date. We've enclosed a copy of our standard installation drawings for this type of assembly. Your CCS should oversee the installation of the assembly to ensure compliance with these standards.

We appreciate your cooperation in this matter. If you have any questions, please contact me at **(360) 279-4753**.

Sincerely,

Rich Tyhuis
Operations Manager

cc: {City/County Plumbing Inspector}

Enclosures: Standard Installation Drawings

CITY OF
Oak Harbor
WHIDBEY ISLAND, WASHINGTON

Request To Submit Test of Backflow Prevention Assembly

Date

Customer Account Number (optional)
Customer Name
Customer Address Line 1
Customer Address Line 2

Dear ________ Water System Customer:

Washington State drinking water regulations, WAC 246-290-490, require public water systems to develop and implement cross-connection control programs to protect the drinking water supply from contamination. As part of this program, backflow prevention assemblies have been installed on your water service(s) and/or within your plumbing system to protect our water distribution system. Annual testing is required to ensure that the backflow prevention assemblies properly function.

The purpose of this letter is to request that you now arrange for the annual testing of the reduced pressure principle (RPBA), double check valve (DCVA), and/or pressure vacuum breaker (PVBA or SVBA) assembly/assemblies described on the attached list. A Washington State Department of Health certified backflow assembly tester (BAT) must conduct the testing. **Testing results should be sent to the address above and submitted by {insert date}.**

For your convenience, we are enclosing a list of backflow assembly testers pre-approved to test assemblies that protect the water system. Test report forms are also enclosed. The test report forms need to be properly completed by the BAT, signed by the customer/assembly owner, and returned to the City of Oak Harbor.

Note: the Uniform Plumbing Code in effect in Washington also requires annual assembly testing. In addition to the testing required for the assemblies that protect the public water system (i.e., identified on the attached list), you may wish to have all of the remaining assemblies within your premises tested at this time.

If you have any questions, please feel free to contact me at **(360) 279-4753**.

Sincerely,

Rich Tyhuis
Operations Manager

Enclosures: Assembly List
Pre-Approved BAT List
Assembly Test Report Forms

Second Notice to Test Backflow Prevention Assembly

Date

Customer Account Number (optional)
Customer Name
Customer Address Line 1
Customer Address Line 2

Subject: Testing of Backflow Prevention Assembly - Second Notice
First Notice Date: ________________ Second Notice Date: _______________

Dear ________ Water System Customer:

Washington State drinking water regulations, WAC 246-290-490, require public water systems to implement cross-connection control programs to protect the drinking water supply from contamination. As part of this program, backflow prevention assemblies were installed on your service or within your premises to protect our water distribution system from contamination. The WAC requires these assemblies to be tested annually to verify that they are in good working condition.

The assembly/assemblies identified in our letter of {**insert date**} (copy attached) must be tested by a Department of Health certified Backflow Assembly Tester (BAT) upon installation and annually thereafter. This requirement is a condition of our system continuing to supply potable water to your premises. **According to our records, as of today's date, you have not submitted the requested Assembly Test Report(s).** If you believe this is in error, please contact me as soon as possible at the number below.

If you have not submitted the Assembly Test Reports as requested, please:

- Immediately employ a DOH-certified BAT to test the listed assembly/assemblies; and
- Submit a signed copy of the completed Assembly Test Report(s) to me at the address above **within 15 days of the date of this letter**.

Your cooperation in this matter is essential for protecting your drinking water supply and the public water supply from contamination. Failure to comply with the annual assembly testing requirement will trigger an enforcement action by our system. Enforcement could include a shut-off of your water service.

If you have any questions, please contact me at **(360) 279-4753**.

Sincerely,

Rich Tyhuis
Operations Manager

Enclosure: First Test Notice Letter

APPENDIX C

BACKFLOW ASSEMBLY TESTERS

CITY OF Oak Harbor WHIDBEY ISLAND, WASHINGTON

APPROVED BACKFLOW TESTER LIST

COMPANY	ADDRESS	CITY	ZIP CODE	PHONE #1	PHONE #2
FIRE ES	P.O. BOX 283	MOUNT VERNON	98273	360-424-3473	360-770-2284
COMMERCIAL PLUMBING, INC.		MOUNT VERNON	98273	360-428-5636	360-293-3774
COMMERCIAL FIRE PROTECTION, INC.		MOUNT VERNON	98273	360-848-9093	800-460-5990
BLYTHE PLUMBING & HEATING, INC.	2201 HUMBOLDT STREET	BELLINGHAM	98225	360-733-7810	
AMERICAN SPRINKLER CORPORATION	2311 153RD AVE SE	SNOHOMISH	98290	425-335-4645	
KING WATER COMPANY	P.O. BOX 2243	OAK HARBOR	98277	360-678-5336	1-888-241-2503
AACRA BACKFLOW ASSEMBLY TESTING AND SERVICE	PNB A-11 621 SR 9 NE	LAKE STEVENS	98258	425-334-4507	425-438-5316
SINPLEX GRINNELL	9520 10TH AVE S, #100	SEATTLE	98108	206-291-1400	
ROTO ROOTER SERVICES CO.	20508 56 AVE W, SUITE C	LYNNWOOD	98036	425-670-8442	
AFFORDABLE BACKFLOW TESTING	14441 158TH PL SE	RENTON	98059	206-369-6178	
R & H MECHANICAL, INC.	1711 PORT DRIVE	BURLINGTON	98233	360-757-6909	360-757-6919 FAX
EASTSIDE BACKFLOW	14137 105TH AVE NE	KIRKLAND	98034	425-445-4020	
BELLINGHAM LOCK & SAFE	1619 N STATE ST	BELLINGHAM	98225	360-734-4940	

APPENDIX D

BACKFLOW INCIDENT RESPONSE PLAN

Appendix D
Backflow Incident Response Plan
for the City of Oak Harbor

A. General

This Backflow Incident Response Plan should be considered a supplement to the Purveyor's Emergency Plan.

Purveyors should immediately begin a backflow incident investigation whenever the initial evaluation of a water quality complaint indicates that:

1. A backflow incident has occurred (i.e., drinking water supply has been contaminated) or may have occurred; or

2. The complaint can't be explained as a "normal" aesthetic problem.

Also, whenever a water main break (or power outage for pumped systems) causes a widespread loss of water pressure in the system (creating backsiphonage conditions), purveyors should initiate a check of distribution system water quality as a precursor to the need for a backflow incident investigation.

WAC 246-290-490 requires purveyors to notify DOH, the Local Administrative Authority and local health jurisdiction as soon as possible, but no later than the end of the next business day when a backflow incident contaminates the potable water supply (in the distribution system and/or in the customer's plumbing system). Purveyors should include a list of emergency contact telephone numbers at the beginning of the water system's O & M Manual, so that the information is readily available when an incident occurs.

A backflow incident investigation is often a team effort. The investigation should be made by or initially led by the DOH-certified Cross-Connection Control Specialist employed by the Purveyor. The investigation team may include state health (regional) staff, local health personnel and/or local plumbing inspectors.

Purveyors can get more detailed guidance on how to respond to a backflow incident from the manual, *Backflow Incident Investigation Procedures*, published by the Pacific Northwest Section, American Water Works Association (PNWS-AWWA). Contact information for the PNWS-AWWA is provided in Appendix F.

B. Short List of Tasks

Purveyors should consult the most recently published edition of the PNWS-AWWA *Backflow Incident Investigation Procedures Manual* referenced above for greater detail as soon as possible after learning of a possible or confirmed backflow incident. Note: the water system is referred to as the Purveyor in the short task list.

1. **Customer Notification**

    a. As soon as possible, the Purveyor will notify customers not to consume or use water.

    b. The Purveyor will start the notification with the customers nearest in location to the assumed source of contamination (usually the customer(s) making the water quality complaint).

    c. The Purveyor will inform the customer about the reason for the backflow incident investigation and the Purveyor's efforts to restore water quality as soon as possible. The Purveyor will let the customer know that customers will be informed when they may use water, the need to boil water used for consumption until a satisfactory bacteriological test result is obtained from the lab, etc.

    d. Where a customer cannot be contacted immediately, the Purveyor will place a written notice on the front door handle, and a follow-up visit will be made to confirm that the customer received notice about the possible contamination of the water supply.

    e. When dealing with a backflow incident, the Purveyor will let customers know that it could take several days to identify the source and type of contaminant(s) and to clean and disinfect the distribution system.

2. **Identification of Source of Contamination**

    a. The Purveyor will give consideration to the distribution system as a potential source of the contaminant (e.g., air valve inlet below ground).

    b. The Purveyor will not start flushing the distribution system until the source of contamination is identified (flushing may aggravate the backflow situation, and will likely remove the contaminant before a water sample can be collected to fully identify the contaminant).

    c. The Purveyor will conduct a house-to-house survey to search for the source of contamination and the extent that the contaminant has spread through the distribution system. Note: a check of water meters may show a return of water (meter running backward) to the distribution system.

    d. When the cross connection responsible for the system contamination is located, the Purveyor should discontinue water service to that customer, until the customer completes the corrective action ordered by the Purveyor.

3. **Isolation of Contaminated Portion of System**

    a. The Purveyor will isolate the portions of the system that are suspected of being contaminated by closing isolating valves; leave one valve open to ensure that positive water pressure is maintained throughout the isolated system.

    b. The Purveyor will be sure to notify all affected customers in the isolated area first and then notify other customers served by the system.

4. **Public Health Impacts**

    a. The Purveyor will seek immediate input from and work with state and local health agencies to accurately communicate and properly mitigate potential health effects resulting from the backflow incident.

    b. If appropriate, the Purveyor will refer customers that may have consumed the contaminant or had their household (or commercial) plumbing systems contaminated to public health personnel and Local Administrative Authorities (plumbing inspectors).

5. **Cleaning/Disinfecting the Distribution System**

    a. The Purveyor will develop and implement a program for cleaning the contaminated distribution system consistent with the contaminant(s) identified.

    b. Where both chemical and bacteriological contamination has occurred, the Purveyor will disinfect the system after the removal of the chemical contaminant.

    c. Where any bacteriological contamination is suspected, the Purveyor will provide field disinfection.

C. Additional Information on Cleaning/Disinfecting the Distribution System

Most chemical or physical contaminants can be flushed from the water distribution system or customer's plumbing system with adequate flushing velocity. However, this may not be the case in systems where scale and corrosion deposits (e.g., tuberculation on old cast iron mains) provide a restriction to obtaining adequate flushing velocity, or where chemical deposits or bacteriological slimes (biofilm) are present (on which the chemical contaminant may adhere).

To remove a chemical or physical contaminant from the distribution system, purveyors may need to:

1. Physically clean the affected area using foam swabs (pigs); and/or

2. Alter the form of the chemical contaminant (e.g., through oxidation using chlorination or addition of detergents).

When adding any chemical (including chlorine) to remove a contaminant from the distribution system, it is essential that the Purveyor fully understand the chemistry of the contaminant. **Adding the wrong chemical could make the contaminant more toxic to customers and/or more difficult to remove from the distribution system.**

To disinfect water mains using the "slug" or "continuous flow" method, a field unit should be used for chlorine injection, such as a chemical feed - metering or proportioning pump for sodium hypochlorite. Purveyors should contact the appropriate DOH regional office to discuss proposed approaches to contaminant removal and disinfection prior to taking corrective action.

APPENDIX E

BROCHURES

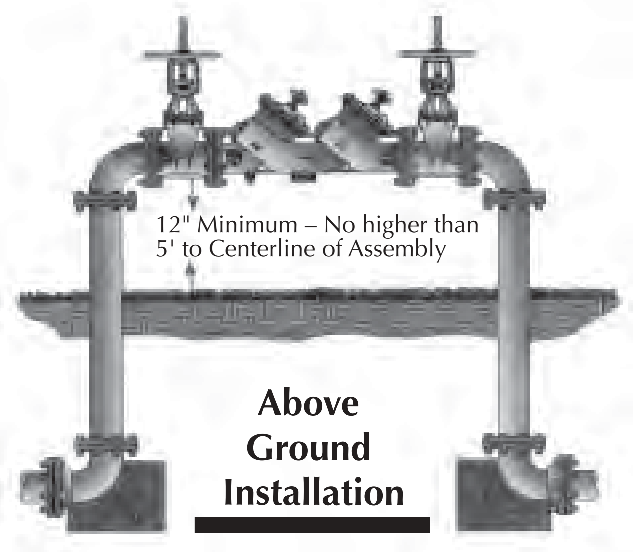
Double check valve assembly and double check detector assembly procedure requirements:

1) All assemblies must be on the Washington State Approved Backflow Assembly List. This list is available through the Department of Heath, (360) 236-3140.

2) **ALL ASSEMBLIES ARE REQUIRED TO BE TESTED BY A WASHINGTON STATE CERTIFIED TESTER UPON INSTALLATION AND ANNUALLY THEREAFTER. ASSEMBLIES MUST BE TESTED AFTER REPAIRS, RELOCATION OR REINSTALLATION.**

3) Contact Local Water Purveyor for inspection of all newly installed assemblies.

4) When choosing the backflow assembly, consult with the local purveyor to ensure it is the right assembly for the application, that is appropriate for the water temperature and is sized hydraulically to avoid excessive pressure loss.



Above Ground Installation

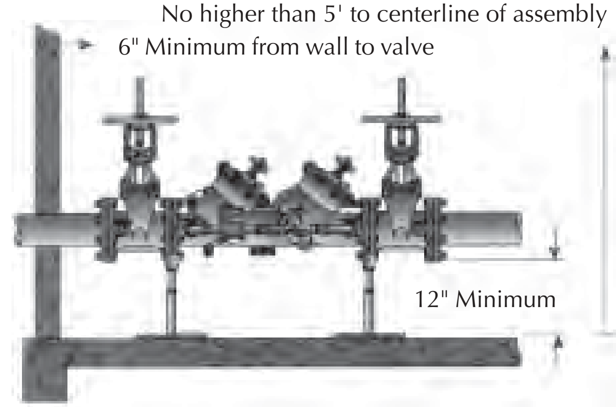
Assembly installation requirements for double check valve assembly and double check detector assembly:

1) **CONTACT LOCAL WATER PURVEYOR TO ENSURE YOU ARE INSTALLING THE CORRECT ASSEMBLY FOR THE DEGREE OF HAZARD.**

2) Assembly must be installed as a complete unit, including two shut off valves, two check valves and four test cocks for each DCVA. All assemblies are required to be installed as a unit in the configuration they were approved by USC.

3) **THOROUGHLY FLUSH** the waterline prior to installing assemblies.

4) Assemblies must be installed a minumum of 12 inches from bottom of assembly, and no higher than 5 feet from floor* to the centerline of assembly. All assemblies must be installed horizontally, unless they have Washington State and use approval to be installed vertically. If installed in a vertical configuration, it must be a minimum of 6 inches from floor, and no higher than 5 feet to the centerline of the #2 shut-off valve. All assemblies must maintain a sufficient clearance from any wall, and 24 inches in front of assembly to ensure accessibility for maintenance and testing. Clearances may vary on small units -contact the local water purveyor for special installation requirements.



Side View or Vault

*An Assembly installed more than 5 feet above floor or ground level must have a permanent platform under it for the plumber, tester or maintenance person to stand on. The platform must comply with all applicable safety standards and codes in effect.

5) Assemblies 2-1/2 inches and larger (in diameter) shall have support blocks to prevent flange damage.

ASSEMBLIES MUST MEET ABOVE REQUIREMENTS TO ENSURE ACCESSIBILITY FOR TESTING, MAINTENANCE AND APPROVAL OF THE WATER PURVEYOR. VARIANCE OF ANY INSTALLATION MUST HAVE PRIOR WRITTEN APPROVAL OF THE LOCAL WATER PURVEYOR AND THE LOCAL OFFICIAL OF THE PLUMBING CODE AND IT'S INSPECTOR.

6) Plugs must be installed in all test cocks on DCVA and DCDA'S.

7) Follow all safety procedures referencing confined space entry.

8) Protect assembly from freezing, flooding and mechanical damage due to water hammer and excessive pressure.

9) Assemblies in vaults require proper drainage.

Double check detector assembly:

1) Assembly shall be installed as a complete unit as it is approved by DOH and USC.

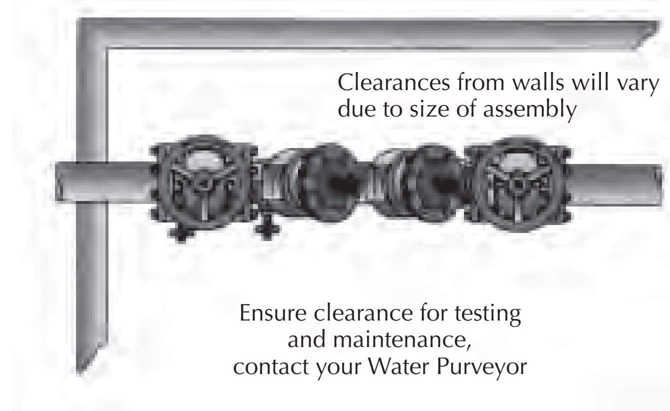
2) All assemblies must maintain a sufficient clearance from anything to ensure accessibility for maintenance and testing.

3) When testing a Double Check Detector Assembly, both the main unit and the assembly on the Bypass must be tested and two test reports submitted to the Water Purveyor.

4) All other requirements are the same as the Double Check Valve Assembly.

5) Check with the local water purveyor for special requirements.

Indoor Installation Top View



This brochure is published by the Western Washington Cross Connection Prevention Professional Group (WWCCPP)
PO Box 94551
Seattle WA 98124

Provided By

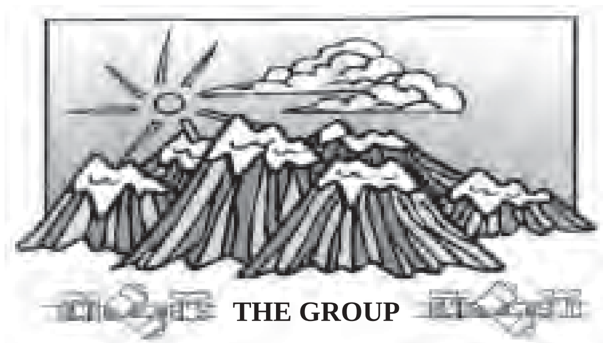
The Local Water Purveyor

For more information, special installation requirements or to schedule an initial inspection, please contact the local Water Purveyor.

3/00

Proper Installation Procedures for

The Double Check Valve Assembly & The Double Check Detector Assembly



Western Washington Cross Connection Prevention Professionals

Help Us Protect Your Drinking Water

Double Check Valve Assembly & Double Check Detector Assembly

1) Thoroughly flush service line prior to installation of assembly.

2) The backflow assembly shall be a Washington State Approved Backflow Assembly and must be:
   - Installed as a unit,
   - Accessible for testing and maintenance,
   - Protected from freezing and vandalism,
   - Installed no higher than 5 feet from floor to centerline of assembly and a minimum of 12 inches from floor to bottom of assembly, and
   - If installed* in a vertical configuration, assembly must be a minimum of 23 inches from floor, and no higher than 5 feet from floor to center of #2 shut off valve.

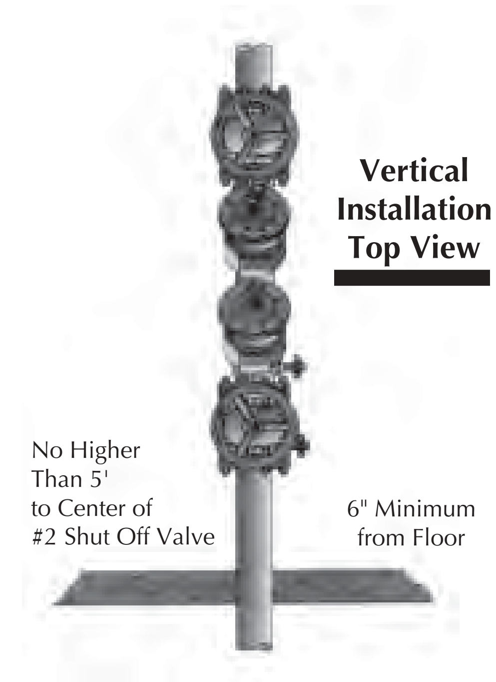
   *Only assemblies with approval from USC & DOH

3) Do not install in an area subject to flooding. If installed in a vault, a small assembly requires a 12 inch clearance below the assembly with pea gravel for drainage.

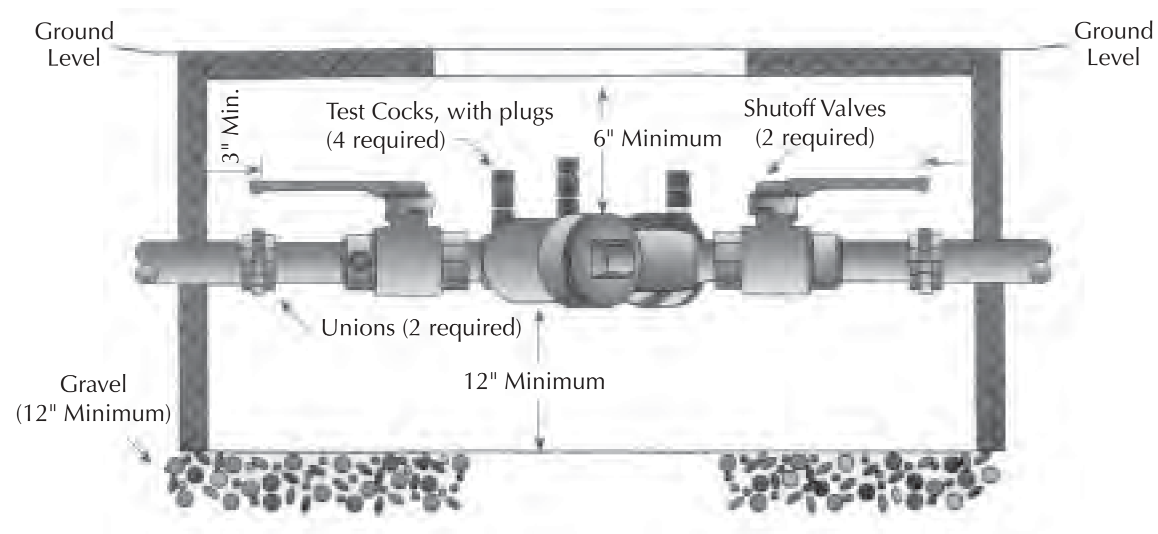
4) Assembly must be tested after initial installation, annually, after repairs or after relocation or reinstallation. Contact the Water Purveyor for inspection of all newly installed assemblies.

5) Test reports must be signed by a certified Backflow Assembly Tester and immediately sent to Local Water Purveyor.

Vertical Installation Top View



DCVA Installation Side View 2" or Smaller



What is a Cross Connection?

A cross connection is a point in a plumbing system where the potable water supply is connected to a non-potable source. Briefly, a cross connection exists whenever the drinking water system is or could be connected to any non-potable source (plumbing fixture, equipment used in any plumbing system). Pollutants or contaminants can enter the safe drinking water system through uncontrolled cross connections when backflow occurs.

Backflow is the unwanted flow of non-potable substances back into the consumer's plumbing system and/or public water system (i.e., drinking water).

There are two types of backflow: ***backsiphonage*** and ***backpressure***. ***Backsiphonage*** is caused by a negative pressure in the supply line to a facility or plumbing fixture. Backsiphonage may occur during waterline breaks, when repairs are made to the waterlines, when shutting off the water supply, etc.

Backpressure can occur when the potable water supply is connected to another system operated at a higher pressure or has the ability to create pressure, etc. Principal causes are booster pumps, pressure vessels, elevated plumbing, etc.

Backflow preventers are mechanical devices designed to prevent backflow through cross connections. However, for backflow preventers to protect as designed, they must meet stringent installation requirements.

For further information contact your local water purveyor or the PNWS/AWWA Cross-Connection Control Committee through the PNWS office at (877) 767-2992

Cross Connections can create Health Hazards

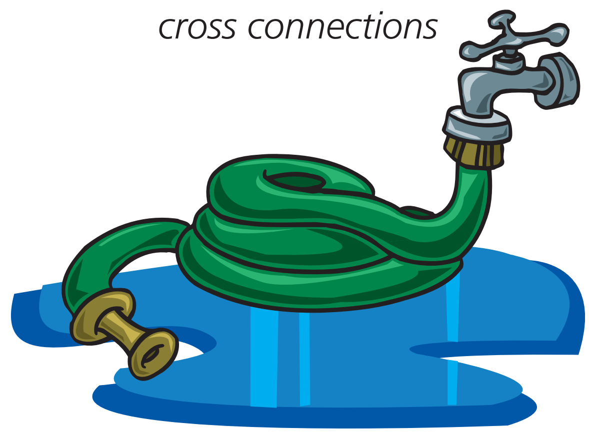
Drinking water systems may become

Polluted

or

Contaminated

through uncontrolled cross connections



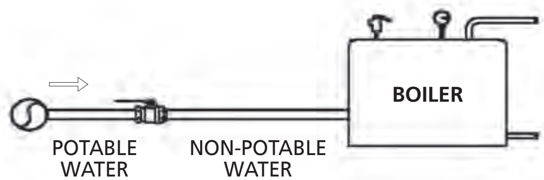
American Water Works Association
Pacific Northwest Section

Why Be Concerned?

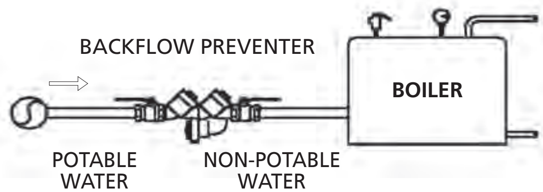
Most water systems in the United States and Canada have good sources of water and/or sophisticated treatment plants to convert impure water to meet drinking water standards. Millions of dollars are spent to make the water potable before it enters the distribution system so most water purveyors think that their supplies are not in jeopardy from this point on. Studies have proven this to be wrong. Drinking water systems may become polluted or contaminated in the distribution system through uncontrolled cross connections.

Cross connections are installed each day in the United States because people are unaware of the problems they can create. Death, illness, contaminated food products, industrial and chemical products rendered useless are some of the consequences of such connections. As a result, many hours and dollars are lost due to ***cross connections***.

Wrong:
Uncontrolled Cross Connection



Right:
Controlled Cross Connection



Where are Cross Connections Found?

Cross connections are found in all plumbing systems. It is important that each cross connection be identified and evaluated as to the type of backflow protection required to protect the drinking water supply. Some plumbing fixtures have built-in backflow protection in the form of a physical air gap. However, most cross connections will need to be controlled through the installation of an approved mechanical backflow prevention device or assembly. Some common cross connections found in plumbing and water systems include:

1. Wash basins and service sinks.
2. Hose bibs.
3. Irrigation sprinkler systems.
4. Auxiliary water supplies.
5. Laboratory and aspirator equipment.
6. Photo developing equipment.
7. Processing tanks.
8. Boilers.
9. Water recirculating systems.
10. Swimming pools.
11. Solar heat systems.
12. Fire sprinkler systems.

Every water system has cross connections. Plumbing codes and State drinking water regulations require cross connections to be controlled by approved methods (physical air gap) or approved mechanical backflow prevention devices or assemblies. The various types of mechanical backflow preventers include: reduced pressure backflow assembly (RPBA), reduced pressure detector assembly (RPDA), double check valve assembly (DCDA), double check detector assembly (DCDA), pressure vacuum breaker assembly (PVBA), spill resistant vacuum breaker assembly (SVBA) and atmospheric vacuum breaker (AVB).

For a backflow preventer to provide proper protection, it must be approved for backflow protection, designed for the degree of hazard and backflow it is controlling, installed correctly, tested annually by a State certified tester, and repaired as necessary. Some States require mandatory backflow protection on certain facilities where high health-hazard-type cross connections are normally found. The following is a partial list of those facilities:

1. Hospitals, mortuaries, clinics.
2. Laboratories.
3. Food and beverage processing.
4. Metal plating and chemical plants.
5. Car washes.
6. Petroleum processing and storage plants.
7. Radioactive processing plants and nuclear reactors.
8. Piers and docks.
9. Sewage treatment plants.

What to Do?

It is impossible to cover all of the information pertaining to cross connections in a pamphlet. We hope the preceding information will inspire you to further educate yourself on the hazards of unprotected cross connections. Cross connection control manuals and training schools are offered throughout the Northwest. Information on manuals, schools and cross connection control can be obtained from:

Washington

Department of Health
Airdustrial Way, Bldg. 3
P.O. Box 47822
Olympia WA 98504-7822
(360) 236-3133

Oregon

Oregon Health Division
3420 Cherry Av NE, #110
Keizer OR 97303
(503) 373-7201

British Columbia, Canada

BC Water & Waste Association
Ste. 342 – 17 Fawcett Road
Coquitlam B.C. V3K 6V2
(604) 540-0111

Idaho

Idaho Division of Environment
1410 N Hilton
Boise ID 83706
(208) 373-0275

Additional sources of information may be found on the PNWS-AWWA web site: www.pnws-awwa.org

Common Household Hazards

Chemical Spray Applicators

The chemicals used on your lawn and garden can be toxic or fatal if ingested. These chemicals include pesticides, herbicides, and fertilizers. Even strong cleaning chemicals sprayed on cars, house siding, etc., may cause health problems if ingested.

Submerged Hoses

Water held in pools, ponds or other vats open to the air and exposed to humans or animals may contain microbiological contaminants. Hoses submerged in buckets or containers can act as a conduit for contaminants under backflow conditions.

Underground Lawn Irrigation Systems

Underground irrigation systems often have puddles of standing water around the ground-level sprinkler heads. The sprinkler heads **are not** designed to be drip-tight under backflow conditions. The puddles of water may contain microbiological contaminants, such as excrement from animals or chemical residue from fertilizer and herbicides sprayed on the lawn.

For further

information

contact your

local water

purveyor or the

PNWS/AWWA

Cross-Connection

Control Committee

through the

PNWS office at

(877) 767-2992

Help protect your ***Drinking Water*** *from* ***Contamination***

Household Hazards

American Water Works Association
Pacific Northwest Section

How Contamination Occurs

Water normally flows in one direction, from the public water system through the customer's cold or hot water plumbing to a sink tap or other plumbing fixture. The plumbing fixture is the end of the potable water system and the start of the waste disposal system.

Under certain conditions water can flow in the reverse direction. This is known as ***backflow***. Backflow occurs when a backsiphonage or backpressure condition is created in a water line.

Backsiphonage may occur due to a loss of pressure in the water distribution system during a high withdrawal of water for fire protection, a water main or plumbing system break, or a shutdown of a water main or plumbing system for repair. A reduction of pressure below atmospheric pressure creates a vacuum in the piping. If a hose bib was open and the hose was submerged in a wading pool during these conditions, the non-potable water in the pool would be siphoned into the house's plumbing and back into the public water system.

Backpressure may be created when a source of pressure, such as a pump, creates a pressure greater than that supplied from the distribution system. If a pump supplied from a non-potable source, such as a landscape pond, were accidentally connected to the plumbing system, the non-potable water could be pumped into the potable water supply.

How to Prevent Contamination of Your Drinking Water

Protect your drinking water by taking the following precautions:

Don't:

- Submerge hoses in buckets, pools, tubs, sinks, ponds, etc.
- Use spray attachments without a backflow prevention device.
- Connect waste pipes from water softeners or other treatment systems to the sewer, submerged drain pipe, etc.
- Use a hose to unplug blocked toilets, sewers, etc.

Do:

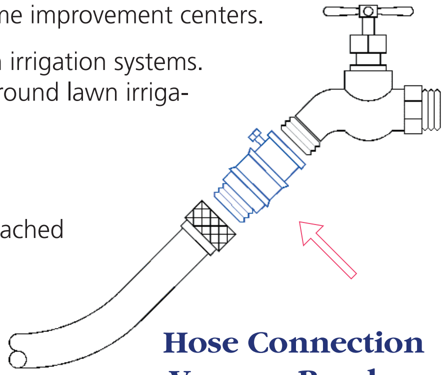
✔ Keep the ends of hoses clear of all possible contaminants.

✔ If not already equipped with an integral (built-in) vacuum breaker, buy and install hose bib type vacuum breakers (see reverse side of this pamphlet) on all threaded faucets around your home. These devices are inexpensive and are available at hardware stores and home improvement centers.

✔ Install an approved backflow prevention assembly on all underground lawn irrigation systems. Remember, a plumbing permit is required for the connection of an underground lawn irrigation system to your plumbing system.

Hose Connection Vacuum Breaker

Hose connection vacuum breakers are specifically made for portable hoses attached to hose thread faucets. Their purpose is to prevent the flow of contaminated water back into the drinking water. These devices screw directly to the faucet outlet. They can be used on a wide variety of installations, such as service sinks, hose faucets near a wading pool, laundry tub faucets, etc.



Hose Connection Vacuum Breaker

Some units are designed for manual draining for freezing conditions. Some are furnished with breakaway set screws as a tamper proof feature.

These device are not intended for operation under continuous pressure.

Protection of the Water Purveyor's Distribution System

In general, the installation of plumbing in compliance with the plumbing code will provide adequate protection for your plumbing system from contamination.

However, the water purveyor may require (as a condition of service) the installation of a backflow prevention assembly on the water service to provide additional protection for the public water system. A backflow prevention assembly will normally be required where a single-family residence has special plumbing that increases the hazard above the normal level found in residential homes, or where a hazard survey cannot be completed.

To help determine if a backflow prevention assembly is required, the water purveyor may send residential customers a Cross Connection Control Survey Questionnaire. The water purveyor will evaluate the returned questionnaires to assess the risk of contamination to the public water system. Based on the results of the evaluation, the installation of backflow prevention assemblies may be required on services to some customers.

LAWN (TURF) IRRIGATION SYSTEMS

For the protection of the water purveyor's distribution system, all irrigation systems must have an approved backflow prevention assembly that is commensurate with the degree of hazard. Irrigation systems are categorized as high health hazard or moderate health hazard as defined below.

Any irrigation system that contains pumps or injectors for the addition of chemicals and/or fertilizers is considered a high hazard. This risk assessment is also based on the additional hazard posed by bacterial contaminants found on lawns, and on the possibility of changes being made to the irrigation system by the customer. An approved reduced pressure backflow assembly (RPBA), or an approved air gap separation, should be required in all cases where chemicals or herbicides may be injected into the irrigation system, or where an auxiliary water supply is also provided for irrigation water.

All irrigation systems that are not classified as high health hazard are considered to be moderate health hazards. This risk assessment is based on the hazard posed by bacterial and chemical contaminants found on lawns, and on the possibility of changes being made to the irrigation system by the customer. An approved double check valve assembly (DCVA), or pressure vacuum breaker assembly (PVBA), should be required.

However, an approved PVBA does not provide adequate protection if it is subjected to flooding, backpressure, elevated piping, or if compressed air is used to winterize the irrigation systems. In these situations, an approved DCVA should be required as a minimum level of protection.

APPROVED BACKFLOW ASSEMBLIES

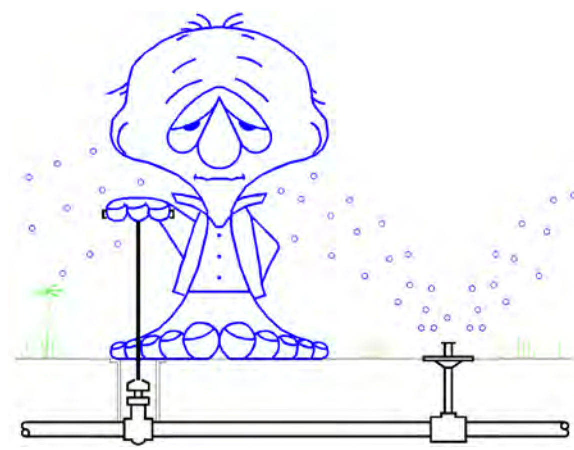
The water purveyor relies on approved backflow prevention assemblies to protect the public water system. Approved assemblies are manufactured with isolation valves and test cocks to permit field-testing to demonstrate that the assemblies are properly functioning to prevent backflow.

In addition to the above assemblies, plumbing codes also allow the use of atmospheric vacuum breakers (AVB) on lawn irrigation systems without chemical addition. Because an atmospheric vacuum breaker is not designed to be tested, some water purveyors require the installation of approved, testable assemblies. Contact your water purveyor regarding the requirements for isolation of your lawn irrigation system.

NOTE:

All irrigation piping should be considered as a non-potable water system due to an actual or potential health hazard.

LAWN IRRIGATION SYSTEMS AND BACKFLOW PREVENTION



American Water Works Association
PACIFIC NORTHWEST SECTION
Oregon – Washington - Idaho

R 9/30/02 [Brochure #3]

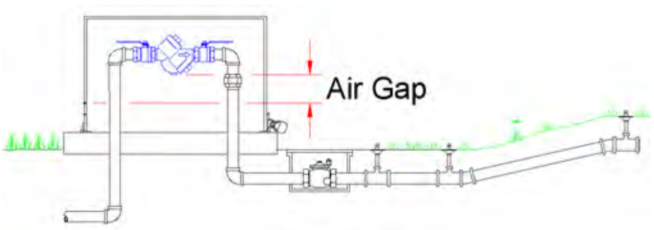
REDUCED PRESSURE BACKFLOW ASSEMBLY FOR ISOLATION OF LAWN IRRIGATION SYSTEM

The reduced pressure backflow assembly (RPBA) shall be installed to isolate irrigation systems using injectors or pumps to apply fertilizer and other agricultural chemicals.

The RPBA must be installed above ground to prevent the relief valve opening from becoming submerged.

The RPBA should be installed in an insulated enclosure to provide freeze protection.

The RPBA shall be tested by a certified backflow assembly tester upon installation, after repair of relocation, and at least annually.



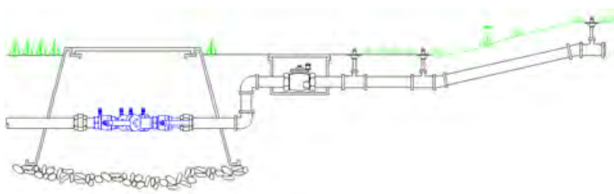
Reduced Pressure backflow Assembly in Above-Ground Enclosure

DOUBLE CHECK VALVE ASSEMBLY FOR ISOLATION OF LAWN IRRIGATION SYSTEM

The double check valve assembly (DCVA) may be installed to isolate all irrigation systems that do not use injectors or pumps to apply fertilizer and other agricultural chemicals.

The DCVA may be installed in a below ground enclosure provided the assembly test cocks are plugged; the test cocks are pointed up; adequate space is provided for maintenance and testing, and any compressed air connections are installed only downstream of the DCVA.

The DCVA shall be tested by a certified backflow assembly tester upon installation, after repair of relocation, and at least annually.



Double Check Valve Assembly in Below-Ground Box

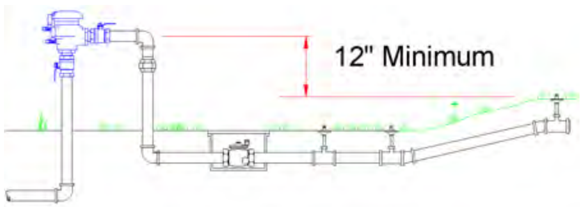
For further information contact your local water purveyor or the PNWS/AWWA Cross-Connection Control Committee through the PNWS office at (877) 767-2992.

PRESSURE VACUUM BREAKER ASSEMBLY FOR ISOLATION OF LAWN IRRIGATION SYSTEMS

The pressure vacuum breaker assembly (PVBA) may be installed to isolate all irrigation systems that do not use injectors or pumps to apply fertilizer and other agricultural chemicals.

The PVBA shall be installed at least 12 inches above the highest point in the irrigation piping.

The PVBA shall be tested by a certified backflow assembly tester upon installation, after repair of relocation, and at least annually.



Pressure Vacuum Breaker Assembly

This brochure is published by the Western
Washington Cross Connection Prevention
Professional Group (WWCCPP)
PO Box 94551
Seattle WA 98124

Provided By

The Local Water Purveyor

For more information, special installation requirements or to schedule an initial inspection, please contact the local Water Purveyor.

Proper Installation Procedures for

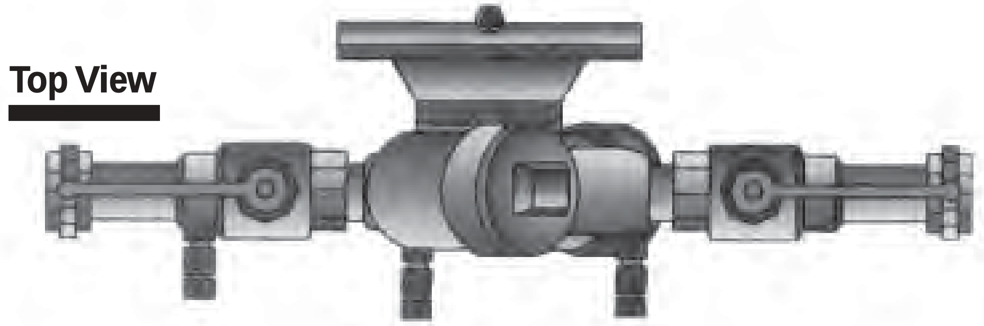
The Reduced Pressure Backflow Assembly & The Reduced Pressure Detector Assembly

THE GROUP

Western Washington Cross Connection Prevention Professionals

Help Us Protect Your Drinking Water

Top View



Reduced Pressure Backflow Assembly/Reduced Pressure Detector Assembly

1) Thoroughly flush service line prior to installation of assembly.

2) The backflow assembly shall be a Washington State Approved Backflow Assembly and must be:
   - Installed as a unit,
   - Accessible for testing and maintenance,
   - Protected from freezing and vandalism, Installed no higher than 5 feet from floor to centerline of assembly and a minimum of 12 inches from floor to bottom of assembly, and
   - If installed* in a vertical configuration, assembly must be a minimum of 23 inches from floor, and no higher than 5 feet from floor to center of #2 shut off valve.

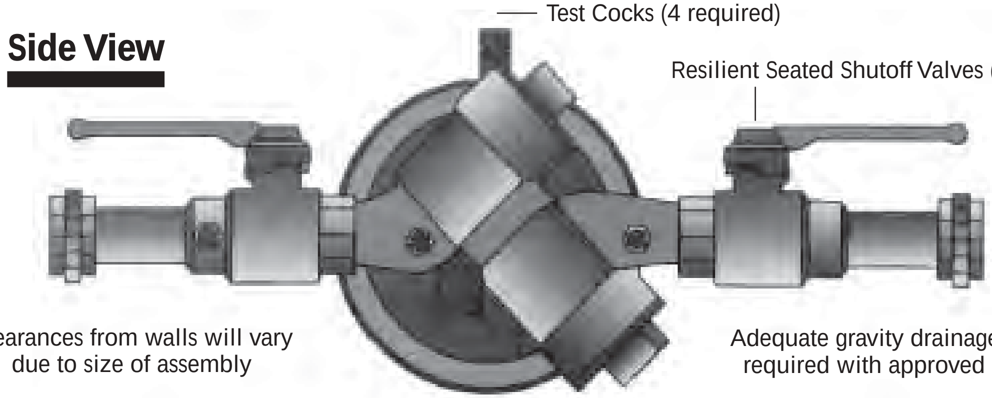
   *Only assemblies with approval from USC & DOH

3) Do not install in an area subject to flooding. Assemblies must be installed above ground.

4) Assembly must be tested after initial installation, annually, after repairs or after relocation or reinstallation. Contact the Water Purveyor for inspection of all newly installed assemblies.

5) Test reports must be signed by a certified Backflow Assembly Tester and immediately sent to Local Water Purveyor.

Side View



Reduced pressure backflow assembly/reduced pressure detector assembly procedure requirements:

1) All assemblies must be on the Washington State Approved Backflow Assembly List. This list is available through the Department of Heath, (360) 236-3140/1800-521-0323.

2) **ALL ASSEMBLIES ARE REQUIRED TO BE TESTED BY A WASHINGTON STATE CERTIFIED TESTER UPON INSTALLATION AND ANNUALLY. IN ADDITION, ASSEMBLIES MUST BE TESTED AFTER REPAIRS, RELOCATION OR REINSTALLATION.**

   Please note: Air gaps installed in lieu of a reduced pressure backflow assembly also require annual inspection. Test reports must be submitted immediately to Local Water Purveyor.

3) Contact Local Water Purveyor for inspection of all newly installed assemblies.

4) When choosing the backflow assembly, consult Local Water Purveyor to ensure it is the right assembly for the application, is appropriate for the water temperature and is sized hydraulically to avoid excessive pressure loss.

5) When installing an assembly inside a building, ensure assembly is located where occasional spitting from the relief valve port, a fouled check, or water flushed out during the annual test will not be objectionable. Proper drainage must be provided.

6) Protect assembly from freezing, flooding and mechanical damage due to water hammer and excessive pressure build up.

Assembly installation requirements for reduced pressure backflow assembly/reduced pressure detector assembly:

1) **CONTACT LOCAL WATER PURVEYOR TO ENSURE YOU ARE INSTALLING THE CORRECT ASSEMBLY FOR THE DEGREE OF HAZARD.**

2) Assembly must be installed as a unit, including two shut off valves, relief port, two check valves and four test cocks. All assemblies are required to be installed as a unit in the configuration they were approved by USC.

3) **THOROUGHLY FLUSH** the waterline prior to installing assemblies.

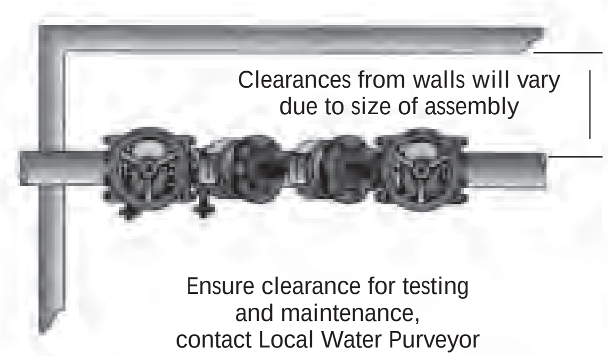
4) Assemblies must be installed a minimum of 12 inches from the bottom of the relief port, and no higher than 5 feet from floor* to centerline of assembly. All assemblies must be installed horizontally, unless they have Washington State approval to be installed vertically. If installed in a vertical configuration, it must be a minimum of 12 inches from floor, and no higher than 5 feet from floor* to center of the #2 shut off valve. All assemblies must maintain a sufficient clearance from any wall to ensure accessibility of maintenance and testing. Clearances may vary on small units - contact the Local Water Purveyor. Sizes 2 1/2 inches and larger in diameter may require additional space on one side of the assembly. Assemblies 2 1/2 inches and larger in diameter shall have support blocks to prevent flange damage.

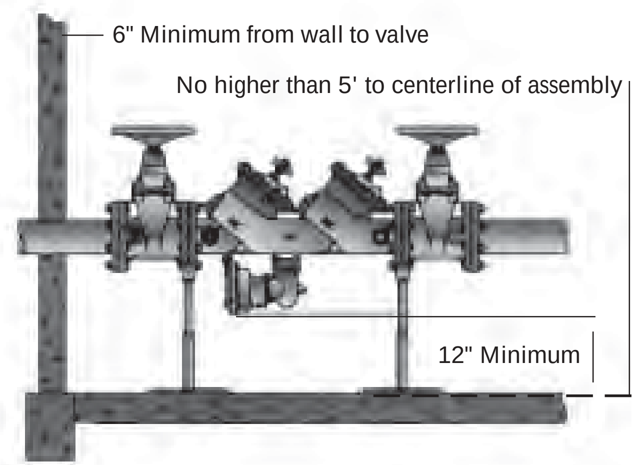
* An assembly installed more than 5 feet above floor or ground level must have a permanent platform under it for the tester or maintenance person to stand on. The platform must comply with all applicable safety standards and codes in effect.

REDUCED PRESSURE BACKFLOW ASSEMBLIES CANNOT BE INSTALLED BELOW GROUND AT ANY TIME.

ASSEMBLIES MUST MEET ABOVE REQUIREMENTS TO ENSURE ACCESSIBILITY FOR TESTING, MAINTENANCE AND APPROVAL OF THE WATER PURVEYOR. VARIANCE OF ANY INSTALLATION MUST HAVE PRIOR WRITTEN APPROVAL OF LOCAL WATER PURVEYOR.

Top View





Side View

Requirements for air gaps:

1) Air gap must be twice the diameter of the inlet pipe, minimum of 1 inch.

2) The air gap must provide a physical separation from the bottom of the inlet piping to the top of the overflow rim of the receiving vessel.

3) If inlet piping is cut diagonally to decrease splashing, the air gap separation is measured from the bottom of the cut to the receiving vessel.

4) If air gap is located near sidewalks, the separation increases to three times the diameter of the inlet piping, minimum of 1 1/2 inches.

Reduced pressure detector assembly:

1) Assembly shall be installed as a unit as it is approved by DOH and USC.

2) All assemblies must maintain a sufficient clearance from any wall to ensure accessibility for maintenance and testing.

3) When testing a Reduced Pressure Detector Assembly, both assemblies must be tested and two test reports submitted to the Local Water Purveyor.

4) All other requirements are the same as the Reduced Pressure Backflow Assembly.

Flow-through protection systems are those systems that do not have fire department pumper connections. They are constructed of approved potable water piping and materials to which sprinkler heads are attached. The system terminates at a connection to a toilet or other plumbing fixture to prevent the water from becoming stagnant.

Combination protection systems also do not have fire department pumper connections and are constructed of approved potable water piping and materials that serve both the fire sprinkler system and the consumer's potable water system.

Both of the above two systems do not require backflow preventers because they are connected directly to the potable water and the inherently designed to potable water standards.

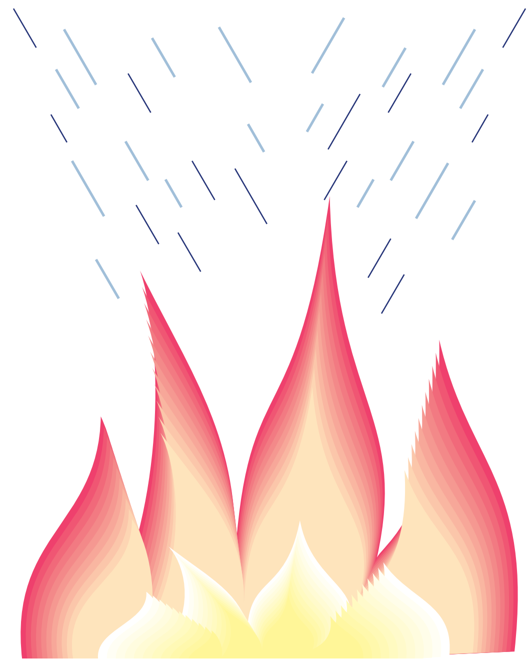
Closed fire protection systems are separated from the potable water system by the minimum use of a Double Check Valve Assembly (DCVA) as long as no chemicals are used and a Reduced Pressure Backflow Assembly (RPBA) if chemicals are used. Closed system may have a fire department pumper connection.

Note:

1. The water purveyor must be consulted for proper backflow prevention requirements.
2. It is important to have the system engineered hydraulically. The NFPA standards 13 and/or 13D must be considered when designing the fire system.
3. Flow and pressure may not be adequate for fire protection.
4. A plumbing and/or fire permit may be required prior to starting the project.
5. A system is less expensive to install at initial house construction.
6. Some water purveyor's requirements may be more stringent than others – consult you local purveyor for requirements.

For further information contact your local water purveyor or the PNWS/AWWA Cross-Connection Control Committee through the PNWS office at (877) 767-2992

Residential Fire Sprinkler Systems *and* Backflow Prevention



American Water Works Association
Pacific Northwest Section

Residential Fire Sprinkler Systems

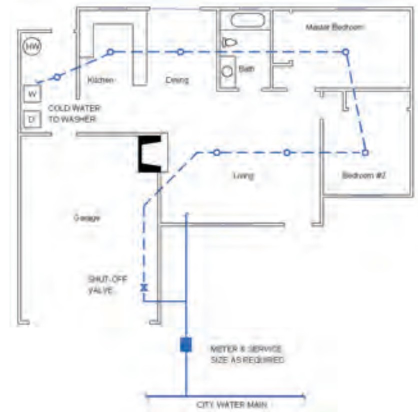
Residential fire sprinklers are in greater demand today than ever before. Personal fire safety is such a trend that in many areas ordinances or resolutions require fire sprinklers on all new residential construction.

Residential fire sprinkler systems help save lives and reduce property damage. However, from the water purveyor's point of view, the residential fire sprinkler system presents a potential pollutant and/or contaminant source to the potable water system from cross-connections. Both homeowners and the public may be exposed to health hazards from residential fire sprinkler systems. Such hazards include stagnant water, non-potable piping, heterotrophic bacteria, and chemicals. Therefore these systems must be evaluated for health and system hazards.

The following minimal information should be considered in the selection of backflow protection on residential fire sprinkler systems.

Residential fire sprinkler systems are categorized as ***flow-through***, ***combination***, and ***closed*** fire protection systems. Each of these systems has their advantages and disadvantages. It should also be noted that what the local fire departments, local administrative authorities and water purveyors allow will determine which of these systems can be found in any particular jurisdiction. It is imperative that the water purveyor, local administrative authority, fire department, and other agencies coordinate their efforts in the design and operation of these systems.

Flow-Through Fire Protection Systems



Advantages

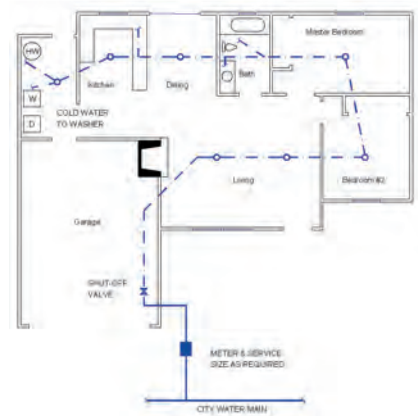
1. Contains no standing or stagnant water.
2. No backflow protection is required.
3. Usually requires a single meter.

Disadvantages

1. Service line, meter and plumbing system must be designed hydraulically to supply both domestic and fire flow requirements.

Sprinkler system must have connection at the end to a clothes washer, dishwasher, toilet or other fixture to prevent water from becoming stagnant.

Combination Protection Systems



Advantages

1. Contains no standing or stagnant water.
2. No backflow protection is required.
3. Usually requires a single meter.
4. Water use throughout the potable water system eliminates need for water use at the end of the system.

Disadvantages

The service line, meter and plumbing system must be designed hydraulically to supply both domestic and fire flow requirements.

Closed Fire Protection Systems

Advantages

1. Installing a separately metered service line may be cheaper than upgrading an existing service.
2. A fire service rate is usually cheaper than a residential service rate.

Disadvantages

1. Approved backflow preventers must be installed, thereby increasing the homeowner's cost by its initial installation, and thereafter for annual testing and maintenance.
2. When chemicals are added to the fire sprinkler system to prevent freezing, a high health hazard exists. This requires a higher, more expensive, level of protection, i.e., a Reduced Pressure Backflow Assembly (RPBA).

If the fire service and domestic service are combined, the fire service may not be turned off because of safety reasons.

Protection from Thermal Expansion

Protection from thermal expansion is provided in a plumbing system by the installation of a ***thermal expansion tank*** in the hot water system piping downstream of the hot water tank and a ***temperature and pressure relief valve*** (T & P Valve) at the top of the tank.

The thermal expansion tank controls the increased pressure generated within the normal operating temperature range of the water heater. The small tank with a sealed compressible air cushion provides a space to store and hold the additional expanded water volume.

The T & P Valve is the primary safety feature for the water heater. The ***temperature*** portion of the T & P Valve is designed to open and vent water to the atmosphere whenever the water temperature within the tank reaches approximately 210° F (99° C). Venting allows cold water to enter the tank.

The ***pressure*** portion of a T & P Valve is designed to open and vent to the atmosphere whenever water pressure within the tank exceeds the pressure setting on the valve. The T & P Valve is normally pre-set at 125 psi or 150 psi.

Water heaters installed in compliance with the current plumbing code will have the required T & P Valve and thermal expansion tank. For public health protection, the water purveyor may require the installation of a check valve or backflow preventer downstream of the water meter. In these situations, it is essential that a T & P Valve and thermal expansion tank be properly installed and maintained in the plumbing system.

For further information contact your local water purveyor, City or County building department, licensed plumber or the PNWS/AWWA Cross-Connection Control Committee through the PNWS office at (877) 767-2992

Protect Your ***Water Heater*** *from* Thermal Expansion

Without a functioning Temperature & Pressure Relief Valve your water heater can

American Water Works Association
Pacific Northwest Section

Thermal Expansion Danger

Most homes are supplied with hot water from an electric or gas heated tank. Until the heating element stops working, and one is faced with a cold shower, the water heater is usually taken for granted. However, if not properly maintained, a water heater may become a safety hazard.

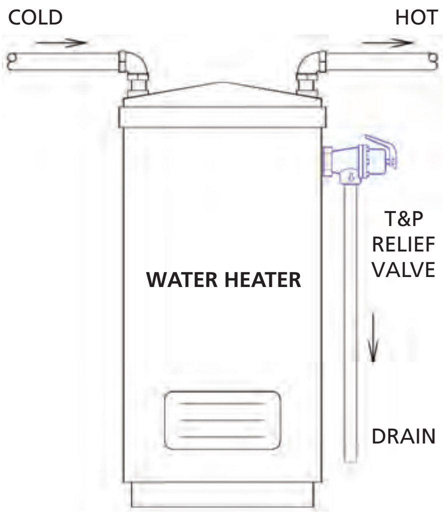
Water expands in volume as its temperature rises. The extra volume caused by thermal expansion must go somewhere. If not, the heated water creates an increase in pressure. This is the principle of a steam engine.

The temperature and pressure in the water heater is reduced when hot water is withdrawn from a faucet and cold water enters the tank. The increase in pressure from thermal expansion can also be reduced by water flowing back into the public water system. However, when a check valve, pressure-reducing valve or backflow preventer is installed in the service pipe a "closed system" is created. Provisions must be made for thermal expansion in these cases.

The thermostat of the water heater normally maintains the water temperature at about 130° F (54° C). However, if the thermostat fails to shut off the heater, the temperature of the water will continue to increase.

If the water temperature increases to more than 212° F (100° C), the water within the tank becomes "super heated". When this super heated water is suddenly exposed to the atmosphere when a faucet is opened, it instantly flas hes into steam and a violent reaction may result. As the pressure within the tank continues to build up under super heated conditions, the tank may explode.

T&P Valve Location



Why the Installation of a Backflow Preventer is Required on a Water Service

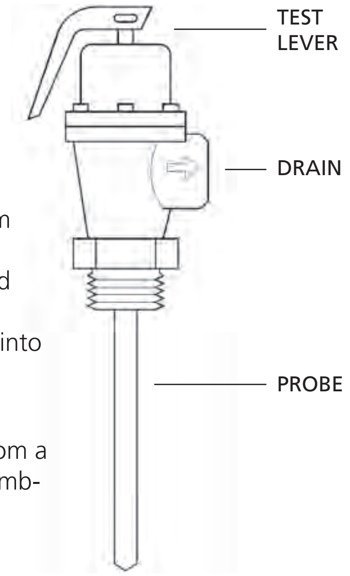
Water normally flows in one direction, from the public water system through the customer's cold or hot water plumbing to a sink tap or other plumbing fixture. The plumbing fixture is the end of the potable water system and the start of the waste disposal system.

Under certain conditions water can flow in the reverse direction. This is known as ***backflow***. Backflow occurs when a backsiphonage or backpressure condition is created in a water line.

Backsiphonage may occur due to a loss of pressure in the water distribution system during a high withdrawal of water for fire protection, a water main or plumbing system break, or a shutdown of a main or plumbing system for repair. A reduction of pressure below atmospheric pressure creates a vacuum in the piping. If a hose bib was open and the hose was submerged in a wading pool were flowing during these conditions, the non-potable water in the pool would be siphoned into the house plumbing then back into the public water system.

Backpressure may be created when a source of pressure, such as a pump, creates a pressure greater than that supplied from the distribution system. If a pump supplied from a non-potable source, such as a landscape pond, were accidentally connected to the plumbing system, the non-potable water could be pumped into the potable water supply.

Typical T&P Valve



What the Homeowner Should Do to Ensure Protection from Thermal Expansion

- The homeowner should check to see that an expansion tank and T & P Valve are in place. If there is any doubt, the homeowner should contact a licensed plumber.
- The T & P Valve should be periodically inspected to ensure that is properly operating. Some T & P Valves are equipped with a test level. Manually lifting the lever unseats the valve, allowing water to discharge. If water continues to leak from the T & P Valve after closing, the valve may need to be replaced. A drain line must be installed to avoid water damage and scalding injury when the valve operates.
- The T & P Valve should be periodically removed and visually inspected for corrosion deposits and to insure it has not been improperly altered or repaired.
- The above work can best be done by a licensed plumber.

APPENDIX F

ANNUAL SUMMARY REPORT FORM

Appendix F
Annual Summary Report Forms

The three forms are:

1. **Cross-Connection Control Activities Annual Summary Report**

   Purveyors use this form to report (for a calendar year) their CCC implementation activities, such as status of high-hazard premises protection, backflow preventer inventory/testing information, and hazard evaluations. This is the "blue form."

2. **Cross-Connection Control Program Summary Report**

   This form is use to report the type, policies, and provisions of a public water system's CCC written program. This is the "cream form."

3. **Exceptions to High Health Hazard Premises Isolation Requirements**

   Purveyors use this form to document and report exceptions to mandatory premises isolation requirements allowed under WAC 246-290-490(4)(b)(iii). Only purveyors granting exceptions need to complete and submit this form. This is the "green form."

Washington State Department of Health

Office of Drinking Water
Public Water System Cross-Connection Control Activities
Annual Summary Report for 2005

Part 1: Public Water System (PWS) and Cross-Connection Control Specialist (CCS) Information

PWS ID:	PWS Name:	County:
Provide name and Certification Number of CCS who develops and implements your CCC program.		
CCS Name (Last, First & MI):		CCS Phone: (0) ___-____
CCS Cert. No.:	BAT Cert. No. (if applicable):	
CCS is (check one): PWS owner or employee ☐	On contract to PWS ☐	Volunteer or other ☐

Part 2: Status of Cross-Connection Control (CCC) Program at End of 2005

PWS has (check one box in each column below):	
A written CCC program plan Y ☐ N ☐	CCC implementation activities Y ☐ N ☐

Written program plan may be a separate document or part of water system plan or small water system management program.

Provide information about PWS's specific CCC Program Elements.

Check one box in each column for each row.

Program Element Number	**Description of Element [See WAC 246-290-490(3)]**	**This Program Element is Currently: Included in Written Program**	**Being Implemented or is Completed**
1	Legal Authority Established	Y ☐ N ☐	Y ☐ N ☐
2	Hazard Evaluation Procedures and Schedules	Y ☐ N ☐	Y ☐ N ☐
3	CCC Procedures and Schedules	Y ☐ N ☐	Y ☐ N ☐
4	Certified CCS Provided	Y ☐ N ☐	Y ☐ N ☐
5	Backflow Preventer Inspection and Testing	Y ☐ N ☐	Y ☐ N ☐
6	Testing Quality Control Assurance Program	Y ☐ N ☐	Y ☐ N ☐
7	Backflow Incident Response Procedures	Y ☐ N ☐	Y ☐ N ☐
8	Public Education Program	Y ☐ N ☐	Y ☐ N ☐
9	CCC Records	Y ☐ N ☐	Y ☐ N ☐
10	Reclaimed Water Permit	Y ☐ N ☐ N/A ☐	Y ☐ N ☐ N/A ☐

Did you check one box in EACH of the above columns for EACH row?

Part 3A: System Characteristics at End of 2005

Indicate the number of connections of each type that the PWS serves (whether or not they are protected by backflow preventers). **Estimate if necessary.**

Type of Service Connection	**Number**
Residential (as defined by PWS)	
All Other (include dedicated fire sprinkler and irrigation lines and PWS-owned facilities such as water and wastewater treatment plants and pumping stations, parks, piers and docks)	
Total Number of Connections	

Part 3B: Cross-Connection Control for High-Hazard Premises or Systems Served by the PWS

If PWS does not serve any high-hazard premises or systems, check here ☐ and go to Part 4.

- Complete all cells. Count only premises PWS serves water to. Enter zero (0) if PWS doesn't serve such premises.

Report data as accurately as possible. DOH currently bases CCC compliance actions on this information.

Type of High-Hazard Premises or Systems [WAC 246-290-490(4)(b)]	Number of Connections at end of 2005			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG or RP[2]	C. With Premises Isolation AG Inspected or RP Tested[3]	D. Granted Exception from Mandatory Premises Isolation
Agricultural (farms and dairies)				
Beverage bottling plants (including breweries)				
Car washes				
Chemical plants				
Commercial laundries and dry cleaners				
Both reclaimed water and potable water provided				
Film processing facilities				
Dedicated fire protection systems with chemical addition or using unapproved auxiliary supplies				
Food processing plants (including canneries, slaughter houses, rendering plants)				
Hospitals, medical centers, nursing homes, veterinary, medical and dental clinics, and blood plasma centers				
Dedicated irrigation systems using purveyor's water supply *and* with chemical addition[4]				
Laboratories				
Metal plating industries				
Mortuaries				
Petroleum processing or storage plants				
Piers and docks				
Radioactive material processing plants or nuclear reactors				
Survey access denied or restricted				
Wastewater lift/pump stations (non-residential only)				
Wastewater treatment plants				
Unapproved auxiliary water supply interconnected with potable water supply				
Other high-hazard premises (please list):[5]				
Totals				

1) Count multiple connections or parallel installations to the same premises as ***separate*** connections.
2) Count only those connections with AG or RPBA installed for premises isolation. Don't include connections with in-premises protection only or connections with DCVAs or DCDAs installed for premises isolation.
3) Count only those connections ***whose premises isolation preventers*** were inspected (AG) or tested (RPBA) during 2005.
4) For example, dedicated lines to irrigation systems in parks, playgrounds, golf courses, cemeteries, estates, etc.
5) Premises with hazardous materials or processes (requiring isolation by AG or RPBA) such as: aircraft and automotive manufacturers, pulp and paper mills, metal manufacturers, military bases, and wholesale customers that pose a high hazard to the PWS. May be grouped together in categories, e.g.: other manufacturing or other commercial. ***If needed, attach additional sheet giving same information as requested in table.***

Part 4A: Backflow Preventer Inventory and Testing Data During Year 2005

- Complete all cells. **Count only backflow preventers relied on to protect the PWS.** Enter zero (0) if PWS doesn't rely on any preventers in a particular category.
- **If PWS records don't distinguish between premises isolation and in-premises protection preventers**, *enter all data in Premises Isolation Section (rows 1-7) and check the box in the Premises Isolation heading row (above row 1).*
- Count AVBs on irrigation systems only. **If you don't track AVBs, check the box above the "AVB" column.**
- Count multiple tests (or failures) for any particular backflow preventer as one test (or failure) for that backflow preventer.
- Count each assembly separately for multiple service connections or parallel installations. Count RPDAs and DCDAs as single assemblies (don't count bypass separately).
- Count assemblies installed on dedicated fire or irrigation lines as Premises Isolation Assemblies.

If PWS doesn't track AVBs, check here. ☐

	Backflow Preventer Category and Inspection/Testing Information	Air Gap	RPBA	RPDA	DCVA	DCDA	PVBA	SVBA	AVB
Premises Isolation, including preventers isolating PWS-owned facilities. ***If In-Premises Protection preventers are also included, check here*** ☐.									
Rows 1 – 3 pertain ONLY to Premises Isolation preventers in service at beginning of 2005									
1	In service at beginning of 2005								
2	[illegible][1]								
3									
Rows 4 – 6 pertain ONLY to NEW Premises Isolation preventers installed during 2005									
4	New preventers installed in 2005[2]								
5	[illegible][1]								
6									
7	Preventers taken out of service in 2005[3]								
Premises Isolation Total at end of 2005[4]									
In-Premises Protection (Fixture Protection or Area Isolation), including preventers within PWS-owned facilities.									
Rows 8 – 10 pertain ONLY to In-Premises Protection preventers in service at beginning of 2005									
8	In service at beginning of 2005								
9	[illegible][1]								
10									
Rows 11 – 13 pertain ONLY to NEW In-Premises Protection preventers installed during 2005									
11	New preventers installed in 2005[2]								
12	[illegible][1]								
13									
14	Preventers taken out of service in 2005[3]								
In-Premises Protection Total at end of 2005[4]									
Grand Total at end of 2005									

1 Initial and/or routine annual inspection (for proper installation and approval status) and/or test (for testable assemblies only using DOH/USC test procedures).
2 Includes preventers installed on connections where backflow prevention was not previously required and any preventers that replaced those in service at beginning of 2005. Replacement preventers may be of a different type than the original.
3 New or existing preventers taken out of service, whether or not they were replaced by the same type or different type of preventer.
4 Total at end of 2005 should be equal to the number of preventers in service at beginning of 2005 plus those installed during 2005 minus the number of preventers taken out of service during 2005.

Complete all cells. Enter zero (0) if not applicable.

Activity or Condition	Number
New service connections evaluated in 2005 for cross-connection hazards to PWS.	
New service connections requiring backflow protection to protect the PWS.[1]	
Existing service connections evaluated in 2005 for cross-connection hazards to PWS.	
Existing service connections requiring backflow protection to protect the PWS.[1, 2]	
Exceptions granted in 2005 to high-hazard premises per WAC 246-290-490(4)(b).[3]	
CCC enforcement actions taken by PWS during 2005.[4]	

Part 4B: Other Implementation Activities in 2005

1) Include services where either premises isolation or in-premises preventers were required to protect the PWS.
2) Include existing services that need new, additional or higher level backflow prevention.
3) A DOH Exception to High Health Hazard Premises Isolation Requirements Form (green) *must* be attached for each exception granted during the year.
4) "Enforcement actions" mean actions taken by the PWS (such as water shut-off, PWS installation of backflow preventer, etc.) when the customer fails to comply with PWS's CCC requirements.

Part 5: Backflow Incidents, Risk Factors and Indicators during 2005

Complete only one column for each row. Check "Data Not Available" if PWS doesn't track such data.

Backflow Incidents, Risk Factors and Indicators during 2005		Number (Enter 0 if none)	Check if Data Not Available
Backflow Incidents during 2005			
1	Backflow incidents that contaminated the PWS.[5]		☐
2	Backflow incidents that contaminated the customer's drinking water system ***only***.[5]		☐
Risk Factors for Backflow during 2005			
3	Distribution main breaks per 100 miles of pipe.		☐
4	Low pressure events (<20 psi in PWS distribution system).		☐
5	Water outage events.		☐
Indicators of Possible Backflow during 2005			
6	Total health-related complaints received by PWS.[6]		☐
7	Received during BWA or PN events.[7]		☐
8	Received during low pressure or water outage events.		☐
9	Total aesthetic complaints (color, taste, odor, air in lines, etc.).		☐
10	Received during BWA or PN events.[7]		☐
11	Received during low pressure or water outage events.		☐

5) Complete and submit a DOH Backflow Incident Report form for each known backflow incident. The form is available on the Office of Drinking Water (ODW) website or from the ODW upon request.

6) Such as stomachache, headache, vomiting, diarrhea, skin rashes, etc.

7) "**BWA**" means ***Boil Water Advisory*** and **"PN"** means ***Public Notification*** for water quality reasons.

Part 6: Comments and Clarifications

Enter comments or clarifications to any of the information included in this report.

Part No.	Comment

Part 7: Report Completion Information

Enter dates in MM/DD/YYYY format.

1) CCC Program Manager is generally the CCS responsible for developing and implementing the PWS's CCC Program.

I certify that the information provided in this CCC Activities Report is complete and accurate to the best of my knowledge.		
CCC Program Mgr. Name (Print) [1]:		Title:
Signature:		Date:
Phone: (___) ___-____	E-mail: ________________@__________________________	
I have reviewed this report and certify that the information provided is complete and accurate to the best of my knowledge.		
PWS Mgr./Owner Name (Print)[2]:		Title:
Signature:	Op. Cert. No.:	Date:

2) The person that the CCC Program Manager reports to or other manager having direct responsibility and/or oversight of the CCC program. This person doesn't need to be in charge of the entire water system.

Washington State Department of Health

Office of Drinking Water

Cross-Connection Control Program Summary Report For 2005

Describe the characteristics of the PWS's CCC Program at the end of 2005. Complete this form only if the PWS had *written* CCC program plan, policies or procedures at end of 2005.

Part 1: Public Water System (PWS) Identification

PWS ID:	PWS Name:	County:

Part 2: Cross-Connection Control (CCC) Program Characteristics

A. Type of Program Currently Implemented

Type of Program	Check One
Premises isolation only.	☐
Combination program: reliance on both premises isolation and in-premises protection.	☐
In transition from a combination program to a premises isolation only program.	☐

B. Coordination with Local Administrative Authority (LAA) on Cross-Connection Issues

Indicate the status of coordination with LAAs in your service area. The LAA is the entity that enforces the Uniform Plumbing Code. ***Check one box in each of last 3 columns for each LAA in your service area.***

LAA No.	Name of LAA[1] (e.g., the City or County Building Department)	PWS currently: Coordinates with LAA	If Not Coordinating, did LAA Decline to Coordinate?	Has Written Agreement with LAA
1		Y N	Y N	Y N
2		Y N	Y N	Y N
3		Y N	Y N	Y N
4		Y N	Y N	Y N
5		Y N	Y N	Y N

If more than 5 LAAs, attach separate sheet giving the above information.

C. Corrective or Enforcement Actions Available to the Purveyor

Type of Corrective Action	Indicate Whether Available	Most Often Used (check one)
Denial or discontinuance of water service.	Y N	☐
Purveyor installs backflow preventer and bills customer.	Y N	☐
Assessment of fines (in addition to elimination or control of cross-connection).	Y N	☐
Other corrective actions (describe):	Y N	☐
	Y N	☐

D. CCC Program Responsibilities

Do not include enforcement action related procedures or circumstances.

CCC Program Activity	Responsible Party (Check only one box per row)	
	Customer	Purveyor
Hazard Evaluation by DOH-certified CCS.	☐	☐
Backflow preventer (BP) ownership.	☐	☐
BP installation.	☐	☐
BP ***initial*** inspection (for proper installation – all BPs).	☐	☐
BP ***initial*** test (for testable assemblies).	☐	☐
BP ***annual*** inspection (Air Gaps and AVBs).	☐	☐
BP ***annual*** test (for testable assemblies).	☐	☐
BP maintenance and repair.	☐	☐

E. Backflow Protection for Fire Protection Systems

Please remember to enter number of days allowed if you require retrofitting.

PWS coordinates with ***LAA*** on CCC issues for fire protection systems (FPS).	Y N	N/A
PWS coordinates with ***local Fire Marshal*** on CCC issues for FPS.	Y N	N/A
PWS ensures backflow prevention is installed before serving ***new*** connections with FPS.	Y	N
PWS requires retrofits to ***high***-hazard FPS.	Y (No. of days allowed: ______) N	N/A
PWS requires retrofits to ***low***-hazard FPS.	Y (No. of days allowed: ______) N	N/A

F. Backflow Protection for Irrigation Systems

Minimum level of backflow prevention required on irrigation systems ***without*** chemical addition.	Not AddresPV/SVBA sed	AVB DCVA	RPBA
PWS currently inspects AVBs upon ***initial*** installation.	Y	N	N/A
PWS currently inspects AVBs upon repair, reinstallation or relo cation.	Y	N	N/A

G. Used Water

PWS prohibits, by ordinance, rules, policy or agreement, the intentional return of used water (e.g. for heating or cooling) into the distribution system.		Y N
If not prohibited at present, date plan to prohibit.	Date (mm/dd/yyyy):	N/A
Current number of service connections returning used water to distribution system.		

H. Backflow Protection for Unapproved Auxiliary Water Supplies[1] NOT Interconnected with PWS

Indicate the **minimum** backflow preventer and type of protection required for service connections having unapproved auxiliary water supplies *when they are NOT interconnected to the PWS.* Check only one box per row.

Existing service connections.	None DCVA RPBA AG
Type of protection required.	None In-premises protection Premises isolation
New service connections.	None DCVA RPBA AG
Type of protection required.	None In-premises protection Premises isolation

An auxiliary water supply is any water supply on or available to the customer's premises in addition to the purveyor's potable water supply.

I. Backflow Protection for Tanker Trucks and Temporary Water Connections

Minimum level of backflow protection (installed on or associated with the truck) required for tanker trucks taking water from PWS.	AG DCVA RPBA Not specified Tanker trucks not allowed
PWS requires tanker trucks to obtain water at designated filling sites each equipped with permanently installed backflow preventer(s).	Y (Min. site protection: DCVA RPBA) N N/A No sites provided
PWS currently accepts tanker trucks approved by other PWSs without further inspection or testing.	Y N N/A
Minimum level of backflow protection required for temporary water connections (e.g., for construction sites).	AG DCVA RPBA Not specified Temp. connections not allowed
PWS requires testing each time the temporary connection backflow preventer is relocated.	Y N N/A (Temp. connections not allowed)
PWS provides approved backflow preventer for temporary connections.	Y N N/A (Temp. connections not allowed)

J. Backflow Protection for Non-Residential Connections

For each category shown, indicate whether PWS has non-residential connections of that type and the **minimum** level of ***premises isolation*** backflow protection required (whether or not PWS currently has that type of customer).

Type of Connection	**PWS has Customers of this Type**	**Minimum Premises Isolation Backflow Protection Required**
Commercial	Y N	Not required DCVA RPBA
Industrial	Y N	Not required DCVA RPBA
Institutional	Y N	Not required DCVA RPBA
Other (specify): ___________	Y N	Not required DCVA RPBA
Other (specify): ___________	Y N	Not required DCVA RPBA

K. Backflow Protection for Wholesale Customers

Indicate whether the PWS requires backflow protection at interties with wholesale customers (other PWSs).

Type of Intertie	**PWS has (plans to have) Customers of this Type**	**Backflow Protection Required** (If protection is required, indicate minimum level)
Existing	Y N	Not specified/Not required Always required Required only if purchaser's CCC program is inadequate Minimum required (if applicable): DCVA RPBA
New	Y N	Not specified/Not required Always required Required only if purchaser's CCC program is inadequate Minimum required (if applicable): DCVA RPBA

Part 3: CCC Program Record-Keeping and Inventory

Indicate the type or name of the computer software used by the PWS to track CCC records.

Cross-Track (BMI)	BPMS	XC2 (Engsoft)	Tokay
Other commercial CCC software (specify): ______________		Custom developed for or by PWS[1]	
Other non-CCC software (e.g. Excel)		None Used	

[1] Do not include commercial CCC software customized for PWS. If PWS uses customized commercial software, check the box for the appropriate commercial software name.

Part 4: Comments and Clarifications

Enter comments or clarifications to any of the information included in this report.

Part No.	Comment

Part 5: CCC Program Summary Completion Information

Enter dates in MM/DD/YYYY format.

I certify that the information provided in this CCC Program Summary is complete and accurate to the best of my knowledge.		
CCC Program Mgr. Name (Print)[2]:		Title:
Signature:		Date:
Phone: (___) ___-____	E-mail: _____________@_______________________	
I certify that the information provided in this report accurately represents the status and description of this water system's CCC Program.		
PWS Mgr./Owner Name (Print)[3]:		Title:
Signature:	Op. Cert No:	Date:

The CCC Program Manager is generally the CCS responsible for developing and implementing the PWS's CCC program.
The person that the CCC Program Manager reports to or other manager having direct responsibility and/or oversight of the CCC program. This person doesn't need to be in charge of the entire water system.

Washington State Department of Health

Office of Drinking Water

Exceptions to High Health Hazard Premises Isolation Requirements for 2005 Annual Summary Report

Exceptions forms must be completed and submitted to the Department of Health (DOH) with the Annual Summary Report per WAC 246-290-490(4)(b)(iii).

Complete and submit one form for **each** exception PWS granted:

In 2005.

Before 2005, **if** PWS didn't previously submit an Exceptions form to DOH.

***Don't*:**

Duplicate previously submitted Exceptions forms.

Submit any Exceptions forms for 2005, if PWS didn't grant any exceptions in 2005 and already submitted forms for exceptions granted before 2005.

Part 1: Public Water System (PWS) Information

PWS ID:	PWS Name:	County:

Part 2: Premises Information

Name of Premises		
Service Address		
Premises Type or Category – Refer to Table 9 of WAC 246-290-490(4)(b)		
Additional information or description of premises to help explain why exception is appropriate:		

Part 3: Information Regarding Exception to Premises Isolation

Enter dates in MM/DD/YYYY format.

a. Date of Hazard Evaluation	
b. Date Exception Granted	
c. Expiration Date of Exception (if any)	
d. Date of Next Hazard Evaluation	

Name of Premises: ____

Part 4: Justification for not Requiring Premises Isolation Using AG, RPBA or RPDA

The following table shows typical reasons for not requiring mandatory premises isolation. *The WAC doesn't require purveyors to grant exceptions – exceptions are optional.*
Purveyors may provide other reasons consistent with WAC 246-290-490(4)(b)(ii), i.e. no hazard exists, for this particular service.

Reason that the Premises *Do Not* Pose a High Health Hazard to the Public Water System	Check at Least One
Medical/Health Services Facility not having laboratory or similar facilities, e.g. Psychiatric or Counseling Office.	☐
Dental Office having independent water supplies for dental work (no interconnection with purveyor's water system).	☐
"Bottling Plant" without bottling processes, e.g. Warehousing only.	☐
Laundry or Dry Cleaners without cleaning processes on premises, e.g. customer drop-off and/or pick-up only.	☐
Marina/Dock for small boat moorage only (no water/sewage facilities on board).	☐
Agricultural Premises with "hobby farm" (non-commercial) activities only.	☐
Other (please describe):___________________________	☐
	☐
	☐
	☐

Part 5: Form Completion Information

Enter dates in MM/DD/YYYY format.

I am the Cross-Connection Control Specialist (CCS) who granted this exception to mandatory premises isolation. I certify that the information provided is complete and accurate to the best of my knowledge.			
Name (Print):		CCS Cert. No:	
Signature:		Date:	
Phone: (___) ___-____	E-mail: _______________@________________________		
I am the PWS Manager/Owner*,and I concur with the granting of this exception to mandatory premises isolation. I certify that the information provided is complete and accurate to the best of my knowledge.			
Name (Print):		Title:	
Signature:	Op. Cert. No:		Date:

* The person that the CCS reports to or other manager having direct responsibility for and/or oversight of the CCC program. This person doesn't need to be in charge of the entire water system.

APPENDIX G

WAC 246-290-490
CROSS CONNECTION CONTROL

Appendix G
WAC 246-290-490 Cross Connection Control

1) Applicability, purpose, and responsibility.

(a) All community water systems shall comply with the cross-connection control requirements specified in this section.

(b) All noncommunity water systems shall apply the principles and provisions of this section, including subsection (4)(b) of this section, as applicable to protect the public water system from contamination via cross-connections. Noncommunity systems that comply with subsection (4)(b) of this section and the provisions of WAC 51-56-0600 of the UPC (which addresses the installation of backflow preventers at points of water use within the potable water system) shall be considered in compliance with the requirements of this section.

(c) The purpose of the purveyor's cross-connection control program shall be to protect the public water system, as defined in WAC 246-290-010, from contamination via cross-connections.

(d) The purveyor's responsibility for cross-connection control shall begin at the water supply source, include all the public water treatment, storage, and distribution facilities, and end at the point of delivery to the consumer's water system, which begins at the downstream end of the service connection or water meter located on the public right of way or utility-held easement.

(e) Under the provisions of this section, purveyors are not responsible for eliminating or controlling cross-connections within the consumer's water system. Under chapter 19.27 RCW, the responsibility for cross-connection control within the consumer's water system, i.e., within the property lines of the consumer's premises, falls under the jurisdiction of the local administrative authority.

2) General program requirements.

(a) The purveyor shall develop and implement a cross-connection control program that meets the requirements of this section, but may establish a more stringent program through local ordinances, resolutions, codes, bylaws, or operating rules.

(b) Purveyors shall ensure that good engineering and public health protection practices are used in the development and implementation of cross-connection control programs. Department publications and the most recently published editions of references, such as, but not limited to, those listed below, may be used as guidance for cross-connection program development and implementation:

(i) *Manual of Cross-Connection Control* published by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California (USC Manual); or

(ii) *Cross-Connection Control Manual, Accepted Procedure and Practice* published by the Pacific Northwest Section of the American Water Works Association (PNWS-AWWA Manual).

(c) The purveyor may implement the cross-connection control program, or any portion thereof, directly or by means of a contract with another agency or party acceptable to the department.

(d) The purveyor shall coordinate with the local administrative authority in all matters concerning cross-connection control. The purveyor shall document and describe such coordination, including delineation of responsibilities, in the written cross-connection control program required in (e) of this subsection.

(e) The purveyor shall include a written description of the cross-connection control program in the water system plan required under WAC 246-290-100 or the small water system management program required under WAC 246-290-105. The cross-connection control program shall include the minimum program elements described in subsection (3) of this section.

(f) The purveyor shall ensure that cross-connections between the distribution system and a consumer's water system are eliminated or controlled by the installation of an approved backflow preventer commensurate with the degree of hazard. This can be accomplished by implementation of a cross-connection program that relies on:

(i) Premises isolation as defined in WAC 246-290-010; or

(ii) Premises isolation and in-premises protection as defined in WAC 246-290-010.

(g) Purveyors with cross-connection control programs that rely both on premises isolation and in-premises protection:

(i) Shall comply with the premises isolation requirements specified in subsection (4)(b) of this section; and

(ii) May reduce premises isolation requirements and rely on in-premises protection for premises other than the type not addressed in subsection (4)(b) of this section, if the conditions in (h) of this subsection are met.

(h) Purveyors may rely on in-premises protection only when the following conditions are met:

(i) The in-premises backflow preventers provide a level of protection commensurate with the purveyor's assessed degree of hazard;

(ii) Backflow preventers which provide the in-premises backflow protection meet the definition of approved backflow preventers as described in WAC 246-290-010;

(iii) The approved backflow preventers are installed, inspected, tested (if applicable), maintained, and repaired in accordance with subsections (6) and (7) of this section;

(iv) Records of such backflow preventers are maintained in accordance with subsections (3)(j) and (8) of this section; and

(v) The purveyor has reasonable access to the consumer's premises to conduct an initial hazard evaluation and periodic reevaluations to determine whether the in-premises protection is adequate to protect the purveyor's distribution system.

(i) The purveyor shall take appropriate corrective action within its authority if:

(i) A cross-connection exists that is not controlled commensurate to the degree of hazard assessed by the purveyor; or

(ii) A consumer fails to comply with the purveyor's requirements regarding the installation, inspection, testing, maintenance or repair of approved backflow preventers required by this chapter.

(j) The purveyor's corrective action may include, but is not limited to:

(i) Denying or discontinuing water service to a consumer's premises until the cross-connection hazard is eliminated or controlled to the satisfaction of the purveyor;

(ii) Requiring the consumer to install an approved backflow preventer for premises isolation commensurate with the degree of hazard; or

(iii) The purveyor installing an approved backflow preventer for premises isolation commensurate with the degree of hazard.

(k) Purveyors denying or discontinuing water service to a consumer's premises for one or more of the reasons listed in (i) of this subsection shall notify the local administrative authority prior to taking such action except in the event of an emergency.

(l) The purveyor shall prohibit the intentional return of used water to the purveyor's distribution system. Such water would include, but is not limited to, water used for heating, cooling, or other purposes within the consumer's water system.

3) Minimum elements of a cross-connection control program.

(a) To be acceptable to the department, the purveyor's cross-connection control program shall include the minimum elements identified in this subsection.

(b) Element 1: The purveyor shall adopt a local ordinance, resolution, code, bylaw, or other written legal instrument that:

(i) Establishes the purveyor's legal authority to implement a cross-connection control program;

(ii) Describes the operating policies and technical provisions of the purveyor's cross-connection control program; and

(iii) Describes the corrective actions used to ensure that consumers comply with the purveyor's cross-connection control requirements.

(c) Element 2: The purveyor shall develop and implement procedures and schedules for evaluating new and existing service connections to assess the degree of hazard posed by the consumer's premises to the purveyor's distribution system and notifying the consumer within a reasonable time frame of the hazard evaluation results. At a minimum, the program shall meet the following:

(i) For new connections made on or after the effective date of these regulations, procedures shall ensure that an initial evaluation is conducted before service is provided;

(ii) For existing connections made prior to the effective date of these regulations, procedures shall ensure that an initial evaluation is conducted in accordance with a schedule acceptable to the department; and

(iii) For all service connections, once an initial evaluation has been conducted, procedures shall ensure that periodic reevaluations are conducted in accordance with a schedule acceptable to the department and whenever there is a change in the use of the premises.

(d) Element 3: The purveyor shall develop and implement procedures and schedules for ensuring that:

(i) Cross-connections are eliminated whenever possible;

(ii) When cross-connections cannot be eliminated, they are controlled by installation of approved backflow preventers commensurate with the degree of hazard; and

(iii) Approved backflow preventers are installed in accordance with the requirements of subsection (6) of this section.

(e) Element 4: The purveyor shall ensure that personnel, including at least one person certified as a CCS, are provided to develop and implement the cross-connection control program.

(f) Element 5: The purveyor shall develop and implement procedures to ensure that approved backflow preventers are inspected and/or tested (as applicable) in accordance with subsection (7) of this section.

(g) Element 6: The purveyor shall develop and implement a backflow prevention assembly testing quality control assurance program, including, but not limited to, documentation of tester certification and test kit calibration, test report contents, and time frames for submitting completed test reports.

(h) Element 7: The purveyor shall develop and implement (when appropriate) procedures for responding to backflow incidents.

(i) Element 8: The purveyor shall include information on cross-connection control in the purveyor's existing program for educating consumers about water system operation. Such a program may include periodic bill inserts, public service announcements, pamphlet distribution, notification of new consumers and consumer confidence reports.

(j) Element 9: The purveyor shall develop and maintain cross-connection control records including, but not limited to, the following:

(i) A master list of service connections and/or consumer's premises where the purveyor relies upon approved backflow preventers to protect the public water system from contamination, the assessed hazard level of each, and the required backflow preventer(s);

(ii) Inventory information on:

(A) Approved air gaps installed in lieu of approved assemblies including exact air gap location, assessed degree of hazard, installation date, history of inspections, inspection results, and person conducting inspections;
(B) Approved backflow assemblies including exact assembly location, assembly description (type, manufacturer, model, size, and serial number), assessed degree of hazard, installation date, history of inspections, tests and repairs, test results, and person performing tests; and
(C) Approved AVBs used for irrigation system applications including location, description (manufacturer, model, and size), installation date, history of inspection(s), and person performing inspection(s).

(iii) Cross-connection program summary reports and backflow incident reports required under subsection (8) of this section.

(k) Element 10: Purveyors who distribute and/or have facilities that receive reclaimed water within their water service area shall meet any additional cross-connection control requirements imposed by the department under a permit issued in accordance with chapter 90.46 RCW.

4) Approved backflow preventer selection.

(a) The purveyor shall ensure that a CCS:

(i) Assesses the degree of hazard posed by the consumer's water system upon the purveyor's distribution system; and

(ii) Determines the appropriate method of backflow protection for premises isolation in accordance with Table 8.

TABLE 8

APPROPRIATE METHODS OF BACKFLOW PROTECTION FOR PREMISES ISOLATION

Degree of Hazard	**Application Condition**	**Appropriate Approved Backflow Preventer**
High health cross-connection hazard	Backsiphonage or backpressure backflow	AG, RPBA, or RPDA
Low health cross-connection hazard	Backsiphonage or backpressure backflow	AG, RPBA, RPDA, DCVA, or DCDA

(b) Premises isolation requirements.

(i) For service connections with remises posing a high health cross-connection hazard including, but not limited to, those premises listed in Table 9, the purveyor shall ensure that an approved air gap or RPBA is installed for premises isolation.

(ii) If the purveyor's CCS determines that no hazard exists for a connection serving premises of the type listed in Table 9, the requirements of (b)(i) of this subsection do not apply.

(iii) The purveyor shall document, on a case-by-case basis, the reasons for not applying the requirements of (b)(i) of this subsection to a connection serving premises of the type listed in Table 9 and include such documentation in the cross-connection control program summary report required in subsection (8) of this section.

TABLE 9

HIGH HEALTH CROSS-CONNECTION HAZARD PREMISES REQUIRING PREMISES ISOLATION BY AG OR RPBA

Agricultural (farms and dairies)
Beverage bottling plants
Car washes
Chemical plants
Commercial laundries and dry cleaners
Premises where both reclaimed water and potable water are provided
Film processing facilities
Food processing plants
Hospitals, medical centers, nursing homes, veterinary, medical and dental clinics, and blood plasma centers
Premises with separate irrigation systems using the purveyor's water supply and with chemical addition+
Laboratories
Metal plating industries
Mortuaries
Petroleum processing or storage plants
Piers and docks
Radioactive material processing plants or nuclear reactors*
Survey access denied or restricted
Wastewater lift stations and pumping stations
Wastewater treatment plants*
Premises with an unapproved auxiliary water supply interconnected with the potable water supply

+ For example, parks, playgrounds, golf courses, cemeteries, estates, etc.

* RPBAs for connections serving these premises are acceptable only when used in combination with an in-plant approved air gap; otherwise, the purveyor shall require an approved air gap at the service connection.

(c) Backflow protection for single-family residences.

(i) For single-family residential service connections, the purveyor shall comply with the requirements of (b) of this subsection when applicable.

(ii) If the requirements of (b) of this subsection do not apply and the requirements specified in subsection (2)(h) of this section are met, the purveyor may rely on backflow protection provided at the point of hazard in accordance with WAC 51-56-0600 of the UPC for hazards such as, but not limited to:

(A) Irrigation systems;
(B) Swimming pools or spas;
(C) Ponds; and
(D) Boilers.

For example, the purveyor may accept an approved AVB on a residential irrigation system, if the AVB is properly installed in accordance with the UPC.

(d) Backflow protection for fire protection systems.

(i) Backflow protection is not required for residential flow-through or combination fire protection systems constructed of potable water piping and materials.

(ii) For service connections with fire protection systems other than flow-through or combination systems, the purveyor shall ensure that backflow protection consistent with WAC 51-56-0600 of the UPC is installed. The UPC requires minimum protection as follows:

(A) An RPBA or RPDA for fire protection systems with chemical addition or using unapproved auxiliary water supply; and
(B) A DCVA or DCDA for all other fire protection systems.

(iii) For new connections made on or after the effective date of these regulations, the purveyor shall ensure that backflow protection is installed before water service is provided.

(iv) For existing fire protection systems:

(A) With chemical addition or using unapproved auxiliary supplies, the purveyor shall ensure that backflow protection is installed within ninety days of the purveyor notifying the consumer of the high health cross-connection hazard or in accordance with an alternate schedule acceptable to the purveyor.
(B) Without chemical addition, without on-site storage, and using only the purveyor's water (i.e., no unapproved auxiliary supplies on or available to the premises), the purveyor shall ensure that backflow protection is installed in accordance with a schedule acceptable to the purveyor or at an earlier date if required by the agency administering the Uniform Building Code as adopted under chapter 19.27 RCW.
(C) When establishing backflow protection retrofitting schedules for fire protection systems that have the characteristics listed in (d)(iv)(B) of this subsection, the purveyor may consider factors such as, but not limited to, impacts of assembly installation on sprinkler performance, costs of retrofitting, and difficulty of assembly installation.

(e) Purveyors may require backflow preventers commensurate with the degree of hazard determined by the purveyor to be installed for premises isolation for connections serving premises that have characteristics such as, but not limited to, the following:

(i) Complex plumbing arrangements or plumbing potentially subject to frequent changes that make it impracticable to assess whether cross-connection hazards exist;

(ii) A repeated history of cross-connections being established or reestablished; or

(iii) Cross-connection hazards are unavoidable or not correctable, such as, but not limited to, tall buildings.

5) Approved backflow preventers.

(a) The purveyor shall ensure that all backflow prevention assemblies relied upon by the purveyor are models included on the current list of backflow prevention assemblies approved for use in Washington state. The current approved assemblies list is available from the department upon request.

(b) The purveyor may rely on testable backflow prevention assemblies that are not currently approved by the department, if the assemblies:

(i) Were included on the department and/or USC list of approved backflow prevention assemblies at the time of installation;

(ii) Have been properly maintained;

(iii) Are commensurate with the purveyor's assessed degree of hazard; and

(iv) Have been inspected and tested at least annually and have successfully passed the annual tests.

(c) The purveyor shall ensure that an unlisted backflow prevention assembly is replaced by an approved assembly commensurate with the degree of hazard, when the unlisted assembly:

(i) Does not meet the conditions specified in (b)(i) through (iv) of this subsection;

(ii) Is moved; or

(iii) Cannot be repaired using spare parts from the original manufacturer.

(d) The purveyor shall ensure that AVBs meet the definition of approved atmospheric vacuum breakers as described in WAC 246-290-010.

6) Approved backflow preventer installation.

(a) The purveyor shall ensure that approved backflow preventers are installed in the orientation for which they are approved (if applicable).

(b) The purveyor shall ensure that approved backflow preventers are installed in a manner that:

(i) Facilitates their proper operation, maintenance, inspection, and/or in-line testing (as applicable) using standard installation procedures acceptable to the department such as those in the USC Manual or PNWS-AWWA Manual;

(ii) Ensures that the assembly will not become submerged due to weather-related conditions such as flooding; and

(iii) Ensures compliance with all applicable safety regulations.

(c) The purveyor shall ensure that approved backflow assemblies for premises isolation are installed at a location adjacent to the meter or property line or an alternate location acceptable to the purveyor.

(d) When premises isolation assemblies are installed at an alternate location acceptable to the purveyor, the purveyor shall ensure that there are no connections between the point of delivery from the public water system and the approved backflow assembly, unless the installation of such a connection meets the purveyor's cross-connection control requirements and is specifically approved by the purveyor.

(e) The purveyor shall ensure that approved backflow preventers are installed in accordance with the following time frames:

(i) For new connections made on or after the effective date of these regulations, the following conditions shall be met before service is provided:

(A) The provisions of subsection (3)(d)(ii) of this section; and
(B) Satisfactory completion of a test by a BAT in accordance with subsection (7) of this section.

(ii) For existing connections where the purveyor identifies a high health cross-connection hazard, the provisions of (3)(d)(ii) of this section shall be met:

(A) Within ninety days of the purveyor notifying the consumer of the high health cross-connection hazard; or
(B) In accordance with an alternate schedule acceptable to the purveyor.

(iii) For existing connections where the purveyor identifies a low health cross-connection hazard, the provisions of subsection (3)(d)(ii) of this section shall be met in accordance with a schedule acceptable to the purveyor.

(f) The purveyor shall ensure that bypass piping installed around any approved backflow preventer is equipped with an approved backflow preventer that:

(i) Affords at least the same level of protection as the approved backflow preventer that is being bypassed; and

(ii) Complies with all applicable requirements of this section.

7) Approved backflow preventer inspection and testing.

(a) The purveyor shall ensure that:

(i) A CCS inspects backflow preventer installations to ensure that protection is provided commensurate with the assessed degree of hazard;

(ii) Either a BAT or CCS inspects:

(A) Air gaps installed in lieu of approved backflow prevention assemblies for compliance with the approved air gap definition; and
(B) Backflow prevention assemblies for correct installation and approval status.

(iii) A BAT tests approved backflow prevention assemblies for proper operation.

(b) The purveyor shall ensure that inspections and/or tests of approved air gaps and approved backflow assemblies are conducted:

(i) At the time of installation;

(ii) Annually after installation, or more frequently, if required by the purveyor for connections serving premises or systems that pose a high health cross-connection hazard or for assemblies that repeatedly fail;

(iii) After a backflow incident; and

(iv) After an assembly is repaired, reinstalled, or relocated or an air gap is replumbed.

(c) The purveyor shall ensure that inspections of AVBs installed on irrigation systems are conducted:

(i) At the time of installation;

(ii) After a backflow incident; and

(iii) After repair, reinstallation, or relocation.

(d) The purveyor shall ensure that approved backflow prevention assemblies are tested using procedures acceptable to the department, such as those specified in the most recently published edition of the USC Manual. When circumstances, such as, but not limited to, configuration or location of the assembly, preclude the use of USC test procedures, the purveyor may allow, on a case-by-case basis, the use of alternate (non-USC) test procedures acceptable to the department.

(e) The purveyor shall ensure that results of backflow prevention assembly inspections and tests are documented and reported in a manner acceptable to the purveyor.

(f) The purveyor shall ensure that an approved backflow prevention assembly or AVB, whenever found to be improperly installed, defective, not commensurate with the degree of hazard, or failing a test (if applicable) is properly reinstalled, repaired, overhauled, or replaced.

(g) The purveyor shall ensure that an approved air gap, whenever found to be altered or improperly installed, is properly replumbed or, if commensurate with the degree of hazard, is replaced by an approved RPBA.

8) Recordkeeping and reporting.

(a) Purveyors shall keep cross-connection control records for the following time frames:

(i) Records pertaining to the master list of service connections and/or consumer's premises required in subsection (3)(j)(i) of this section shall be kept as long as the premises pose a cross-connection hazard to the purveyor's distribution system;

(ii) Records regarding inventory information required in subsection (3)(j)(ii) of this section shall be kept for five years or for the life of the approved backflow preventer whichever is shorter; and

(iii) Records regarding backflow incidents and annual summary reports required in subsection (3)(j)(iii) of this section shall be kept for five years.

(b) Purveyors may maintain cross-connection control records in original form or transfer data to tabular summaries.

(c) Purveyors may maintain records or data in any media, such as paper, film, or electronic format.

(d) The purveyor shall complete the cross-connection control program summary report annually. Report forms and guidance on completing the report are available from the department.

(e) The purveyor shall make all records and reports required in subsection (3)(j) of this section available to the department or its representative upon request.

(f) The purveyor shall notify the department, local administrative authority, and local health jurisdiction as soon as possible, but no later than the end of the next business day, when a backflow incident is known by the purveyor to have:

(i) Contaminated the public water system; or

(ii) Occurred within the premises of a consumer served by the purveyor.

(g) The purveyor shall:

(i) Document details of backflow incidents on a form acceptable to the department such as the backflow incident report form included in the most recent edition of the PNWS-AWWA Manual; and

(ii) Include all backflow incident report(s) in the annual cross-connection program summary report referenced in (d) of this subsection, unless otherwise requested by the department.

[Statutory Authority: RCW 43.20.050 (2) and (3) and70.119A.080 . 03-08-037, § 246-290-490, filed 3/27/03, effective 4/27/03. Statutory Authority: RCW 43.02.050 [43.20.050]. 99-07-021, § 246-290-490, filed 3/9/99, effective 4/9/99. Statutory Authority: RCW 43.20.050. 91-02-051 (Order 124B), recodified as § 246-290-490, filed 12/27/90, effective 1/31/91. Statutory Authority: P.L. 99-339. 89-21-020 (Order 336), § 248-54-285, filed 10/10/89, effective 11/10/89. Statutory Authority: RCW 34.04.045. 88-05-057 (Order 307), § 248-54-285, filed 2/17/88. Statutory Authority: RCW 43.20.050. 83-19-002 (Order 266), § 248-54-285, filed 9/8/83.]

APPENDIX H

STANDARD INSTALLATION DRAWINGS

Appendix H
Standard Installation Drawings

Illustration 5
Standard Details - Service Connection Options
Single Family Residential

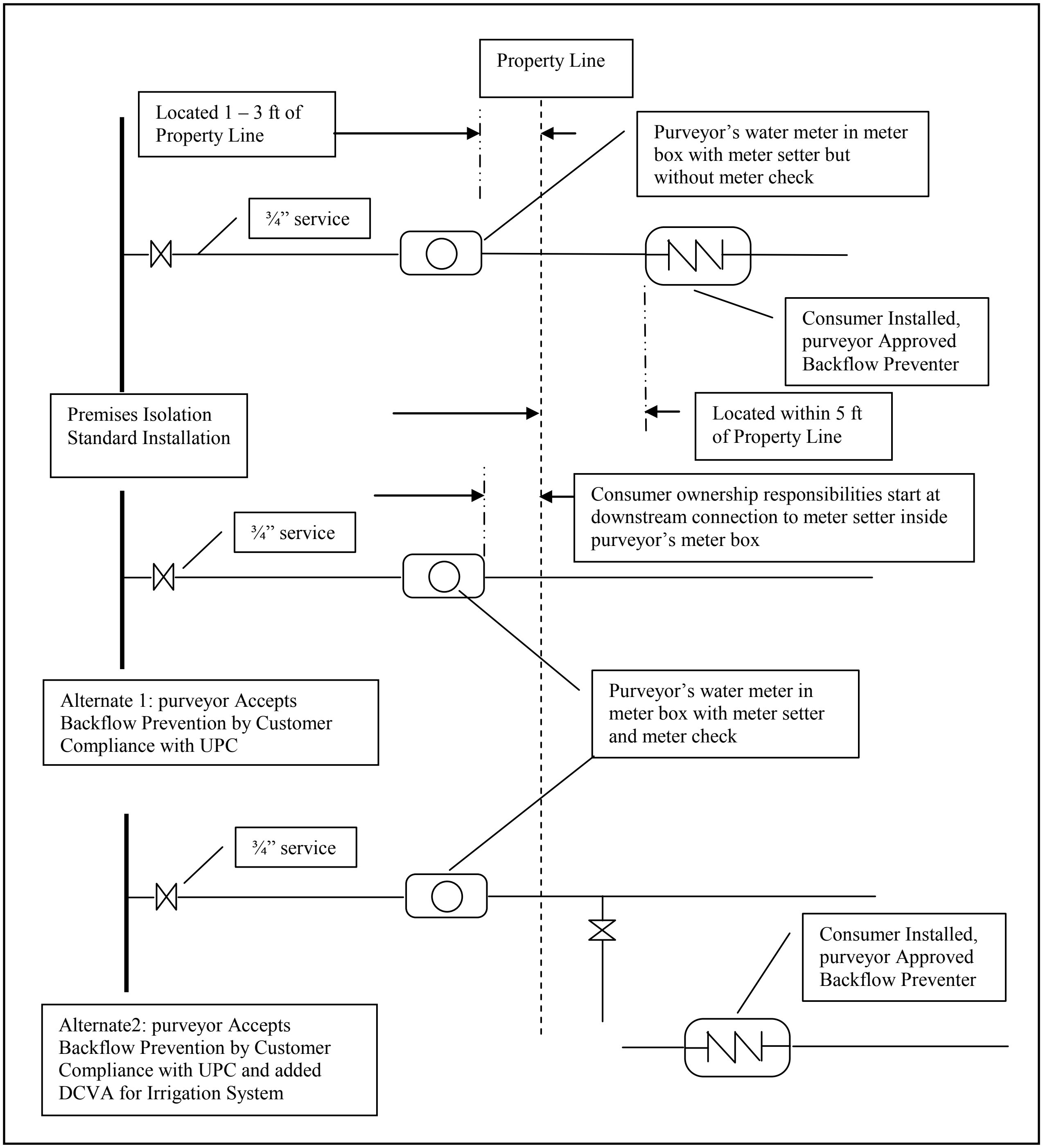
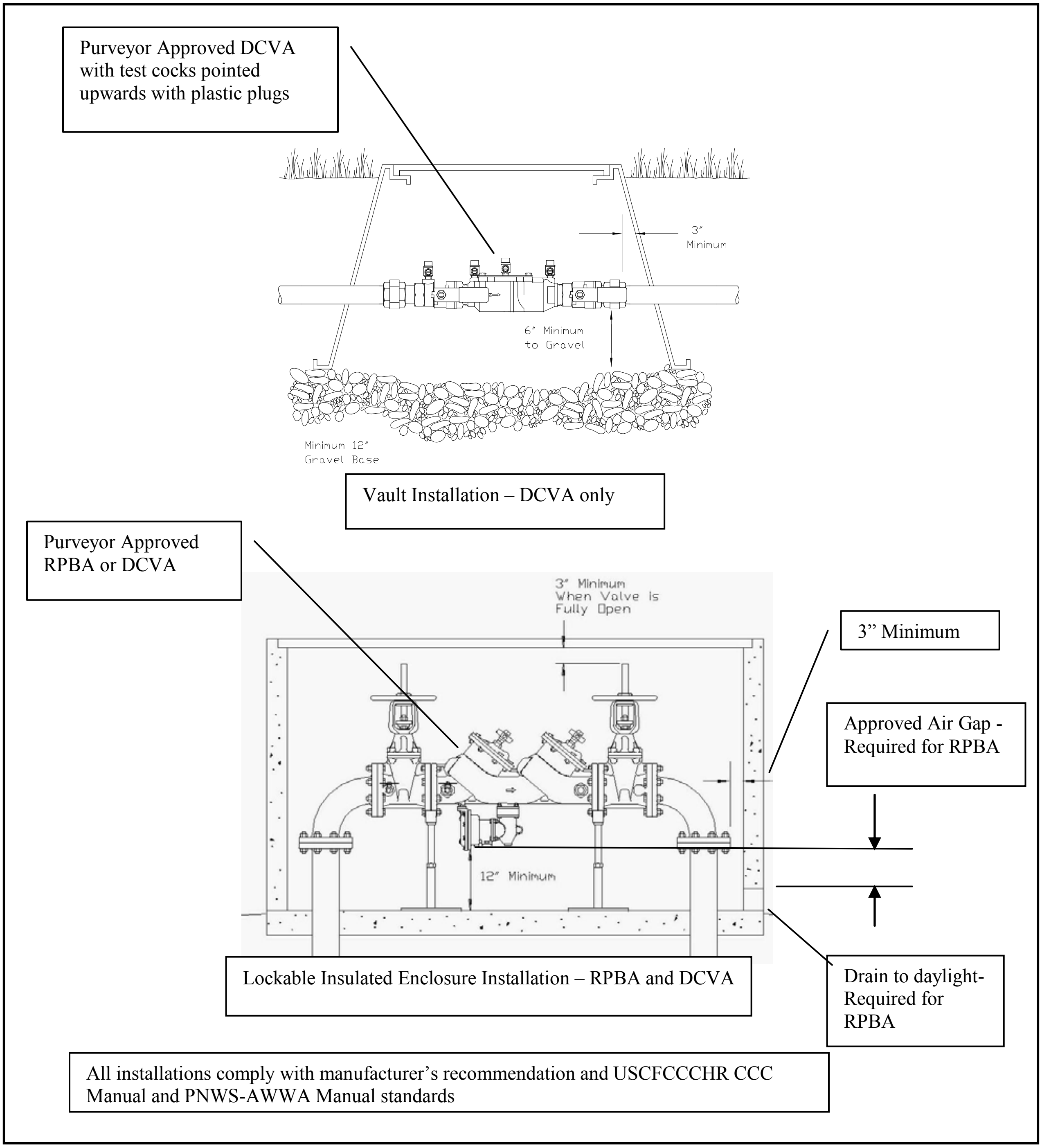


Illustration 6
Backflow Prevention Assemblies
Recommended Premises Isolation Installations



APPENDIX I

DEFINITIONS

Appendix I

Washington State Department of Health
Drinking Water Regulations Relating to Cross-Connection

(This section has been extracted from WAC 246-290, Group A Drinking Water Regulations)

DEFINITIONS, abbreviations and acronyms relating to cross-connections which have been extracted from WAC 246-290-010.

"Approved air gap" means a physical separation between the free-flowing end of a potable water supply pipeline and the overflow rim of an open or nonpressurized receiving vessel. To be an air gap approved by the department, the separation must be at least:

- Twice the diameter of the supply piping measured vertically from the overflow rim of the receiving vessel, and in no case be less than one inch, when unaffected by vertical surfaces (sidewalls); and:
- Three times the diameter of the supply piping, if the horizontal distance between the supply pipe and a vertical surface (sidewall) is less than or equal to three times the diameter of the supply pipe, or if the horizontal distance between the supply pipe and intersecting vertical surfaces (sidewalls) is less than or equal to four times the diameter of the supply pipe and in no case less than one and one-half inches.

"Approved atmospheric vacuum breaker" means an AVB of make, model, and size that is approved by the department. AVBs that appear on the current approved backflow prevention assemblies list developed by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research or that are listed or approved by other nationally recognized testing agencies (such as IAPMO, ANSI, or UL) acceptable to the local administrative authority are considered approved by the department.

"Approved backflow preventer" means an approved air gap, an approved backflow prevention assembly, or an approved AVB. The terms "approved backflow preventer," "approved air gap," or "approved backflow prevention assembly" refer only to those approved backflow preventers relied upon by the purveyor for the protection of the public water system. The requirements of WAC 246-290-490 do not apply to backflow preventers installed for other purposes.

"Approved backflow prevention assembly" means an RPBA, RPDA, DCVA, DCDA, PVBA, or SVBA of make, model, and size that is approved by the department. Assemblies that appear on the current approved backflow prevention assemblies list developed by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research or other entity acceptable to the department are considered approved by the department.

"Backflow" means the undesirable reversal of flow of water or other substances through a cross-connection into the public water system or consumer's potable water system.

"Backflow assembly tester" means a person holding a valid BAT certificate issued in accordance with chapter 246-292 WAC.

"Backpressure" means a pressure (caused by a pump, elevated tank or piping, boiler, or other means) on the consumer's side of the service connection that is greater than the pressure provided by the public water system and which may cause backflow.

"Backsiphonage" means backflow due to a reduction in system pressure in the purveyor's distribution system and/or consumer's water system.

"Combination fire protection system" means a fire sprinkler system that:

- Is supplied only by the purveyor's water;
- Does not have a fire department pumper connection; and
- Is constructed of approved potable water piping and materials that serve both the fire sprinkler system and the consumer's potable water system.

"Consumer" means any person receiving water from a public water system from either the meter, or the point where the service line connects with the distribution system if no meter is present. For purposes of cross-connection control, "consumer" means the owner or operator of a water system connected to a public water system through a service connection.

"Consumer's water system," as used in WAC 246-290-490, means any potable and/or industrial water system that begins at the point of delivery from the public water system and is located on the consumer's premises. The consumer's water system includes all auxiliary sources of supply, storage, treatment, and distribution facilities, piping, plumbing, and fixtures under the control of the consumer.

"Cross-connection" means any actual or potential physical connection between a public water system or the consumer's water system and any source of nonpotable liquid, solid, or gas that could contaminate the potable water supply by backflow.

"Cross-connection control program" means the administrative and technical procedures the purveyor implements to protect the public water system from contamination via cross-connections as required in WAC 246-290-490.

"Cross-connection control specialist" means a person holding a valid CCS certificate issued in accordance with chapter 246-292 WAC.

"Cross-connection control summary report" means the annual report that describes the status of the purveyor's cross-connection control program.

"Flow-through fire protection system" means a fire sprinkler system that:

- Is supplied only by the purveyor's water;
- Does not have a fire department pumper connection;
- Is constructed of approved potable water piping and materials to which sprinkler heads are attached; and
- Terminates at a connection to a toilet or other plumbing fixture to prevent the water from becoming stagnant.

"High health cross-connection hazard" means a cross-connection which could impair the quality of potable water and create an actual public health hazard through poisoning or spread of disease by sewage, industrial liquids or waste.

"In-premises protection" means a method of protecting the health of consumers served by the consumer's potable water system, located within the property lines of the consumer's premises by the installation of an approved air gap or backflow prevention assembly at the point of hazard, which is generally a plumbing fixture.

"Local administrative authority" means the local official, board, department, or agency authorized to administer and enforce the provisions of the Uniform Plumbing Code as adopted under chapter 19.27 RCW.

"Low health cross-connection hazard" means a cross-connection that could cause an impairment of the quality of potable water to a degree that does not create a hazard to the public health, but does adversely and unreasonably affect the aesthetic qualities of such potable waters for domestic use.

“Premises Isolation” means a method of protecting a public water system by installation of approved air gaps or approved backflow prevention assemblies at or near the service connection or alternative location acceptable to the purveyor to isolate the consumer’s water system from the purveyor’s distribution system.

"Reclaimed water" means effluent derived in any part from sewage from a wastewater treatment system that has been adequately and reliably treated, so that as a result of that treatment, it is suitable for beneficial use or a controlled use that would not otherwise occur, and it is no longer considered wastewater.

"Unapproved auxiliary water supply" means a water supply (other than the purveyor's water supply) on or available to the consumer's premises that is either not approved for human consumption by the health agency having jurisdiction or is not otherwise acceptable to the purveyor.

"Uniform Plumbing Code" means the code adopted under RCW 19.27.031(4) and amended under chapter 51-56 WAC. This code establishes statewide minimum plumbing standards applicable within the property lines of the consumer's premises.

"Used water" means water which has left the control of the purveyor.

Abbreviations and Acronyms

AG	air gap
AVB	atmospheric vacuum breaker
BAT	backflow assembly tester (for WAC 246-290-490)
CCS	cross-connection control specialist
DCDA	double check detector assembly
DCVA	double check valve assembly
IAPMO	International Association of Plumbing and Mechanical Officials
PVBA	pressure vacuum breaker assembly
RPBA	reduced pressure backflow assembly
RPDA	reduced pressure detector assembly
SVBA	spill resistant vacuum breaker assembly
UBC	Uniform Building Code
UL	Underwriters Laboratories Inc.
UPC	Uniform Plumbing Code

APPENDIX J

DRAFT
QUALITY ASSURANCE AND QUALITY CONTROL

Appendix J
DRAFT Quality Assurance and Quality Control for Testing of Backflow Prevention Assemblies

George Bratton, P.E.

The following discussion is provided as a supplement to the PNWS-AWWA *Cross Connection Control Manual, Accepted Procedures and Practices,* Sixth Edition, 1995. This discussion paper provides recommendations for quality assurance and quality control for the purveyor's cross connection control program. The recommendations cover both the performance of the backflow prevention assemblies relied upon by the purveyor and the testing of those assemblies.

The purveyor's quality assurance and quality control program for cross connection control differs from programs undertaken by the purveyor's customers primarily with respect to the ownership of backflow prevention assemblies. The purveyor may rely upon backflow prevention assemblies owned by its customers for protection of the public water system. In this case, the purveyor's quality assurance and quality control program must address the issue of the customer's compliance in carrying out some quality assurance and quality control tasks necessary to the purveyor's program. Also, the purveyor may rely upon a backflow assembly tester employed by its customer. In this case the purveyor's program must address a third party's (tester's) involvement in the purveyor's quality assurance and quality control program.

The guidance provided herein may differ from the requirements imposed by state regulations pertaining to public water systems. Where regulations exist, they form the minimum requirements. However, for good quality assurance and quality control, additional procedures may be needed.

The water purveyor relies on the proper selection, installation and operation of backflow prevention assemblies for the protection of its water system from contamination. The operation of a quality assurance and quality control program is essential to the purveyor's reliance on backflow prevention assemblies.

Background:

A quality assurance program consists of proactive procedures to obtain a desired product quality (e.g., for a backflow prevention assembly) or performance (e.g., testing of a backflow prevention assembly).

A quality control program consists of reactive procedures for determining if desired product quality or performance was achieved. The procedures are intended to detect faults in the manufacture or operation of a product or performance of a procedure, so that remedial action can be taken.

The following are recommended components for the purveyor's cross connection control quality assurance and quality control program:

1. Quality Assurance Program

a. Backflow prevention assembly (BPA) standards
b. BPA approval
c. BPA installation standards
d. BPA testing procedures
e. Backflow assembly tester (BAT) training
f. BAT certification and periodic re-certification
g. BAT approval (acceptance) by purveyor
h. Cross connection control specialists (CCS) training for program administration
i. CCS certification
j. BPA testing requirements
k. BPA test reporting requirements
l. BPA test equipment standards
m. BPA test equipment approval
n. BPA test equipment periodic check of calibration

2. Quality Control Program

a. Inspection of BPA installation
b. Monitoring of test results for
    i. BPA performance
    ii. BAT performance
c. Monitoring of BAT certification and other conditions for employment
d. Monitoring of BAT performance of test procedure of BPA
e. Monitoring of CCS performance
f. Monitoring of BAT check of test equipment calibration
g. Remedial action for performance failure
    i. BPA performance
    ii. BPA [proper] installation
    iii. Customer reporting of BPA test results
    iv. BAT performance
    v. BAT check of test equipment calibration
    vi. BAT fraud
    vii. CCS performance
    viii. CCA fraud

The components of a quality assurance and quality control program may vary based on the type of cross connection control program adopted by the purveyor. There are two basic types of cross connection control programs the purveyor could adopt:

A. Purveyor accepts sole responsibility for protection of its distribution system through the installation of backflow prevention assemblies on its service pipes for premises isolation, i.e., the purveyor owns all assemblies it relies upon to protect the public water system.

B. Purveyor accepts in whole or in part the customer's installation of backflow prevention assemblies within the premises, i.e., the customer owns all or some of the assemblies the purveyor relies upon to protect the public water system.

When the purveyor owns all assemblies it relies upon for protection of the public water system, quality assurance and quality control covers only the purveyor's employees or contractors. In this respect, the quality assurance and quality control has similarities to the other activities of the purveyor, such as water main installation, maintenance of pump stations, etc.

For the purveyor to place reliance upon assemblies owned by the customer, the purveyor must implement additional levels of quality assurance and quality control. The purveyor must deal with performance of assemblies and personnel over which it does not have control. For example, the purveyor does not have a direct relationship with the backflow assembly tester (BAT) employed by its customer. Any wrongdoing by the BAT cannot be directly addressed by the purveyor, such as would be the case with a disciplinary action against an employee.

Also for quality assurance and quality control, size matters. A small public water system with a limited number of assemblies it relies upon and limited staff resources will have a different program than a large public water system with thousands of assemblies. For example, a small public water system may not have the staff resources to audit the performance of a backflow assembly tester.

State regulations pertaining to the purveyor's cross connection control program may establish many of the components for a quality assurance and quality control program. Typical components include:

- List of approved backflow prevention assemblies (e.g., assemblies approved by USC FCCCHR).
- Procedures for testing of backflow prevention assemblies, etc.
- Certification of backflow assembly testers (BAT) and cross connection control specialists (CCS).
- Reporting to the state of the inventory of assemblies, number of annual tests, number of assemblies failing annual test.

The purveyor's quality assurance and quality control efforts reduce the risk of a backflow incident, and thus, the purveyor's exposure to liability for allowing a contaminant to enter its distribution system. The greater the effort, the lower the risk and exposure to liability. Just as the failure to require premises isolation significantly increases the purveyor's risk, the failure to operate an effective quality assurance and quality control program (e.g., verifying the proper selection and installation of assemblies) significantly increases the purveyor's risk.

The purveyor is responsible for the prevention of contamination of its distribution system through cross connections. While state regulations may establish the minimum requirements for the purveyor's quality assurance and quality control program, these minimum requirements may not provide the level of risk and liability management desired by the purveyor. The purveyor should then augment the minimum quality assurance and quality control measures required by state regulations. This may include establishing additional requirements for backflow assembly approval, procedures for testing of backflow prevention assemblies, training and certification of testers, etc.

COMPONENTS OF QUALITY ASSURANCE PROGRAM:

Backflow Prevention Assembly Standards

Not all standards for the manufacture of a product are equal. For example, the requirement for a field performance evaluation is a major criterion in the American Water Works Association standards that is not common to the product standards referenced in plumbing codes.

The purveyor could specify industry standards (e.g., AWWA or USC FCCCHR) as a minimum requirement, and impose additional standards for design and performance. This would reduce the makes and models of backflow prevention assemblies available for installation and could be challenged as a restraint of trade by manufacturers for their products that do not comply with the purveyor's additional requirements. The purveyor would need to demonstrate the expertise to substantiate the exclusion of a product.

A private water company (non-government agency) that owns all the assemblies it relies upon has great latitude in the purchase of material. In this case, the purveyor may elect for reasons of standardizing its inventory to limit assemblies to the one or two manufactures it prefers based on quality rather than cost.

A government owned utility, whether it owns assemblies or relies upon customer owned assemblies, must adhere to regulations for the purchase of materials and imposition of requirements for the customer's purchase of assemblies. The government agency must justify any limitation it places on the selection of material. Even the adoption of a list of "approved assemblies" by a private (for-profit or non-profit) organization without an "or equal" provision may lead to a challenge by a manufacturer or purchaser.

Approval of Backflow Prevention Assemblies (BPA)

Any manufacturer may claim that its product meets a specification. The usual statement is that an item "meets or exceeds" the standards. A significant part of quality assurance is specifying an agency to perform quality control to confirm that the manufacturer's claim of conformance to a standard.

To approve an assembly (verify compliance) the purveyor would need the staff expertise and resources to evaluate a product. For this reason, the purveyor or government regulatory agency (e.g. state health department) relies upon a third party evaluation of products and listing of "approved assemblies".

For a private water company, the selection of an agency for product testing and approval may be discretionary. For a government agency, the selection of an approval agency (e.g., USC FCCCHR) is subject to the same scrutiny as the setting of standards and section of materials. To specify an approval agency (e.g., USC FCCCHR) without an "or equal" provision (ASSE or state evaluation and approval by a specified procedure) may lead to a challenge by a manufacturer or purchaser.

Standards for Installation of PBA

The standards for backflow prevention assemblies, the agencies approving assemblies and the manufacture of assemblies stipulate installation requirements for proper assembly performance. Installation requirements are also established to prevent contaminants entering through assembly vents, freeze protection, maintenance, etc.

To ensure assemblies are installed in the desired manner, the purveyor should adopt standards for assembly installation, either by reference to published standards or by issuance of its own standards. Such installation standards should be readily available to those installing assemblies.

Procedure for Testing of BPA

Procedures for the testing of assemblies may be established by the state. The state regulations may specifically prescribe a test procedure (e.g., procedures in the USC FCC CHR *"Manual of Cross-Connection Control",* Tenth Edition) or may specify more than one procedure.

Where the purveyor may find deficiencies in the state specified test procedures additional procedures should be specified. For example, the purveyor may require the field test of reduced pressure backflow assemblies to include an additional step to verify if the relief valve will continue to open beyond the "drip point" indicated by verifying the relief valve opening pressure differential.

Training of Backflow Assembly Testers (BAT)

In assessing the quality of the BAT training the purveyor should consider:

- Course syllabus.
- Course training manual and other course references.
- Number of classroom and testing lab hours.
- Backflow assemblies and test gauges available for training.
- Course instructor (experience and teaching skill).
- Quality assurance where a training institution may use different instructors.
- Testing procedures utilized (e.g., state adopted procedure).
- Inclusion of troubleshooting and maintenance.

The purveyor may find deficiencies in the locally available BAT training program, even where those programs are state sanctioned.

As part of certification and re-certification of backflow assembly testers, some states establish a base curriculum, hours of classroom and lab time. Instructors may also require special training and certification.

Technical organizations such as AWWA Sections, American Backflow Prevention Association (APBA), etc., may provide recommended course guidelines, types of assemblies for training of testers, etc. They may also provide a voluntary certification program, training for instructors and exam proctors, etc.

Where the purveyor owns all assemblies it relies upon to protect the public water system, the purveyor may supplement the local training and state certification for its employee BAT or may require its contractor BAT to obtain supplemental training and certification. For example, the purveyor may send an employee to an out-of-state training course (e.g., USC FCCCHR course) or require a contractor BAT to obtain the additional training.

Where the purveyor relies upon assemblies owned by its customer for protection of the public water system, imposing additional training requirements is more difficult if such training and certification is not readily available.

The options available to the purveyor include:

- The purveyor and/or a local technical group (e.g., AWWA, APBA) provide supplemental training.
- The purveyor compensates by strengthening other quality assurance procedures (e.g., require premises isolation for a larger number of categories of customers) and quality control procedures (e.g., more frequently audit the work of testers).

One major difficultly for small purveyor is often the lack of technical knowledge by the purveyor's supervisory staff to audit the work of its employee BAT, or for the purveyor's employee BAT or CCS to audit the work of a commercial tester's.

Certification and Re-certification of BAT

In assessing the quality of the BAT certification and re-certification the purveyor should consider the:

- Written exam (comprehensiveness and applicability of exam questions).
- Practical exam (use of proctors, exam procedures, inclusion of all types of assemblies).
- Proctors training and certification.
- Re-certification requirements.
- Re-certification written exam.
- Practical exam for re-certification.
- Criteria for pass/fail of certification and re-certification exams (minimum level of competency).

Similar to BAT training, the purveyor may find deficiencies in state (or local voluntary) certification program. State certification may be based on minimal "need to know" criteria. A voluntary program or a program in another state may set higher standards for certification. For greater reliance upon certification to ensure BAT the performance, the purveyor may require certification other than the one required by the state (e.g., APBA certification).

Similar to BAT training, it is easier for purveyor that owns all assemblies it relies upon to protect the public water system to require its employees or contractor BAT to obtain additional certification.

Where the purveyor relies upon assemblies owned by its customer for protection of the public water system, imposing additional certification requirements is more difficult if such certification is not readily available. The purveyor may compensate by strengthening other quality assurance procedures and quality control procedures (e.g., more frequently audit the work of testers).

Purveyor's Approval (Acceptance) of BAT

The purveyor may pre-approve a BAT for testing assemblies it replies upon for the protection of the distribution system. The list of pre-approved testers can then be given to the purveyor's customers along with a notice for the testing of assemblies. The purveyor may establish additional requirements (i.e., to state certification) for a contractor BAT it employs, such as:

- State contractor license.
- County/City business license.
- Insurance.
- Proof of BAT certification(s).
- Proof of insurance, amount of insurance coverage, type of insurance (e.g., errors and omission), purveyor named in coverage, etc.
- Proof of ownership of appropriated (approved) test equipment.
- Proof of recent calibration check of test equipment.
- Minimum experience or testing history (e.g., minimum number of assemblies).
- CCS certification in addition to BAT certification.

For a BAT employed by the purveyor's customer, the imposition of additional requirements must be reasonable in terms of the legitimate interests of the purveyor. For example, the purveyor may make the requirement that a BAT show proof of a recent check of test equipment calibration, but may not be able to require that a BAT show proof of a business license.

Training of Cross Connection Control Specialists (CCS) for Program Administration

Similar to BAT training, not all training CCS courses are equal. Moreover, in some states, CCS certification does not require completion of a course; certification is based solely on a written exam.

In assessing the quality of the CCS training the purveyor should consider:

- Course syllabus.
- Course training manual and other course references.
- Number of classroom hours.
- Inclusion of training on testing of backflow assemblies.
- Course instructor (experience and teaching skill).
- Quality assurance where a training institution may use different instructors.

The purveyor's CCS may be an employee or contractor/consultant CCS. The purveyor may also require the customer to employ a CCS to provide the purveyor with a hazard survey. Compensating for deficiencies in local CCS training is easiest for the purveyor's employees. For example, the purveyor may send an employee to an out-of-state training course.

For a contractor CCS, the options available to the purveyor include:

- The purveyor and/or a local technical group (e.g., AWWA, APBA) provide supplemental education.
- The purveyor compensates by strengthening other quality assurance procedures (e.g., require premises isolation for a larger number of categories of customers).
- The purveyor provide periodic third-party oversight (of purveyor's staff CCS) by a contractor CCS.
- The purveyor obtains an independent evaluation of the purveyor's program.

One major difficultly for small purveyor is often the lack of technical knowledge by the purveyor's supervisory staff to supervise the work of its employee or contractor CCS. To overcome this shortcoming the purveyor may obtain an independent evaluation of the program. This may be provided by:

- State health department staff
- Large utility staff CCS
- Consultant

Certification of CCS

Not all certifications are equal. In assessing the quality of the CCS certification and re-certification the purveyor should consider:

- Written exam (comprehensiveness and applicability of exam questions)
- Criteria for pass/fail of certification and re-certification exams (minimum level of competency)

Similar to BAT certification, the purveyor may find deficiencies in state or voluntary certification programs. The purveyor may require certification other than the one required by the state (e.g., APBA certification).

Testing of BPA

The frequency for testing of assemblies should be established by the purveyor. The minimum frequency may be established by state regulations (e.g., once per year). The purveyor may establish more frequent testing of assemblies in general or for specific makes and models of assemblies or for particular installations (e.g., test RPBA for a sewer treatment plant every six months).

For purveyor owned assemblies, increasing the testing frequency for greater quality assurance is discretionary. For customer owned assemblies, the customer may object to the cost of for frequent testing. For government owned utilities, the reasonableness of requiring more frequent testing than standard industry practice may need to be justified to the elected officials of the government agency.

Where there are a limited number of certified testers are available in an area, the purveyor may compensate by:

- At the same time each year, issuing the annual notice to all customers to have their assemblies tested. This allows testers from outside the area to schedule one trip to test multiple assemblies.
- Arrange for a purveyor-selected contractor BAT to test the customer's assemblies.
- Own all assemblies it relies upon (purveyor's staff or contract BAT tests all assemblies).

Where few testers provide a service, the purveyor's quality assurance and quality control efforts (e.g., monitoring and auditing of BAT performance) are reduced. The least effort involves purveyor staff or purveyor employed contractor BAT.

Reporting Results of BPA Tests

The results of tests should be on a form supplied by the purveyor or acceptable to the purveyor. Standard forms may be helpful to the tester, but may not include all of the information desired by the purveyor.

Standards for BPA Test Equipment

Equipment for the testing of backflow prevention assemblies utilizing differential pressure reading is expensive. Testers have assembled differential and duplex test kits from purchased component parts from sources other than the manufacturers of test equipment.

To ensure that test equipment is of a quality acceptable to the purveyor, the purveyor must either specify test equipment by make and model, or specify industry standards (e.g., USC FCCCHR). It is easier for a non-government purveyor to specify test equipment by make and model. For a government agency, a standard should be specified.

Approval of BPA Test Equipment

A non-government purveyor may specify test equipment by make and model. The decision on approval of equipment may be subjective (based on preference). Alternatively, the selection of an agency for product testing and approval may be discretionary.

For government agencies, approval of test equipment would need the staff expertise and resources to evaluate a product or it must rely upon a third party evaluation of products and listing of "approved test equipment".

For a government agency, the selection of an approval agency (e.g., USC FCCCHR) is subject to the same scrutiny as the setting of standards and section of materials. To specify an approval agency (e.g., USC FCCCHR) without an "or equal" provision may lead to a challenge by a manufacturer or purchaser.

Check of Test Equipment Calibration

The accuracy of test equipment is essential to the testing of assemblies. The degree of accuracy is established by the product standards.

The frequency for checking the calibration of test equipment must be established by the purveyor. The minimum frequency may be established by state regulations.

The methods for checking the calibration of test equipment may be obtained from the manufactures of the equipment or in the test equipment standards. The purveyor must specify the calibration procedure.

For the checking of test equipment, the purveyor may:

- Provide the required equipment (e.g., mercury manometer) and staff.
- Specify an approved agency (e.g., instrument lab).

For purveyors that own all of the assemblies it relies upon, the task of checking test equipment calibration is relatively simple. Only one or two sets of equipment may be owned by the purveyor or the purveyor's contractor.

For testing of customer owner assemblies by commercial testers, there may be a large number of units of test equipment. Each tester approved for submitting test reports to the purveyor would need to provide proof of a check of test equipment calibration.

Some testing equipment cannot be re-calibrated. The purveyor must establish a policy on accepting test results that have been adjusted for calibration inaccuracies, or the replacement of equipment.

COMPONENTS OF QUALITY CONTROL PROGRAM: Inspection of Backflow Prevention Assembly Installation

The inspection of the installation of new assemblies should include:

- Confirmation of the appropriate type (e.g., RPBA), make and model (approved assembly).
- Confirmation of the proper installation for the type of assembly installed (e.g., horizontal), and compliance with the purveyor's adopted installation standards (e.g., ground clearance).
- Recording of assembly nameplate information (e.g., serial number, model number).
- Recording of the assembly location (e.g., record drawing, photograph).

The acceptance of the installation of an assembly should be based on the purveyor's requirements for the proper operation of the assembly. For purveyor owned assemblies, the acceptance of the installation may also include the following:

- Adequate drainage (e.g., for RPBA relief valve discharge).
- Worker safety (ventilation).
- Landscaping around or paint of enclosures.
- Vehicle access.

For customer owned assemblies, those located downstream of the purveyor's meter for premises isolation or in-premises assemblies relied upon by the purveyor, the purveyor must make a clear statement that approval of the installation of an assemblies indicates:

1. That the assembly is:
   a. The approved type and make for protection of the purveyor's system, and
   b. Installed in an approved manner for its type and make, including an approved air gap for an RPBA.

2. That the purveyor's approval does not address:
   a. If the assembly or its installation complies with the building code, plumbing code, safety code or other regulations pertaining to customer's premises.
   b. If the assembly is properly restrained or supported, protected from freezing and vandalism, has adequate drainage to prevent flooding damage from the RPBA relief valve discharge, etc.

The above items are recommended to limit the purveyor's exposure to liability for any deficiencies in the customer's installation of backflow assemblies.

For customer owned assemblies, the purveyor may include the requirements:

- That a plumbing and building permit is obtained for the assembly installation,
- The customer provides proof that the local administrative authority approved the assembly installation.

Inspection of the installation of backflow prevention assemblies relied upon by the purveyor should be completed prior to providing service to a new customer.

The purveyor may also include with the inspection of the assembly installation:

- The initial testing of the assembly or assemblies.
- A hazard survey of the premises to confirm the assessment made based on plan review.

Monitoring of Test Results

The reporting of test results may vary from a simple statement that an assembly passed or failed a prescribed test procedure, to reporting detailed results of the test (e.g., opening pressure of the RPBA relief valve). Greater quality control is obtained through the review of detailed results.

Just as the test procedures do not verify all performance parameters established by design standards, for practical reasons limits may be set for the number of parameters to be reported for the test of a backflow prevention assembly. Increasing the number of parameters reported increases the task of reviewing and recording of data (e.g., in a spreadsheet database), but decreases the purveyor's risk and exposure to liability.

For quality control, the person reviewing test data must have specific knowledge of the quality control criteria. The "inspector" must be trained.

Entry of the data into a computer database may facilitate the review of test result. Some computer programs for data recording provide check features, such as verifying assembly approval by make and model number, BAT certification, etc. However, to utilize the computer data entry for quality control requires the input of the appropriate parameters. The knowledge of the person reviewing the submitted test data (or writing a computer program to assist in data review) is essential to the level of quality control obtained from the submission and review of details in the test report.

Without the purveyor providing staff (employee CCS or contractor CCS/consultant) with adequate knowledge for and effort in quality control utilizing the results the BAT testing of an assembly, the test report need only include the statement that the assembly passed or failed. Total reliance is then placed on the performance of the BAT.

To reduce the purveyor's risk and liability, any quality control utilizing the review of test report data should be undertaken as soon as possible after the purveyor obtains a test report. This may be only a cursory review to determine the assembly passed or failed a test, that the BAT did not make a statement concerning improper application of the assembly to the degree of hazard, etc. A thorough review could be made at a more convenient time. This offers the options of the more thorough review being made by a selected staff member or contractor CCS/consultant with suitable knowledge for the task. As a minimum, the detailed review should be made annually.

The field test of a backflow prevention assembly does not include all of the design parameters included in design standards. The procedures may not include a test of an assembly component to determine if backflow will occur. For example, a check valve may be tested in the direction of flow, rather than reverse direction of flow. An assembly that fails the field test (e.g., check valve holds tight with 0.5 psi in the direction of flow) may continue to perform to prevent backflow. The field test only determines if the assembly complies with the test procedures. Conversely an assembly may pass the field test with a component that does not properly function. For example, the relief valve of an RPBA may be reported as opening at 2.1 psi, but may not continue to open to dispel the quantity of water need to stop backflow.

All assemblies will eventual fail to perform, and thus, would allow backflow to occur. The review of field test report for passing or failing the prescribe field test is for the purpose of providing timely maintenance or replacement. As noted above, field tests may not demonstrate a failure to prevent actual backflow test conditions. Repair or replacement is required to restore a level of confidence in the reliability of an assembly.

The review of the performance data obtained in the field test is for the purpose of determining the reliability of an assembly to prevent backflow. This review may result in the preventative replacement of an assembly because of increased failure rate, removal of a specific make and model from the purveyor's approval list due to above average failure rates, or establishing a preference in the purveyor's purchase of assemblies.

In monitoring the performance of the assembly, the purveyor should review the following parameters:

Parameter	Quality Control Review
Line pressure	Under high line pressure some assemblies may have a higher than average failure rate.
Service meter reading	Under low or no-flow conditions some assemblies (e.g., on fire lines) may have a higher than average failure rate.
Pressure readings	As an assembly parts show wear, the pressure readings will change (e.g., opening pressure of the RPBA relief valve will decrease). Monitoring of this data may give an indication of the need for maintenance and replacement.

If an assembly shows a higher than average failure rate (compared to other makes and model) the purveyor may remove the make and model from its list of approved assemblies. For purveyor owned assemblies, the purchase of assemblies is discretionary, based on better performance rather than lowest cost.

To restrict the customer's purchase of assemblies is a more difficult task, both with respect to administration (e.g., assuring that contractors and suppliers are aware of restriction) and enforcement. For a government owned utility, a manufacturer of a product withdrawn from an "approved list" by a local jurisdiction would likely be challenged.

The purveyor should report any issue with the performance of an assembly to the state (if the state issues a list of approved assemblies) and to the approval agency. There is no assurance that the make and model removed from the purveyor's list will be removed from the state or testing agency's approval list. The conditions for a make or model to show higher than normal failure rates may be due to conditions found in the purveyor's system (e.g., water is corrosive or contains high levels of iron and manganese).

The above parameters may also be used in monitoring the performance of the tester. By comparing the test report data over several years the purveyor may detect BAT fraud, test equipment inaccuracy, assembly replacement, etc.

To limit the purveyor's liability, all test reports for assemblies owned by the customer should be returned to the purveyor by the purveyor's customer, not directly from the customer employed BAT. The customer should be required to sign the test report after its completion by the BAT. This confirms that the customer is aware of any deficiency in the assembly performance and installation reported by the BAT.

Monitoring of Bat Certification and Other Conditions for Employment

The purveyor should verify that the BAT submitting a test report currently holds the certifications required by the purveyor. As the minimum effort, this would require proof of the certification required by the state.

Where readily available, the purveyor may rely upon a state listing of certified testers. If not readily available (e.g., though the Internet), or if the purveyor requires certification supplemental to the state certification, the purveyor should annually assemble a list of pre-approved certified testers that may submit reports on the testing of assemblies the purveyor relies upon.

The purveyor's requirements for listing may include proof of ownership of appropriate test equipment, recent check of test equipment calibration, etc.

For a small system, the purveyor may rely partially or completely upon the list from another nearby [larger] system following acceptable listing criteria.

The purveyor should base its listing of certified testers on pre-established criteria. The criteria must be in the legitimate interests of the purveyor and not contain arbitrary criteria that restrict employment.

Monitoring of BAT Test Procedure

This entails the verification that a BAT is properly performing the testing procedure required by the purveyor. The issue may arise from a review of test reports submitted by each BAT, customer complaints, or accusation of improper testing by another BAT. Without a specific reason for evaluating the performance of a specific BAT, the purveyor may wish to make a random audit of BAT testing.

To undertake a review of the testing ability of a BAT, the purveyor must have qualified staff and test equipment, or must arrange to use a qualified contractor BAT.

Two options are available for auditing BAT performance:

1. Retest an assembly immediately before issuing a test notice or immediately after receiving the test report.
2. Arrange to witness the testing of an assembly by a BAT.

The audit may reveal that:

1. Failed to follow the requisite state testing procedure, and:
   a. The BAT falsified a previous test (option "1", above).
   b. The BAT shows a fundamental error in the prescribed test procedures.
   c. The BAT shows a minor error in the prescribed test procedures.

2. Failed to follow the purveyor's required additional test procedures, and:
   a. The BAT falsified a previous test (option "1", above).
   b. The BAT shows a fundamental error in the prescribed test procedures.
   c. The BAT shows a minor error in the prescribed test procedure.

Option 1, above, is most useful in determining BAT fraud. Past history has revealed:

- The assembly was no longer installed.
- A pressure-reducing valve was found at the location listed as being tested.
- A RPBA relief valve opening pressure was recorded for a DCVA installation.
- Dirt and debris was found in the test cocks of an assembly recently claimed as being tested.

Option 2 is necessary in determining BAT competency.

For a small system, the purveyor may rely partially or completely upon the monitoring of BAT performance by another nearby [larger] system.

Monitoring of Test Equipment Calibration

As a minimum, the purveyor should either perform the check of the calibration of the equipment or have a qualified testing laboratory submit a report on the calibration check.

Remedial Action for Performance Failure

Quality control requires correction of any failure to perform.

Quality control may require the purveyor to take corrective actions for the following:

a. Backflow assembly failure to meet performance requirements.
b. Backflow assembly is improperly installed.
c. Customer failure to submit report of test results.
d. BAT improper performance of assembly test.
e. BAT failure to check calibration of test equipment.
f. BAT fraud.
g. CCS improper performance.
h. CCS fraud.

Where the purveyor owns the assemblies it relies upon, remedial action is relatively easy. All parameters for quality assurance are under the control of the purveyor.

For assemblies owned by the customer, the purveyor must have suitable means of enforcement. Ultimately, the enforcement could involve termination of water service or the purveyor's installation of a backflow assembly for premises isolation. Litigation may result from a termination of water service or the assessment to the customer for the purveyor's installation of a premises isolation assembly.

The following table is provided for the purveyor to audit its quality assurance and quality control program.

CROSS CONNECTION CONTROL PROGRAM
QUALITY ASSURANCE AND QUALITY CONTROL PROGRAM

CHECKLIST

	PROGRAM COMPONENTS	PURVEYOR OWNED ASSEMBLIES (yes/no)	CUSTOMER OWNED ASSEMBLIES (yes/no)
1	**QUALITY ASSURANCE**		
A	Backflow prevention assembly (BPA) standards		
B	BPA approval		
C	BPA installation standards		
D	BPA testing procedures		
E	Backflow assembly tester (BAT) training		
F	BAT certification and periodic re-certification		
G	BAT approval (acceptance) by purveyor		
I	Cross connection control specialists (CCS) training		
I	CCS certification and re-certification		
J	BPA testing requirements		
K	BPA test reporting requirements		
L	BPA test equipment standards		
M	BPA test equipment approval		
N	BPA test equipment periodic check of calibration		
2	**QUALITY CONTROL**		
A	Inspection of BPA installation		
B	Monitoring of test results		
	(i) For BPA performance		
	(ii) For BAT performance		
C	Monitoring of BAT certification		
D	Monitoring of BAT performance (testing) of BPA		
E	Monitoring of CCS performance		
F	Monitoring of BAT check of test equipment calibration		
G	Remedial action for performance failure		
	(i) BPA performance and installation		
	(ii) Customer reporting of BPA test results		
	(iii) BAT performance		
	(iv) BAT check of test equipment calibration		
	(v) BAT fraud		
	(vi) CCS performance		
	(vii)CCS fraud		

WAC 51-56-0600

CHAPTER 6
WATER SUPPLY AND DISTRIBUTION

WAC 51-56-0600
Chapter 6 — Water supply and distribution.

601.1 Except where not deemed necessary for safety or sanitation by the AHJ, each plumbing fixture shall be provided with an adequate supply of potable running water piped thereto in an approved manner, so arranged as to flush and keep it in a clean and sanitary condition without danger of backflow or cross-connection. Water closets and urinals shall be flushed by means of an approved flush tank or flushometer valve.

EXCEPTION: Listed fixtures that do not require water for their operation and are not connected to the water supply.

Kitchen sinks, lavatories, bathtubs, showers, bidets, laundry tubs and washing machine outlets shall be provided with hot and cold water. This requirement shall not supersede the requirements for individual temperature control limitations for public lavatories, bidets, bathtubs, whirlpool bathtubs and shower control valves.

601.2.2 Color and Information. Each system shall be identified with a colored pipe or band and coded with paints, wraps and materials compatible with the piping.

Except as required in Chapter 16, nonpotable water systems shall have a yellow background with black uppercase lettering, with the words "CAUTION: NONPOTABLE WATER, DO NOT DRINK." Each nonpotable system shall be identified to designate the liquid being conveyed, and the direction of normal flow shall be clearly shown. The minimum size of the letters and the length of color field shall conform to Table 6-1.

The background color and required information shall be indicated every twenty (20) feet (6,096 mm) but not less than once per room, and shall be visible from the floor level.

603.0 Cross-Connection Control. Cross-connection control shall be provided in accordance with the provisions of this chapter. Devices or assemblies for protection of the public water system must be models approved by the department of health under WAC 246-290-490. The authority having jurisdiction shall coordinate with the local water purveyor where applicable in all matters concerning cross-connection control within the property lines of the premises.

No person shall install any water operated equipment or mechanism, or use any water treating chemical or substance, if it is found that such equipment, mechanism, chemical or substance may cause pollution or contamination of the domestic water supply. Such equipment or mechanism may be permitted only when equipped with an approved backflow prevention device or assembly.

603.1 Approval of Devices or Assemblies. Before any device or assembly is installed for the prevention of backflow, it shall have first been approved by the authority having jurisdiction. Devices or assemblies shall be tested for conformity with recognized standards or other standards acceptable to the authority having jurisdiction. Backflow prevention devices and assemblies shall comply with Table 6-2, except for specific applications and provisions as stated in Section 603.4 through 603.4.22.

All devices or assemblies installed in a potable water supply system for protection against backflow shall be maintained in good working condition by the person or persons having control of such devices or assemblies. Such devices or assemblies shall be tested in accordance with Section 603.3.3 and WAC 246-290-490. If found to be defective or inoperative, the device or assembly shall be replaced or repaired. No device or assembly shall be removed from use or relocated or other device or assembly substituted, without the approval of the authority having jurisdiction.

Testing shall be performed by a Washington state department of health certified backflow assembly tester.

TABLE 6-2

Backflow Prevention Devices, Assemblies and Methods

The following line is deleted from the table:

Device, Assembly or Method	Applicable Standards	Pollution (Low Hazard)		Contamination (High Hazard)		Installation
		Back Siphonage	Back Pressure	Back Siphonage	Back Pressure	
Backflow preventer for	ASSE 1022	X				Installation includes

carbonated beverage dispensers (two independent check valves with a vent to the atmosphere.)						carbonated beverage machines or dispensers. These devices operate under intermittent or continuous pressure conditions.

603.3.3 For devices and assemblies other than those regulated by the Washington department of health in conjunction with the local water purveyor for the protection of public water systems, the authority having jurisdiction shall ensure that the premise owner or responsible person shall have the backflow prevention assembly tested by a Washington state department of health certified backflow assembly tester:

(1) At the time of installation, repair or relocation; and

(2) At least on an annual schedule thereafter, unless more frequent testing is required by the authority having jurisdiction.

603.4.6.1 Potable water supplies to systems having no pumps or connections for pumping equipment, and no chemical injection or provisions for chemical injection, shall be protected from backflow by one of the following devices:

(1) Atmospheric vacuum breaker.

(2) Pressure vacuum breaker.

(3) Spill-resistant pressure vacuum breaker.

(4) Reduced pressure backflow preventer.

(5) A double check valve may be allowed when approved by the water purveyor and the authority having jurisdiction.

603.4.10 **Potable Water Make Up Connections to Steam or Hot Water Boilers** shall be protected by an air gap or a reduced pressure principle backflow preventer.

603.4.12 **Potable Water Supply to Carbonators** shall be protected by a listed reduced pressure principle backflow preventer as approved by the authority having jurisdiction for the specific use. The backflow preventer shall be located in accordance with Section 603.3.4. The piping downstream of the backflow preventer shall not be of copper, copper alloy, or other material that is affected by carbon dioxide.

603.4.14 Backflow preventers shall not be located in any area containing fumes or aerosols that are toxic, poisonous, infectious, or corrosive.

603.4.16.1 Except as provided under Sections 603.4.16.2 and 603.4.16.3, potable water supplies to fire protection systems that are normally under pressure, including but not limited to standpipes and automatic sprinkler systems, except in one or two family residential flow-through or combination sprinkler systems piped in materials approved for potable water distribution systems, shall be protected from back-pressure and back-siphonage by one of the following testable devices:

1. Double check valve assembly.

2. Double check detector assembly.

3. Reduced pressure backflow preventer.

4. Reduced pressure detector assembly.

Potable water supplies to fire protection systems that are not normally under pressure shall be protected from backflow and shall meet the requirements of the appropriate standard(s) referenced in Table 14-1.

604.15 Plastic water service piping may terminate within a building, provided the connection to the potable water distribution system shall be made as near as is practical to the point of entry and shall be accessible. Barbed insert fittings with hose clamps are prohibited as a transition fitting within the building.

608.5 Relief valves located inside a building shall be provided with a drain, not smaller than the relief valve outlet, of galvanized steel, hard drawn copper piping and fittings, CPVC, or listed relief valve drain tube with fittings which will not reduce the internal bore of the pipe or tubing (straight lengths as opposed to coils) and shall extend from the valve to the outside of the building, with the end of the pipe not more than two (2) feet (610 mm) nor less than six (6) inches (152 mm) above the ground or the flood level of the area receiving the discharge and pointing downward. Such drains may terminate at other approved locations. No part of such drain pipe shall be trapped or subject to freezing. The terminal end of the drain pipe shall not be threaded.

EXCEPTION: Replacement water heating equipment shall only be required to provide a drain pointing downward from the relief valve to extend between two feet (610 mm) and six inches (152 mm) from the floor. No additional floor drain need be provided.

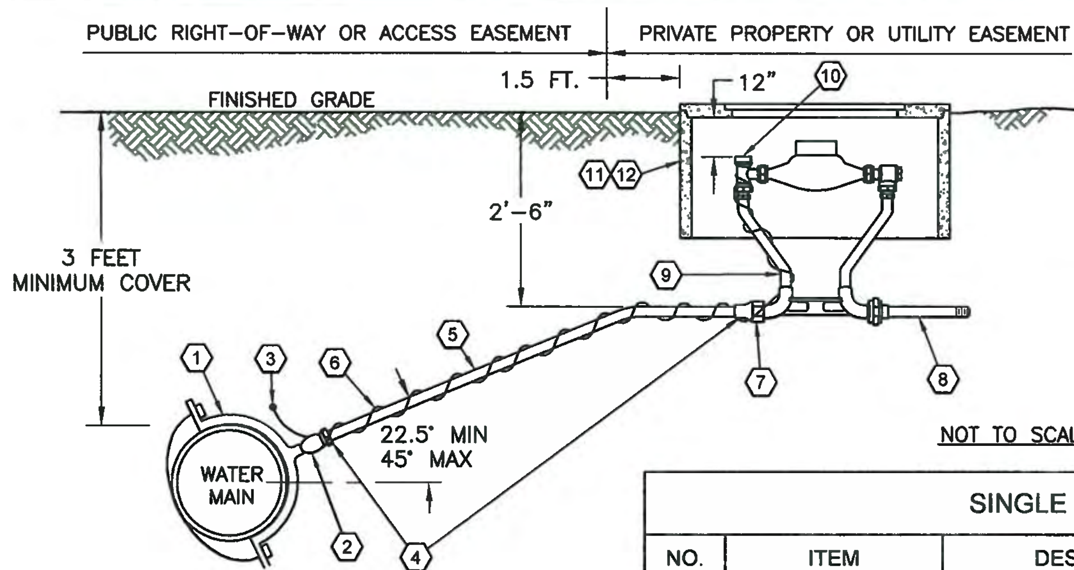
610.4 Systems within the range of Table 6-6 may be sized from that table or by the method set forth in Section 610.5.

Listed parallel water distribution systems shall be installed in accordance with their listing.

[Statutory Authority: RCW 19.27.031, 19.27.035, 19.27.074, and chapters 19.27 and 34.05 RCW. 12-07-018, § 51-56-0600, filed 3/12/12, effective 4/12/12. Statutory Authority: RCW 19.27.074, 19.27.031 and chapters 19.27 and 34.05 RCW. 10-03-101, § 51-56-0600, filed 1/20/10, effective 7/1/10. Statutory Authority: RCW 19.27.190, 19.27.020 and chapters 19.27 and 34.05 RCW. 07-01-094, § 51-56-0600, filed 12/19/06, effective 7/1/07. Statutory Authority: RCW 19.27.031 and 19.27.074. 04-01-110, § 51-56-0600, filed 12/17/03, effective 7/1/04; 02-01-114, § 51-56-0600, filed 12/18/01, effective 7/1/02.]

APPENDIX H

DESIGN AND PERFORMANCE STANDARDS



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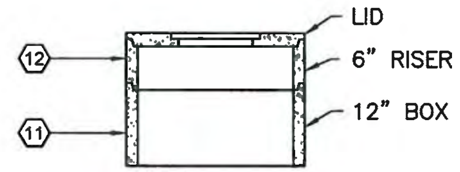


METER BOX

APPROVED
City of Oak Harbor
Engineering Dept.

Signature

1-20-11

Date

NOTES:

1. CONTRACTORS SHALL USE THE MATERIAL LIST SHOWN. SUBSTITUTION REQUESTS WILL BE CONSIDERED BUT MUST BE APPROVED BY THE CITY PRIOR TO INSTALLATION.
2. AN OLYMPIC FOUNDRY SM-29 TRAFFIC BOX SHALL BE USED FOR METERS SET IN PAVED AREAS, DRIVEWAYS, SIDEWALKS, ETC.
3. ALL SETTERS SHALL BE SET FLUSH, PLUMB, AND CENTERED IN THE METER BOX.
4. INSTALL WATER SERVICE LINE PERPENDICULAR TO MAIN.
5. CORPORATION STOP TO BE IN FULL ON POSITION PRIOR TO PLACEMENT OF BACKFILL.
6. SERVICE LINE AND SETTER SHALL BE FLUSHED FOR 1-MINUTES. MUD, FOREIGN MATERIALS OR CONTAMINANTS SHALL NOT BE PERMITTED TO ENTER ANY TUBING OR FITTINGS.
7. A TIGHT FITTING CAP SHALL BE INSTALLED OVER OPEN END OF FITTING (MAKE WATER TIGHT) IF SERVICE CONNECTION IS NOT COMPLETE TO BUILDING.
8. WATER SERVICE FROM THE METER TO THE BUILDING SHALL BE INSTALLED IN ACCORDANCE WITH THE UNIFORM PLUMBING CODE (UPC).
9. BACK FLOW PREVENTION DEVICES SHALL BE INSTALLED FOR ALL IRRIGATION SERVICES AND WHERE NECESSARY TO PREVENT BACK FLOW CONTAMINATION OF THE CITY WATER SUPPLY.
10. METER BOXES SHALL BE SET ON A SAND BASE THAT IS PLACED TO WITHIN 18" OF FINISH GRADE.
11. SERVICE LINE SHALL HAVE A MINIMUM OF 4" DEPTH OF SAND BEDDING ABOVE AND BELOW THE PIPE.
12. TOP OF LID SHALL BE 2" ABOVE FINISHED GRADE EXCEPT WHEN IN HARD SURFACE.

SINGLE 5/8" X 3/4" METERED SERVICE

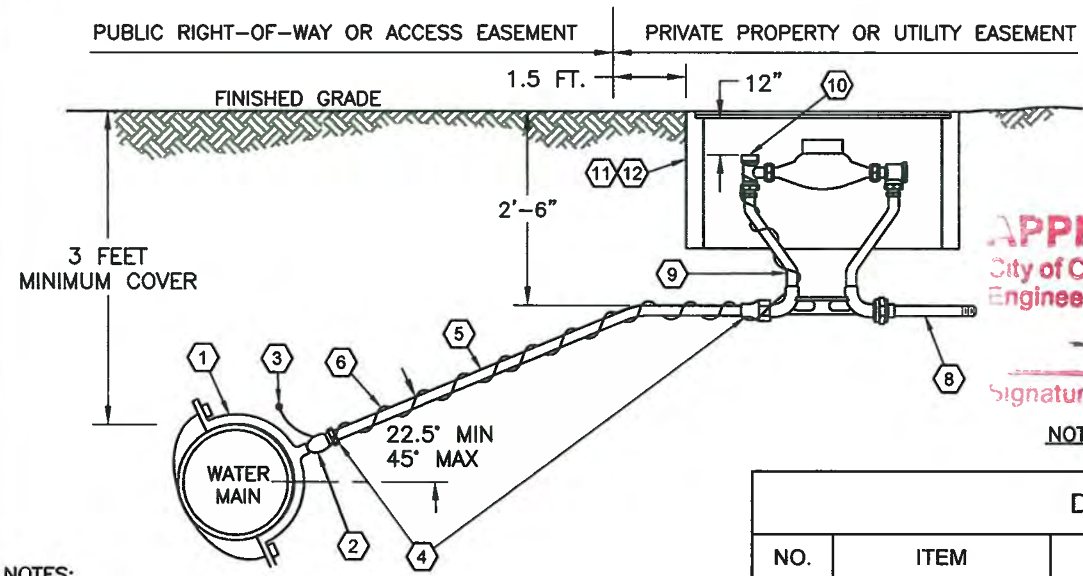
NO.	ITEM	DESCRIPTION	QUANTITY	PART NUMBER	BRAND
1	SADDLE	ALL BRASS BY 1" IPT TAP	1	S91-SERIES / 202B SERIES	FORD
2	CORP STOP	1" IPT (M) X PEP GJ	1	F-1101-4G	FORD
3	WIRE CONNECTOR	3-WAY SEALED/TAPE	1	903 / 6147	IBS
4	STIFFENERS	SS INSERT FOR 1" PEP IPS PIPE	2	# 72	
5	PIPE	1" IRON PIPE SIZE PEP 200PSI	AS NEEDED	PE3408	
6	LOCATE WIRE	12 GAUGE COPPER, BLUE	AS NEEDED		
7	ADAPTER	3/4"(M) IPT X 1" PEP GJ	1	C8634G	FORD
8	NIPPLE	3/4" IPT X IPT X 12" BRASS	1	3007N120	
9	METER SETTER	3/4" IPT X IPT X 18" W/ DBL CHECK	1	VHH72-18W-1133	FORD
10	METER LOCK	FIRAMATIC METER LOCK	1		
11	METER BOX	CONC W/ STEEL READER	1	#1 W/ STL RDR, CONC LID	BERG VLT
12	METER BOX RISER	6" CONCRETE	1	#1	BERG VLT

NOTE: DETAIL IS SCHEMATIC. ACTUAL ITEM SPECIFIED IN MATERIAL LIST MAY VARY IN STYLE OR APPEARANCE.

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

SINGLE WATER SERVICE 5/8 X 3/4-INCH METER

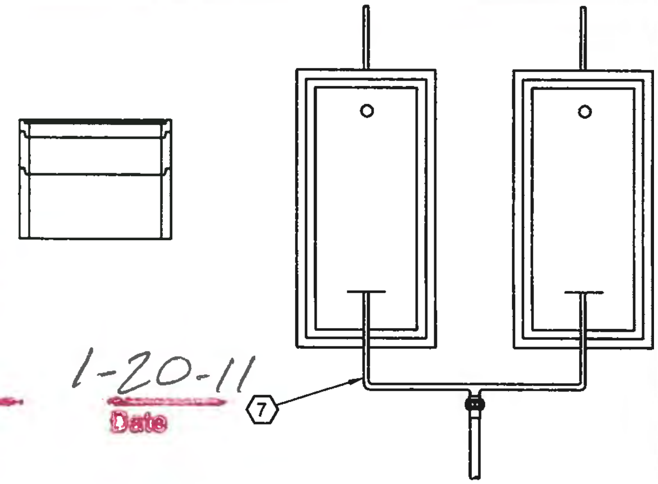
ACAD-W-3A 5_8 X 3_4-inch water meter.dwg



APPROVED
City of Oak Harbor
Engineering Dept.

Signature

1-20-11
Date



NOT TO SCALE

DOUBLE 5/8" X 3/4" METERED SERVICE					
NO.	ITEM	DESCRIPTION	QUANTITY	PART NUMBER	BRAND
1	SADDLE	ALL BRASS BY 1" IPT TAP	1	S91-SERIES / 202B SERIES	FORD
2	CORP STOP	1" IPT (M) X PEP GJ	1	F-1101-4G	FORD
3	WIRE CONNECTOR	3-WAY SEALED/TAPE	1	903 / 6147	IBS
4	STIFFENERS	SS INSERT FOR 1" PEP IPS PIPE	2	# 72	
5	PIPE	1" IRON PIPE SIZE PEP 200PSI	AS NEEDED	PE3408	
6	LOCATE WIRE	12 GAUGE COPPER, BLUE	AS NEEDED		
7	U BRANCH	1" IPS PEP GJ X (2)IPT M X 14"	1	U68-43-14	FORD
8	NIPPLE	3/4" IPT X IPT X 12" BRASS	2	3007N120	
9	METER SETTER	3/4" IPT X IPT X 18" W/ DBL CHECK	2	VHH72-18W-11-33	FORD
10	METER LOCK	FIRAMATIC METER LOCK	2		
11	METER BOX	CONC W/ STEEL READER	2	#1 W/ STL RDR, CONC LID	BERG VLT
12	METER BOX RISER	6" CONCRETE	2	#1	BERG VLT

NOTE: DETAIL IS SCHEMATIC. ACTUAL ITEM SPECIFIED IN MATERIAL LIST MAY VARY IN STYLE OR APPEARANCE.

NOTES:

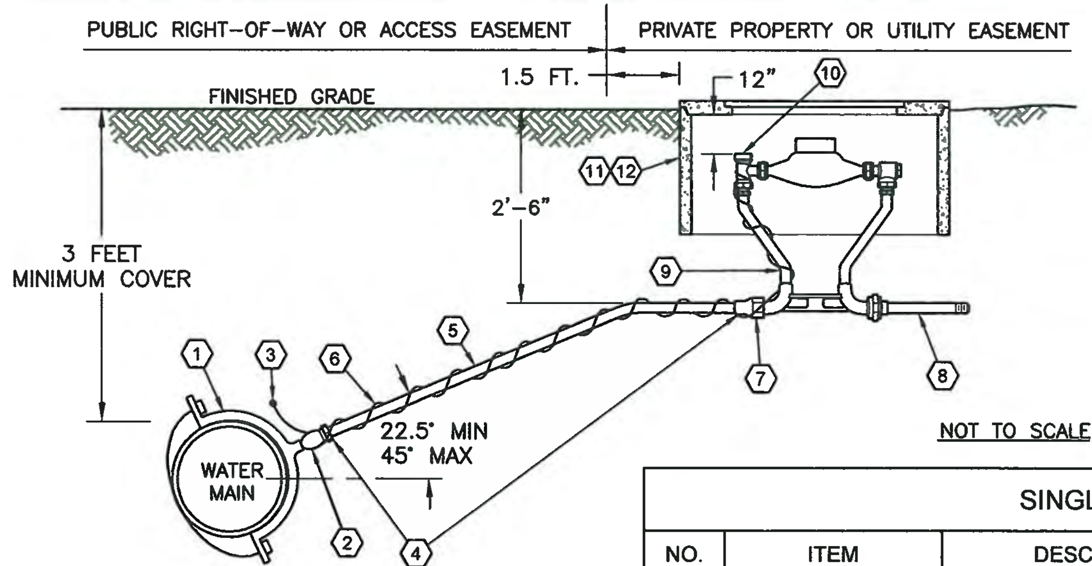
1. CONTRACTORS SHALL USE THE MATERIAL LIST SHOWN. SUBSTITUTION REQUESTS WILL BE CONSIDERED BUT MUST BE APPROVED BY THE CITY PRIOR TO INSTALLATION.
2. AN OLYMPIC FOUNDRY SM-29 TRAFFIC BOX SHALL BE USED FOR METERS SET IN PAVED AREAS, DRIVEWAYS, SIDEWALKS, ETC.
3. ALL LINE SETTERS SHALL BE SET FLUSH, PLUMB, AND CENTERED IN THE METER BOXES.
4. INSTALL WATER SERVICE LINE PERPENDICULAR TO MAIN.
5. CORPORATION STOP TO BE IN FULL ON POSITION PRIOR TO PLACEMENT OF BACKFILL.
6. SERVICE LINE AND SETTER SHALL BE FLUSHED FOR 1-MINUTE. MUD, FOREIGN MATERIALS OR CONTAMINANTS SHALL NOT BE PERMITTED TO ENTER ANY TUBING OR FITTINGS.
7. A TIGHT FITTING PLUG SHALL BE INSTALLED OVER OPEN END OF FITTING (MAKE WATER TIGHT) IF SERVICE CONNECTIONS ARE NOT COMPLETE TO BUILDING.
8. WATER SERVICES FROM THE METERS TO THE BUILDING SHALL BE INSTALLED IN ACCORDANCE WITH THE UNIFORM PLUMBING CODE (UPC).
9. ALL MANIFOLD METERS SHALL BE APPROVED BY THE CITY ENGINEER PRIOR TO INSTALLATION.
10. BACK FLOW PREVENTION DEVICES SHALL BE INSTALLED FOR ALL IRRIGATION SERVICES AND WHERE NECESSARY TO PREVENT BACK FLOW CONTAMINATION OF THE CITY WATER SUPPLY.
11. METER BOXES SHALL BE SET ON A SAND BASE THAT IS PLACED TO WITHIN 18" OF FINISH GRADE.
12. SERVICE LINE SHALL HAVE A MINIMUM OF 4" DEPTH OF SAND BEDDING ABOVE AND BELOW THE PIPE.

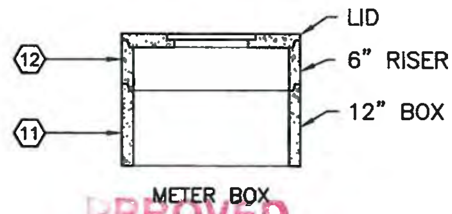
CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

MANIFOLD WATER SERVICE 5/8" METER

ACAD-W-3E Manifolded half inch water meter.dwg





APPROVED
City of Oak Harbor
Engineering Dept.
Signature
1-20-11
Date

NOTES:

1. CONTRACTORS SHALL USE THE MATERIAL LIST SHOWN. SUBSTITUTION REQUESTS WILL BE CONSIDERED BUT MUST BE APPROVED BY THE CITY PRIOR TO INSTALLATION.
2. AN OLYMPIC FOUNDRY SM-29 TRAFFIC BOX SHALL BE USED FOR METERS SET IN PAVED AREAS, DRIVEWAYS, SIDEWALKS, ETC.
3. ALL LINE SETTERS SHALL BE SET FLUSH, PLUMB, AND CENTERED IN THE METER BOX.
4. INSTALL WATER SERVICE LINE PERPENDICULAR TO MAIN.
5. CORPORATION STOP TO BE IN FULL ON POSITION PRIOR TO PLACEMENT OF BACKFILL.
6. SERVICE LINE AND SETTER SHALL BE FLUSHED FOR 1-MINUTE. MUD, FOREIGN MATERIALS OR CONTAMINANTS SHALL NOT BE PERMITTED TO ENTER ANY TUBING OR FITTINGS.
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10. METER BOXES SHALL BE SET ON A SAND BASE THAT IS PLACED TO WITHIN 18" OF FINISH GRADE.
11. SERVICE LINE SHALL HAVE A MINIMUM OF 4" DEPTH OF SAND BEDDING ABOVE AND BELOW THE PIPE.
12. TOP OF LID SHALL BE 2" ABOVE FINISHED GRADE EXCEPT WHEN IN HARD SURFACE.

SINGLE 1" METERED SERVICE

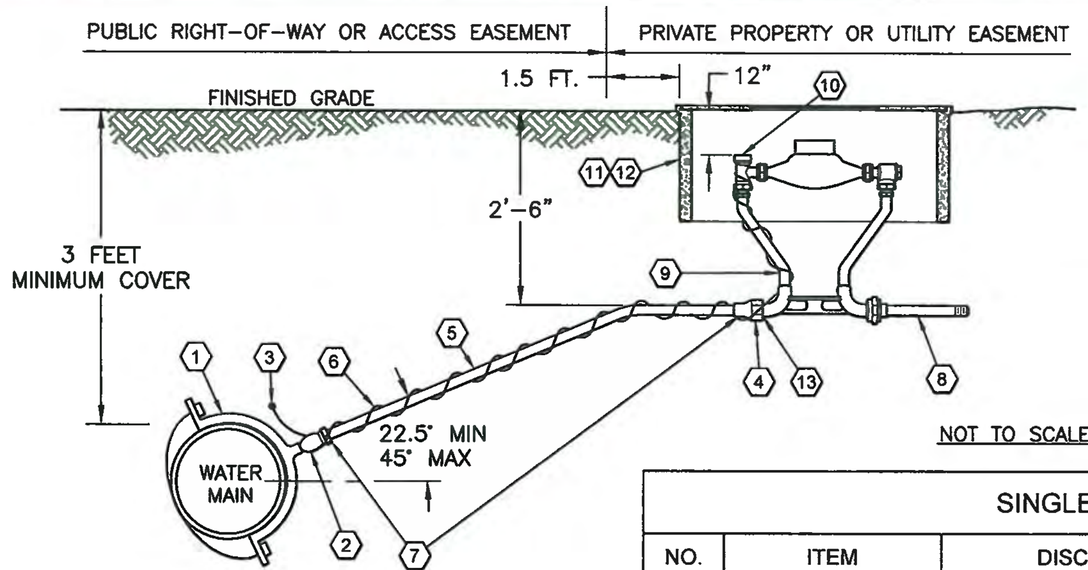
NO.	ITEM	DESCRIPTION	QUANTITY	PART NUMBER	BRAND
1	SADDLE	ALL BRASS BY 1" IPT TAP	1	S91-SERIES / 202B SERIES	FORD
2	CORP STOP	1" IPT (M) X PEP GJ	1	F-1101-4G	FORD
3	WIRE CONNECTOR	3-WAY SEALED/TAPE	1	903 / 6147	IBS
4	STIFFENERS	SS INSERT FOR 1" PEP IPS PIPE	2	# 72	
5	PIPE	1" IRON PIPE SIZE PEP 200PSI	AS NEEDED	PE3408	
6	LOCATE WIRE	12 GAUGE COPPER, BLUE	AS NEEDED		
7	ADAPTER	1"(M) IPT X 1" IPS PEP GJ	1	C86-44-G	FORD
8	NIPPLE	1" IPT X IPT X 12" BRASS	1	SCH-40 B-43	
9	METER SETTER	1" IPT X IPT X 18" W/ DBL CHECK	1	VHH72-18W-11-44	FORD
10	METER LOCK	FIRAMATIC METER LOCK	1		
11	METER BOX	CONC W/ STEEL READER	1	#3 CONCRETE LID W/ STEEL READER	BERG VLT
12	METER BOX RISER	6" CONCRETE	1	#3	BERG VLT

NOTE: DETAIL IS SCHEMATIC. ACTUAL ITEM SPECIFIED IN MATERIAL LIST MAY VARY IN STYLE OR APPEARANCE.

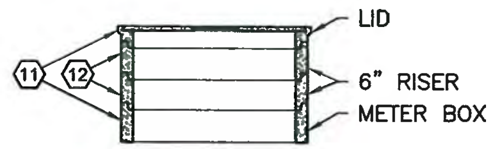
City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

SINGLE WATER SERVICE 1-INCH METER

ACAD-W-3B 1-inch water meter.dwg



NOT TO SCALE



METER BOX
(1 1/2" & 2" SERVICES)

APPROVED
City of Oak Harbor
Engineering Dept.
gnature
1-20-11
Date

NOTES:

1. CONTRACTORS SHALL USE THE MATERIAL LIST SHOWN. SUBSTITUTION REQUESTS WILL BE CONSIDERED BUT MUST BE APPROVED BY THE CITY PRIOR TO INSTALLATION.
2. AN OLYMPIC FOUNDRY SM–30 TRAFFIC BOX SHALL BE USED FOR METERS SET IN PAVED AREAS, DRIVEWAY, SIDEWALK, ETC.
3. ALL LINE SETTERS SHALL BE SET FLUSH, PLUMB, AND CENTERED IN THE METER BOX.
4. INSTALL WATER SERVICE LINE PERPENDICULAR TO MAIN.
5. CORPORATION STOP TO BE IN FULL ON POSITION PRIOR TO PLACEMENT OF BACKFILL.
6. SERVICE LINE AND SETTER SHALL BE FLUSHED FOR 1–MINUTE. MUD, FOREIGN MATERIALS OR CONTAMINANTS SHALL NOT BE PERMITTED TO ENTER ANY TUBING OR FITTINGS.
7. A TIGHT FITTING PLUG SHALL BE INSTALLED OVER OPEN END OF FITTING (MAKE WATER TIGHT) IF SERVICE CONNECTION IS NOT COMPLETE TO BUILDING.
8. WATER SERVICE FROM THE METER TO THE BUILDING SHALL BE INSTALLED IN ACCORDANCE WITH THE UNIFORM PLUMBING CODE (UPC).
9. BACK FLOW PREVENTION DEVICES SHALL BE INSTALLED FOR ALL IRRIGATION SERVICES AND WHERE NECESSARY TO PREVENT BACK FLOW CONTAMINATION OF THE CITY WATER SUPPLY.
10. METER BOXES SHALL BE SET ON A SAND BASE THAT IS PLACED TO WITHIN 18" OF FINISH GRADE.
11. SERVICE LINE SHALL HAVE A MINIMUM OF 4" DEPTH OF SAND BEDDING ABOVE AND BELOW THE PIPE.
12. TOP OF LID SHALL BE 2" ABOVE FINISHED GRADE EXCEPT WHEN IN HARD SURFACE.

SINGLE 1 1/2" METERED SERVICE

NO.	ITEM	DISCRIPTION	QUANTITY	PART NUMBER	BRAND
1	SADDLE	ALL BRASS BY 2" IPT TAP	1	S91-SERIES / 202B SERIES	FORD
2	CORP STOP	2" IPT (M) X PEP GJ	1	FB-500-7	FORD
3	WIRE CONNECTOR	3-WAY SEALED/TAPE	1	903 / 6147	IBS
4	BUSHING	2" IPT X 1 1/2" IPT BRASS	1		
5	PIPE	2" TYPE K COPPER	AS NEEDED	TYPE "K"	
6	LOCATE WIRE	12 GAUGE COPPER, BLUE	AS NEEDED		
7	ADAPTER	2"(F) IPT X 2" CTS GJ	2	C1477G	FORD
8	NIPPLE	1 1/2" IPT X IPT X 12" BRASS	1	SCH-40 B-43	
9	METER SETTER	1 1/2" IPT X IPT X 12" W/ DBL CHECK AND HIGH BYPASS	1	VBHH76-12HB-11-66	FORD
10	METER LOCK	FIRAMATIC METER LOCK	2		
11	METER BOX	CONC W/ STEEL READER	1	#2 CONCRETE LID W/ STEEL READER	BERG VLT
12	METER BOX RISER	6" CONCRETE	2	#2	BERG VLT
13	NIPPLE	1 1/2" IPT CLOSE NIPPLE	1	3015N120	

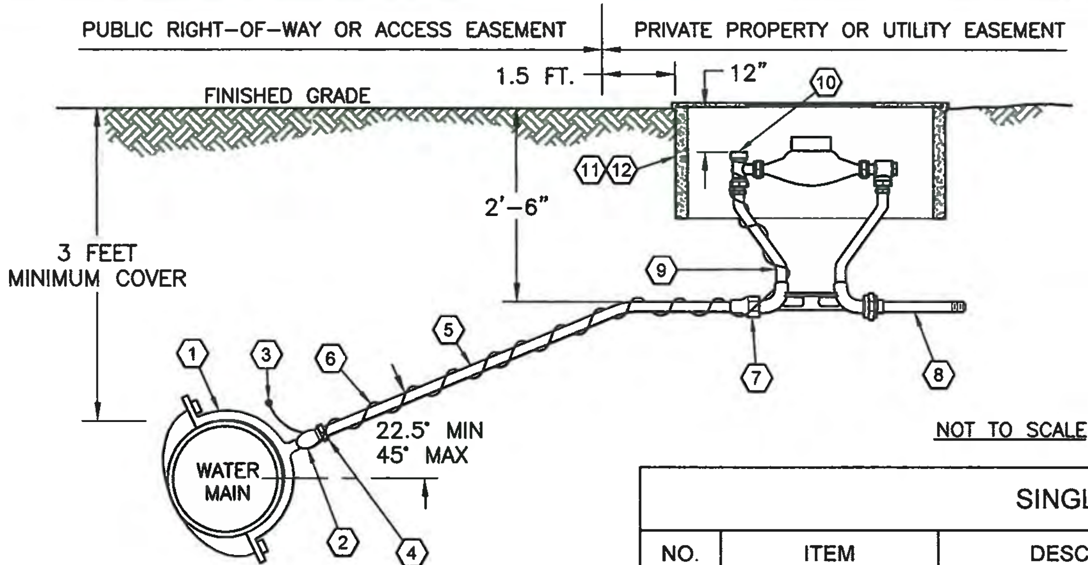
NOTE: FOR 1 1/2" IRRIGATION SERVICE, SUBSTITUTE VB76-12-1166 FOR METER SETTER PART NUMBER ABOVE. DETAIL IS SCHEMATIC. ACTUAL ITEM SPECIFIED IN MATERIAL LIST MAY VARY IN STYLE OR APPEARANCE.

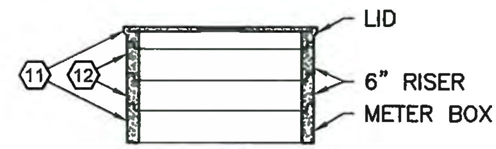
CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

SINGLE WATER SERVICE 1.5 INCH METER

ACAD–W–3C 1.5 inch water meter.dwg





METER BOX
(1 1/2" & 2" SERVICES)

NOT TO SCALE

APPROVED
City of Oak Harbor
Engineering Dept.

Signature 1-20-11 Date

NOTES:

1. CONTRACTORS SHALL USE THE MATERIAL LIST SHOWN. SUBSTITUTION REQUESTS WILL BE CONSIDERED BUT MUST BE APPROVED BY THE CITY PRIOR TO INSTALLATION.
2. AN OLYMPIC FOUNDRY SM-30 TRAFFIC BOX SHALL BE USED FOR METERS SET IN PAVED AREAS, DRIVEWAY, SIDEWALK, ETC.
3. ALL LINE SETTERS SHALL BE SET FLUSH, PLUMB, AND CENTERED IN THE METER BOX.
4. INSTALL WATER SERVICE LINE PERPENDICULAR TO MAIN.
5. CORPORATION STOP TO BE IN FULL ON POSITION PRIOR TO PLACEMENT OF BACKFILL.
6. SERVICE LINE AND SETTER SHALL BE FLUSHED FOR 1-MINUTE. MUD, FOREIGN MATERIALS OR CONTAMINANTS SHALL NOT BE PERMITTED TO ENTER ANY TUBING OR FITTINGS.
7. A TIGHT FITTING PLUG SHALL BE INSTALLED OVER OPEN END OF FITTING (MAKE WATER TIGHT) IF SERVICE CONNECTION IS NOT COMPLETE TO BUILDING.
8. WATER SERVICE FROM THE METER TO THE BUILDING SHALL BE INSTALLED IN ACCORDANCE WITH THE UNIFORM PLUMBING CODE (UPC).
9. BACK FLOW PREVENTION DEVICES SHALL BE INSTALLED FOR ALL IRRIGATION SERVICES AND WHERE NECESSARY TO PREVENT BACK FLOW CONTAMINATION OF THE CITY WATER SUPPLY.
10. METER BOXES SHALL BE SET ON A SAND BASE THAT IS PLACED TO WITHIN 18" OF FINISH GRADE.
11. SERVICE LINE SHALL HAVE A MINIMUM OF 4" DEPTH OF SAND BEDDING ABOVE AND BELOW THE PIPE.
12. TOP OF LID SHALL BE 2" ABOVE FINISHED GRADE EXCEPT WHEN IN HARD SURFACE.

SINGLE 2" METERED SERVICE

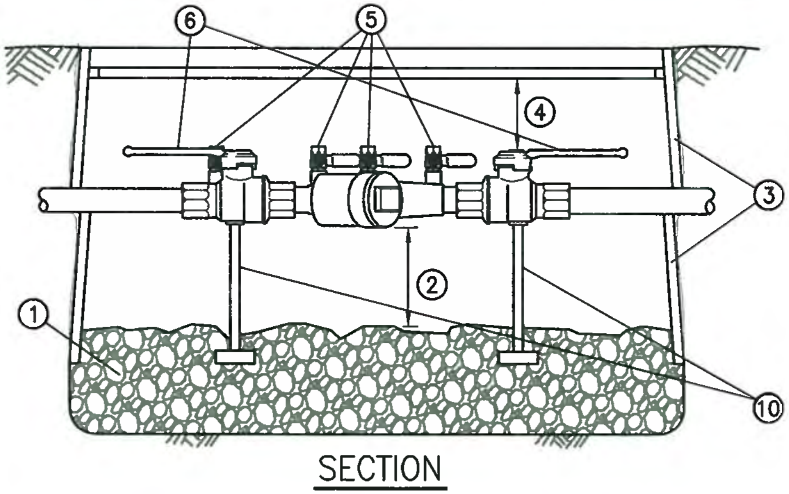
NO.	ITEM	DESCRIPTION	QUANTITY	PART NUMBER	BRAND
1	SADDLE	ALL BRASS BY 2" IPT TAP	1	S91-SERIES / 202B SERIES	FORD
2	CORP STOP	2" IPT (M) X IPT (M)	1	FB-500-7	FORD
3	WIRE CONNECTOR	3-WAY SEALED/TAPE	1	903 / 6147	IBS
4	ADAPTER	2" IPT (F) X 2 " COPPER GJ	1	C14-77-G	FORD
5	PIPE	2" TYPE K COPPER	AS NEEDED	TYPE "K"	
6	LOCATE WIRE	12 GAUGE COPPER, BLUE	AS NEEDED		
7	ADAPTER	2" IPT M X 2" COPPER GJ	1	C84-77-G	FORD
8	NIPPLE	2" IPT X IPT X 12" BRASS	1	SCH-40 B-43	
9	METER SETTER	2" IPT X IPT X 12" W/ DBL CHECK AND HIGH BYPASS	1	VBHH77-12HB-11-77	FORD
10	METER LOCK	FIRAMATIC METER LOCK	2		
11	METER BOX	CONC W/ STEEL READER	1	#2 CONCRETE LID W/ STEEL READER	BERG VLT
12	METER BOX RISER	6" CONCRETE	2	#2	BERG VLT

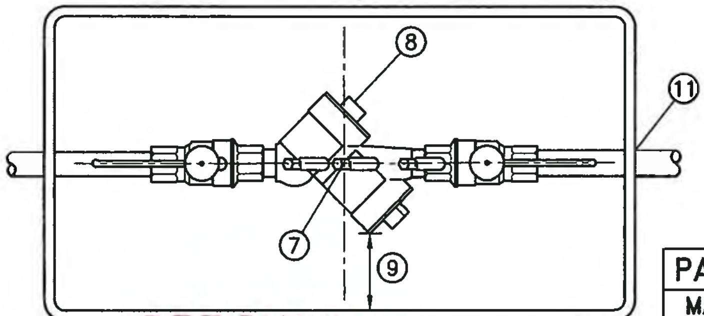
NOTE: FOR 2" IRRIGATION SERVICE, SUBSTITUTE VB77-12-1177 FOR METER SETTER PART NUMBER ABOVE. DETAIL IS SCHEMATIC. ACTUAL ITEM SPECIFIED IN MATERIAL LIST MAY VARY IN STYLE OR APPEARANCE.

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

SINGLE WATER SERVICE 2-INCH METER

ACAD-W-3D 2-inch water meter.dwg





APPROVED
City of Oak Harbor
Engineering Dept.

1-20-11

Signature
Date

NOTES:

1. IF DAYLIGHT DRAIN SYSTEM CANNOT BE PROVIDED THEN INSTALL A 6" MINIMUM LAYER OF 1" ROUND WASHED GRAVEL AT THE BOTTOM OF THE BOX.
2. MINIMUM OF 6" BETWEEN LOWEST POINT OF DEVICE AND DRAIN ROCK.
3. TWO NO. 2 METER BOXES STACKED ON TOP OF EACH OTHER OR APPROVED EQUAL. MINIMUM 14" X 20" LID OPENING.
4. MINIMUM OF 6" AND A MAXIMUM OF 12" DISTANCE BETWEEN UNDERSIDE OF LID AND HIGHEST POINT OF THE DEVICE.
5. THE DEVICE MUST BE EQUIPPED WITH FOUR RESILIENT SEATED TEST COCKS WITH PLUGS INSTALLED. THE ASSEMBLY MUST ALSO BE INSTALLED WITH THE TEST COCKS FACING UP OR TO ONE SIDE. PLUGS SHALL BE THREADED BRASS.
6. THE DEVICE MUST ALSO BE EQUIPPED WITH TWO RESILIENT SEATED SHUT OFF VALVES.
7. CENTER DEVICE IN BOX.
8. Y-PATTERN D.C.V.A. SHOULD BE INSTALLED ON SIDE WITH TESTCOCKS FACING UPWARDS.
9. A MINIMUM DISTANCE OF 6" IS REQUIRED BETWEEN THE SIDE OF THE BOX AND THE TEST COCKS WHEN THEY ARE INSTALLED SIDE WAYS.
10. SUPPORTS WILL BE REQUIRED ON 2" AND LARGER DEVICES AS SHOWN.
11. SEAL PIPE CUTOUTS AND UNDERLAY DRAIN ROCK WITH WEED CONTROL FABRIC OR POLYETHYLENE TO PREVENT SOIL INTRUSION.

PARTIAL LISTING OF STATE APPROVED DOUBLE CHECK VALVE ASSEMBLIES

MAKE	MODEL	SIZES	SHUTOFFS
WATTS	U007M1QT	3/4" OR 1"	– WATTS FIGURE FBV (FBV–E)–QT OR WATTS SERIES 6080 (& 6080–E)–QT
WATTS	950XL	3/4"	– FORTUNE FIGURE 620–QT (FORMERLY FIGURE 601 PRIVATE LABELED AS: AMES, BUCKNER, FEBCO, FLOMATIC, HERSEY AND WILKINS) – NIGBO BALL VALVES (FEBCO SERIES 622–QT & WILKINS SERIES 855–QT)
WILKINS	975XL	3/4", 1", 1 1/2", OR 2"	– FORTUNE FIGURE 620–QT (FORMERLY FIGURE 601 PRIVATE LABELED AS: AMES, BUCKNER, FEBCO, FLOMATIC, HERSEY AND WILKINS) – NIGBO BALL VALVES (FEBCO SERIES 622–QT & WILKINS SERIES 855–QT)
WILKINS	975XL	1 1/4"	– FORTUNE FIGURE 620–QT (FORMERLY FIGURE 601 PRIVATE LABELED AS: AMES, BUCKNER, FEBCO, FLOMATIC, HERSEY AND WILKINS) – FORTUNE FIGURE 620U–QT
WATTS	995QT	3/4", 1", 1 1/4", OR 1 1/2"	– SHUTOFF VALVE IS INTEGRAL PART OF ASSEMBLY

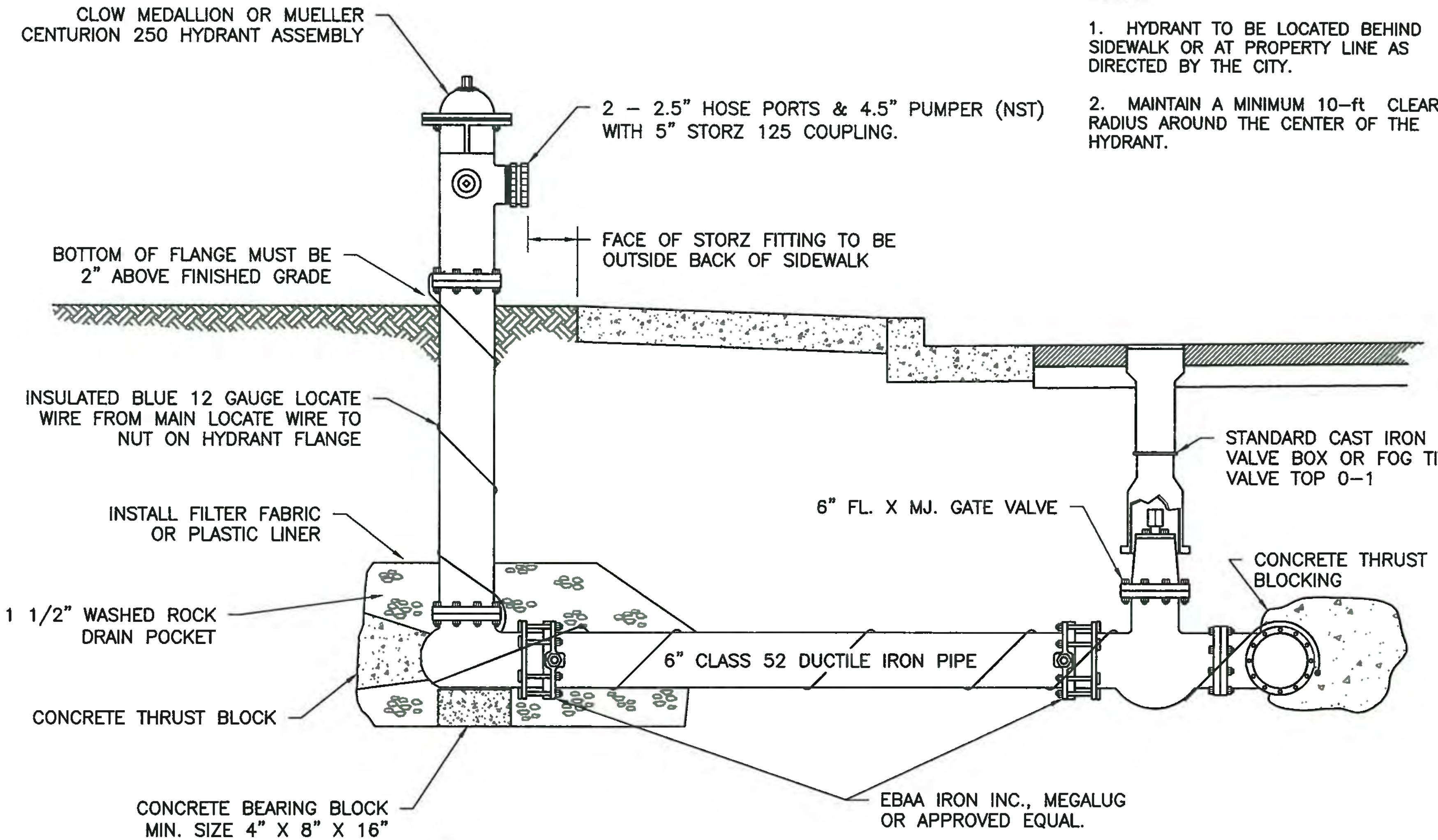
GENERAL REQUIREMENTS:

1. THE D.C.V.A. CHOSEN MUST BE ON THE MOST RECENT WASHINGTON STATE APPROVAL LISTING.
2. THE D.C.V.A. MUST BE TESTED BY A WASHINGTON STATE CERTIFIED BACKFLOW ASSEMBLY TESTER AT THE TIME OF INSTALLATION, ANNUALLY, AND WHEN MOVED OR REPAIRED.
3. ALL INSTALLATION MUST MEET MANUFACTERS SPECIFICATIONS AND THE MINIMUM STANDARDS OF THE U.P.C.
4. INSTALLATION INSPECTION BY CITY OF OAK HARBOR IS REQUIRED BEFORE WATER SERVICE IS ACTIVATED.

CITY OF Oak Harbor WHIDBEY ISLAND WASHINGTON
City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

DOUBLE CHECK VALVE ASSEMBLY - 0.75-2.5"

ACAD-W-11Double Check Valve .75 to 2.5 inch.dwg
REVISED 1-14-11



NOTES:

1. HYDRANT TO BE LOCATED BEHIND SIDEWALK OR AT PROPERTY LINE AS DIRECTED BY THE CITY.
2. MAINTAIN A MINIMUM 10–ft CLEAR RADIUS AROUND THE CENTER OF THE HYDRANT.

APPROVED
City of Oak Harbor
Engineering Dept.

Signature

1-20-11
Date

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

FIRE HYDRANT ASSEMBLY

ACAD–W–6Fire Hydrant Assembly.dwg

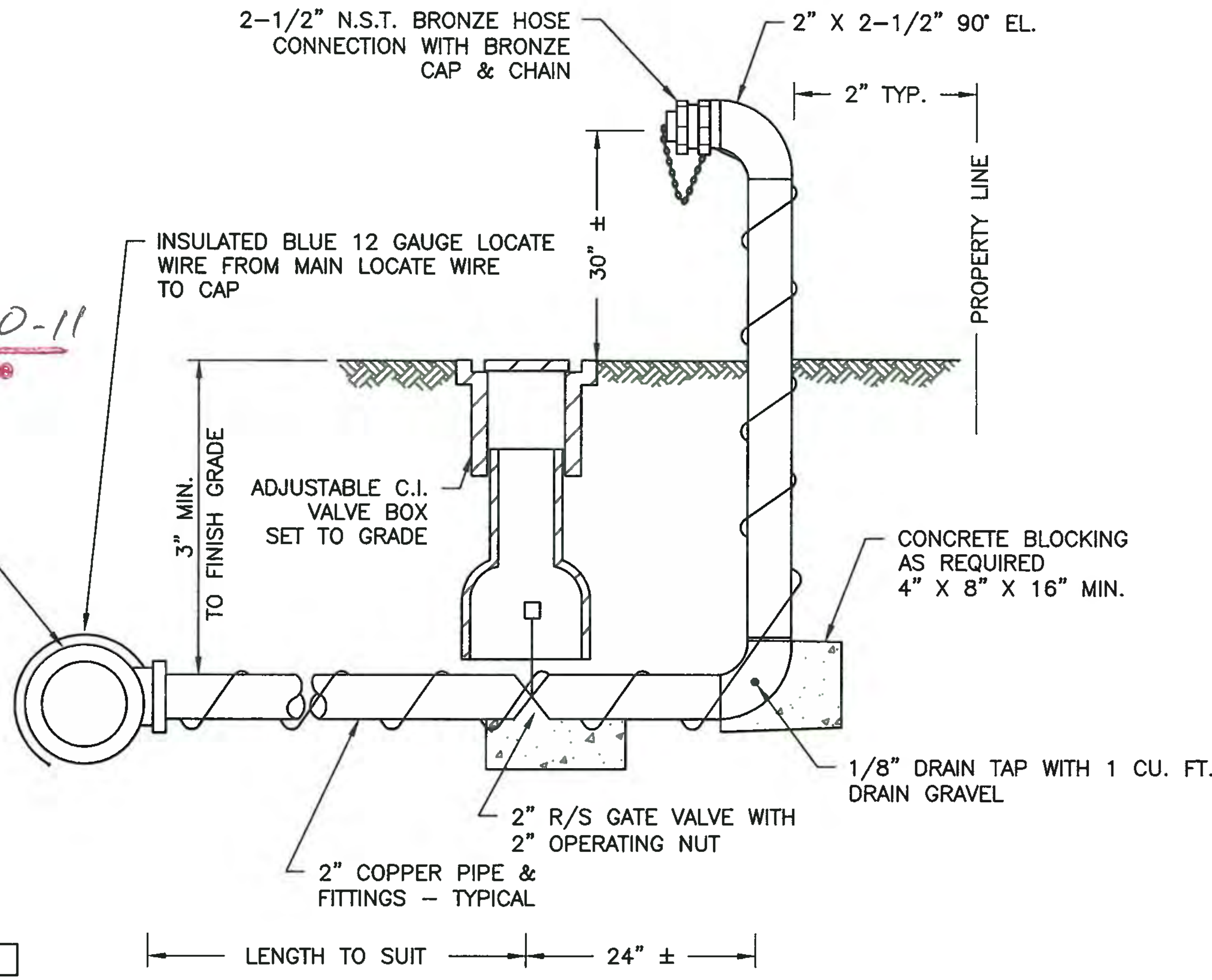
NOTES:

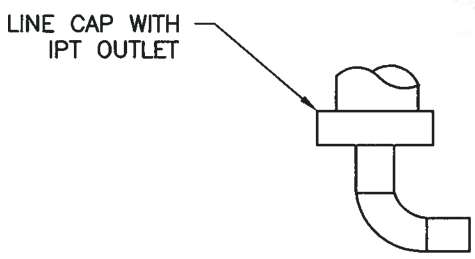
1. ALL BLOWOFF ASSEMBLIES SHALL BE TYPE K COPPER OR APPROVED EQUIVALENT.
2. SEE THRUST BLOCKING DETAIL FOR THRUST BLOCKING REQUIREMENTS.

APPROVED
City of Oak Harbor
Engineering Dept.

—
Signature

1-20-11
Date





PLAN VIEW

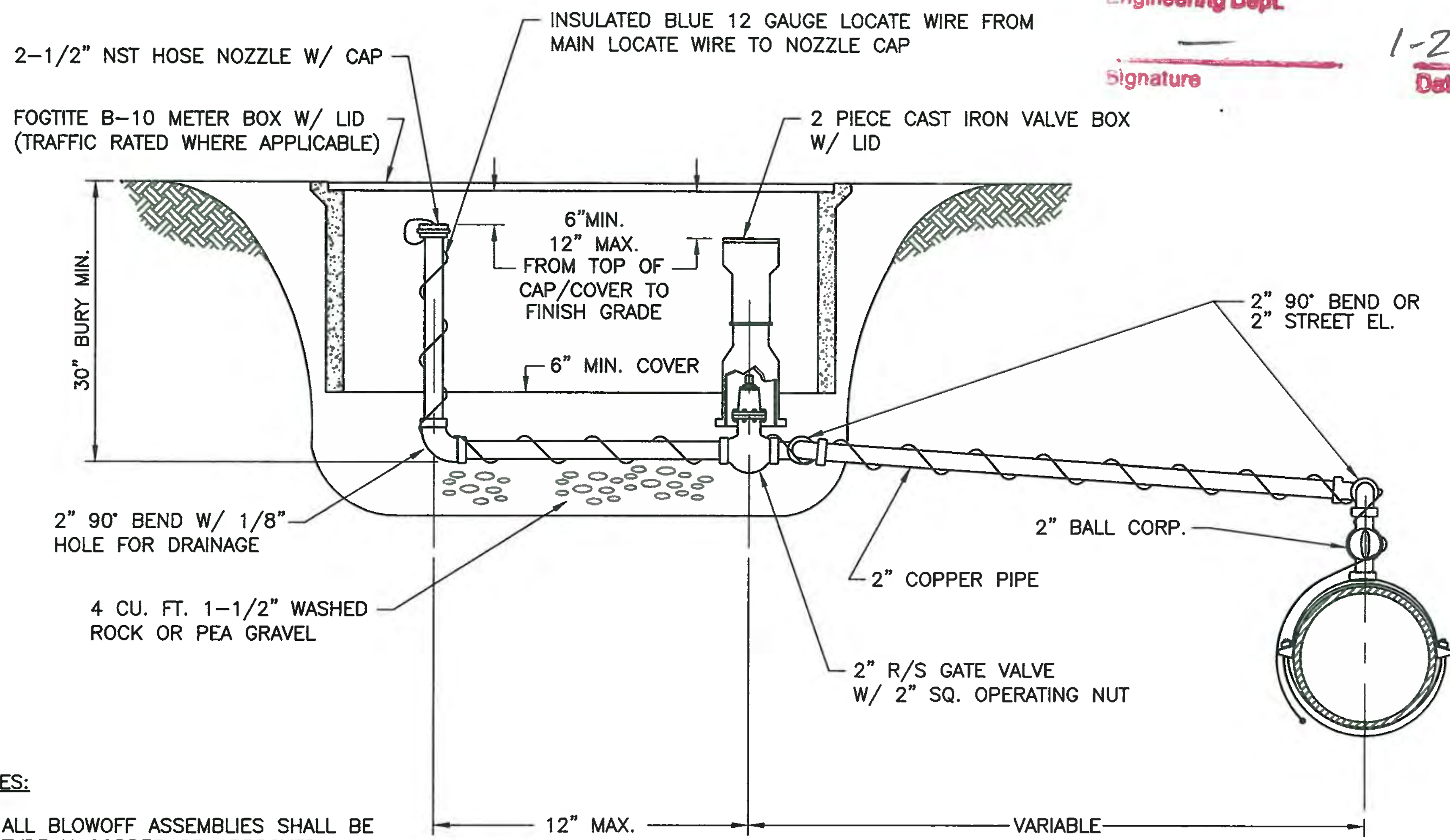
City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

BLOWOFF ASSEMBLY (TEMPORARY)

ACAD-W-2Blow off Assembly Temp.dwg

APPROVED
City of Oak Harbor
Engineering Dept.

Signature 1-20-11 Date



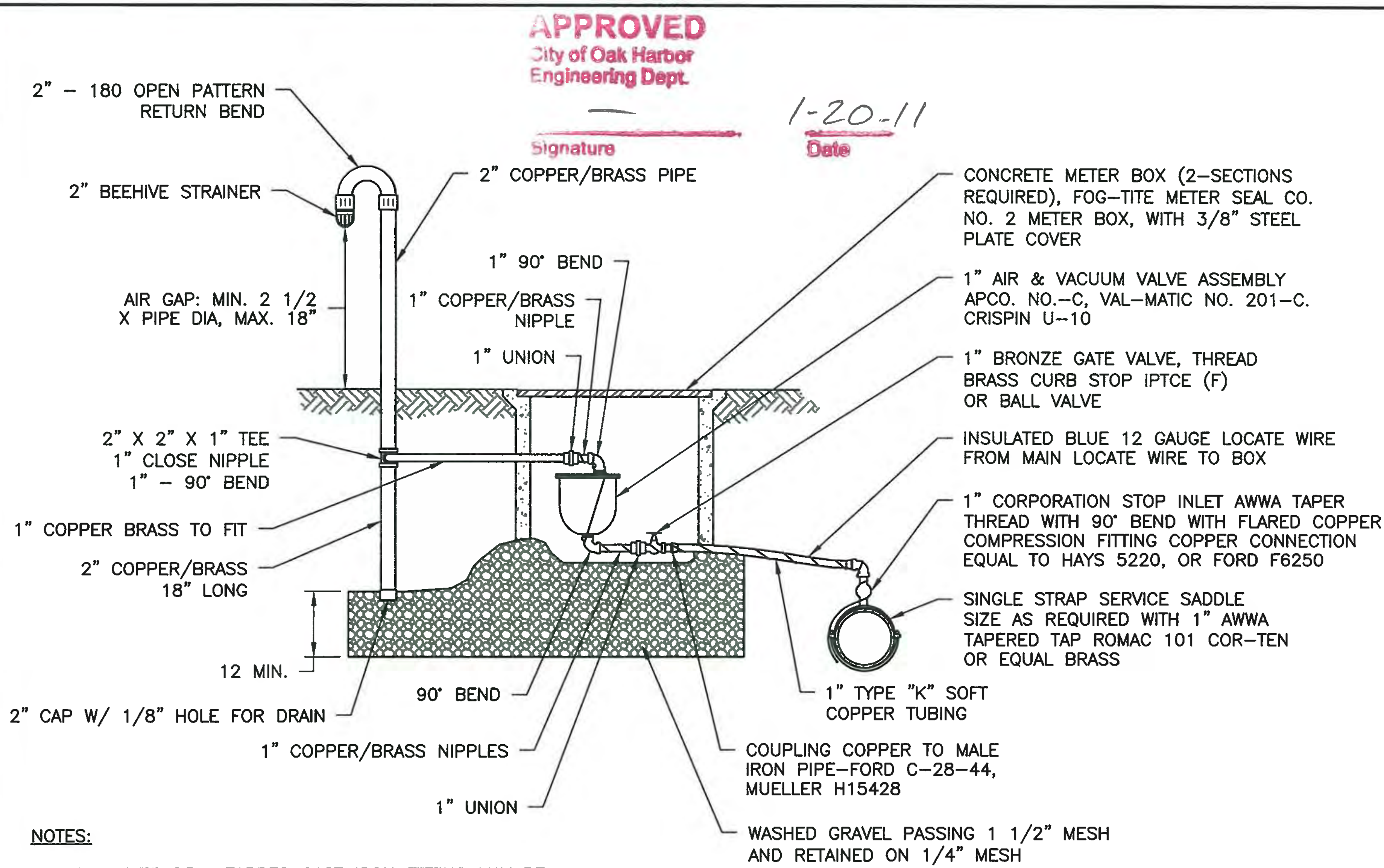
NOTES:

1. ALL BLOWOFF ASSEMBLIES SHALL BE TYPE K COPPER OR APPROVED EQUIVALENT.
2. SEE THRUST BLOCKING DETAIL FOR THRUST BLOCKING REQUIREMENTS.
3. KUFERLE FOUNDRY COMPANY MODEL #77 OR #78 MAINGUARD HYDRANT INSTALLED PER MANUFACTURER DETAIL MAY BE USED IN LIEU OF THE ASSEMBLY SHOWN HERE.

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

BLOWOFF ASSEMBLY (PERMANENT)

ACAD-W-1 Blow Off Assembly Perm.dwg



NOTES:

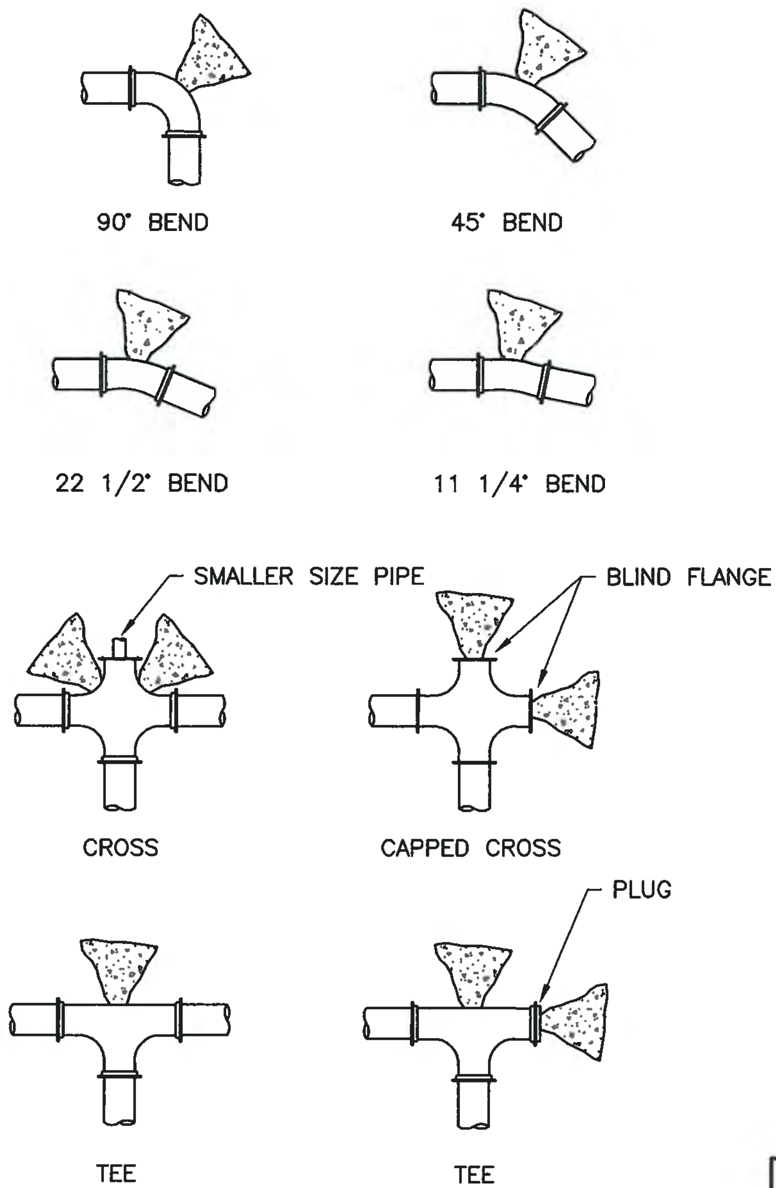
1. ALTERNATE OF A TAPPED CAST IRON FITTING MAY BE INSTALLED IN THE MAIN.
2. ALL FITTINGS TO BE BRASS OR COPPER FROM WATER MAIN TO 1" GATE VALVE.
3. AIR AND VACUUM RELEASE VALVE ASSEMBLY MUST BE INSTALLED AT HIGHEST POINT OF LINE. IF HIGH POINT FALLS IN A LOCATION WHERE ASSEMBLY CANNOT BE INSTALLED, PROVIDE ADDITIONAL DEPTH OF LINE TO CREATE HIGH POINT AT A LOCATION WHERE ASSEMBLY CAN BE INSTALLED.

CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

AIR AND VACUUM RELEASE VALVE STANDARD

ACAD–W–7Air & Vacuum Release Valve.dwg



BEARING AREA OF BLOCK IN SQUARE FEET

FITTING SIZE (INCHES)	TEES & PIPE ENDS	90 BEND	45 BEND	22-1/2 BEND	11-1/4 BEND
100 PSF SOIL BEARING CAPACITY					
3	1.8	2.5	1.4	1.0	1.0
4	3.2	4.5	2.4	1.3	1.0
6	7.1	10.0	5.5	2.8	1.4
8	12.6	17.8	9.7	4.9	2.5
10	19.7	27.8*	15.1	7.7	3.9
12	28.3*	40.0*	21.7	11.1	5.6
14	38.5*	54.5*	29.5*	15.1	7.6
16	50.3*	71.1*	38.5*	19.7	9.9
2500 PSF SOIL BEARING CAPACITY					
3	1.0	1.0	1.0	1.0	1.0
4	1.3	1.8	1.0	1.0	1.0
6	2.9	4.0	2.2	1.1	1.0
8	5.1	7.2	3.9	2.0	1.0
10	7.9	11.2	6.1	3.1	1.6
12	11.4	16.0	8.7	4.5	2.3
14	15.4	21.8	11.8	6.1	3.1
16	20.2	28.5*	15.4	7.9	4.0

* MAXIMUM BEARING AREA ALLOWED IS 25 SQ.FT. BEARING AREA MAY BE REDUCED BY USING RESTRAINED JOINT PIPE OR BY CONDUCTING SOILS TESTS.

NOTES:

1. BLOCK HEIGHT SHALL BE EQUAL OR LESS THAN ONE HALF OF THE TOTAL DEPTH FROM GROUND SURFACE TO BLOCK BASE.
2. BLOCK SIZE BASED ON 250 PSI WATER PRESSURE AND 2500 PSI CONCRETE.
3. CONTRACTOR SHALL USE PLASTIC SHEETING TO PREVENT CONTACT BETWEEN PIPE FITTINGS, BOLTS AND CONCRETE BLOCKING.
4. NO BLOCKING MAY BE COVERED WITHOUT PERMISSION OF THE ENGINEER.
5. PIPE JOINT RESTRAINING SYSTEMS MUST BE APPROVED BY THE CITY ENGINEER PRIOR TO INSTALLATION.

APPROVED
City of Oak Harbor
Engineering Dept.

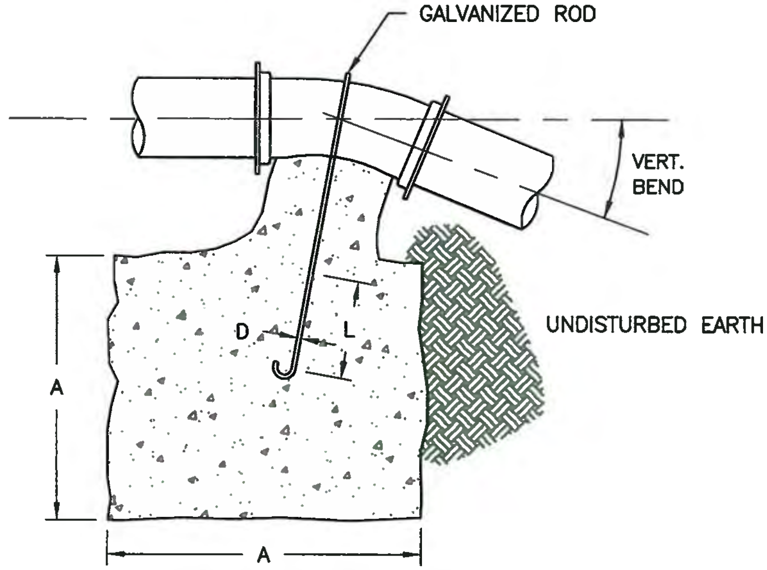
Signature

1-20-11
Date

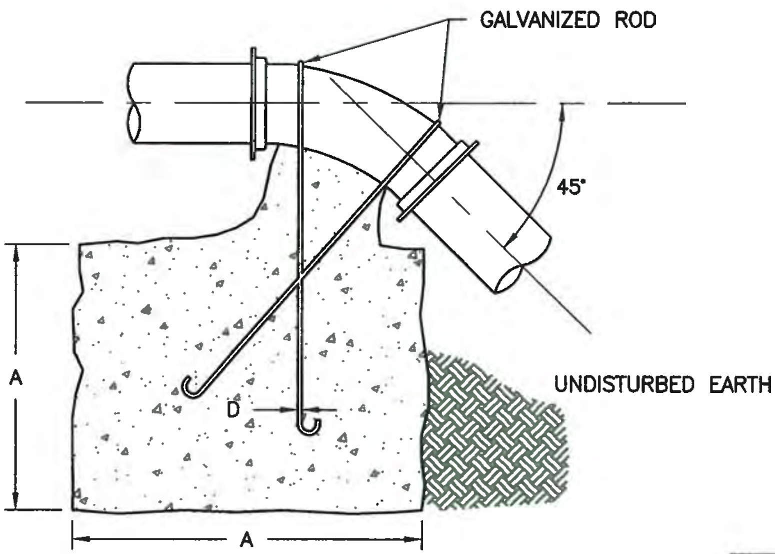
City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

THRUST BLOCKING (HORIZONTAL)

ACAD-W-4Horizontal Thrust Blocking.dwg



VERTICAL BLOCKING FOR
11 1/4° & 22 1/2° BENDS



VERTICAL BLOCKING FOR
45° BENDS

VERTICAL BLOCKING FOR 11-1/4" & 22-1/2" BENDS

FITTING SIZE	BENDS	VOL. (CU. FT.)	A	D	L
4	11-1/4°	8	2.0'	3/4"	1.5'
	22-1/2°	11	2.2'		2.0'
6	11-1/4°	11	2.2'	3/4"	2.0'
	22-1/2°	25	2.9'		
8	11-1/4°	16	2.5'	3/4"	2.0'
	22-1/2°	47	3.6'		
12	11-1/4°	32	3.2'	3/4"	2.0'
	22-1/2°	88	4.5'	7/8"	3.0'
16	11-1/4°	70	4.1'	7/8"	3.0'
	22-1/2°	184	5.7'	1-1/8"	4.0'
20	11-1/4°	91	4.5'	7/8"	3.0'
	22-1/2°	225	6.1'	1-1/4"	4.0'
24	11-1/4°	128	5.0'	1"	3.5'
	22-1/2°	320	6.8'	1-3/8"	4.5'
VERTICAL BLOCKING FOR 45° BENDS					
4	45°	30	3.1'	3/4"	2.0
6	45°	68	4.1'	3/4"	2.0
8	45°	123	5.0'	3/4"	2.0
12	45°	232	6.1'	3/4"	2.5
16	45°	478	7.8'	1-1/8"	4.0
20	45°	560	8.2'	1-1/4"	4.0
24	45°	820	9.4'	1-3/8"	4.5

NOTES:

1. BLOCK HEIGHT SHALL BE EQUAL OR LESS THAN ONE HALF OF THE TOTAL DEPTH FROM GROUND SURFACE TO BLOCK BASE.
2. BLOCK SIZE BASED ON 250 PSI WATER PRESSURE AND 2500 PSI CONCRETE.
3. CONTRACTOR SHALL USE PLASTIC SHEETING TO PREVENT CONTACT BETWEEN PIPE FITTINGS, BOLTS AND CONCRETE BLOCKING.
4. NO BLOCKING MAY BE COVERED WITHOUT PERMISSION OF THE ENGINEER.
5. PIPE JOINT RESTRAINING SYSTEMS MUST BE APPROVED BY THE CITY ENGINEER PRIOR TO INSTALLATION.

APPROVED
City of Oak Harbor
Engineering Dept.

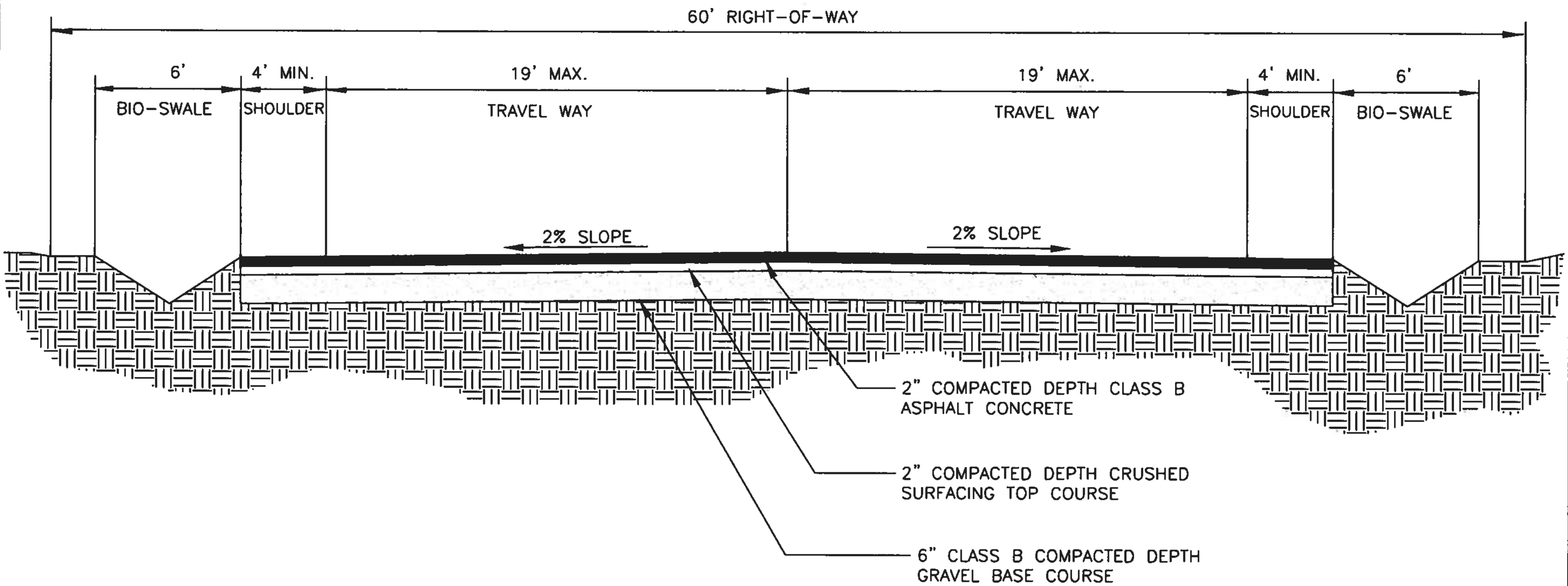
Signature — Date 1-20-11

CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

City of
Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

THRUST BLOCKING (VERTICAL)

ACAD-W-5Vertical Thrust Blocking.dwg



NOTES:

1. PUBLIC ROAD
2. WITH BIKE LANE, ADD 2' FOR TOTAL SHOULDER WIDTH OF 4'
3. ENCLOSED DRAINAGE MAY BE REQUIRED DUE TO RUNOFF VOLUME

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City of Oak Harbor
Engineering Dept.

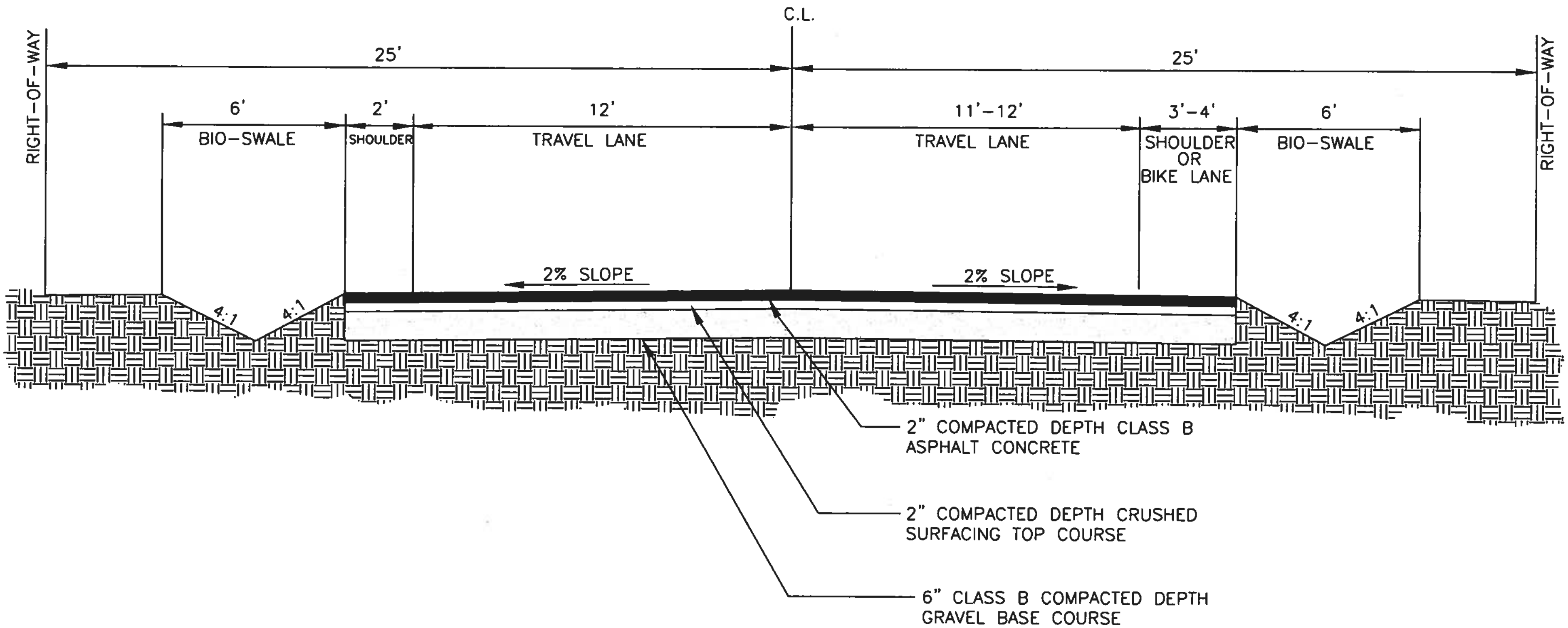
Signature

6/8/06
Date

ARTERIAL INDUSTRIAL (MINOR)

ENTERPRISE AREA STREET STANDARDS

Arterial-Industrial.dwg
REVISED 04-05-06



NOTES:

1. PUBLIC ROAD
2. CURBS DEVELOPER OPTION
3. ENCLOSED DRAINAGE DEVELOPER OPTION
4. THICKENED EDGE DEVELOPER OPTION

APPROVED
City of Oak Harbor
Engineering Dept.

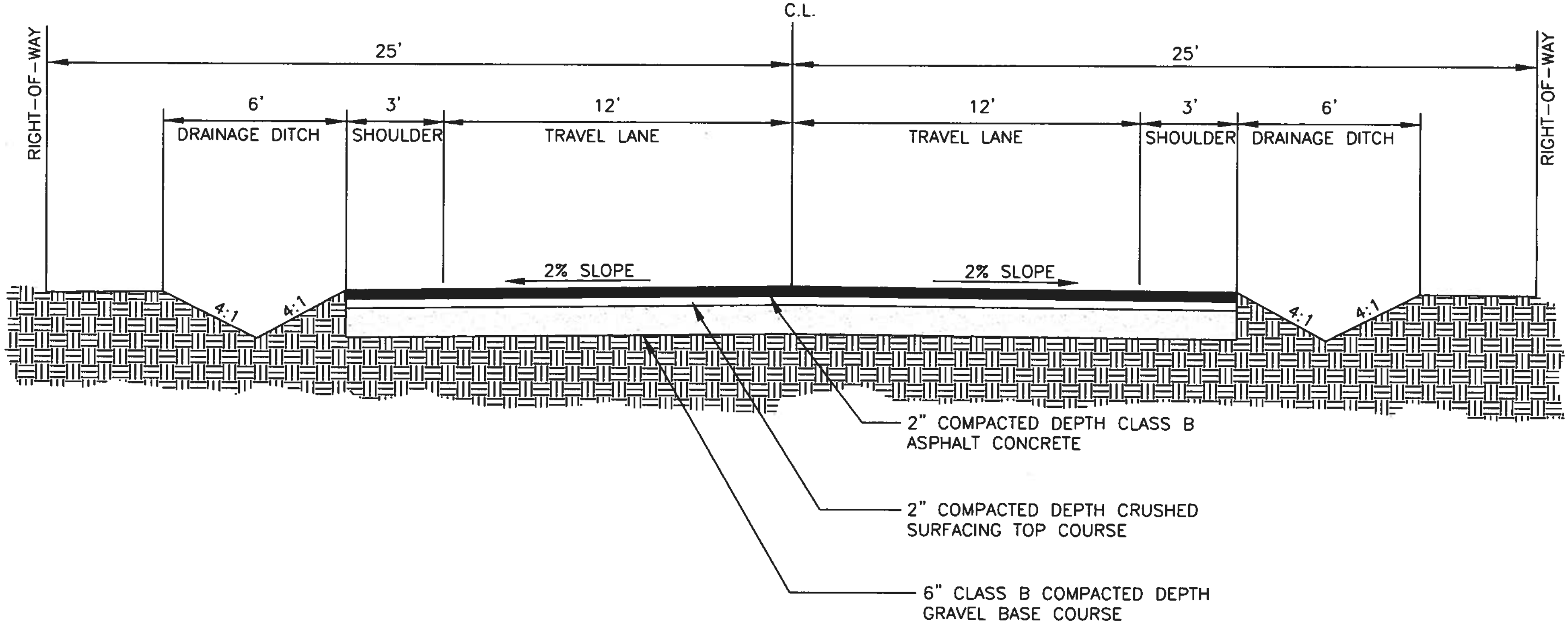
Signature

6/8/06
Date

COLLECTOR INDUSTRIAL

ENTERPRISE AREA STREET STANDARDS

Collector-Industrial.dwg
REVISED 04-05-06



NOTES:

1. PRIVATE OR PUBLIC ROAD
2. CURBS OPTIONAL
3. ENCLOSED DRAINAGE OPTIONAL
4. THICKENED EDGE OPTIONAL

APPROVED
City of Oak Harbor
Engineering Dept.

Signature **Date** 6/8/06

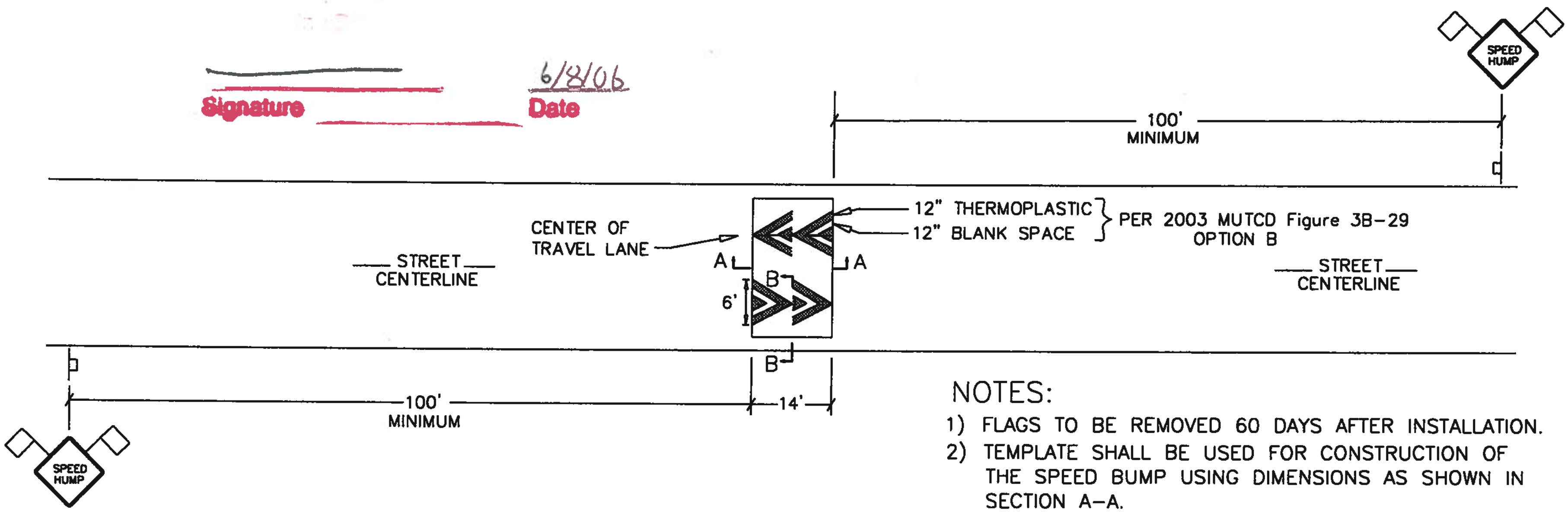
LOCAL INDUSTRIAL

ENTERPRISE AREA STREET STANDARDS

Indusjtrial Street Standards Combo.dwg
REVISED 04-05-06

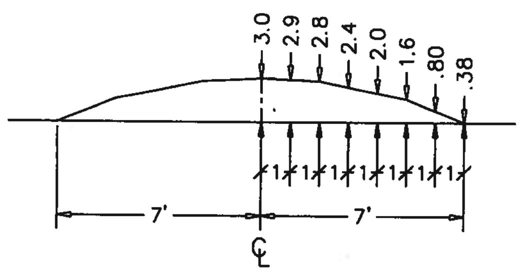
APPROVED

Signature Date 6/8/06



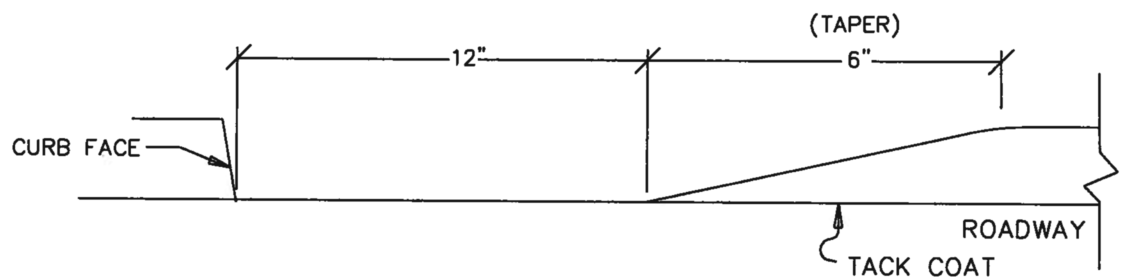
NOTES:

1) FLAGS TO BE REMOVED 60 DAYS AFTER INSTALLATION.
2) TEMPLATE SHALL BE USED FOR CONSTRUCTION OF THE SPEED BUMP USING DIMENSIONS AS SHOWN IN SECTION A–A.
3) MAXIMUM HEIGHT AT CROWN SHALL BE NO MORE THAN 3.00 INCHES AFTER COMPACTION WITH A MINIMUM ACCEPTABLE HEIGHT OF 2.75".



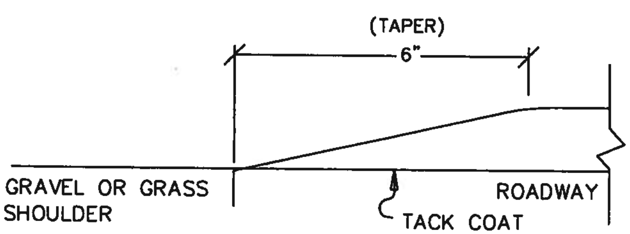
SECTION A–A

NOT TO SCALE



SECTION B–B
SHOULDER DETAIL FOR
STREETS WITH CURBS

NOT TO SCALE



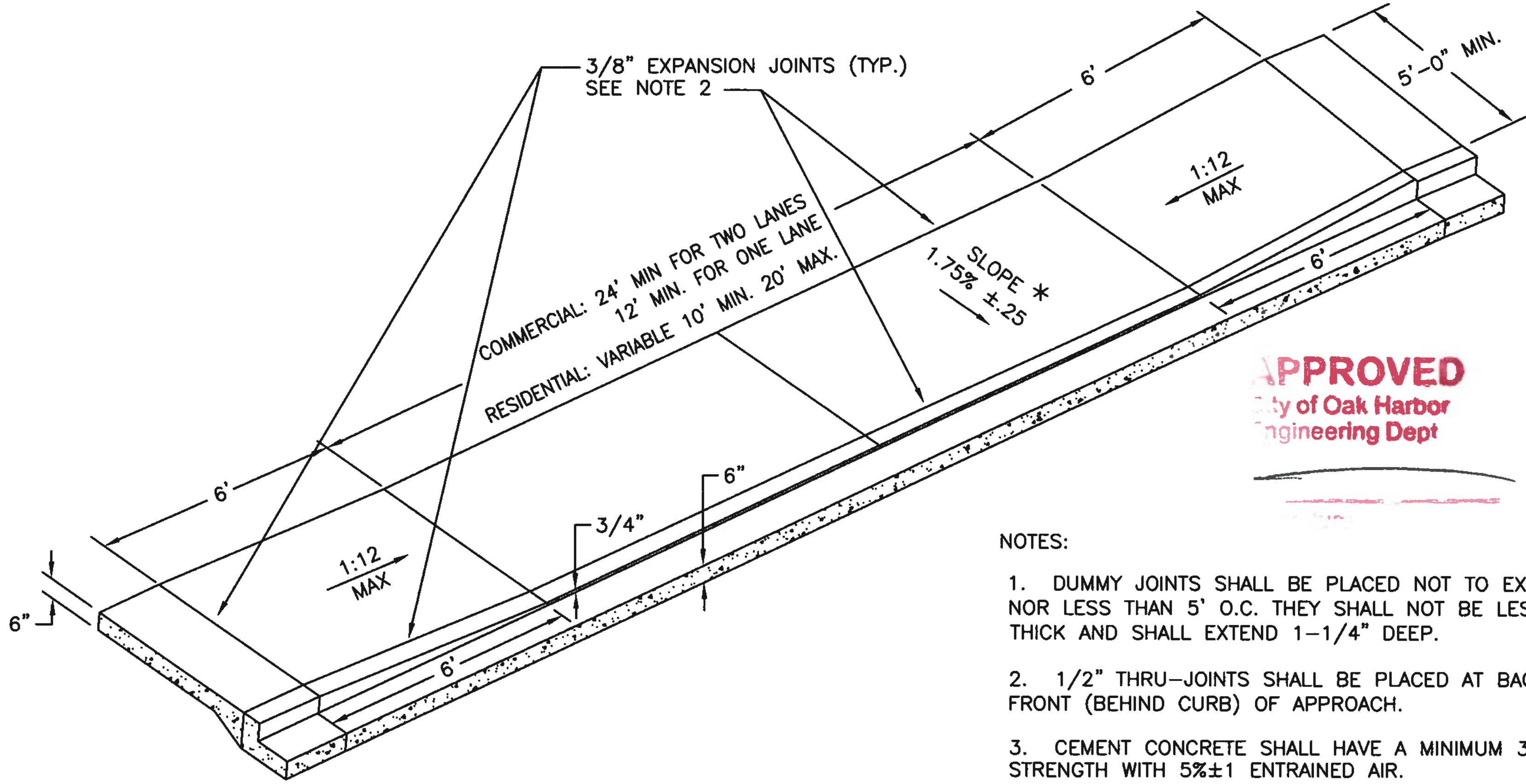
SECTION B–B
SHOULDER DETAIL FOR
STREETS WITHOUT CURBS

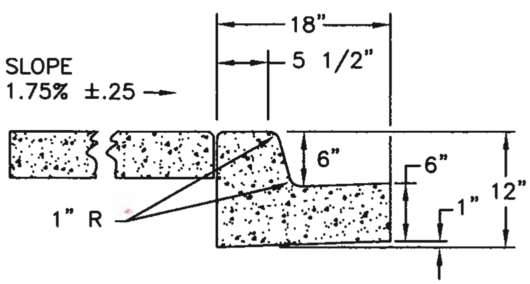
NOT TO SCALE

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

SPEED HUMP

SpeedHump.dwg
REVISED 5-23-06





PPROVED
ty of Oak Harbor
ngineering Dept

7-16-10
Date

NOTES:

1. DUMMY JOINTS SHALL BE PLACED NOT TO EXCEED 15' O.C. NOR LESS THAN 5' O.C. THEY SHALL NOT BE LESS THAN 3/16" THICK AND SHALL EXTEND 1-1/4" DEEP.

2. 1/2" THRU-JOINTS SHALL BE PLACED AT BACK, SIDES AND FRONT (BEHIND CURB) OF APPROACH.

3. CEMENT CONCRETE SHALL HAVE A MINIMUM 3000psi 28-DAY STRENGTH WITH 5%±1 ENTRAINED AIR.

4. ALL JOINTS SHALL BE CLEANED AND EDGED.

5. APPROACH SHALL NOT BE POURED INTEGRAL WITH CURB AND GUTTER.

6. SUBGRADE COMPACTION SHALL BE TO 95% MODIFIED PROCTOR DENSITY.

* 7. THE ACCEPTABLE CROSS SLOPE OF SIDEWALK SHALL NOT BE LESSS THAN 1.5% AND NOT GREATER THAN 2.0%.

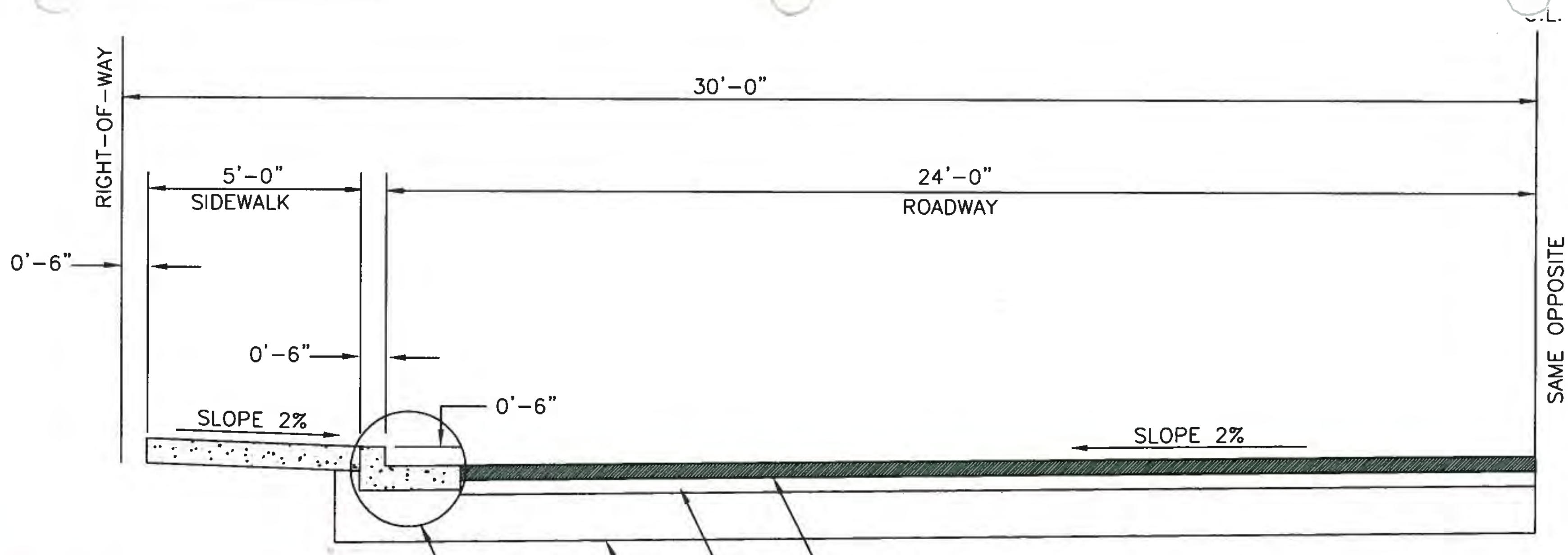
NOT TO SCALE

CITY OF Oak Harbor WHIDBEY ISLAND, WASHINGTON

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

Concrete Sidewalk Driveway Detail

ST-1Concrete driveway sidewalk detail.dwg
REVISED 7-16-10



APPROVED
City of Oak Harbor
Engineering Dept

Signature

6/8/06
Date

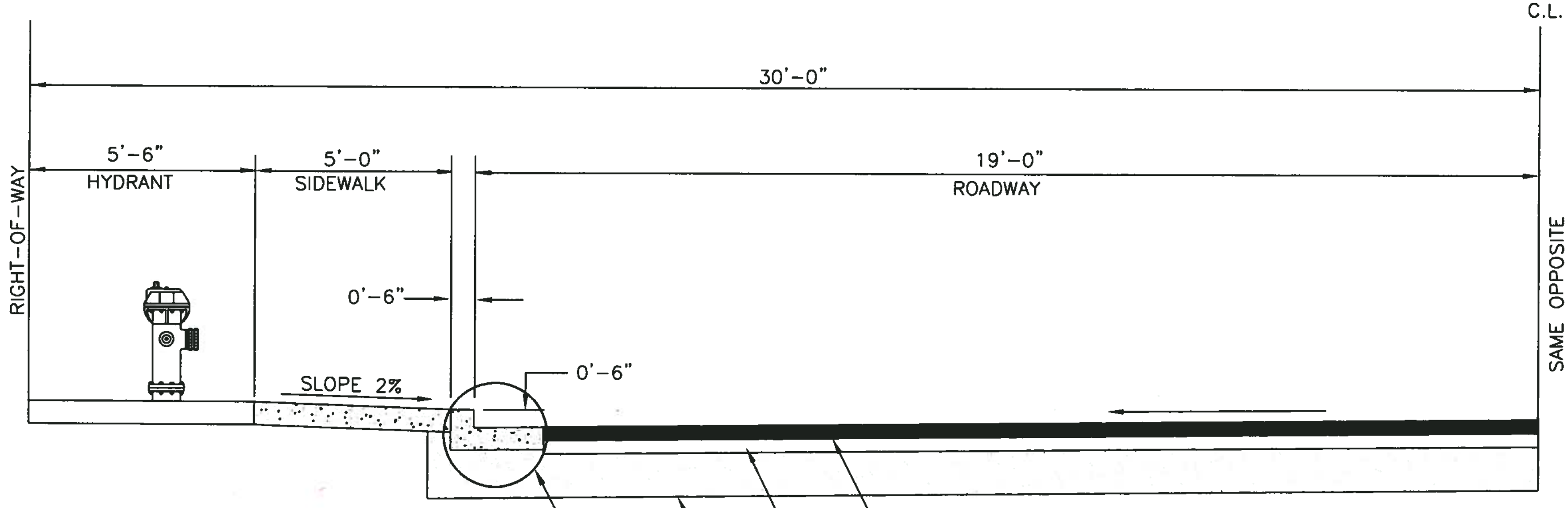
SIEVE SIZE	PERCENT PASSING BASE COURSE	PERCENT PASSING TOP COURSE
1 1/4" square	100	
3/4" square		100
5/8" square	50–80	
1/4" square	30–50	55–75
U.S. No. 40	3–18	8–24
U.S. No. 200	7.5 max	10.0 max
% Fracture	75 min	75 min
Sand Equivalent	35 min	35 min

NOT TO SCALE

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

Typical Street Section Arterial – 60 Foot ROW

ST-2Typical Street Section Arterial 60 foot ROW .dwg
REVISED 2-24-06



APPROVED
City of Oak Harbor
Engineering Dept.

Signature

6/8/06
Date

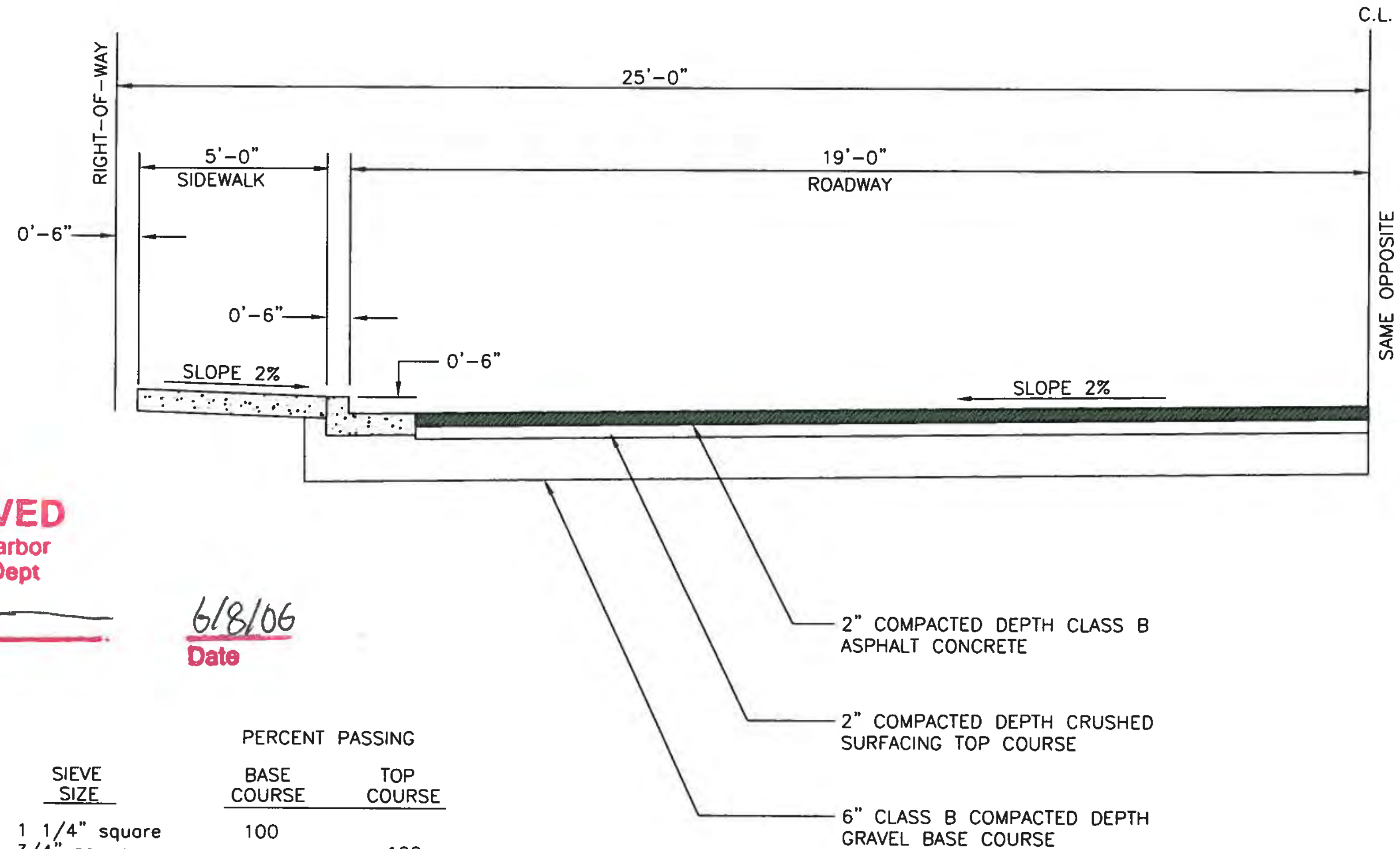
SIEVE SIZE	PERCENT PASSING BASE COURSE	PERCENT PASSING TOP COURSE
1 1/4" square	100	
3/4" square		100
5/8" square	50–80	
1/4" square	30–50	55–75
U.S. No. 40	3–18	8–24
U.S. No. 200	7.5 max	10.0 max
% Fracture	75 min	75 min
Sand Equivalent	35 min	35 min

NOT TO SCALE

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

Street Section
Residential – 60 Foot ROW

ST-3Residential Street Section 60 foot ROW.dwg
REVISED 2-24-06



APPROVED
City of Oak Harbor
Engineering Dept

Signature

6/8/06
Date

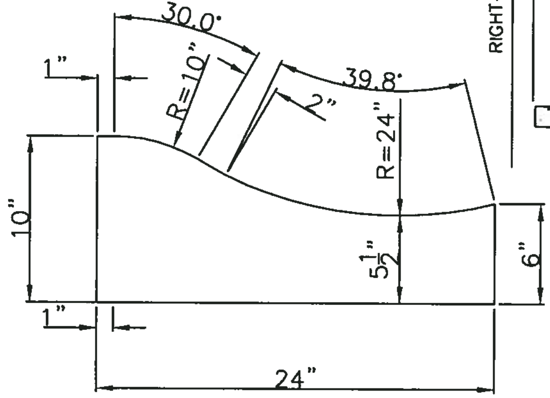
SIEVE SIZE	PERCENT PASSING BASE COURSE	PERCENT PASSING TOP COURSE
1 1/4" square	100	
3/4" square		100
5/8" square	50-80	
1/4" square	30-50	55-75
U.S. No. 40	3-18	8-24
U.S. No. 200	7.5 max	10.0 max
% Fracture	75 min	75 min
Sand Equivalent	35 min	35 min

NOT TO SCALE

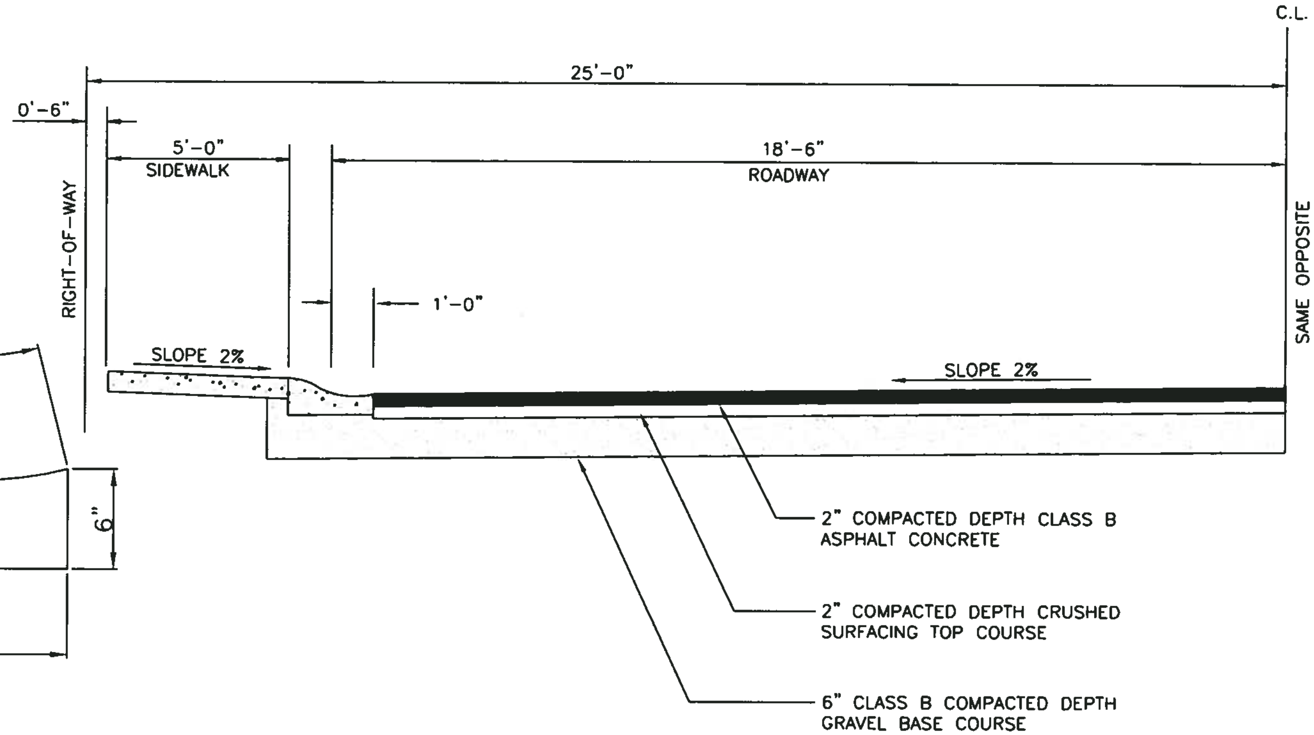
City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

Street Section
Residential – 50 Foot ROW

ST-4Residential Street section 50 foot ROW standard curbing.dwg
REVISED 2-24-06



ROLLED CURB
TYPICAL SECTION
(NOT TO SCALE)



SIEVE SIZE	PERCENT PASSING BASE COURSE	PERCENT PASSING TOP COURSE
1 1/4" square	100	
3/4" square		100
5/8" square	50-80	
1/4" square	30-50	55-75
U.S. No. 40	3-18	8-24
U.S. No. 200	7.5 max	10.0 max
% Fracture	75 min	75 min
Sand Equivalent	35 min	35 min

APPROVED
City of Oak Harbor
Engineering Dept.

Signature

6/8/06
Date

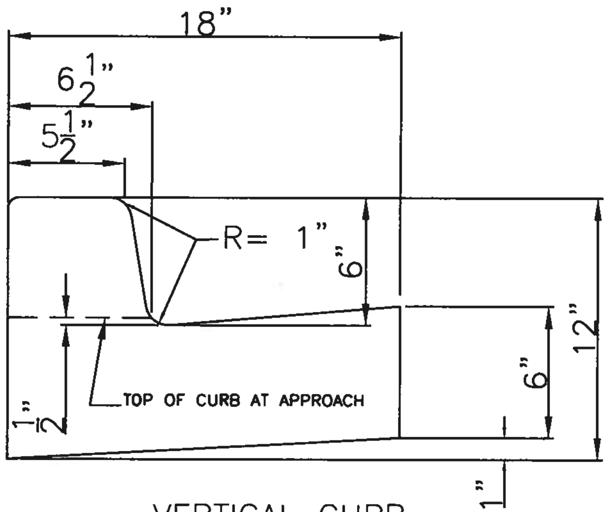
NOT TO SCALE

CITY OF Oak Harbor
WHIDBEY ISLAND, WASHINGTON

City of
Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

Street Section
Residential – 50 Foot ROW

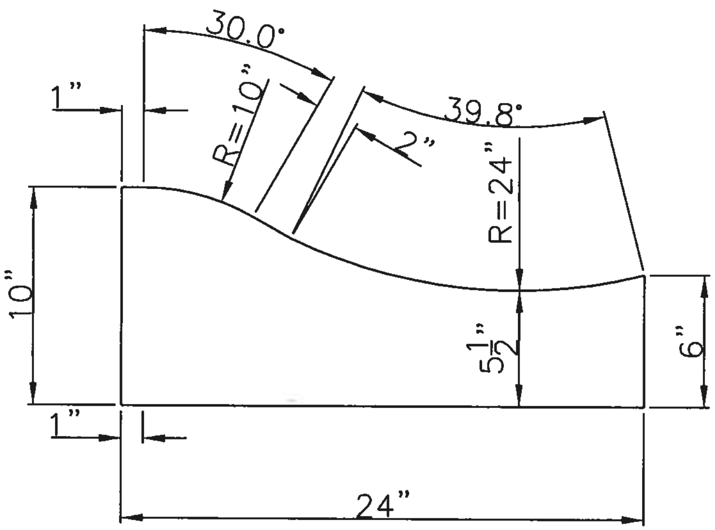
ST-5Residential Street Section 50 foot ROW rolled curbing.dwg
REVISED 2-24-06



VERTICAL CURB

TYPICAL SECTION

(NOT TO SCALE)



ROLLED CURB

TYPICAL SECTION

(NOT TO SCALE)

NOTES:

1. FORMS SHALL BE METAL OR WOOD AND SHALL EXTEND THE FULL DEPTH OF THE CONCRETE

2. SIDEWALKS SHALL BE BRUSH OR BROOMED FINISHED

3. FIBERBOARD EXPANSIONS JOINTS SHALL BE PLACE AT 15' o.c.

4. SIDEWALKS SHALL BE SCORED (DUMMY JOINTS) AT 5' o.c.

5. CONCRETE SHALL HAVE A MINIMUM 28-DAY STRENGTH OF 3,000psi WITH 5%±1 ENTRAINED AIR.

6. SIDEWALK TERMINUS SHALL BE RAMPED WITH CONCRETE OR ASPHALT TO MATCH LOCAL GRADE CONDITIONS AS DIRECTED BY THE CITY ENGINEER.

APPROVED
City of Oak Harbor
Engineering Dept

Signature

6/8/06
Date

NOT TO SCALE

City of Oak Harbor

ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

Curbing Sections

ST-6 Rolled curb detail.dwg

REVISED 2-24-06

NOTES:

1. All street openings will require a permit prior to excavation. Contractors must be bonded with the City piror to working in the right-of-way.

2. One lane of traffic must be maintained at all times. Street closures will not be authorized unless approved by the City Engineer.

3. Proper street signage is required on all projects as per the M.U.T.C.D. Flaggers must have cards stating that they are qualified flaggers.

4. Contractor shall notify all utilities in the area by giving a minimum 48-hour notice by calling 1-800-424-5555, a one number call system, before excavation begins.

5. Contractor shall notify City Engineering Department a minimum of 24 hours before start of work.

6. Maximum trench length that may be opened at one time is 300 feet.

7. Coldmix asphalt shall be placed in all street cutts within 48 hours if hotmix asphalt cannot be obtained. Coldmix to be maintained until final patch is completed. Final patch to be completed no later than 2 weeks after street opening.

8. "Skin patches" are not authorized by the City. If street patch settles, existing asphalt shall be removed, subgrade re-compacted and new hotmix asphalt placed.

9. Surface smoothness shall conform to Standard Spec. 5-04.3(13).

10. Gravel backfill for pipe zone bedding shall be in accordance with WSDOT Standard Spec. 9-03.12(3) and shall meet the following specifications for grading:

Sieve	Percent Passing
1 1/2" square	100
1" square	75-100
5/8" square	50-100
U.S. No. 4	20-80
U.S. No. 40	3-24
U.S. No. 200	10.0 max.
Sand Equivalent	35 min.

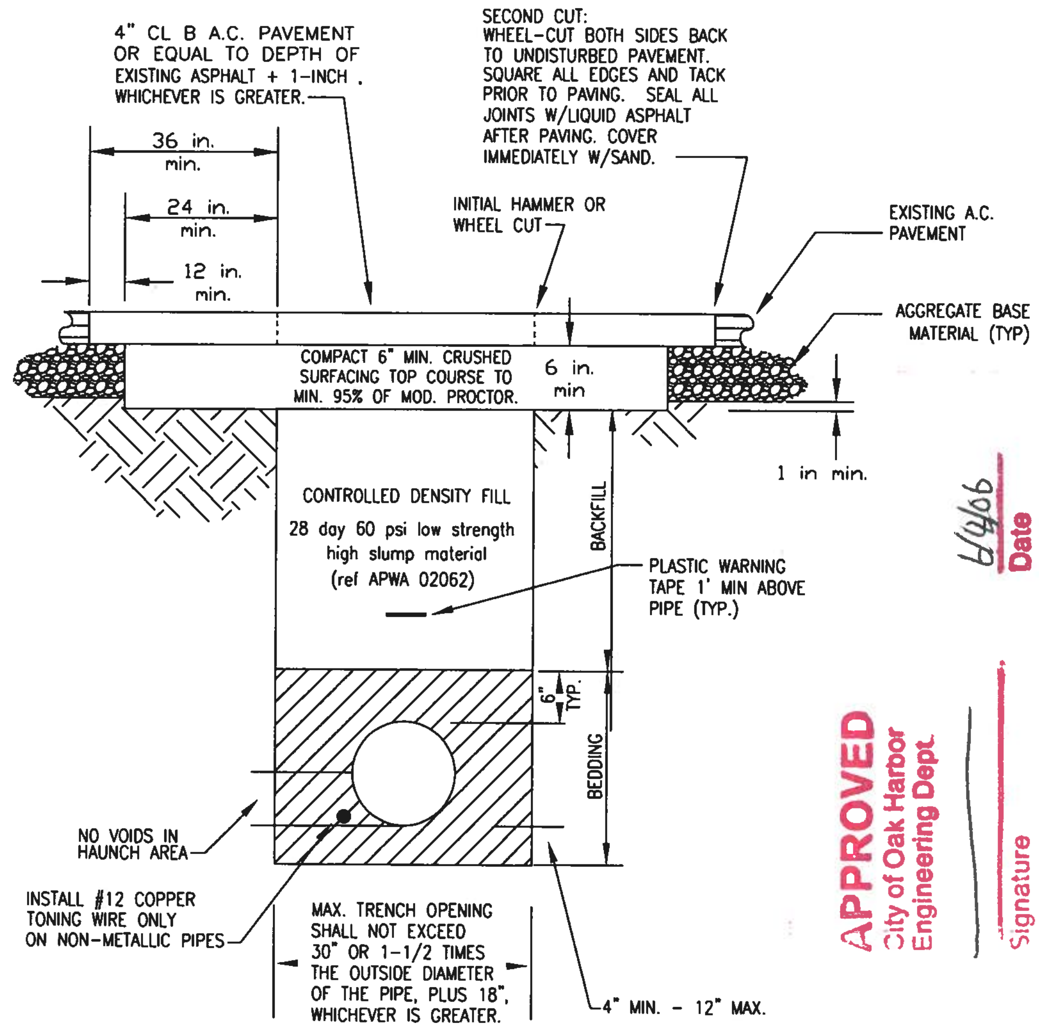
All percentages are by weight. Bedding placement shall be in accordance with WSDOT Standard Spec. 7-08.3(3).

11. Trench backfill materials shall consist of Controlled Density Fill (CDF), flowable fill, or equivalent in accordance with APWA section 02062.

12. All material excavated in a City street section shall be exported and new backfill imported in. Pea gravel shall not be used for backfill without prior approval of the City Engineer.

NOTES (continued):

13. CDF applies to all road crossings and all other trenches 6' deep or less. Import gravel backfill may be substituted in non-road crossing trenches if independent compaction testing is utilized and results provided to city inspector.



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City of Oak Harbor
Engineering Dept.
6/4/06
Date
Signature

City of Oak Harbor
ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

Typical Utility Trench
Asphalt Pavement Repair Section
Within Right-Of-Way

ST-8 Asphalt Street Repair-pipes 12 & Smaller.dwg

REVISED 2-24-06

NOTES:

1. All street openings will require a permit prior to excavation. Contractors must be bonded with the City piror to working in the right-of-way.

2. One lane of traffic must be maintained at all times. Street closures will not be authorized unless approved by the City Engineer.

3. Proper street signage is required on all projects as per the M.U.T.C.D. Floggers must have cards stating that they are qualified flaggers.

4. Contractor shall notify all utilities in the area by giving a minimum 48-hour notice by calling 1-800-424-5555, a one number call system, before excavation begins.

5. Contractor shall notify City Engineering Department a minimum of 24 hours before start of work.

6. Maximum trench length that may be opened at one time is 300 feet.

9. Surface smoothness shall conform to APWA/WSDOT Section 5-04.3(13).

10. Native or import backfill shall be in accordance with WSDOT Standard Spec. 9-03.15.

11. Trench backfill shall be gravel backfill in accordance with WSDOT Standard Spec. 9-03.19 and shall meet the following specifications for grading:

Sieve	Percent Passing
2 1/2" square	100
2" square	75-100
U.S. No. 4	22-100
U.S. No. 200	0-10
Dust Ratio:	2/3 max.
Sand Equivalent	30 min.

All percentages are by weight.

12. Gravel backfill for pipe zone bedding shall be in accordance with WSDOT Standard Spec. 9-03.12(3) and shall have such shall be the following grading:

Sieve	Percent Passing
1 1/2" square	100
1" square	75-100
5/8" square	50-100
U.S. No. 4	20-80
U.S. No. 40	3-24
U.S. No. 200	10.0 max.
Sand Equivalent	35 min.

All percentages are by weight.

13. Bedding and backfill placement shall be in accordance with WSDOT Standard Spec. 7-08.3(3).

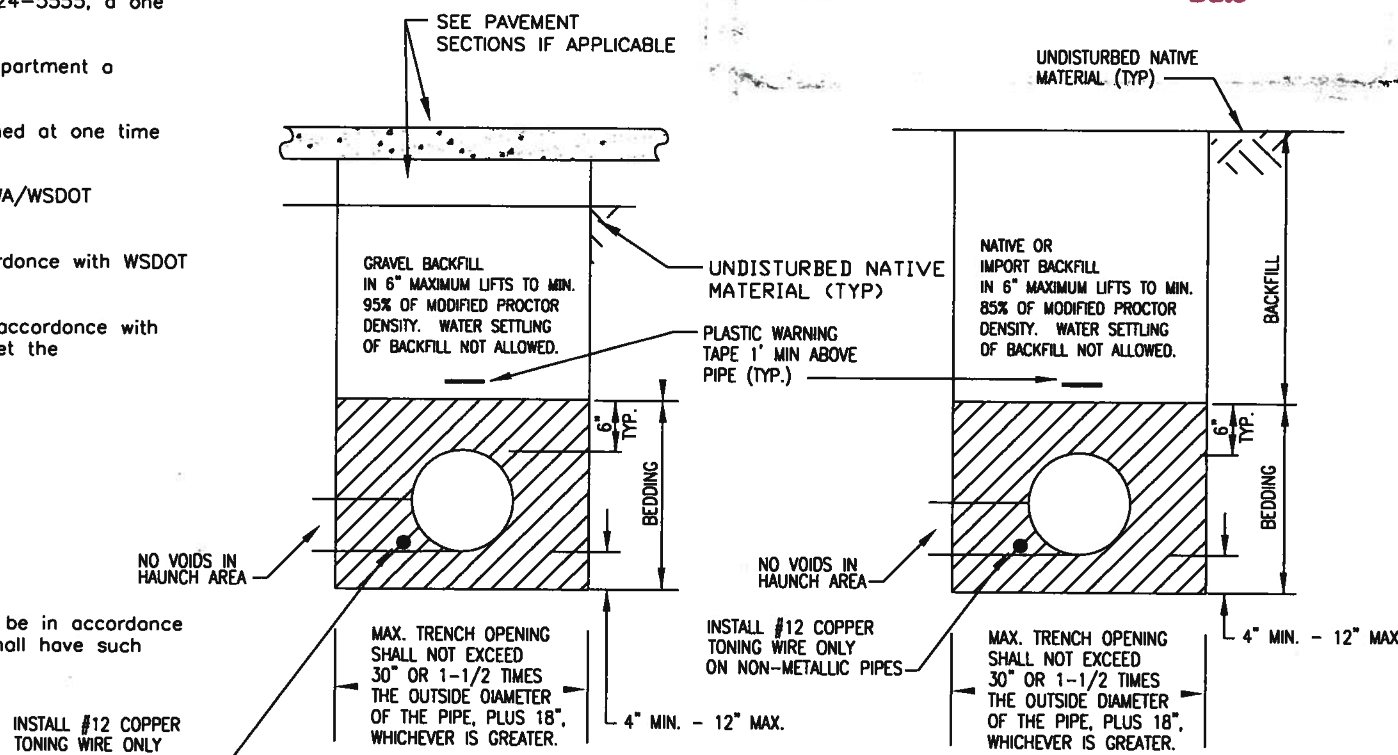
notes continued:

14. All material excavated in a City street section shall be exported and new backfill imported in. Pea gravel shall not be used for backfill without prior approval of the City Engineer.

APPROVED
City of Oak Harbor
Engineering Dept

Signature

7/12/06
Date



TYPICAL TRENCH DETAIL FOR NEW PAVEMENT SECTIONS WITHIN RIGHT-OF-WAY, TRAFFIC AREAS OUTSIDE OF RIGHT-OF-WAY, AND UNPAVED RIGHT-OF-WAY

TYPICAL TRENCH DETAIL NONTRAFFIC AREAS OUTSIDE OF RIGHT-OF-WAY

City of Oak Harbor

ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

Typical Utility Trench Standard Detail

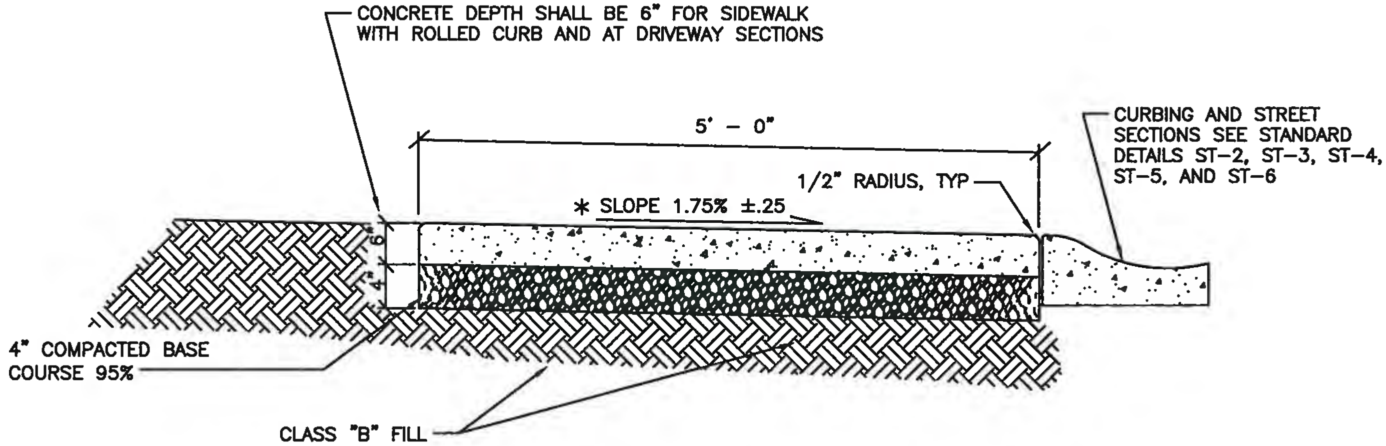
ST8B Typical Utility Trench.dwg

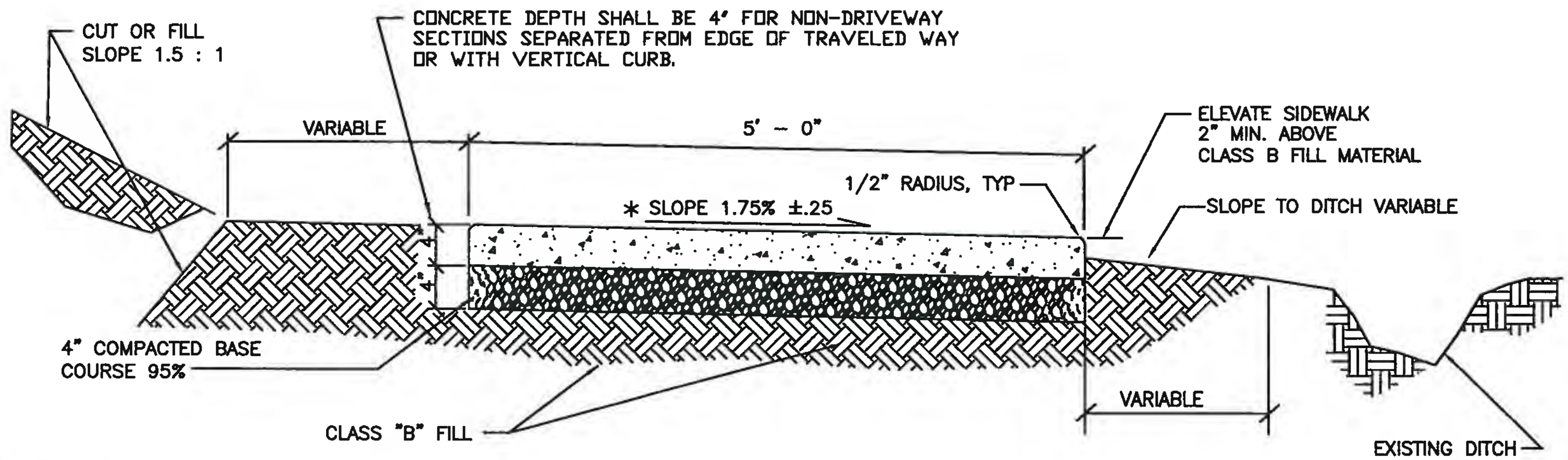
REVISED 2-24-06

NOTES:

1. FORMS SHALL BE METAL OR WOOD AND SHALL EXTEND THE FULL DEPTH OF CONCRETE.
2. SIDEWALKS SHALL BE BROOM FINISHED
3. FIBERBOARD EXPANSION JOINTS SHALL BE SPACED AT 15-FEET O.C.
4. SCORED DUMMY JOINTS SHALL BE PLACED AT 5-FEET O.C.
5. CURB AND SIDEWALK TERMINI SHALL BE RAMPED OR BEVELED TO MATCH LOCAL GRADE AS DIRECTED BY THE CITY ENGINEER
6. CEMENT CONCRETE SHALL HAVE A MINIMUM 3000psi 28-day STRENGTH WITH 5% ±1 ENTRAINED AIR

*7. THE ACCEPTABLE CROSS SLOP OF SIDEWALK SHALL NOT BE LESS THAN 1.5% AND NOT GREATER THAN 2.0%.





APPROVED
City of Oak Harbor
Engineering Dept.

Signature

11-22-06
Date

NOT TO SCALE

CITY OF Oak Harbor WHIDBEY ISLAND, WASHINGTON

City of Oak Harbor

ENGINEERING DEPARTMENT
865 SE Barrington Drive
Oak Harbor, WA 98277

SIDEWALK SECTION DETAIL

ST-9Sidewalk section.dwg
REVISED 11-22-06

APPENDIX I

LOCAL GOVERNMENT CONSISTENCY REVIEW CHECKLIST

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Local Government Consistency Review Checklist

Water System Name: City of Oak Harbor PWS ID: 62650

Planning/Engineering Document Title: 2013 Water System Plan Update Plan Date: March 7, 2014

Local Government with Jurisdiction: Island County

WAC 246-290-108 Consistency with local plans and regulations:
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).

1) 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 Department of Health (DOH). Complete the table below and see instructions on back.

Local Government Consistency Statement	Page(s) in Planning Document	Yes – No – Not Applicable
a) The water system service area is consistent with the adopted land use and zoning within the applicable service area.	1-25	—
b) The six-year growth projection used to forecast water demand is consistent with the adopted city/county's population growth projections. If a different growth projection is used, provide an explanation of the alternative growth projection and methodology.	2-16	Yes
c) Applies to cities and towns that provide water service: All water service area policies of the city or town are consistent with the utility service extension ordinances of the city or town.	1-32	—
d) Service area policies for new service connections are consistent with the adopted local plans and adopted development regulations of all jurisdictions with authority over the service area [City(ies), County(ies)].	1-32	Yes
e) Other relevant elements related to water supply are addressed in the water system plan, if applicable; Coordinated Water System plans, Regional Wastewater plans, Reclaimed Water plans, Groundwater Area Management plans, and Capital Facilities Element of Comprehensive plans.	1-30	Yes

I certify that the above statements are true to the best of my knowledge and that these specific elements are consistent with adopted local plans and development regulations.

Signature: [signature] Date: 7/2/2014

William Simpson, Associate Planner, Island County
Printed Name, Title, & Jurisdiction

Washington State Department of Health

Local Government Consistency Review Checklist

Water System Name: City of Oak Harbor PWS ID: 62650

Planning/Engineering Document Title: 2013 Water System Plan Update Plan Date: March 7, 2014

Local Government with Jurisdiction: Island County

WAC 246-290-108 Consistency with local plans and regulations:
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).

1) 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 Department of Health (DOH). Complete the table below and see instructions on back.

Local Government Consistency Statement	Page(s) in Planning Document	Yes – No – Not Applicable
a) The water system service area is consistent with the adopted land use and zoning within the applicable service area.	1-25	Yes
b) The six-year growth projection used to forecast water demand is consistent with the adopted city/county's population growth projections. If a different growth projection is used, provide an explanation of the alternative growth projection and methodology.	2-16	No. See attached
c) Applies to cities and towns that provide water service: All water service area policies of the city or town are consistent with the utility service extension ordinances of the city or town.	1-32	Yes
d) Service area policies for new service connections are consistent with the adopted local plans and adopted development regulations of all jurisdictions with authority over the service area [City(ies), County(ies)].	1-32	Yes
e) Other relevant elements related to water supply are addressed in the water system plan, if applicable; Coordinated Water System plans, Regional Wastewater plans, Reclaimed Water plans, Groundwater Area Management plans, and Capital Facilities Element of Comprehensive plans	1-30	Yes

I certify that the above statements are true to the best of my knowledge and that these specific elements are consistent with adopted local plans and development regulations.

Ethan Spoo 9/3/2014

Signature Date

Ethan Spoo, Senior Planner, City of Oak Harbor

Printed Name, Title, & Jurisdiction

Consistency Review Guidance

For Use by Local Governments and Municipal Water Suppliers

This checklist may be used to meet the requirements of WAC 246-290-108. When using an alternative format, it must describe all of the elements; 1a), b), c), d), and e), when they apply.

For **water system plans (WSP)**, a consistency review is required for the retail service area and any additional areas where a municipal water supplier wants to expand its water right's place of use.

For **small water system management programs**, a consistency review is only required for areas where a municipal water supplier wants to expand its water right's place of use. If no water right place of use expansion is requested, a consistency review is not required.

For **engineering documents**, a consistency review is required for areas where a municipal water supplier wants to expand its water right's place of use (water system plan amendment is required). For non-community water systems, a consistency review is required when requesting a place of use expansion. All engineering documents must be submitted with a service area map per WAC 246-290-110(4)(b)(ii).

A) Documenting Consistency: Municipal water suppliers must document all of the elements in a consistency review per WAC 246-290-108.

1 a) Provide a copy of the adopted **land use/zoning** map corresponding to the service area. The uses provided in the WSP should be consistent with the adopted land use/zoning map. Include any other portions of comprehensive plans or development regulations that are related to water supply planning.

1 b) Include a copy of the **six-year growth projections** that corresponds to the service area. If the local population growth rate projections are not used, provide a detailed explanation on why the chosen projections more accurately describe the expected growth rate. Explain how it is consistent with the adopted land use.

1c) Include water service area policies and show that they are consistent with the **utility service extension ordinances** within the city or town boundaries. This applies to cities and towns only.

1 d) Include all **service area policies** for how new water service will be provided to new customers.

1 e) **Other relevant elements** related to water supply planning as determined by the department (DOH). See Local Government Consistency – Other Relevant Elements, Policy B.07, September 2009.

B) Documenting an Inconsistency: Please document the inconsistency, include the citation from the comprehensive plan or development regulation, and provide direction on how this inconsistency can be resolved.

C) Documenting Lack of Consistency Review by Local Government: Where the local government with jurisdiction did not provide a consistency review, document efforts made and the amount of time provided to the local government for their review. Please include: name of contact, date, and efforts made (letters, phone calls, and e-mails). In order to self-certify, please contact the DOH Planner.

EXPLANTION OF POPULATION AND GROWTH PROJECTIONS FOR OAK HARBOR WATER SYSTEM PLAN, 2014.

Background

WAC 246-290-108 requires that six-year population growth projections used to develop the City's Water System Plan be consistent with the population projections used in the City's Comprehensive Plan or that an explanation is provided if the projections are different. The population projections used in the City of Oak Harbor Comprehensive Plan are different from those used in the Water System Plan. This document explains those differences and the reasons for them.

Explanation of Population Projections Used in the Water System Plan and Comparison to the Comprehensive Plan

The City of Oak Harbor's population projections in its Comprehensive Plan were developed as part of the 2005 Comprehensive Plan Update. The 2005 projections used a methodology to project population in the future which was based on the growth in housing units during the previous three years (2002 – 2004) and assumed that growth rate would continue. As the City now recognizes, those projections were based on assumptions about housing unit growth in a "boom" economy that were atypical and do not represent the average population growth seen in Oak Harbor over longer periods of time. The population projections completed in 2005 predict that Oak Harbor's population will be 29,704 in the year 2020.

The 2014 Draft Water System Plan uses a straight-line projection of Oak Harbor's historical growth rate over the period 2000-2010 of 0.78 percent per year. That growth rate is combined with information about squadron increases at Naval Air Station Whidbey Island (NASWI) and the existing populations of the Seaplane Base and Ault Field Base. The projected population in the Water System Plan, therefore, more accurately reflects anticipated events in Oak Harbor's future, such as the NASWI squadron increases, as well as a more realistic internal growth rate for Oak harbor based on a longer historical average which weren't known at the time of the 2005 Comprehensive Plan population projections. The Water System Plan projection provides better information as an input to the Water System Plan capital project list. The population projections used in the Water System Plan estimate that there will be 23,418 people in Oak Harbor in the year 2020 and 24,116 in the retail service area (See Table 2-13 of the Draft Water System Plan).

Oak Harbor's adopted Future Land Use Map was taken into account in water system planning. A copy of the Future Land Use Map for the service area is included in Figure 1-14 of the Draft Water System Plan. The Future Land Use Map was based on a population projection of 29,704 in the six-year planning period for the year 2020, which is 5,588 (24 percent) more people than the Water System Plan predicts in that same year. Because the Future Land Use Map was formed based on a greater population, the Water System Plan predicted population will not fall outside of the limits established for the Future Land Use Map and is, therefore, consistent with the city's adopted land use map.

APPENDIX J

PLAN REVIEW COMMENTS AND CORRESPONDENCE

Gray & Osborne, Inc.

CONSULTING ENGINEERS

March 7, 2014

Ms. Jennifer Kropack
Washington State Department of Health
Office of Drinking Water
20435 72nd Avenue South, Suite 200
Kent, Washington 98032

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Ms. Kropack:

Enclosed are three copies of the final draft of the City of Oak Harbor's Water System Plan. The plan has been reviewed by the City and is ready for adoption by the City, subject to receiving comments from DOH and Island County. At this time, the plan has also been submitted to Island County and made available to adjacent purveyors and wholesale customers for their review.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor
Mr. William Oakes P.E., Public Works Director, Island County
Mr. Fred Buckenmeyer, Public Works Director, City of Anacortes
Mr. David Goodchild, Utilities Engineer, Naval Air Station Whidbey Island
Mr. Robert Boehm, Member, Island County Water Resources Advisory Committee
Mr. Joe Farina, Manager, North Whidbey Water District
Mr. Chris Johnson, Manager, Deception Pass State Park Water System
Ms. Sandra Bodamer, Manager, Bayview Estates Water Company, Crosswoods Water Company, Evergreen Park Water System, Pine Terrace Water Association, Suburban Mobile Home Park, and West Ridge Water System
Mr. Clive Defty, Manager, Bets Water System, Fairway Estates, Inc., Fir Grove Mobile Home Park, Valley High Point Water Association, and Waterloo Acres Community Water System
Mr. Jon Breilein, Manager, Hillcrest Village Water Company, Inc. and Suburban Hills Community Association
Ms. Kelly Birch, Manager, Highland Trace Water Company, Inc.
Mr. Joseph Waldrup, Manager, Indian Ridge Water Company
Ms. Anna Livingston, Manager, Parkwood Manor Mobile Home Park
Mr. Corey Johnson, Manager, Swantown Water District

Gray & Osborne, Inc.
CONSULTING ENGINEERS

March 7, 2014

Mr. William Oakes, P.E.
Public Works Director
Island County
P.O. Box 5000
Coupeville, Washington 98239-5000

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Mr. Oakes:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health. The Island County Review Guidance Checklist and Emergency Plan Checklist are included in Appendix S of the plan, while the Consistency Checklist is included in Appendix I.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

701 Dexter Avenue N., Suite 200 Seattle, Washington 98109 (206) 284-0860 Fax (206) 283-3206

Gray & Osborne, Inc.
CONSULTING ENGINEERS

March 7, 2014

Mr. Robert Boehm
Water Resources Advisory Committee – Island County
P.O. Box 5000
Coupeville, Washington 98239

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Mr. Boehm:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

701 Dexter Avenue N., Suite 200 Seattle, Washington 98109 (206) 284-0860 Fax (206) 283-3206

Gray & Osborne, Inc.
CONSULTING ENGINEERS

March 7, 2014

Ms. Sandra Bodamer
Manager
Bayview Estates Water Company
Crosswoods Water Company
Evergreen Park Water System
Pine Terrace Water Association
Suburban Mobile Home Park
West Ridge Water System
P.O. Box 2243
Oak Harbor, Washington 98277

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Ms. Bodamer:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

Gray & Osborne, Inc.
CONSULTING ENGINEERS

March 7, 2014

Mr. Clive Defty
Manager
Bets Water System
Fairway Estates, Inc.
Fir Grove Mobile Home Park
Valley High Point Water Association
Waterloo Acres Community Water System
P.O. Box 2243
Oak Harbor, Washington 98277

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Mr. Defty:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

Gray & Osborne, Inc.
CONSULTING ENGINEERS

March 7, 2014

Mr. Jon Breilein
Manager
Hillcrest Village Water Company, Inc.
Suburban Hills Community Association
70 NE Midway Boulevard
Oak Harbor, Washington 98277

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Mr. Breilein:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

Gray & Osborne, Inc.

CONSULTING ENGINEERS

March 7, 2014

Ms. Anna Livingston
Manager
Parkwood Manor Mobile Home Park
700 NW Crosby Avenue, Site 187
Oak Harbor, Washington 98277

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Ms. Livingston:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

Gray & Osborne, Inc.

CONSULTING ENGINEERS

March 7, 2014

Mr. Fred Buckenmeyer
Public Works Director
City of Anacortes
P.O. Box 547
Anacortes, Washington 98221

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Mr. Buckenmeyer:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

Gray & Osborne, Inc.
CONSULTING ENGINEERS

March 7, 2014

Mr. David Goodchild
Utilities Engineer
NAVFAC NW, Whidbey Island
Naval Facilities Engineering Command
1115 West Lexington B-103
Oak Harbor, Washington 98278

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Mr. Goodchild:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

Gray & Osborne, Inc.
CONSULTING ENGINEERS

March 7, 2014

Mr. Joe Farina
Manager
North Whidbey Water District
505 West Quinn Drive
Oak Harbor, Washington 98277

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Mr. Farina:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

Gray & Osborne, Inc.

CONSULTING ENGINEERS

March 7, 2014

Mr. Chris Johnson
Manager
Deception Pass State Park Water System
220 North Walnut
Burlington, Washington 98233

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Mr. Johnson:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

Gray & Osborne, Inc.
CONSULTING ENGINEERS

March 7, 2014

Ms. Kelly Birch
Manager
Highland Trace Water Company, Inc.
976 Capital Street
Oak Harbor, Washington 98277

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Ms. Birch:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

701 Dexter Avenue N., Suite 200 Seattle, Washington 98109 (206) 284-0860 Fax (206) 283-3206

Gray & Osborne, Inc.
CONSULTING ENGINEERS

March 7, 2014

Mr. Joseph Waldrup
Manager
Indian Ridge Water Company
2172 Norman Drive
Oak Harbor, Washington 98277

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Mr. Waldrup:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

Gray & Osborne, Inc.
CONSULTING ENGINEERS

March 7, 2014

Mr. Corey Johnson
Manager
Swantown Water District
P.O. Box 610
Oak Harbor, Washington 98277

SUBJECT: DRAFT WATER SYSTEM PLAN
CITY OF OAK HARBOR, ISLAND COUNTY, WASHINGTON
G&O #13404.00

Dear Mr. Johnson:

On behalf of the City of Oak Harbor, I would like to inform you that the City's draft 2013 Water System Plan is ready for review by interested parties. The plan is available on the City's Web site at www.oakharbor.org, under the Public Works Department Documents section. Printed copies are also available through the City Administration. In accordance with WAC 246-290-100(7), the City is transmitting this plan to all adjacent water purveyors and wholesale customers to assess consistency with ongoing and adopted planning efforts.

Attached is a copy of the letter that was sent along with the plan to the Washington State Department of Health.

We anticipate that the Department of Health will complete its review of the plan within 90 days, at which point the plan will be finalized. We would appreciate receiving any comments you may have within this time period, if possible.

Please contact me at your convenience at (206) 284-0860 if you have any questions.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RLP/hhj
Encl.

cc: Mr. Arnie Peterschmidt, P.E., City of Oak Harbor

701 Dexter Avenue N., Suite 200 Seattle, Washington 98109 (206) 284-0860 Fax (206) 283-3206

ISLAND COUNTY
PLANNING & COMMUNITY DEVELOPMENT

PHONE: (360) 679-7339 ■ from Camano (360) 629-4522, Ext. 7339 ■ from S. Whidbey (360) 321-5111, Ext. 7339 FAX: (360) 679-7306 ■ 1 NE 6th Street, P. O. Box 5000, Coupeville, WA 98239-5000
Internet Home Page: http://www.islandcounty.net/planning/

June 9, 2014

Mr. Arnold Peterschmidt, P.E.
Project Engineer
City of Oak Harbor
865 SE Barrington Drive
Oak Harbor, WA 98277

Re: Oak Harbor Draft Water System Plan

Dear Mr. Peterschmidt,

Planning & Community Development appreciates the opportunity to comment on the draft 2013 Water System Plan Update for the City of Oak Harbor. As your plan indicates, planning and engineering documents must be consistent with local plans and regulations in accordance with WAC 246-290. After reviewing the draft plan, Planning & Community Development's only concern regards the city-adopted Urban Growth Area (UGA) referenced on page 1-3, 1-4, and expressed in a number of maps and figures throughout the document.

As the courts have determined that the UGA referenced in your draft plan is invalid, our department encourages you to consider revising the relevant maps and figures so that the UGA and corresponding Future Retail Service Area are consistent with our locally adopted Comprehensive Plan. Amending the relevant figures so that UGAs are expressed as the County Adopted UGA, which is demonstrated in Figure 1-4, would alleviate our concerns.

Please feel free to contact me if you have additional questions or concerns in regards to our comments.

Sincerely,

David L. Wechner, M.S. AICP
Director

Cc:
Jennifer Kropack, WA Department of Health
Steve Powers, Oak Harbor Development Services
Bill Oakes, Island County Public Works
Keith Higman, Island County Public Health

ISLAND COUNTY
PLANNING & COMMUNITY DEVELOPMENT

PHONE: (360) 679-7339 ■ from Camano (360) 629-4522, Ext. 7339 ■ from S. Whidbey (360) 321-5111, Ext. 7339 FAX: (360) 679-7306 ■ 1 NE 6th Street, P. O. Box 5000, Coupeville, WA 98239-5000
Internet Home Page: http://www.islandcounty.net/planning/

June 17, 2014

Mr. Arnold Peterschmidt, P.E.
Project Engineer
City of Oak Harbor
865 SE Barrington Drive
Oak Harbor, WA 98277

Re: Oak Harbor Draft Water System Plan

Dear Mr. Peterschmidt,

Island County Planning & Community Development has reviewed the updated maps in the draft Water System Plan for the City of Oak Harbor provided on June 13, 2014. Our department no longer has objections to the draft plan and, upon request, can provide a consistency review form in accordance with WAC 246-290-108.

Sincerely,

David L. Wechner, M.S. AICP
Director

Cc:
Jennifer Kropack, WA Department of Health
Steve Powers, Oak Harbor Development Services
Bill Oakes, Island County Public Works
Keith Higman, Island County Public Health

NOTICE OF WORKSHOP MEETING

NOTICE IS HEREBY GIVEN that the Oak Harbor City Council will hold a Workshop Meeting on Wednesday, August 27th, 2014, at 3:00 p.m. to discuss the following agenda items. The meeting will be held in the Council Chambers, 865 SE Barrington Drive.

DATED this 22nd day of August 2014.

Anna M. Thompson, City Clerk

The City Council may meet informally in workshop sessions (open to the public) to do concentrated strategic planning, to review forthcoming programs of the City, receive progress reports on current programs or projects, or receive other similar information from the City Administrator, provided that all discussions and conclusions thereon shall be informal. Council shall make no disposition of any item at a workshop meeting. Public comment is not normally allowed at workshop meetings, although Council may allow, or request participation.

WORKSHOP MEETING
CITY COUNCIL
August 27, 2014 — AGENDA — 3:00 p.m.

Departmental Briefings

1. 42-Inch Outfall Project - PW
2. Engineer Opinion Letter on the Whidbey Avenue Crosswalk - PW
3. Scheduling Parliamentary Procedure Workshop - Admin

Pending Agenda Items

1. 2016 Comprehensive Plan Amendments Public Participation Plan - Dev/Services (9/16)
2. Ordinance 1695: Extension of Impact Fee Reduction – Dev/Services (9/02)
3. Ordinance 1692: Extending Medical Marijuana Moratorium – Dev/Services (9/02)
4. ERCI On-Call Archaeology Contract Amendment No. 3 – Engineering (9/02)
5. LED Lighting Conversion Contract (Department of Enterprise Systems) - PW
6. Water System Plan – Engineering – (9/02 and 9/16)

Emerging Issues

1. Capital Projects Assessment Exercise – Results of City Council Review
2. Sale or Exchange of Real Property (Chapter 1.30 OHMC)

CITY OF OAK HARBOR PLANNING COMMISSION
NOTICE OF PUBLIC HEARING
PC# 05-27-14

Notice is hereby given that the Planning Commission will conduct its regular monthly meeting on Tuesday, May 27, 2014. Staff will conduct a pre-meeting briefing with Planning Commission beginning at 7:00 pm in the Council conference room. The business meeting starts at 7:30 p.m. and will be held in the Council Chambers at City Hall, 865 SE Barrington Drive, Oak Harbor WA. The Planning Commission will consider the following:

BECKETT LANDING SUBDIVISION– Public Hearing
"Beckett Landing" is a proposed subdivision on 4.90 acres located south of the terminus of NW Prow Street, north of the existing and proposed Island Place development, and west of the Paragon Place development and Heller Road. The applicant proposes 22 single-family detached lots, with associated street and utility improvements and native vegetation areas. The Planning Commission will conduct a public hearing and potentially make a recommendation to City Council.

WATER SYSTEM PLAN – Public Hearing
The City of Oak Harbor is updating its Water System Plan of which the Water Use Efficiency program is a part. A Water System Plan and Water Use Efficiency program is required to be adopted by the City every six years by the Washington State Department of Health for all public water systems. The purpose of the Plan and Efficiency program is to preserve state water resources and provide long-term maintenance of public water supplies. Staff will present information on the city water supply, current status of the Water Use Efficiency program and the goals proposed for the program as it continues to the public and the Commission. An essential component of the program is the water rate structure. Public comment is invited especially from water system customers. Materials supporting the rationale for water efficiency goals can be viewed at the Development Services Department at Oak Harbor City Hall, 865 SE Barrington Drive. This Planning Commission meeting will also serve as the informational meeting for consumers as required by WAC 246-290-100(8). Planning Commission is expected to accept comments in a public hearing for this item.

2014 COMPREHENSIVE PLAN AMENDMENT – SCENIC VIEWS – Public Meeting
Staff will continue the discussion related to Scenic Views within Oak Harbor. Staff will present various goals and policies currently within the Comprehensive Plan that either support or conflict with ideas surrounding the preservation of scenic views.

MEDICAL MARIJUANA – Public Meeting
A moratorium is presently in place prohibiting the establishment of medical marijuana collective gardens and marijuana dispensaries in Oak Harbor. Last month staff briefed the Planning Commission on the current status of medical marijuana law in Washington state. Staff will once again brief the Commission on this matter.

All meetings of the Planning Commission are open to the public.

Published Whidbey News Times
May 10, 2014

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
NORTHWEST DRINKING WATER REGIONAL OPERATIONS
20425 72nd Avenue South, Suite 310, Kent Washington 98032-2388

GRAY & OSBORNE, INC.
REC'D - SEATTLE
JUN 06 2014
JOB #

June 4, 2014

RICHARD TYHUIS
OAK HARBOR, CITY OF
865 SE BARRINGTON DR
OAK HARBOR, WA 98277

RE: City of Oak Harbor, ID # 62650
Island County
Water System Plan
Submittal # 14-0303

Dear Mr. Rich Tyhuis:

Thank you for submitting the draft Water System Plan (WSP) for the City of Oak Harbor on March 14, 2014. Upon review of the plan, we offer the following comments. Please address all of the comments prior to approval.

Planning Data and System Description

1. Figures 1-5, 1-8 and 1-12. Per Municipal Water Law, there is a need to identify your retail service area and your largest service area for water right place of use benefit. Island County's Coordinated Water System Plan (CWSP) is only tracking the "retail service area" boundary which equals existing and future service areas. Clarify whether the Seaplane Base is in your retail service area or wholesale water service area. Clarify whether the UGA is within your retail service area. In the future, if you don't include the UGA in your RSA and you add connections outside your RSA, then a WSP plan amendment and CWSP service area change will be required. Future wholesale service area appears to equal current wholesale service area. Consider combining the two. Clarify these figures and the corresponding narrative. Or are the many boundaries overlapping because of a GIS technical issue? Please explain.

2. Provide local government consistency signed statements from the City planner and Island County.

3. The water sales contract information between Anacortes and Oak Harbor is for the time period 2008 - 2010. Provide the most recent contract. Identify any changes.

System Demand, Analysis and Design Specifications

4. Page 2-15, Table 2-13. The percentages of growth are very difficult to follow. Consider showing the percentages clearly for each type of service area. For instance, the text states the city population will increase 1.26% annually, while the table shows annual increase of 0.8% for the city population which seems to reflect the combined population growth rate (including UGA and not just city). Also, the projections would be easier to follow if the assumed 25% increase in the NASWI personnel over the 5 year period was shown in the table.

5. Page 3-17, Table 3-11. The wells are proposed to be used at their water right limit which is higher than their current pumping capacity. Please justify or use the existing pumping capacity from the sources with the recommended pumping of 18 hours a day per source.

6. Page 3-20 operational storage. The City describes closing the intertie valves at night in order to drawdown reservoir levels to promote water circulation. Explain your decision criteria and procedure in more detail and clarify how this was accounted for in the capacity analysis.

7. Pages 3-19 and 3-25. Clarify the reason for the different MDDs used in the Ault Field Booster Station analyses shown in Tables 3-15 and 3-13. Consider combining these tables.

8. Hydraulic analysis. The future analysis does not appear to include the NASWI seaplane base and yet, consolidation or a new supply line is proposed. You may include in the water system plan resubmittal or submit separately prior to the changes. Clarify whether the NASWI Seaplane base will become part of the City or remain as a separate water system following the changes in the supply piping to the area.

9. Distribution Main Installation Standards:
   a. Include hydrostatic testing, disinfection and bacteriological testing requirement.
   b. The municipal code states the city supervisor approves minimum separation between water and non-potable pipelines. Please ensure you have a policy, minimum standards, or something else in place to provide the criteria for this determination.
   c. Include typical trench cross section and minimum depth of bury for the pipes.
   d. Include the requirement to install all mains in a public right-of-way or provide easements.

Operations and Maintenance

10. Per the pre-plan agreement, provide a summary status for Cross Connection Control similar to the Puyallup example provided at the 2013 meeting and enclosed.

11. Page 3-14 and Appendix L, Coliform Monitoring Plan. The groundwater rule applies to the City because it has groundwater wells. Correct the narrative and plan. Oak Harbor must collect a sample from each groundwater source (S11, S12, S14) at a sample tap prior to any treatment if an unsatisfactory coliform sample occurs in the distribution system and if any of your sources were in use (and pumped into the distribution system). It may be helpful to include decision criteria for your staff to understand what "in use" means.

12. Appendix L, Coliform Monitoring Plan. Indicate the routine sample site will also be used as one of the required three repeat sample sites and include the referenced map showing the locations of the sample sites.

13. Page 7-18. Public notice is required within 24 hours of an acute MCL violation such as coliform or nitrate. You are required to issue a boil water advisory to your customers upon an acute coliform MCL violation. Update the news release template. A rolling boil of 1 minute is now adequate.

14. Include a copy of the DBP stage 2 monitoring plan.

15. The preplan agreement requested submittal of as-built documentation for chlorine treatment with the water system plan. Since these were not included, submit a separate engineering project.

Water Use Efficiency (WUE)

16. It appears your goal expired on January 15, 2014. We recommend taking care of the WUE customer demand goal-setting at the same presentation as for your WSP and provide documentation of the public forum. Advertising on our web page three weeks prior to your meeting satisfies notification "beyond your own customers."

Financials

17. Table E-3, page E-7 and Table 9-3, page 9-7. A plan must demonstrate financial viability and show how the City plans to collect the necessary revenue per WAC 246-290-100 (j) (ii) and (iii). Revise both tables accordingly.

Other

18. Have any comments from Anacortes or other adjacent utilities been received and addressed? Provide update and documentation.

19. Provide a copy of your franchise agreement.

20. Provide documentation of the customer meeting regarding the plan and your Elected's approval of the plan prior to DOH final approval.

We hope that you have found these comments to be clear, constructive and helpful in the development of your final WSP. We ask that you submit the revised WSP pages, maps, etc. (two copies) on or before September 4, 2014. In order to expedite the review of your revised submittal, please include a cover letter summarizing how each of the above comments was addressed and where each response is located (i.e., page numbers, Appendices, etc.).

Regulations establishing a schedule for fees for review of planning, engineering and construction documents have been adopted (WAC 246-290-990). Please note that we have included an invoice in the amount of **$3,705.00** for the review of the Water System Plan. This fee covers our cost for review of the initial submittal, plus the review of one revised document. Please remit your complete payment in the form of a check or money order within thirty days of the date of this letter to: **DOH, Revenue Section, and P.O. Box 1099, Olympia, WA 98507-1099.**

Sincerely,

Jennifer Kropack
Regional Planner
253-395-6769

Virpi Salo-Zieman
Regional Engineer
253-395-6761

Enclosure: CCC City of Puyallup example

Cc: Arnold Peterschmidt, PE, City of Oak Harbor
Russell Porter, PE, Gray & Osborne, Inc.
Island County Public Health
Will Simpson, Island County Planner
Ingrid Salmon, DOH

APPENDIX K

COLIFORM AND NITRATE VIOLATION LETTERS AND NOTIFICATIONS

PUBLIC NOTICE CERTIFICATION
Acute Coliform MCL

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Within 10 days of notifying your customers, you must send a copy of each type of notice you distribute (hand-delivered notices, press releases, newspaper articles, etc.) to our regional office. Also, complete and send this form, which certifies that you have met all the public notification requirements. If the boil water advisory remains in effect more than three months, you must notify your water users again and provide another Public Notice Certification to us. *With this certification, you are also stating that you will meet future requirements for notifying new billing units of the violation or situation.*

Water System:____ID #__________County:_______________

Violation Date:_____ / _____ / _____ Violation Type:____

This public water system certifies that public notice has been given to water users, following state and federal requirements for delivery, content, and deadlines.

Complete the following items:

Yes No

☐ ☐ Distribution was completed on ___ / ___ /____. Check all that apply:
- ☐ Hand delivery,
- ☐ Press release (TV, radio, newspaper, etc.),
- ☐ Posting at__________________________ (by DOH approval only),
- ☐ Other _____________________________ (by DOH approval only).

☐ ☐ Were the water users notified within 24 hours?

____ ____________________ _____________________

Signature of owner or operator / Position / Date

If you need this publication in an alternate format, call (800) 525-0127 or for TTY/TDD call (877) 833-6341.

Northwest Regional Office:
20425 72nd Ave S Suite 310
Kent WA 98032
(253) 395-6775
Fax: (253) 395-6760

Southwest Regional Office:
PO Box 47823
Olympia WA 98504-7823
(360) 236-3030
Fax (360) 664-8058

Eastern Regional Office:
16201 E Indiana Ave Suite 1500
Spokane Valley WA 99216
(509) 329-2100
Fax: (509) 329-2104

IMPORTANT NOTICE ABOUT YOUR WATER SYSTEM

Coliform Maximum Contaminant Level (MCL) Exceeded: Non-acute MCL

The ____________________________ water system, ID# ____________ in __________ County routinely monitors for the presence of total coliform bacteria and in ____________ this type of bacteria was detected. Although this incident was not an emergency, as our customer, you have a right to know what happened and what we did or are doing to correct the situation.

Coliforms are bacteria which are naturally present in the environment and are used as indicators that other, potentially-harmful, bacteria may be present. Coliforms were found in more samples than allowed and this was a warning of potential problems. The samples that showed the presence of coliform were further tested to see if other bacteria of greater concern, such as fecal coliform or *E.coli* were present. **None of these bacteria were found.**

You do not need to boil your water. People with severely compromised immune systems, infants, and some elderly may be at an increased risk. These people should seek advice from their health care provider.

What happened? What is the suspected or known source of contamination?

At this time:

- ☐ The problem is resolved. Additional samples collected were found to be free of coliform bacteria.
- ☐ We anticipate resolving the problem by ____ / ____ / ____.
- ☐ Other ____.

For more information, contact ______________________________ at (   )____-______ or at ______________________.
(owner or operator) (phone number) (address)

Please share this notice with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

This notice is sent to you by ____ Date Distributed ____ / ____ / ____.

Coliform Non-acute Public Notice Certification Form

The purpose of this form (below) is to provide documentation to the department that public notice was distributed. Please check the appropriate box and fill in the date that the notice was distributed:

- ☐ Notice was mailed to all water customers on ____ / ____/____.
- ☐ Notice was hand delivered to all water customers on ___ / ___ /___.
- ☐ Notice was posted (*with department approval*) at:

____________________________________ on ___ / ___ /____.

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

____________________________________ ____________________ ____________________

Signature of owner or operator Position Date

If you need this publication in an alternate format, call (800) 525-0127. For TTY/TDD call (800) 833-6388.

Send copy of completed notification and certification to:

☐ Northwest Drinking Water
Department of Health
20425 72nd Ave S, Suite 310
Kent, WA 98032-2358
Phone: (253) 395-6750
Fax: (253) 395-6760

☐ Southwest Drinking Water
Department of Health
PO Box 47823
Olympia, WA 98504-7823
Phone: (360) 236-3030
Fax: (360) 664-8058

☐ Eastern Drinking Water
Department of Health
16201 E Indiana Ave, Suite 1500
Spokane Valley, WA 99216
Phone: (509) 329-2100
Fax: (509) 329-2104

AVISO IMPORTANTE ACERCA DEL SISTEMA DE SUMINISTRO DE AGUA

Las bacterias coliformes rebasaron el Nivel Máximo de Contaminación: NMC no agudo

El sistema de suministro de agua ______________, número (ID#) ________ en el condado de ____________ monitorea rutinariamente la presencia de bacterias coliformes totales. En la fecha ______________________, se encontró este tipo de bacteria. Aunque este incidente no es considerado una emergencia, como consumidor, Usted tiene el derecho a saber que pasó y que se ha hecho o se esta haciendo para corregir esta situación.

Las bacterias coliformes se encuentran naturalmente en el medio ambiente y se usan como indicador de la posible presencia de otras bacterias que pueden causar daño a la salud. En las muestras tomadas, las bacterias se encontraron en mayor número que el permitido y esto es una indicación de posibles problemas. Las muestras con bacterias coliformes se analizaron con más detalle en el laboratorio para ver si bacterias coliformes fecales o E. Coli pudieran también haber estado presentes. Estas bacterias causan daño a la salud de las personas. **No se encontró ninguna de estas bacterias.**

No es necesario que usted hierva el agua. Personas con un sistema inmunológico severamente comprometido, los recién nacidos y algunas personas de edad avanzada pueden tener mas riesgo de salud y deberían llamar a algún personal médico para mayor información.

¿Qué fue lo que pasó? ¿Cuál es la fuente de contaminación de la que se sabe o sospecha?

En este momento:

- ☐ El problema esta resuelto. En muestras adicionales que se colectaron no se encontraron bacterias coliformes.
- ☐ Anticipamos resolver el problema el día ____/____/____.
- ☐ Otro ____.

Para mayor información comuníquese con _______________ al teléfono (   ) ______-__ _____ o con

________________________	__________________	_______________________
(dueño u operador)	(teléfono)	(dirección)

Pase esta información a todas las personas pudieran tomar agua de este suministro, especialmente aquellas personas que no hayan recibido este aviso (por ejemplo, personas que vivan en apartamentos, asilos de ancianos, escuelas y negocios.) Usted puede hacer esto colocando este aviso en un lugar público donde se pueda leer claramente o distribuyendo copias en persona o enviándolas por correo.

Este aviso es enviado a Usted por el Sistema de Suministro de Agua________________ fecha ___/___/____.

Aug. 2013
DOH 331-179
Revised

Questions & Answers

Public Health Advisory
Coliform

Why must I boil my water?

Recent tests show that your water system is contaminated with organisms that can cause illness.

Who can be affected? Can I become ill?

Anyone who drinks contaminated water may become ill. Infants, young children, the elderly, and people with severely compromised immune systems are more at risk of illness.

Who are people with compromised immune systems?

People who are on chemotherapy, organ or bone marrow recipients, those with HIV or AIDS, malnourished children, infants, and some of the elderly have compromised or weakened immune systems. An infection from a disease-causing organism may lead to very serious health problems for these people.

Can these diseases be spread in ways other than drinking the water?

Yes. Many of these disease-causing organisms are shed in the feces of infected people. In fact, some infected people do not have any symptoms but still shed these organisms. Childcare workers, young children who attend childcare, and caregivers for people who are sick and shedding these organisms are at the greatest risk of becoming ill. Washing hands with soap and water after using the toilet and before preparing food prevents the spread of diseases to others.

What are the symptoms to watch for?
What should I do if I think I have a waterborne illness?

Disease-causing organisms in water can cause diarrhea, stomach cramps, bloating, gas, fatigue, weight loss, nausea, vomiting, and/or fever. Symptoms may appear as early as a few hours to several days after infection and may last more than two weeks. If you are ill with these symptoms, contact your health care provider.

How can I make the water safe?

Boiling is the best way to ensure water is free of illness-causing organisms. Bring the water to a rolling boil for one minute. When it cools, refrigerate the water in clean covered containers.

If you don't want to boil your water, you can disinfect the water using household bleach. Do not use bleach that contains perfume, dyes, or other additives. Use 1/4-teaspoon bleach per gallon of water, mix thoroughly, and then let stand for 60 minutes before using.

Washington State Department of Health
Environmental Public Health
Office of Drinking Water

HELPING TO ENSURE SAFE AND RELIABLE DRINKING WATER

Can I use bottled water?

You can use purchased bottled water. If you choose to use bottled water, Department of Health recommends water that is:

- Reverse-osmosis treated.
- Distilled.
- Filtered through an "absolute" one-micron or smaller filter.

Carbonated water in cans or bottles is usually filtered or heated to remove illness-causing organisms.

During a health advisory, can I use tap water for...?

Drinking	No	Coffee or tea	No
Ice cubes	No	Showers/Baths	Yes
Brushing teeth	No	Washing clothes	Yes
Baby's formula	No	Baby's bath	See below
Washing vegetables/fruits	No	Washing dishes	See below
Preparing food	No	Pet's water bowl	Contact Veterinarian

Can I bathe my baby or child using tap water?

Yes, as long as they do not drink any of the water. Don't let babies suck on a washcloth, as they will be ingesting some of the water.

Can I wash dishes?

You can use your dishwasher if you use the sanitizing/heat cycle and commercial dishwashing detergent. You can hand wash dishes, rinse them in a diluted bleach solution—one teaspoon household bleach to one gallon of water—and then let dishes air dry.

What must be done to fix the problem?

Fixing the problem could be different in each situation depending on whether the problem is at the water source or in the water lines. Usually, in every case the water lines will need to be flushed and the whole system will need to be disinfected using chlorine. The water will then be tested to make sure it is free of coliform bacteria.

How long will this health advisory be in effect?

This health advisory will remain in effect until the water is tested and results show that it meets public health drinking water standards. Your water system will notify you when that occurs.

For more information:

Personal medical questions: Contact your health care provider (physician, nurse consultant, etc.)

Call your local health jurisdiction with general questions about infectious disease, communicable disease transmission, symptoms, causes and prevention of waterborne disease.

PUBLIC HEALTH
ALWAYS WORKING FOR A SAFER AND
HEALTHIER WASHINGTON

WARNING:
Do not drink tap water without boiling it first!

☐ **Fecal coliform**
☐ **E. coli bacteria**
☐ **Other:** ______________________________

were detected in the water supply on:
(date) ____________________.

Boiling kills bacteria and other organisms in the water:

- **Bring water to a rolling boil for one minute**
- **Let water cool before using**

To avoid possible illness: use boiled or purchased bottled water for drinking, making ice, brushing teeth, washing dishes, and food preparation until further notice.

Contact your doctor, if you experience one or more of these symptoms: nausea, cramps, diarrhea, jaundice, headache and/or fatigue. People with chronic illnesses, infants and the elderly may be at higher risk and should seek medical advice.

Water System: __________________________
I.D.: ___________________________________
County: ________________________________
Contact: _______________________________
Telephone: _____________________________
Date notice distributed: _________________

What is fecal coliform and E. coli?

Fecal coliform and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these waters can cause short-term effects, such as diarrhea, cramps, nausea, headaches or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems.

How long will this warning be in effect?

We will consult with the Washington State Department of Health about this incident. We will notify you when you no longer need to boil the water.

Vea al reverso para la versión en Español.

WARNING:
Do not drink tap water without boiling it first!

☐ **Fecal coliform**
☐ **E. coli bacteria**
☐ **Other:** ______________________________

were detected in the water supply on:
(date) ____________________.

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Contact your doctor, if you experience one or more of these symptoms: nausea, cramps, diarrhea, jaundice, headache and/or fatigue. People with chronic illnesses, infants and the elderly may be at higher risk and should seek medical advice.

Water System: __________________________
I.D.: ___________________________________
County: ________________________________
Contact: _______________________________
Telephone: _____________________________
Date notice distributed: _________________

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How long will this warning be in effect?

We will consult with the Washington State Department of Health about this incident. We will notify you when you no longer need to boil the water.

Vea al reverso para la versión en Español.

October 2008

ADVERTENCIA:
¡No tome el agua de la llave sin antes hervirla!

☐ **Bacteria coliforme fecal**
☐ **Bacteria E. coli**
☐ **Otra:** ______________________________

fueron encontradas en su sistema de agua: (el día)___________________.

Hervir el agua mata a las bacterias y otros organismos en el agua:

- **Ponga el agua en la estufa hasta que hierva y deje hervir el agua por un minuto**
- **Deje enfriar el agua antes de usarla**

Para evitar posibles enfermedades y hasta nuevo aviso: use agua hervida o agua potable embotellada para tomar, hacer hielo, limpiarse los dientes, lavar los platos y para preparar comidas.

Hable con su doctor si usted tiene uno o más de los siguientes síntomas: náusea, dolor estomacal, diarrea, ictericia, dolores de cabeza y/o cansancio. La gente con enfermedades crónicas, bebés y personas mayores de edad, pueden estar en situación de alto riesgo y deben consultar con su médico o proveedores de servicios médicos.

Sistema de agua: ______________________
I.D.: ________________________________
Condado: _____________________________
Contacto: _____________________________
Teléfono: _____________________________
Fecha de notificación: __________________

¿Qué son las bacterias coliforme fecal y E. coli?

Coliformes fecales o E. coli son bacterias cuya presencia indica que el agua esta contaminada con desechos humanos o de animales. Microbios de esos desechos pueden causar diarrea, dolor estomacal, náusea, dolores de cabeza u otros síntomas. Pueden representar un peligro para la salud de bebés, niños y niñas de corta edad y personas con sistemas inmunológicos en alto riesgo.

¿Por cuánto tiempo va a estar en efecto esta advertencia?

Vamos a consultar con el Departamento de Salud del estado de Washington acerca de este incidente. Le vamos a notificar cuando ya no sea necesario hervir el agua.

See reverse side for English version.

ADVERTENCIA:
¡No tome el agua de la llave sin antes hervirla!

☐ **Bacteria coliforme fecal**
☐ **Bacteria E. coli**
☐ **Otra:** ______________________________

fueron encontradas en su sistema de agua: (el día)___________________.

Hervir el agua mata a las bacterias y otros organismos en el agua:

- **Ponga el agua en la estufa hasta que hierva y deje hervir el agua por un minuto**
- **Deje enfriar el agua antes de usarla**

Para evitar posibles enfermedades y hasta nuevo aviso: use agua hervida o agua potable embotellada para tomar, hacer hielo, limpiarse los dientes, lavar los platos y para preparar comidas.

Hable con su doctor si usted tiene uno o más de los siguientes síntomas: náusea, dolor estomacal, diarrea, ictericia, dolores de cabeza y/o cansancio. La gente con enfermedades crónicas, bebés y personas mayores de edad, pueden estar en situación de alto riesgo y deben consultar con su médico o proveedores de servicios médicos.

Sistema de agua: ______________________
I.D.: ________________________________
Condado: _____________________________
Contacto: _____________________________
Teléfono: _____________________________
Fecha de notificación: __________________

¿Qué son las bacterias coliforme fecal y E. coli?

Coliformes fecales o E. coli son bacterias cuya presencia indica que el agua esta contaminada con desechos humanos o de animales. Microbios de esos desechos pueden causar diarrea, dolor estomacal, náusea, dolores de cabeza u otros síntomas. Pueden representar un peligro para la salud de bebés, niños y niñas de corta edad y personas con sistemas inmunológicos en alto riesgo.

¿Por cuánto tiempo va a estar en efecto esta advertencia?

Vamos a consultar con el Departamento de Salud del estado de Washington acerca de este incidente. Le vamos a notificar cuando ya no sea necesario hervir el agua.

See reverse side for English version.

Your logo or
company name here.

News Release

For Immediate Release: <DATE>
Contact: Water purveyor/system contact name and telephone number

<Water System> announces boil water advisory for all customers in <area>

CITY NAME — The <SYSTEM NAME> is advising all water customers to boil their drinking water after recent samples showed the presence of <fecal coliform, E. coli, total coliform>. The Washington State Department of Health (DOH) has been notified and <SYSTEM NAME> is working closely with the Office of Drinking Water to find the source of contamination and fix the problem, which may include disinfecting the system. The boil water advisory will remain in effect until further notice.

<System spokesperson quote> (e.g. "We are doing all we can to eliminate the bacteria from the water system. Safe and reliable drinking water is critical to good health and responding to this kind of emergency is our highest priority," said system spokesperson.)

<NUMBER or NO> illnesses related to the community's drinking water have been reported. To correct the problem <WHAT IS BEING DONE> (e.g. Chlorine was applied to the entire system on DATE.)

The boil water advisory includes several precautionary steps that customers should take. These include using purchased treated bottled water or boiled water for any water that might be consumed: drinking, brushing teeth, dishwashing, preparing food and making ice. Water should come to a rolling boil for one minute, then allowed to cool before using.

The advisory will remain in effect until <SYSTEM NAME> and DOH are confident there is no longer a threat of illness to their customers. Once satisfactory results are reported, customers will be notified that the advisory has been lifted.

If you have any questions, please call us at <TELEPHONE NUMBER>.

###

06-22-11

Your logo or
company name here

News Release

For Immediate Release: <DATE>

Contact: Water purveyor/system contact name and telephone number

<Water System Name> Boil Water Advisory Rescinded

CITY NAME – The <SYSTEM NAME> is advising all its water customers that it is no longer necessary to boil their drinking water. Recent test samples show the absence of <fecal coliform, E. coli, total coliform> bacteria.

<SYSTEM SPOKESPERSON QUOTE> (e.g. "Working with the Washington State Department of Health over the last <NUMBER OF > days, we have completed inspections, water quality sampling, disinfection, and flushing to resolve the contamination problem," stated <NAME OF WATER SYSTEM MANAGER>. "We're pleased to be able to lift the boil water advisory."

The inspection of the water system indicated <DESCRIPTION OF SOURCE OF CONTAMINATION, if known, and what will be done to maintain good water quality>

If you have shut off or not used fixtures, water fountains, ice machines, soda machines, and/or other equipment over the past several days, flush the fixture or equipment until there is a change in water temperature before putting it back into service.

The <SYSTEM NAME> encourages customers with questions to call <TELEPHONE NUMBER>.

###

9-15-06

May 2010

DOH 331-259-1

Nitrate
Public Health Advisory Packet

Instructions for water systems

If you have nitrate sample results above the maximum contaminant level (MCL) of 10 milligrams per liter (mg/L), you must notify your customers within 24-hours after receiving the sample results. We developed this packet to help you respond when nitrate levels in your water supply exceed 10 mg/L.

Templates and Forms	DOH Pub.
Door Hanger (English and Spanish)	331-259-2
News Release Template: Announcing the Nitrate Advisory	331-259-3
News Release Template: Rescinding the Nitrate Advisory	331-259-4
Warning to Drinking Water Customers (English)	331-259-5
Warning to Drinking Water Customers (Spanish)	331-259-6
Public Notice Certification Form: Nitrate MCL Violation	331-248

Publications	DOH Pub.
Nitrate in Drinking Water Questions & Answers (English)	331-214
Nitrate in Drinking Water Questions & Answers (Spanish)	331-214s
Nitrate Sampling Procedure Brochure	331-222
Office of Drinking Water authority over operators and water systems Fact Sheet	331-449
Drinking Water After-Hours Emergency Hotline Brochure	331-133

Public Notification Templates and Forms

Page 2 has information and instructions on using the nitrate public notification templates and forms.

Health

HELPING TO ENSURE SAFE AND RELIABLE DRINKING WATER

Templates and forms

Public Notification: You can choose from two templates to provide public notice to your customers.

- **Door Hanger** (331-259-2): English on one-side and Spanish on the other.
  - This public notice is a quick way to inform customers of contamination in the water. It includes precautions they can take to protect themselves.
  - You can get door hangers from local health departments and our regional offices.

- **Warning to Drinking Water Customers:** English (331-259-5) and Spanish (331-259-6). This public notice provides detailed information about health effects and instructions for your customers.

Public Notice Certification Form Nitrate MCL Violation (331-248): You must complete this form and mail it to our regional office within 10 days after notifying your customers about a MCL violation. You must also send us a copy of the public notice you provided to your customers.

News Releases: These templates have sample information we recommend you include in a news release. If you need help contacting the media, contact your regional office.

- **Announcing Nitrate Advisory** (331-259-3): Notifies your customers of a nitrate advisory.

- **Rescinding Nitrate Advisory** (331-259-4): Notifies your customers the nitrate advisory is over.

For more information

Contact our regional office:

Eastern Region: Spokane Valley (509) 329-2100
Northwest Region: Kent (253) 395-6750
Southwest Region: Tumwater (360) 236-3030

PUBLIC HEALTH
ALWAYS WORKING FOR A SAFER AND
HEALTHIER WASHINGTON

People with disabilities can request this publication in other formats. To submit a request, call (800) 525-0127. For TTY or TDD, call (800) 833-6388. Office of Drinking Water publications are online at http://www.doh.wa.gov/ehp/dw

PRINT ON WATER SYSTEM LETTERHEAD

News Release

For immediate release: DATE

Contact: Water System Manager or Spokesperson XXX-XXX-XXXX

<WATER SYSTEM > Issues Drinking Water Warning to Customers

Olympia, WA – The **<WATER SYSTEM >** is alerting its customers that recent drinking water tests have shown concentrations of nitrate that are higher than state standards allow. Pregnant women and infants younger than age one should not drink tap water until further notice. The **<WATER SYSTEM >** will provide **<alternative source of drinking water>** for individuals who believe they are at risk. This drinking water is available at <LOCATION>.

Tap water from this system should not be used to make baby formula or juice. Boiling the water will not reduce the nitrate and, in fact, can make it more concentrated. Nitrate can only be removed from water by special treatment.

Nitrate is a chemical found in most fertilizers, manure, and liquid waste discharged from septic tanks. Drinking water with high levels of nitrate can cause a severe illness in infants, commonly known as "blue baby" syndrome. This illness occurs when nitrate reduces the ability of red blood cells to carry oxygen. Symptoms can develop quickly, usually within a few days.

After reaching about one year of age, infants develop systems in the body to handle the nitrate and they are no longer as much at risk. If an infant has bluish skin or lips and is short of breath, seek medical attention immediately.

"Protecting people's health is our highest priority. We are working closely with the **<WATER SYSTEM >** to identify treatment options or other improvements that can help restore the water to safe levels for the community," said Denise Clifford, director of the Office of Drinking Water.

In the meantime, people should use **<alternative source of drinking water>** to prepare baby food or formula, and infants and pregnant women should not drink tap water. People who know they have a blood enzyme deficiency that may make them susceptible to nitrate should also use an alternative source of drinking water. If in doubt, seek advice from a medical professional.

This health advisory will remain in effect until the **<WATER SYSTEM'S>** water quality is safe. For more information, please call **<WATER SYSTEM CONTACT PERSON>** at **(XXX) XXX-XXXX** or **(XXX) XXX-XXXX**>.

###

PRINT ON WATER SYSTEM LETTERHEAD

News Release

For immediate release: DATE

Contact: Water System Manager or Spokesperson XXX-XXX-XXXX

<WATER SYSTEM > Drinking water warning canceled

OLYMPIA — The <WATER SYSTEM> is advising its customers that its tap water is now safe to drink for all users, and can be used to make baby formula or juice. Recent test results confirm the level of nitrate in the water supply is safe for drinking water.

On <DATE>, the <WATER SYSTEM> advised its customers that pregnant women and infants should not drink the water due to high levels of nitrate, which can cause severe illness in babies.

<SYSTEM SPOKESPERSON QUOTE> (e.g., “It’s important to us to provide safe drinking water to our customers,” said <NAME OF WATER SYSTEM MANAGER>. “We’ve worked with the state Department of Health over the last (# of) days to complete water sampling, and the lab results are now in the safe range for nitrate. We’re pleased to be able to lift the nitrate advisory.”

If you have not used your water fixtures, fountains, ice machines, soda machines, or other equipment over the past several days, flush each one until there is a change in water temperature before putting it back into service.

The <SYSTEM NAME> encourages customers with questions to call <TELEPHONE NUMBER>.

###

Warning to Drinking Water Customers

Your tap water is contaminated with nitrate. Do not give it to infants under 12 months old or other susceptible individuals. Do not use it to make formula or juice for infants.

What's the problem?

The _____________________________ Water System, ID #________________, in _________________ County, received drinking water sample results on _____________ showing nitrate levels of_________mg/L. This level is above the 10 mg/L nitrate standard, or Maximum Contaminant Level (MCL), allowed by the State Board of Health Rules and Regulations.

Nitrate in drinking water can come from natural, industrial, or agricultural sources (including septic systems and run-off). Levels of nitrate in drinking water can vary throughout the year. Most household water filtration systems will not remove nitrate.

The main risk is to infants below the age of 12 months, who could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and "blue baby syndrome," indicated by blueness of the skin. Symptoms in infants can develop rapidly, with health deteriorating over a period of days. Other susceptible individuals include pregnant women and people with certain blood disorders. These individuals may wish to consult their doctor regarding risk of consuming high-nitrate water. Susceptible individuals should use an alternative source of drinking water until further notice.

Do's and Don'ts

- Adults (except pregnant women) and children older than 12 months can drink the tap water. Nitrate is a problem for infants less than 12 months old because they can't process nitrate as well as adults can.
- Share this information with others who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or delivering copies by hand.
- People with certain rare blood enzyme disorders which affect their ability to convert methemoglobin to hemoglobin (glucose-6-phosphate dehydrogenase (G6PD) or cytochrome b5 reductase deficiencies) should use another source of water until further notice.

- Don't give the water to infants under 12 months old.
- Don't use the water to make formula or juice for infants under 12 months old.
- If an infant shows signs of "blue baby syndrome" (bluish skin, shortness of breath) **get medical attention immediately.**
- If you are pregnant or think you may be, use another source of water until further notice.
- **Don't try to make the water okay by boiling it.** Boiling, freezing, filtering, or letting water stand does not reduce nitrate levels. Excessive boiling can even make the nitrate more concentrated, because it stays behind as water evaporates.

What's being done?

Your water system is taking these corrective actions:

For more information, contact _______________________ at ________________

This notice was sent to you by ______________________________________Water System on _______________

Instructions to water systems for notifying customers about nitrate violations

1. You must tell your customers about a nitrate violation **within 24 hours** of being notified that a nitrate MCL violation has occurred. Use the "Warning to Drinking Water Customers" on the other side of this notice as your basic template for public notification.

2. Call the Department of Health (DOH) within 24 hours of receiving a laboratory result that shows a nitrate MCL exceedance has occurred. If you have been notified of a nitrate MCL exceedance and have not yet consulted with DOH, do so immediately.

3. DOH will help you decide how best to distribute this notice to all of your customers. Call your DOH Regional Office (see information below) and fill out all sections of this notice. Copy the other side and deliver the notice to your customers by the method indicated by DOH.

4. You must provide an alternative source of drinking water to customers who request it. The water must be from an approved public water supply or source and be distributed at a convenient location. Examples: A filling station for containers provided by the customer, bottled water, or coupons to purchase bottled water from a local merchant. One-and-a-half (1.5) gallons of water per person per day should be provided for drinking only. Your regional office can help you with technical questions related to providing an alternative source of drinking water for your customers.

5. You should let your customers know what they need to do if they wish to receive an alternative source of drinking water. Use the space provided under the heading "What's Being Done?" to give details related to how and where you are providing an alternative source of drinking water. An example would be "Contact John Doe at (555) 555-5555 if you would like an alternative source of water until sample results are below the MCL."

6. In your notice, under the heading "What's Being Done?", also describe corrective actions you are taking. The following sentence gives an example of one action commonly taken by water systems that have nitrate violations. Use this sentence if it is true for your situation, or develop your own language.

   "We are investigating water treatment options, such as drilling a new well, mixing the water with low-nitrate water from another source, or buying water from another water system."

7. Within 10 days of delivering this notice to your customers, send a copy of each type of notice that you distributed (hand-delivered form, newspaper article, etc.) and a signed **"Public Notice Certification Nitrate MCL Violation"** form (#331-248) to your appropriate DOH Regional Office. **This documentation is a mandatory requirement and must be completed.**

<u>DOH REGIONAL OFFICE INFORMATION</u>

Eastern Regional Office: 16201 E Indiana Ave, Suite 1500, Spokane Valley WA 99216; Main Office (509) 329-2100.
Jurisdiction: *Adams, Asotin, Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Garfield, Grant, Kittitas, Klickitat, Lincoln, Okanogan, Pend Oreille, Spokane, Stevens, Whitman, Walla Walla and Yakima Counties.*

Northwest Regional Office: 20435 72nd Ave S., Suite 200, Kent WA 98032; Main Office (253) 395-6750.
Jurisdiction: *Island, King, Pierce, San Juan, Skagit, Snohomish and Whatcom Counties.*

Southwest Regional Office: 243 Israel Road SE, Tumwater, PO Box 47823, Olympia WA 98504; Main Office (360) 236-3030.
Jurisdiction: *Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Kitsap, Lewis, Mason, Pacific, Skamania, Thurston, and Wahkiakum Counties.*

Advertencia a los clientes de agua potable

El agua de la llave que usted toma está contaminada con Nitrato. No dé el agua a los bebés menores de 12 meses de edad ni a otras personas vulnerables. No la utilice para preparar fórmula (biberón) ni jugo para los bebes menores de 12 meses.

¿Qué es el problema?

El sistema de agua de ______________________________, con número de identificación_______________, en el Condado de _________________, recibió los resultados de la prueba de agua potable el _____________ que muestran niveles de nitrato de _________mg/L. Este nivel está por encima del Nivel Máximo de Contaminación de 10 mg/L de nitrato o (MCL), que permite el Consejo Estatal de Reglas y Normas de Salud (State Board of Health Rules and Regulations).

El nitrato en el agua potable puede provenir de fuentes naturales, industriales o agrícolas (incluyendo sistemas sépticos y escurrimiento). Los niveles de nitrato en el agua potable pueden variar a lo largo del año. La mayoría de los sistemas de filtración de agua para el hogar no removerán el nitrato.

El riesgo principal es para los bebés menores de 12 meses de edad, quienes podrían enfermarse gravemente y, si no se los trata, podrían morir. Los síntomas incluyen la dificultad de respirar y el "síndrome del bebé azul", evidente por un color azul en la piel. Los síntomas en los bebés pueden desarrollarse rápidamente, con el deterioro de la salud durante un período de días. Las mujeres embarazadas también tienen riego y a las personas con ciertos trastornos en la sangre. Es recomendable consultar a su doctor con respecto al riesgo de consumir agua con un nivel alto de nitrato. Los individuos susceptibles deben utilizar una fuente alternativa de agua potable hasta nuevo aviso.

Cosas que se deben y no se deben hacer

- Los adultos (excepto las mujeres embarazadas) y los niños mayores de 12 meses de edad pueden beber el agua. El nitrato es un problema para los bebés con menos de 12 meses de edad, debido a que ellos no pueden procesar el nitrato igual que los adultos.
- Comparta esta información con otros que beben el agua, especialmente con aquellos que no han podido recibir este aviso directamente (por ejemplo, las personas que viven en apartamentos, hospicios para ancianos, escuelas y negocios). Puede hacerlo colocando este aviso en un lugar público o entregando copias en persona.
- Las personas con ciertos trastornos raros de enzimas en la sangre que afecta su capacidad de convertir la metahemoglobina en hemoglobina (deficiencias de glucosa-6-fosfato dehidrogenasa (G6PD) o citocromo b5 reductasa deben usar otra fuente de agua hasta nuevo aviso.
- No dé el agua a los bebés menores de 12 meses de edad.
- No use el agua para preparar fórmula (biberón) ni jugo para los niños menores a 12 meses de edad.
- Si algún niño muestra signos de "síndrome de bebé azul" (piel azulada, dificultad de respirar) **obtenga atención médica inmediatamente**.
- Si está embarazada o cree que lo está, use otra fuente de agua hasta nuevo aviso.
- No trate de mejorar **el agua haciéndola hervir**. Hirviendo, congelando, filtrando, o dejando a reposar el agua no reduce los niveles de nitrato. Hervir el agua excesivamente puede hacer incluso que el nitrato sea más concentrado a medida que el agua se evapora.

¿Qué se está haciendo?

Su sistema de agua está tomando las siguientes acciones correctivas:

Para obtener mas información, llame a ____________________________ al número ________________

Este aviso le fue enviado por el Sistema de Agua _____________________________________Fecha _______________

Instructions to water systems for notifying customers about nitrate violations

1. You must tell your customers about a nitrate violation **within 24 hours** of being notified that a nitrate MCL violation has occurred. Use the "Warning to Drinking Water Customers" on the other side of this notice as your basic template for public notification.

2. Call the Department of Health (DOH) within 24 hours of receiving a laboratory result that shows a nitrate MCL exceedance has occurred. If you have been notified of a nitrate MCL exceedance and have not yet consulted with DOH, do so immediately.

3. DOH will help you decide how best to distribute this notice to all of your customers. Call your DOH Regional Office (see information below) and fill out all sections of this notice. Copy the other side and deliver the notice to your customers by the method indicated by DOH.

4. You must provide an alternative source of drinking water to customers who request it. The water must be from an approved public water supply or source and be distributed at a convenient location. Examples: A filling station for containers provided by the customer, bottled water, or coupons to purchase bottled water from a local merchant. One-and-a-half (1.5) gallons of water per person per day should be provided for drinking only. Your regional office can help you with technical questions related to providing an alternative source of drinking water for your customers.

5. You should let your customers know what they need to do if they wish to receive an alternative source of drinking water. Use the space provided under the heading "What's Being Done?" to give details related to how and where you are providing an alternative source of drinking water. An example would be "Contact John Doe at (555) 555-5555 if you would like an alternative source of water until sample results are below the MCL."

6. In your notice, under the heading "What's Being Done?", also describe corrective actions you are taking. The following sentence gives an example of one action commonly taken by water systems that have nitrate violations. Use this sentence if it is true for your situation, or develop your own language.

   "We are investigating water treatment options, such as drilling a new well, mixing the water with low-nitrate water from another source, or buying water from another water system."

7. Within 10 days of delivering this notice to your customers, send a copy of each type of notice that you distributed (hand-delivered form, newspaper article, etc.) and a signed **"Public Notice Certification Nitrate MCL Violation"** form (#331-248) to your appropriate DOH Regional Office. **This documentation is a mandatory requirement and must be completed.**

DOH REGIONAL OFFICE INFORMATION

Eastern Regional Office: 16201 E. Indiana Ave., Suite 1500, Spokane Valley, WA 99216; Main Office (509) 329-2100.
Jurisdiction: *Adams, Asotin, Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Garfield, Grant, Kittitas, Klickitat, Lincoln, Okanogan, Pend Oreille, Spokane, Stevens, Whitman, Walla Walla and Yakima Counties.*

Northwest Regional Office: 20435 72nd Ave S., Suite 200, Kent WA 98032; Main Office (253) 395-6750.
Jurisdiction: *Island, King, Pierce, San Juan, Skagit, Snohomish and Whatcom Counties.*

Southwest Regional Office: 243 Israel Road SE, Tumwater, PO Box 47823, Olympia WA 98504; Main Office (360) 236-3030.
Jurisdiction: *Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Kitsap, Lewis, Mason, Pacific, Skamania, Thurston, and Wahkiakum Counties.*

PUBLIC NOTICE
CERTIFICATION FORM
NITRATE MCL VIOLATION

Within 10 days of notifying your customers, you are required to send this completed form and a copy of each type of notice you distributed (hand-delivered notices, press releases, newspaper articles, etc.) to the appropriate Office of Drinking Water Regional Office (see address below). This form certifies that you have met all public notification requirements. If chemical contamination remains for more than three months, you must notify your water users again and provide another Public Notice Certification Form to the Department of Health.

With this certification, you are also stating that you will meet future requirements for notifying new billing units of the violation or situation.

Water System: ____ID #: __________County:_______________

Violation Date:_____ / _____ / _____ Violation Type:____

This public water system certifies that public notice has been given to water users following state and federal requirements for delivery, content, and deadlines.

Complete the following items:

Yes No

☐ ☐ Distribution was completed on ___ / ___ /____. Check all that apply:
- ☐ Hand delivery,
- ☐ Press release (TV, radio, newspaper, etc.),
- ☐ Posting at__________________________ (by DOH approval only),
- ☐ Other _____________________________ (by DOH approval only).

☐ ☐ Were the water users notified within 24 hours?

____ ____________________ _____________________
Signature of owner or operator Position Date

Northwest Regional Office:
20425 72nd Ave. S., Suite 310,
Kent WA 98032
Main Office: 253-395-6750
Fax: 253-395-6760

<u>Area of Coverage:</u> Island, King, Pierce, San Juan, Skagit, Snohomish, and Whatcom Counties

Southwest Regional Office:
243 Israel Road SE, Tumwater
PO Box 47823, Olympia WA 98504
Main Office: 360-236-3030
Fax: 360-664-8058

<u>Area of Coverage:</u> Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Kitsap, Lewis, Mason, Pacific, Skamania, Thurston, and Wahkiakum Counties.

Eastern Regional Office:
16201 East Indiana Ave., Suite 1500,
Spokane Valley WA 99216
Main Office: 509-329-2100
Fax: 509-329-2104

<u>Area of Coverage:</u> Adams, Asotin, Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Garfield, Grant, Kittitas, Klickitat, Lincoln, Okanogan, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman, and Yakima Counties.

For people with disabilities, this document is available on request in other formats. To submit a request, please call 1-800-525-0127 (TDD/TTY call 711).

Warning

to Drinking Water Customers

Your tap water is contaminated with nitrate. Do not give it to infants under 12-months-old or use it to make formula or juice for infants.

Nitrate samples collected on ________________ show nitrate levels that exceed the State Board of Health Standard of 10 milligrams per liter (mg/L).

The main health risk is to infants below the age of 12 months, who could become seriously ill and, if untreated, may die. The main symptoms are shortness of breath or blueness of the skin. These symptoms can develop rapidly. Other susceptible individuals include pregnant women and people with certain blood disorders. These individuals should use an alternative source of drinking water until further notice.

To Avoid Possible Illness:

- **DO NOT** give tap water to infants under 12 months of age or use it to make formula or juice.
- **DO NOT** try to treat the water by boiling it. Nitrate stays in water after boiling.
- **If an infant shows signs of "blue baby syndrome" (bluish skin, difficulty breathing) get medical attention immediately.**
- If you are, or think you may be susceptible to nitrate, consult your doctor or use an alternative source of drinking water.
- Please share this information with others who drink this water and may not have received this notice directly (people in apartments, nursing homes, schools, businesses, etc.)

This advisory will remain in effect until additional samples show nitrate at acceptable levels. We will notify you when this happens. For more information on nitrate in drinking water, and what is being done regarding this incident, please contact us.

Water System ____________________________

ID#_____________County_________________

Contact _________________________________

Phone __________________________________

Date notice distributed ____________________

Vea al reverso para la versión en Español.

Warning

to Drinking Water Customers

Your tap water is contaminated with nitrate. Do not give it to infants under 12-months-old or use it to make formula or juice for infants.

Nitrate samples collected on ________________ show nitrate levels that exceed the State Board of Health Standard of 10 milligrams per liter (mg/L).

The main health risk is to infants below the age of 12 months, who could become seriously ill and, if untreated, may die. The main symptoms are shortness of breath or blueness of the skin. These symptoms can develop rapidly. Other susceptible individuals include pregnant women and people with certain blood disorders. These individuals should use an alternative source of drinking water until further notice.

To Avoid Possible Illness:

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- **DO NOT** try to treat the water by boiling it. Nitrate stays in water after boiling.
- **If an infant shows signs of "blue baby syndrome" (bluish skin, difficulty breathing) get medical attention immediately.**
- If you are, or think you may be susceptible to nitrate, consult your doctor or use an alternative source of drinking water.
- Please share this information with others who drink this water and may not have received this notice directly (people in apartments, nursing homes, schools, businesses, etc.)

This advisory will remain in effect until additional samples show nitrate at acceptable levels. We will notify you when this happens. For more information on nitrate in drinking water, and what is being done regarding this incident, please contact us.

Water System ___________________________

ID# ____________ County ________________

Contact ________________________________

Phone __________________________________

Date notice distributed____________________

Vea al reverso para la versión en Español.

Advertencia

Para Usuarios De Agua Potable

El agua del grifo está contaminada con nitrato. No se la dé a bebés menores de 12 meses ni la utilice para preparar fórmula o jugo para bebés.

Las muestras de nitrato tomadas el _____________ indican niveles de nitrato que superan la norma de 10 miligramos por litro (mg/L) establecida por el Consejo de Salubridad del Estado.

El riesgo más importante lo corren los bebés menores de 12 meses, quienes podrían enfermarse de gravedad e incluso morir si no reciben tratamiento. Los síntomas principales son la falta de aliento o la piel azulada. Estos síntomas pueden presentarse con rapidez. También corren riesgo las mujeres embarazadas y las personas con ciertos trastornos de la sangre. Estos individuos deben usar una fuente alternativa de agua potable hasta que se indique lo contrario.

Para Evitar Una Posible Enfermedad:

- **NO** dé agua del grifo a los bebés menores de 12 meses, ni la utilice para preparar fórmula infantil o jugo.
- **NO** trate de purificar el agua hirviéndola. El hervir agua no elimina los nitrato.
- **Si un bebé presenta síntomas del "síndrome del bebé azul" (piel azulada, dificultad para respirar) busque atención médica inmediatamente.**
- Si usted es susceptible al nitrato o piensa que lo podría ser, consulte con su médico o utilice otra fuente de agua potable.
- Comparta esta información con otras personas que toman esta agua y que tal vez no hayan recibido este aviso directamente (residentes de apartamentos, hogares de ancianos, escuelas, negocios, etc.)

Esta advertencia permanecerá en vigor hasta que se tomen muestras adicionales que indiquen que el nivel de nitrato es aceptable. Le informaremos cuando esto suceda. Para información adicional acerca de los nitrato en el agua potable y lo que se está haciendo con respecto a este incidente, póngase en contacto con nosotros.

Sistema de agua____________________________

No. de ID _________ Condado ______________

Contacto __________________________________

Teléfono __________________________________

Fecha de distribución del aviso _______________

See reverse side for English version.

Advertencia

Para Usuarios De Agua Potable

El agua del grifo está contaminada con nitrato. No se la dé a bebés menores de 12 meses ni la utilice para preparar fórmula o jugo para bebés.

Las muestras de nitrato tomadas el _____________ indican niveles de nitrato que superan la norma de 10 miligramos por litro (mg/L) establecida por el Consejo de Salubridad del Estado.

El riesgo más importante lo corren los bebés menores de 12 meses, quienes podrían enfermarse de gravedad e incluso morir si no reciben tratamiento. Los síntomas principales son la falta de aliento o la piel azulada. Estos síntomas pueden presentarse con rapidez. También corren riesgo las mujeres embarazadas y las personas con ciertos trastornos de la sangre. Estos individuos deben usar una fuente alternativa de agua potable hasta que se indique lo contrario.

Para Evitar Una Posible Enfermedad:

- **NO** dé agua del grifo a los bebés menores de 12 meses, ni la utilice para preparar fórmula infantil o jugo.
- **NO** trate de purificar el agua hirviéndola. El hervir agua no elimina los nitrato.
- **Si un bebé presenta síntomas del "síndrome del bebé azul" (piel azulada, dificultad para respirar) busque atención médica inmediatamente.**
- Si usted es susceptible al nitrato o piensa que lo podría ser, consulte con su médico o utilice otra fuente de agua potable.
- Comparta esta información con otras personas que toman esta agua y que tal vez no hayan recibido este aviso directamente (residentes de apartamentos, hogares de ancianos, escuelas, negocios, etc.)

Esta advertencia permanecerá en vigor hasta que se tomen muestras adicionales que indiquen que el nivel de nitrato es aceptable. Le informaremos cuando esto suceda. Para información adicional acerca de los nitrato en el agua potable y lo que se está haciendo con respecto a este incidente, póngase en contacto con nosotros.

Sistema de agua____________________________

No. de ID__________ Condado ______________

Contacto __________________________________

Teléfono __________________________________

Fecha de distribución del aviso________________

See reverse side for English version.

DO NOT DRINK

Water Contaminated with Nitrate

- Unsafe for Pregnant Women and Infants -

- Do not use for drinking if you are pregnant.
- Do not use to mix/dilute baby formula.

For more information, ________________________

____

Si usted esta embarazada, no beba el agua.

No use el agua para preparar la fórmula para bebés (biberón).

APPENDIX L

COLIFORM MONITORING PLAN

CITY OF OAK HARBOR

COLIFORM MONITORING PLAN

CITY OF OAK HARBOR
WATER DIVISION
865 SE BARRINGTON DRIVE
OAK HARBOR, WA 98277

CITY OF OAK HARBOR

COLIFORM MONITORING PLAN

TABLE OF CONTENTS

COLIFORM MONITORING PLAN

<table>
<tr><td colspan="2">WATER SYSTEM NAME
City of Oak Harbor</td><td colspan="2">COUNTY
Island</td><td colspan="2">SYSTEM I.D. NUMBER
62650C</td></tr>
<tr><td>WATER SOURCES</td><td>S01
Anacortes
(purchased)</td><td>S11
Well #8</td><td colspan="2">S12
Well #9</td><td>S14
Well #11</td></tr>
<tr><td colspan="6">STORAGE
3 reservoirs totaling 3,125,000 gallons</td></tr>
<tr><td colspan="6">INTERTIES
3 interties with the U.S. Navy</td></tr>
<tr><td colspan="6">PRESSURE ZONES & STATIONS
3 pressure zones are influenced by 2 booster pump stations and 5 PRV stations</td></tr>
<tr><td colspan="2">MAINLAND PRESSURE ZONE
4,475 connections</td><td>WESTSIDE PRESSURE ZONE
323 connections</td><td colspan="2">REDWING PRESSURE ZONE
162 connections</td><td>DOWNTOWN PRESSURE ZONE
895 connections</td></tr>
<tr><td>POPULATION SERVED
18,880</td><td colspan="5">TREATMENT
Fluoride is injected at the mainland booster pump station and at the 3 well sites.
Chlorine is injected at the 3 well sites.</td></tr>
</table>

Sampling Information

The City of Oak Harbor is required to take 20 routine samples monthly. The following indicates the routine and repeat sample locations.			
MAINLAND PRESSURE ZONE			
SAMPLE NUMBER **	***ROUTINE SAMPLE SITE***	***REPEAT UPSTREAM***	***REPEAT DOWNSTREAM***
3	2485 SW Talon Loop	2419 SW Talon Loop	2525 SW Talon Loop
4	3290 SW Balda Road	3186 SW Scenic Heights	3367 SW Balda Road
5	1756 SW 17th Avenue	1710 SW 17th Avenue	1772 SW 17th Avenue
6	881 SW Quinault St.	805 SW Quinault St.	911 SW Quinault St.
8	901 NW Prow Street	929 NW Prow Street	865 NW Prow Street
9	624 NW Hyak Drive	640 NW Hyak Drive	613 NW Hyak Drive
10	2866 N Oak Harbor Rd	2858 N Oak Harbor Rd	2930 N Oak Harbor Rd
11	642 NE Harvest Drive	660 NE Harvest Drive	525 NE Harvest Drive
12	751 NW 1st Aveneue	747 NW 1st Avenue	775 NW 1st Avenue
13	984 SW 6th Ave.	900 SW 6th Ave.	1041 SW 6th Ave.
14	701 SW Barrington Dr	697 SW Barrington Dr	735 SW Barrington Dr
18	220 NE Nunan Lp #1	250 NE Nunan Loop #1	180 NE Nunan Lp #1
19	1166 NE Taftson Street	1188 NE Taftson Street	1224 NE Taftson Street
20	33860 SR 20	33650 SR 20	34100 SR 20
WESTSIDE PRESSURE ZONE			
SAMPLE NUMBER **	***ROUTINE SAMPLE SITE***	***REPEAT UPSTREAM***	***REPEAT DOWNSTREAM***
7	2090 SW Putnam Dr.	2080 SW Putnam Dr.	2095 SW Putnam Dr.
DOWNTOWN PRESSURE ZONE			
SAMPLE NUMBER **	***ROUTINE SAMPLE SITE***	***REPEAT UPSTREAM***	***REPEAT DOWNSTREAM***
1	931 SE Jensen St.	901 SE Jensen St.	961 SE Jensen St.
2	1974 SW Dillard Lane	1950 SW Dillard Lane	2000 SW Dillard Lane
15	231 SW 8th Avenue	255 SW 8th Avenue	167 SW 8th Avenue
16	372 SE Fisher Court	330 SE Fisher Court	398 SE Fisher Court
17	950 SE Regatta Drive	849 SE Regatta Drive	1085 SE Regatta Drive

** - Number corresponds with map.

PLAN PREPERATION INFORMATION

Prepared by: Rich Tyhuis, Water Distribution Manager III (cert. #1726)
Operations Manager, Water Division
Day time phone number: (360) 240-4753
Prepared on: April 10, 2013
Last review: April

PLAN MAINTENANCE

- The Water Operations Manager, or his or her designee, shall maintain the plan.
- The Water Operations Manager, or his or her designee, shall approve any changes to the Coliform Monitoring Plan with a memo indicating the plan changes, reason for the change, and date of the change.
- All change documentation will be attached to the plan, and will include the revision date.
- The master copy of the Coliform Monitoring Plan shall be located in the front office of the City of Oak Harbor Public Works Facility.
    - Copy with the Operations Manager of the Water Division.
    - Copy with the Water Operations crew who perform the required sampling.

February 2013

DOH 331-447
Updated

Groundwater Rule

Group A Public Water Supplies – Chapter 246-290 WAC

The Groundwater Rule (GWR) builds on the Total Coliform Rule (TCR) by addressing the health risks of fecal contamination in groundwater sources used by a public water system.

Who is affected?

The GWR applies to all Group A public water systems that:

- Rely entirely on one or more groundwater sources.
- Receive finished groundwater from another public water system.
- Mix surface water sources (or groundwater under the direct influence of surface water) with groundwater. *Systems that combine all of their surface water and groundwater sources before treatment are exempt from the GWR.*

How does the rule affect them?

The basic requirements of the Groundwater Rule include source water monitoring (triggered and assessment), compliance monitoring, sanitary surveys, corrective actions, and public notification.

Source Water Monitoring

Triggered Source Water Monitoring is required when one of your system's routine distribution samples collected under the TCR is total coliform positive. Within 24 hours of notification of the total coliform positive result, you must collect triggered source samples and have them tested for *E. coli*. You must test each source (prior to treatment) that was in operation when you collected the routine sample.

If one of your triggered source samples is *E. coli*-positive, we will direct you to either take corrective action or take five additional source samples within 24 hours. If any of the five additional source samples is *E. coli*-positive, you must take corrective actions described on pages 3 and 4.

If you have more than one groundwater source, you may be able to reduce the number of source samples you must collect by submitting a **triggered source water monitoring plan.**

TIP: Your Coliform Monitoring Plan should have most of the information you need to submit a triggered source water monitoring plan.

Your triggered source monitoring plan should be in your coliform monitoring plan (CMP). The CMP must include a system map that clearly identifies each source, routine coliform monitoring location, and any distribution system features that help to identify the source associated with each sample location (such as pressure zones and isolation valves). The Department of Health must approve this plan.

Assessment Source Water Monitoring may be required on a case-by-case basis to evaluate sources that may be at risk for fecal contamination. This usually requires you to collect one source sample per month and have it tested for *E. coli*. We will work with you to determine how long you should sample and if any further action is required based on your results.

Other Source Monitoring Details

Small Systems: If your system serves 1,000 people or fewer and you have to collect a triggered source water sample, you can use this sample as both a triggered source water sample AND a repeat sample to meet the requirements of the Total Coliform Rule. In this case, an *E. coli*-positive source water sample would result in an acute coliform MCL violation under the Total Coliform Rule.

Consecutive and Wholesale Systems: Consecutive systems (systems that purchase water) that receive total coliform positive sample results from a routine distribution sample must notify their wholesaler (the system selling the water) within 24 hours.

The wholesale system is required to sample all of their sources that were in operation on the date the consecutive system's positive routine sample was collected. There may be exceptions to this monitoring, so we encourage wholesale systems to contact us as soon as they get notice from a consecutive system.

Sample Location and Size: You must collect all source water samples at the source prior to treatment. If you are unable to meet these conditions, contact us to request an alternative sample location. All *E. coli* samples must be at least 100 milliliters (mL) and analyzed by an accredited laboratory using EPA-approved methods.

Compliance Monitoring

Compliance monitoring confirms the effectiveness and reliability of your system's treatment. If you provide 4-log treatment of viruses AND perform compliance monitoring, you won't have to meet the triggered source water monitoring requirements. The Department of Health must approve your 4-log treatment system.

For chemical disinfection, you must monitor the residual concentration daily before the first customer during peak flow, and continuously monitor if you serve more than 3,300 people. Your tests must confirm you are providing a chlorine residual high enough to maintain 4-log treatment. The Department of Health must approve membrane and alternative treatment technologies, and you must follow our specifications for operations and maintenance.

4-log Treatment

Systems that provide 4-log treatment of viruses can avoid taking triggered source water monitoring samples by conducting compliance monitoring. You must let us know that you intend to exercise this option.

You will be in violation if you fail to monitor, report, or provide adequate treatment. At a minimum, you must send public notification to your customers.

Systems providing 4-log treatment that is not the result of a corrective action or state mandate may choose to do triggered source water monitoring instead of compliance monitoring.

For more information on 4-log treatment or if you provide disinfection and are not sure if it meets 4-log inactivation, contact our regional office (see Page 5).

Sanitary Surveys and Corrective Actions

The GWR increases the required frequency of sanitary surveys for community water systems from once every 5 years to once every 3 years. A community water system may be allowed to stay on a 5-year schedule if it meets <u>one</u> of the following criteria:

1. Provides 4-log treatment of viruses for all groundwater sources.
2. Has no total coliform MCL violations, has no more than one total coliform monitoring violation since the last survey, and has no unresolved significant deficiencies in the current survey.

For information on sanitary surveys, visit us online at http://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/RegulationandCompliance/SanitarySurveys.aspx

The GWR requires you to take corrective action when you have a significant deficiency or when a source water sample is *E. coli*-positive. A significant deficiency is "a defect in the design, operation, or maintenance, or a failure or malfunction of the sources, treatment, storage, or distribution system that the Department of Health determines to be causing, or have the potential for causing, the introduction of contamination into the water delivered to consumers."

If left unaddressed, a significant deficiency could cause a health risk to your customers. These deficiencies can occur at any time, but are most often detected during a sanitary survey.

Corrective actions can involve one or more of the following:

- Correct all significant deficiencies.
- Provide an alternative source of water.
- Eliminate the source of contamination.
- Provide 4-log treatment.

Your sanitary survey report will identify any deficiencies you need to address. If the report doesn't identify specific actions needed to correct the problem, you must contact us within 30 days to determine corrective actions. Your system has 45 days either to complete corrective actions or to comply with a corrective action plan.

Public Notification

Several situations and violations in the Groundwater Rule require public notification. This table outlines these violations, the type of water system the violation applies to, and the type of notification required:

Issue	Notification Required	System Type
E. coli-positive groundwater source sample[1]	Tier 1 PN, CCR, Special Notification	Community and Noncommunity
Failure to take corrective action within 120 days of notification	Tier 2 PN, CCR, Special Notification	Community and Noncommunity
Failure to maintain at least 4-log treatment of viruses	Tier 2 PN, CCR	Community and Noncommunity
Failure to meet monitoring requirements	Tier 3 PN, CCR	Community and Noncommunity
Uncorrected significant deficiency[2]	Special Notice in CCR	Community
	Special Notice	Noncommunity
Unaddressed *E. coli*-positive groundwater source sample[3]	Special Notice in CCR	Community

1. Consecutive systems served by the groundwater source must also notify the public.
2. Systems must continue to notify the public annually until they correct the significant deficiency.
3. Community systems must put a notice in the CCR annually until they address the positive source water sample.

Systems that receive an *E. coli*-positive result in a source water sample must notify their customers within 24 hours of getting their results.

Wholesale systems that receive *E. coli*-positive results must notify all their customers and the consecutive systems that receive their water within 24 hours. The consecutive system must then notify all of their customers within 24 hours after receiving notification from the wholesale system.

It is important to contact us as soon as possible if you receive an *E. coli*-positive sample result. For more information on public notification requirements and resources, visit us online at http://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/DrinkingWaterEmergencies/PublicNotification.aspx

Resources

EPA developed several guidance documents and fact sheets to assist water systems with the requirements of the rule:

- Compliance Help—includes quick reference guides, fact sheets, and full guidance manuals: http://www.epa.gov/safewater/disinfection/gwr/compliancehelp.html
- Basic Information—includes several questions and answers: http://www.epa.gov/safewater/disinfection/gwr/basicinformation.html

The Office of Drinking developed the following publication to help you:

- Groundwater Rule: Source Water Sample Taps (DOH 331-436): http://www.doh.wa.gov/portals/1/Documents/pubs/331-436.pdf

For more information

Staff from our regional offices can provide technical assistance, especially with source water sampling and *E. coli*-positive results. Please contact them at:

Northwest Regional Office—Kent
Coliform Program: 253-395-6775 Main Office: 253-395-6750

Southwest Regional Office—Tumwater
Coliform Program: 360-236-3044 Main Office: 360-236-3030

Eastern Regional Office—Spokane Valley
Coliform Program: 509-329-2134 Main Office: 509-329-2100

PUBLIC HEALTH
ALWAYS WORKING FOR A SAFER AND
HEALTHIER WASHINGTON

If you need this publication in an alternate format, call 800-525-0127. For TTY/TDD, call 800-833-6388.

APPENDIX M

WATER QUALITY DATA

Washington State Department of Health

Division of Environmental Health
Office of Drinking Water
DOH 331-464

Updated July 2012

Stage 2 DBP Monitoring Plan - Surface Water (Routine Monitoring)

System Name City of Oak Harbor

PWSID# 62650C

Date 11/13/2012

Completed by Tim Shelley

Population 18880

Initial Stage 2 Sampling Period First sampling period following **October 1, 2012**

Number of Samples Required 4 Dual Sample Sets per Quarter

Stage 2 Compliance Monitoring Site ID		Projected Sampling Date (Date or week) - every 90 days			
		Period 1	Period 2	Period 3	Period 4
Highest TTHM	#11	2nd Wk Dec 2012	2nd Wk Mar 2013	2nd Wk Jun 2013	2nd wk Sep 2013
Highest HAA5	#10	2nd Wk Dec 2012	2nd Wk Mar 2013	2nd Wk Jun 2013	2nd wk Sep 2013
	#3	2nd Wk Dec 2012	2nd Wk Mar 2013	2nd Wk Jun 2013	2nd wk Sep 2013
	#12	2nd Wk Dec 2012	2nd Wk Mar 2013	2nd Wk Jun 2013	2nd wk Sep 2013

Determining Compliance for TTHM and HAA5

Our system is required to monitor quarterly. Each quarter we will calculate a locational running annual average (LRAA) for TTHM and HAA5 at each monitoring location. Compliance will be achieved if the TTHM and the HAA5 LRAA at each monitoring location for the four most recent quarters is less than or equal to 0.080 mg/L for TTHM and less than or equal to 0.060 mg/l for HAA5.

Disinfectant Monitoring

Chlorine residuals must be measured at the same time and place as routine or repeat coliform samples

MRDL for chlorine and chloramines = 4.0 mg/l as Cl_2

Determining Compliance for disinfectant residuals

Compliance is based on the running annual average (RAA) of 12 consecutive months

Daily residual measurements will / will not be included in the compliance calculations (circle one)

Attach a distribution map with sample locations

Comments

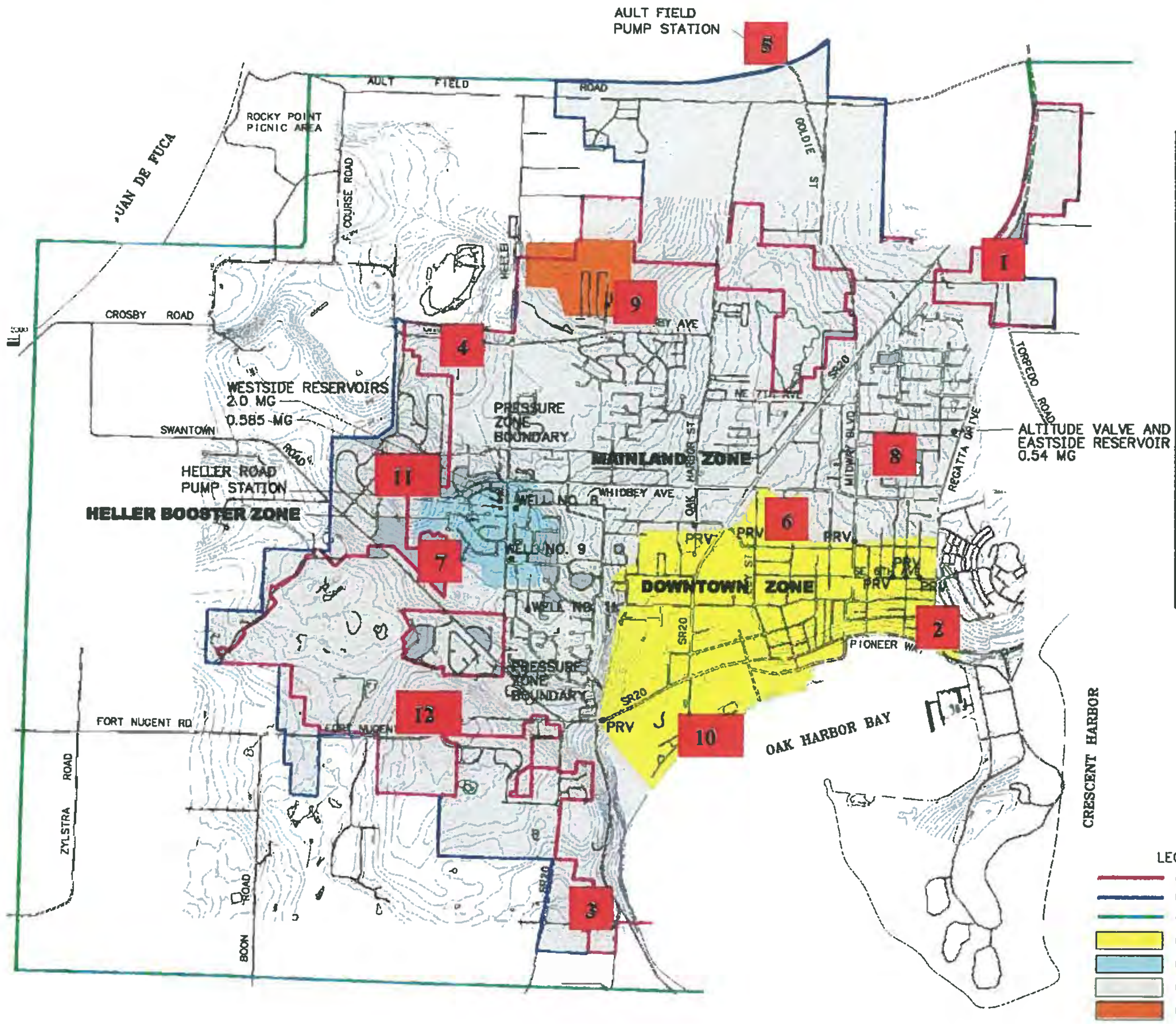
Send copy of completed form to:

☐Eastern Regional Drinking Water Office, 16201 E Indiana Ave, Suite 1500, Spokane Valley, WA 99216
Phone: (509) 329-2100 Fax (509) 329-2104

☐Northwest Regional Drinking Water Office, 20435 72nd Ave S, Suite 200, Kent, WA 98032
Phone: (253) 395-6750 Fax: (253) 395-6760

☐Southwest Regional Drinking Water Office, PO Box 47823, Olympia, WA 98504-7823
Phone: (360) 236-3030 Fax to (360) 664-8058

If you need this publication in an alternate format, call (800) 525-0127. For TTY/TDD call (800) 833-6388.



STAGE 1 SAMPLE LOCATIONS

1 - 33860 SR 20
2 - 950 SE REGATTA DR.
3 - 3335 SW GREINTJES LN.
4 - 947 NW QUARTERDECK LP.

STAGE 2 SAMPLE LOCATIONS

5 - 685 CHRISTIAN RD.
6 - 327 SE FISHER CT.
7 - 881 SW QUINAULT ST.
8 - 220 NE NUNAN LP.
9 – 1300 NW FALLS CREEK #2
10 – 1974 SW DILLARD LN.
11 - 2090 SW PUTNAM DR.
12 - 1756 SW 17TH AVE.

FIGURE 1.2A
CITY OF OAK HARBOR
MAJOR SYSTEM COMPONENTS
2003 WATER SYSTEM PLAN

EDGE ANALYTICAL LABORATORIES

Burlington WA
Corporate Office
1620 S Walnut St - 98233
800.755.9295 $ 360.757.1400

Bellingham WA
Microbiology
805 Orchard Dr Ste 4 - 98225
360.671.0688

Portland OR
Microbiology/Chemistry
9150 SW Pioneer Ct Ste W- 97070
503.682.7802

ACCREDITED IN ACCORDANCE WITH nelac
Florida Dept of Health Lab E871040

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Oak Harbor, City of
865 SE Barrington Drive
Oak Harbor, WA 98277

Reference Number: 11-10026
Project: IOC

System Name: OAK HARBOR, CITY OF
System ID Number: 62650
DOH Source Number: 11
Multiple Sources:
Sample Type: B - Before treatment
Sample Purpose: C - Compliance
Sample Location: Well #8 Sample Tap (raw)
County: Island

Sample Number: IOC
Lab Number: 046-21954
Collect Date: 6/30/11 12:30
Date Received: 6/30/11
Report Date: 7/12/11
Sampled By: Tim Shelly
Sampler Phone: 360-279-4763
Released by:

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	Analyzed	COMMENT
	EPA Regulated									
4	ARSENIC	**0.003**	mg/L	0.001	0.010	0.010	mvp	200.8	07/11/11	
5	BARIUM	**0.006**	mg/L	0.001	2	2	mvp	200.8	07/11/11	
6	CADMIUM	**ND**	mg/L	0.001	0.005	0.005	mvp	200.8	07/11/11	
7	CHROMIUM	**0.002**	mg/L	0.001	0.1	0.1	mvp	200.8	07/11/11	
11	MERCURY	**ND**	mg/L	0.0002	0.002	0.002	kdw	245.1	07/08/11	
12	SELENIUM	**ND**	mg/L	0.005	0.05	0.05	mvp	200.8	07/11/11	
110	BERYLLIUM	**ND**	mg/L	0.001	0.004	0.004	mvp	200.8	07/11/11	
111	NICKEL	**ND**	mg/L	0.005	0.1	0.1	mvp	200.8	07/11/11	
112	ANTIMONY	**ND**	mg/L	0.001	0.006	0.006	mvp	200.8	07/11/11	
113	THALLIUM	**ND**	mg/L	0.001	0.002	0.002	mvp	200.8	07/11/11	
116	CYANIDE, FREE	**ND**	mg/L	0.040	0.2	0.2	kdw	SM4500-CN F	07/11/11	
19	FLUORIDE	**0.78**	mg/L	0.20	2	4	mvp	300.0	06/30/11	
114	NITRITE-N	**ND**	mg/L	0.50	0.5	1	mvp	300.0	06/30/11 20:58	
20	NITRATE-N	**ND**	mg/L	0.50	5	10	mvp	300.0	06/30/11	
161	TOTAL NITRATE/NITRITE	**ND**	mg/L	0.50	5	10	mvp	300.0	06/30/11	
	EPA Regulated (Secondary)									
8	IRON	**0.27**	mg/L	0.100	0.3	0.3	bj	200.7	07/07/11	
10	MANGANESE	**0.004**	mg/L	0.001	0.05	0.05	mvp	200.8	07/11/11	
13	SILVER	**ND**	mg/L	0.010	0.05	0.05	mvp	200.8	07/11/11	
21	CHLORIDE	**3.5**	mg/L	20	250	250	mvp	300.0	06/30/11	
22	SULFATE	**5.8**	mg/L	10	250	250	mvp	300.0	06/30/11	
24	ZINC	**ND**	mg/L	0.005	5	5	mvp	200.8	07/11/11	
	State Regulated									
14	SODIUM	**3.46**	mg/L	5.0			bj	200.7	07/07/11	
15	HARDNESS as Calcium Carbonate	**35.8**	mg/L	10			bj	200.7	07/07/11	
16	ELECTRICAL CONDUCTIVITY	**88.1**	uS/cm	10	700	700	srf	SM2510 B	07/01/11	
17	TURBIDITY	**1.95**	NTU	0.10	1.0	1.0	kdw	180.1	06/30/11 16:40	
18	COLOR	**7**	Color Units	5	15	15	kdw	SM2120 B	06/30/11 17:00	pH:7
	State Unregulated									
9	LEAD	**ND**	mg/L	0.001		0.015	mvp	200.8	07/11/11	
23	COPPER	**ND**	mg/L	0.005		1.3	mvp	200.8	07/11/11	

NOTES:

SRL (State Reporting Level): Indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.
ND (Not Detected): Indicates that the parameter was not detected above the Specified Reporting Limit (SRL).
An * in front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

These test results meet all the requirements of NELAC, unless otherwise stated in writing, and relate only to these samples.
If you have any questions concerning this report contact us at the above phone number.

FORM: IOC_ST

EDGE ANALYTICAL LABORATORIES

Burlington WA
Corporate Office
1620 S Walnut St - 98233
800.755.9295 $ 360.757.1400

Bellingham WA
Microbiology
805 Orchard Dr Ste 4 - 98225
360.671.0688

Portland OR
Microbiology/Chemistry
9150 SW Pioneer Ct Ste W- 97070
503.682.7802

ACCREDITED IN ACCORDANCE WITH nelac
Florida Dept of Health Lab E871040

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Oak Harbor, City of
865 SE Barrington Drive
Oak Harbor, WA 98277

Reference Number: 11-10028
Project: IOC

System Name: OAK HARBOR, CITY OF
System ID Number: 62650
DOH Source Number: 12
Multiple Sources:
Sample Type: B - Before treatment
Sample Purpose: C - Compliance
Sample Location: Well #9 Sample Tap (raw)
County: Island

Sample Number: IOC
Lab Number: 046-21956
Collect Date: 6/30/11 10:40
Date Received: 6/30/11
Report Date: 7/12/11
Sampled By: Pete Heller
Sampler Phone: 360-279-4763
Released by: JA

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	Analyzed	COMMENT
	EPA Regulated									
4	ARSENIC	**0.005**	mg/L	0.001	0.010	0.010	mvp	200.8	07/07/11	
5	BARIUM	**0.026**	mg/L	0.001	2	2	mvp	200.8	07/07/11	
6	CADMIUM	**ND**	mg/L	0.001	0.005	0.005	mvp	200.8	07/07/11	
7	CHROMIUM	**0.006**	mg/L	0.001	0.1	0.1	mvp	200.8	07/07/11	
11	MERCURY	**ND**	mg/L	0.0002	0.002	0.002	kdw	245.1	07/08/11	
12	SELENIUM	**ND**	mg/L	0.005	0.05	0.05	mvp	200.8	07/07/11	
110	BERYLLIUM	**ND**	mg/L	0.001	0.004	0.004	mvp	200.8	07/07/11	
111	NICKEL	**ND**	mg/L	0.005	0.1	0.1	mvp	200.8	07/07/11	
112	ANTIMONY	**ND**	mg/L	0.001	0.006	0.006	mvp	200.8	07/07/11	
113	THALLIUM	**ND**	mg/L	0.001	0.002	0.002	mvp	200.8	07/07/11	
116	CYANIDE, FREE	**ND**	mg/L	0.040	0.2	0.2	kdw	SM4500-CN F	07/11/11	
19	FLUORIDE	**ND**	mg/L	0.20	2	4	mvp	300.0	06/30/11	
114	NITRITE-N	**ND**	mg/L	0.50	0.5	1	mvp	300.0	06/30/11 21:20	
20	NITRATE-N	**0.1**	mg/L	0.50	5	10	mvp	300.0	06/30/11	
161	TOTAL NITRATE/NITRITE	**0.1**	mg/L	0.50	5	10	mvp	300.0	06/30/11	
	EPA Regulated (Secondary)									
8	IRON	**0.15**	mg/L	0.100	0.3	0.3	bi	200.7	07/07/11	
10	MANGANESE	**0.012**	mg/L	0.001	0.05	0.05	mvp	200.8	07/07/11	
13	SILVER	**ND**	mg/L	0.010	0.05	0.05	mvp	200.8	07/07/11	
21	CHLORIDE	**41**	mg/L	20	250	250	mvp	300.0	06/30/11	
22	SULFATE	**10**	mg/L	10	250	250	mvp	300.0	06/30/11	
24	ZINC	**0.006**	mg/L	0.005	5	5	mvp	200.8	07/07/11	
	State Regulated									
14	SODIUM	**22.6**	mg/L	5.0			bi	200.7	07/07/11	
15	HARDNESS as Calcium Carbonate	**167.0**	mg/L	10			bi	200.7	07/07/11	
16	ELECTRICAL CONDUCTIVITY	**466**	uS/cm	10	700	700	srf	SM2510 B	07/01/11	
17	TURBIDITY	**0.96**	NTU	0.10	1.0	1.0	kdw	180.1	06/30/11 16:40	
18	COLOR	**ND**	Color Units	5	15	15	kdw	SM2120 B	06/30/11 17:00	pH:7
	State Unregulated									
9	LEAD	**ND**	mg/L	0.001		0.015	mvp	200.8	07/07/11	
23	COPPER	**0.009**	mg/L	0.005		1.3	mvp	200.8	07/07/11	

NOTES:
SRL (State Reporting Level): Indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.
ND (Not Detected): Indicates that the parameter was not detected above the Specified Reporting Limit (SRL).
An * in front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

These test results meet all the requirements of NELAC, unless otherwise stated in writing, and relate only to these samples.
If you have any questions concerning this report contact us at the above phone number.

FORM: IOC_ST

EDGE ANALYTICAL LABORATORIES

Burlington WA
Corporate Office
1620 S Walnut St - 98233
800.755.9295 $ 360.757.1400

Bellingham WA
Microbiology
805 Orchard Dr Ste 4 - 98225
360.671.0688

Portland OR
Microbiology/Chemistry
9150 SW Pioneer Ct Ste W- 97070
503.682.7802

ACCREDITED IN ACCORDANCE WITH nelac
Florida Dept of Health Lab E871040

INORGANIC COMPOUNDS (IOC) REPORT

Client Name:	Oak Harbor, City of 865 SE Barrington Drive Oak Harbor, WA 98277	Reference Number: Project:	11-10029 IOC
System Name:	OAK HARBOR, CITY OF	Sample Number:	IOC
System ID Number:	62650	Lab Number:	046-21957
DOH Source Number:	14	Collect Date:	6/30/11 10:20
Multiple Sources:		Date Received:	6/30/11
Sample Type:	B - Before treatment	Report Date:	7/12/11
Sample Purpose:	C - Compliance	Sampled By:	Pete Heller
Sample Location:	well #11 Sample Tap (raw)	Sampler Phone:	360-279-4763
County:	Island	Released by:	JH

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	Analyzed	COMMENT
	EPA Regulated									
4	ARSENIC	**0.007**	mg/L	0.001	0.010	0.010	mvp	200.8	07/07/11	
5	BARIUM	**0.041**	mg/L	0.001	2	2	mvp	200.8	07/07/11	
6	CADMIUM	**ND**	mg/L	0.001	0.005	0.005	mvp	200.8	07/07/11	
7	CHROMIUM	**0.009**	mg/L	0.001	0.1	0.1	mvp	200.8	07/07/11	
11	MERCURY	**ND**	mg/L	0.0002	0.002	0.002	kdw	245.1	07/08/11	
12	SELENIUM	**ND**	mg/L	0.005	0.05	0.05	mvp	200.8	07/07/11	
110	BERYLLIUM	**ND**	mg/L	0.001	0.004	0.004	mvp	200.8	07/07/11	
111	NICKEL	**ND**	mg/L	0.005	0.1	0.1	mvp	200.8	07/07/11	
112	ANTIMONY	**ND**	mg/L	0.001	0.006	0.006	mvp	200.8	07/07/11	
113	THALLIUM	**ND**	mg/L	0.001	0.002	0.002	mvp	200.8	07/07/11	
116	CYANIDE, FREE	**ND**	mg/L	0.040	0.2	0.2	kdw	SM4500-CN F	07/11/11	
19	FLUORIDE	**0.1**	mg/L	0.20	2	4	mvp	300.0	06/30/11	
114	NITRITE-N	**ND**	mg/L	0.50	0.5	1	mvp	300.0	06/30/11 21:42	
20	NITRATE-N	**0.55**	mg/L	0.50	5	10	mvp	300.0	06/30/11	
161	TOTAL NITRATE/NITRITE	**0.55**	mg/L	0.50	5	10	mvp	300.0	06/30/11	
	EPA Regulated (Secondary)									
8	IRON	**ND**	mg/L	0.100	0.3	0.3	bi	200.7	07/07/11	
10	MANGANESE	**0.052**	mg/L	0.001	0.05	0.05	mvp	200.8	07/07/11	
13	SILVER	**ND**	mg/L	0.010	0.05	0.05	mvp	200.8	07/07/11	
21	CHLORIDE	**59**	mg/L	20	250	250	mvp	300.0	06/30/11	
22	SULFATE	**34**	mg/L	10	250	250	mvp	300.0	06/30/11	
24	ZINC	**0.340**	mg/L	0.005	5	5	mvp	200.8	07/07/11	
	State Regulated									
14	SODIUM	**33.5**	mg/L	5.0			bi	200.7	07/07/11	
15	HARDNESS as Calcium Carbonate	**264.0**	mg/L	10			bi	200.7	07/07/11	
16	ELECTRICAL CONDUCTIVITY	**675**	uS/cm	10	700	700	srf	SM2510 B	07/01/11	
17	TURBIDITY	**ND**	NTU	0.10	1.0	1.0	kdw	180.1	06/30/11 16:40	
18	COLOR	**ND**	Color Units	5	15	15	kdw	SM2120 B	06/30/11 17:00	pH:7
	State Unregulated									
9	LEAD	**ND**	mg/L	0.001		0.015	mvp	200.8	07/07/11	
23	COPPER	**ND**	mg/L	0.005		1.3	mvp	200.8	07/07/11	

NOTES:

SRL (State Reporting Level): Indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.
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These test results meet all the requirements of NELAC, unless otherwise stated in writing, and relate only to these samples.

If you have any questions concerning this report contact us at the above phone number.

FORM: IOC_ST

Washington State Department of Health

Division of Environmental Health
Office of Drinking Water

View Sample Detail - WSID 62650C - OAK HARBOR, CITY OF

Collect Date	5/14/2013
Lab Number	119
Lab Name	Lab/Cor, Inc
Sample Number	19073
Source	01
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	ASB-ASBESTOS
Sample Location	710 nw dory dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0115	ASBESTOS	LT	1.4000	7.0000	MFL	1.4000

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View Sample Detail - WSID 62650C - OAK HARBOR, CITY OF

Collect Date	9/10/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	38489
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	3335 sw grientjes ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	2.7000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	5.2000		ug/L	1.0000
0416	HAA(5)	EQ	7.9000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

Records 1 - 7 of 7

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Collect Date	9/10/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	38492
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	1974 sw dillard ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	13.6000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.1000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	14.7000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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Collect Date	9/10/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	38489
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	3335 sw grientjes ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	14.7000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.2000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	15.9000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

Records 1 - 5 of 5

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Collect Date	9/10/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	38490
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	1756 sw 17th ave
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	2.4000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	6.4000		ug/L	1.0000
0416	HAA(5)	EQ	8.8000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

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Collect Date	9/10/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	38490
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	1756 sw 17th ave
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	16.4000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.3000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	17.7000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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View Sample Detail - WSID 62650C - OAK HARBOR, CITY OF	
Collect Date	9/10/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	38491
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	2090 sw putman dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	2.5000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	6.5000		ug/L	1.0000
0416	HAA(5)	EQ	9.0000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

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Collect Date	9/10/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	38491
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	2090 sw putman dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	16.0000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.2000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	17.2000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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Collect Date	9/10/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	38492
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	1974 sw dillard ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	2.6000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	5.3000		ug/L	1.0000
0416	HAA(5)	EQ	7.9000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

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Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22896
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	1756 sw 17th ave
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	3.5000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	9.3000		ug/L	1.0000
0416	HAA(5)	EQ	12.8000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

Records 1 - 7 of 7

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View Sample Detail - WSID 62650C - OAK HARBOR, CITY OF

Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22897
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	2090 sw putman dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	2.4000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	10.2000		ug/L	1.0000
0416	HAA(5)	EQ	12.6000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

Records 1 - 7 of 7

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View Sample Detail - WSID 62650C - OAK HARBOR, CITY OF

Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22894
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	3335 sw greintjes ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	4.6000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	9.5000		ug/L	1.0000
0416	HAA(5)	EQ	14.1000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

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View Sample Detail - WSID 62650C - OAK HARBOR, CITY OF

Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22895
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	1974 sw dillard ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	5.6000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	9.2000		ug/L	1.0000
0416	HAA(5)	EQ	14.8000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

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Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22896
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	1756 sw 17th ave
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	18.0000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.1000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	19.1000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22895
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	1974 sw dillard ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	17.6000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.0000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	18.6000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22894
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	3335 sw greintjes ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	18.3000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.0000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	19.3000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22897
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	2090 sw putman dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	22.4000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.5000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	23.9000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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Collect Date	3/14/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	10010
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	2090 sw putman dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	4.3000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	16.7000		ug/L	1.0000
0416	HAA(5)	EQ	21.0000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

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Collect Date	3/14/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	10011
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	1756 sw 17th ave
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	28.2000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.7000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	29.9000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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Collect Date	3/14/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	10010
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	2090 sw putman dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	32.8000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.8000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	34.6000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	10013
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	1974 sw dillard ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	25.5000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.6000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	27.1000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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Collect Date	3/14/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	10013
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	1974 sw dillard ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	11.3000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	16.0000		ug/L	1.0000
0416	HAA(5)	EQ	27.3000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

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Collect Date	3/14/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	10011
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	1756 sw 17th ave
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	7.7000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	15.2000		ug/L	1.0000
0416	HAA(5)	EQ	22.9000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

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Collect Date	3/14/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	10012
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	HAA5-HALO-ACETIC ACIDS
Sample Location	3335 sw greintjes ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0412	DICHLOROACETIC ACID	EQ	12.1000		ug/L	1.0000
0413	TRICHLOROACETIC ACID	EQ	16.4000		ug/L	1.0000
0416	HAA(5)	EQ	28.5000	60.0000	ug/L	15.0000
0411	MONOCHLOROACETIC ACID	LT	2.0000		ug/L	2.0000
0414	MONOBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0415	DIBROMOACETIC ACID	LT	1.0000		ug/L	1.0000
0417	BROMOCHLOROACETIC ACID	LT	1.0000		ug/L	1.0000

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Collect Date	3/14/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	10012
Source	Dist
Analyte Group	DBP-DISINFECTION BY PRODUCTS
Test Panel	THM-TOTAL TRIHALOMETHANE
Sample Location	3335 sw greintjes ln
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	EQ	26.2000		ug/L	0.2500
0028	BROMODICHLOROMETHANE	EQ	1.6000		ug/L	0.5000
0031	TOTAL TRIHALOMETHANE	EQ	27.8000	80.0000	ug/L	
0029	DIBROMOCHLOROMETHANE	LT	1.5000		ug/L	1.5000
0030	BROMOFORM	LT	0.6000		ug/L	0.6000

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Collect Date	7/25/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31444
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	224 sw lansdale
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.1770		mg/L	0.0200

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Collect Date	7/26/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31454
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1661 sw robertson dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0030		mg/L	0.0010
0023	COPPER	EQ	0.0850		mg/L	0.0200

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Collect Date	7/26/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31458
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1176 nw kitsap terr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.1930		mg/L	0.0200

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Collect Date	7/26/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31452
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	830 sw barrington dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0030		mg/L	0.0010
0023	COPPER	EQ	0.1760		mg/L	0.0200

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Collect Date	7/26/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31449
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1265 sw barrington dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0050		mg/L	0.0010
0023	COPPER	EQ	0.0650		mg/L	0.0200

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Collect Date	7/28/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31459
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1279 sw barrington dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.1980		mg/L	0.0200

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Collect Date	7/29/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31457
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	267 nw calista ct
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0030		mg/L	0.0010
0023	COPPER	EQ	0.2890		mg/L	0.0200

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View Sample Detail - WSID 62650C - OAK HARBOR, CITY OF

Collect Date	7/29/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31441
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	196 se ely st
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0023	COPPER	EQ	0.0600		mg/L	0.0200
0009	LEAD	LT	0.0010		mg/L	0.0010

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Collect Date	7/29/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31448
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1081 sw leschi dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.0680		mg/L	0.0200

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Collect Date	7/29/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31446
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	399 se fisher ct
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0030		mg/L	0.0010
0023	COPPER	EQ	0.0570		mg/L	0.0200

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Collect Date	7/29/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31450
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1326 sw looking glass lp
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0023	COPPER	EQ	0.0680		mg/L	0.0200
0009	LEAD	LT	0.0010		mg/L	0.0010

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Collect Date	7/29/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31447
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	599 nw columbia dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0023	COPPER	EQ	0.0890		mg/L	0.0200
0009	LEAD	LT	0.0010		mg/L	0.0010

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Collect Date	7/30/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31451
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	593 nw columbia dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0023	COPPER	EQ	0.0340		mg/L	0.0200
0009	LEAD	LT	0.0010		mg/L	0.0010

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Collect Date	7/30/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	31443
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1052 nw kitsap terr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0010		mg/L	0.0010
0023	COPPER	EQ	0.0560		mg/L	0.0200

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Collect Date	7/31/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	32123
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	372 se fisher ct
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.1060		mg/L	0.0200

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Collect Date	8/1/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	32554
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	538 nw 3rd ave
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0010		mg/L	0.0010
0023	COPPER	EQ	0.0250		mg/L	0.0200

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Collect Date	8/5/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	32556
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1282 nw lanyard lp 2
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.0550		mg/L	0.0200

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Collect Date	8/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	32557
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1961 ne 9th ave
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.0830		mg/L	0.0200

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Collect Date	8/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	33138
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1246 nw lanyard lp 2
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.0540		mg/L	0.0200

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Collect Date	8/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	32558
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	523 nw 3rd ave
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.1930		mg/L	0.0200

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Collect Date	8/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	32555
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1026 nw kitsap terrace
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0023	COPPER	EQ	0.1500		mg/L	0.0200
0009	LEAD	LT	0.0010		mg/L	0.0010

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Collect Date	8/8/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	33137
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1439 nw outrigger lp
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.0530		mg/L	0.0200

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Collect Date	8/12/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	33878
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	857 nw haslo
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0030		mg/L	0.0010
0023	COPPER	EQ	0.1040		mg/L	0.0200

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Collect Date	8/19/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	35149
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	551 nw 7th ave
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0030		mg/L	0.0010
0023	COPPER	EQ	0.0540		mg/L	0.0200

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Collect Date	8/22/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	35785
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	780 se barrington dr
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0020		mg/L	0.0010
0023	COPPER	EQ	0.1190		mg/L	0.0200

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Collect Date	8/23/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	36663
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1443 sw islander ln oh
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0023	COPPER	EQ	0.0800		mg/L	0.0200
0009	LEAD	LT	0.0010		mg/L	0.0010

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Collect Date	9/5/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	37922
Source	Dist
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	LCR-LEAD COPPER
Sample Location	1700 se 10th ave #201
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0009	LEAD	EQ	0.0030		mg/L	0.0010
0023	COPPER	EQ	0.0790		mg/L	0.0200

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Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22697
Source	12
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	NIT-NITRATE SUITE
Sample Location	well 9 s/t
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0020	NITRATE-N	LT	0.2000	10.0000	mg/L	0.2000

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Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22699
Source	14
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	NIT-NITRATE SUITE
Sample Location	well 11 s/t
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0020	NITRATE-N	EQ	0.5400	10.0000	mg/L	0.2000

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Collect Date	6/6/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	22698
Source	11
Analyte Group	IOC-INORGANIC CONTAMINANTS
Test Panel	NIT-NITRATE SUITE
Sample Location	well 8 s/t
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0020	NITRATE-N	EQ	0.2100	10.0000	mg/L	0.2000

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Collect Date	4/4/2013
Lab Number	046
Lab Name	Edge Analytical - Burlington
Sample Number	13300
Source	12
Analyte Group	VOC-VOLATILE ORGANIC CONTAMINANTS
Test Panel	VOC1-VOLATILE ORGANIC
Sample Location	well 9 s-12
Sample Type	Post-Treatment / Finished

Analyte DOH Num	Analyte Name	Result Range	Result Quantity	Maximum Contaminant Level	Units	State Reporting Limit
0027	CHLOROFORM	LT	0.5000		ug/L	0.5000
0028	BROMODICHLOROMETHANE	LT	0.5000		ug/L	0.5000
0029	DIBROMOCHLOROMETHANE	LT	0.5000		ug/L	0.5000
0030	BROMOFORM	LT	0.5000		ug/L	0.5000
0045	VINYL CHLORIDE	LT	0.5000	2.0000	ug/L	0.5000
0046	1,1 DICHLOROETHYLENE	LT	0.5000	7.0000	ug/L	0.5000
0047	1,1,1 TRICHLOROETHANE	LT	0.5000	200.0000	ug/L	0.5000
0048	CARBON TETRACHLORIDE	LT	0.5000	5.0000	ug/L	0.5000
0049	BENZENE	LT	0.5000	5.0000	ug/L	0.5000
0050	1,2 DICHLOROETHANE	LT	0.5000	5.0000	ug/L	0.5000
0051	TRICHLOROETHYLENE	LT	0.5000	5.0000	ug/L	0.5000
0052	1,4 DICHLOROBENZENE	LT	0.5000	75.0000	ug/L	0.5000
0053	CHLOROMETHANE	LT	0.5000		ug/L	0.5000
0054	BROMOMETHANE	LT	0.5000		ug/L	0.5000
0055	CHLOROETHANE	LT	0.5000		ug/L	0.5000
0056	METHYLENE CHLORIDE(DICHLOROMETHANE)	LT	0.5000	5.0000	ug/L	0.5000
0057	TRANS- 1,2 DICHLOROETHYLENE	LT	0.5000	100.0000	ug/L	0.5000
0058	1,1 DICHLOROETHANE	LT	0.5000		ug/L	0.5000
0059	2,2 DICHLOROPROPANE	LT	0.5000		ug/L	0.5000
0060	CIS- 1,2 DICHLOROETHYLENE	LT	0.5000	70.0000	ug/L	0.5000
0062	1,1 DICHLOROPROPENE	LT	0.5000		ug/L	0.5000
0063	1,2 DICHLOROPROPANE	LT	0.5000	5.0000	ug/L	0.5000
0064	DIBROMOMETHANE	LT	0.5000		ug/L	0.5000
0065	CIS- 1,3 DICHLOROPROPENE	LT	0.5000		ug/L	0.5000
0066	TOLUENE	LT	0.5000	1000.0000	ug/L	0.5000

Records 1 - 25 of 61

APPENDIX N

WATER QUALITY MONITORING PLAN

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
OFFICE OF DRINKING WATER
PO BOX 47822 • Olympia, Washington 98504-7822
TDD Relay Service: 1-800-833-6388

March 2012

Subject: **WATER QUALITY MONITORING REPORT FOR 2012**

Dear Water System Manager/Purveyor:

Enclosed is the 2012 Water Quality Monitoring Report (WQMR) for your water system and an information sheet that explains some details about monitoring requirements. We developed the WQMR to help you keep track of the source-specific water quality monitoring requirements for your water system.

New this year: We have changed the way we are granting organic waivers for the 2011-2013 monitoring period. This is the first time we've updated our waiver model since we first introduced it in 1994. We developed the new model using our water quality data, data from Department of Agriculture, and source susceptibility information to waive source monitoring requirements to the maximum extent possible while still protecting public health. Insecticides are now included as a State waiver. **We have already applied monitoring waivers to all eligible sources.** Part 4 will show your monitoring frequency with any applicable waivers. **You will not be invoiced for any of the waivers already granted on the WQMR.**

Please review your WQMR carefully. If you notice anything that doesn't look correct to you, please call your regional office to have your records updated or corrected. Most problems can be resolved with a phone call, and we can send you a revised WQMR.

You can find a complete list of laboratories accredited for drinking water analyses at the Washington State Department of Ecology's website: http://www.ecy.wa.gov/programs/eap/labs/search.html Because radionuclide analyses are conducted by a limited number of labs, that list is included on the back of this letter.

For questions about your 2012 WQMR, please contact the appropriate Department of Health regional office staff listed below.

Eastern Regional Office	Bryony Stasney	(509) 329-2132
Northwest Regional Office	Steve Hulsman	(253) 395-6777
Southwest Regional Office	Sophia Petro	(360) 236-3046

Sincerely,

Mike Means
Manager, Water Quality Section
Office of Drinking Water
Enclosures

Laboratories accredited to perform radionuclides for Washington State drinking water systems*:

Radionuclides:

Energy Laboratories, Inc.
PO Box 3258
Casper, WY 82602
James Judge (888) 235-0515
jjudge@energylab.com

ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487
Matt Sowards (970) 879-6590
matts@acz.com

Benchmark Analytics, Inc.
4777 Saucon Creek Road
Center Valley, PA 18034
Theresa Fenstermaker (610) 974-8100
t.fenstermaker@benchmarkanalytics.com

Eberline Analytical Corp. - Richmond Lab
2030 Wright Ave
Richmond, CA 94804-3849
Katsumi Yamamoto (510) 235-2633
kyamamoto@eberlineservices.com

GEL Laboratories, LLC
PO Box 30712
Charleston, SC 29417
Nancy Mattern (843) 556-8171
nancy.mattern@gel.com

MWH Laboratories – Div. of MWH Americas, Inc.
750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016
Nilda Cox (626) 386-1170
Nilda.Cox@mwhglobal.com

TestAmerica Richland
2800 George Washington Way
Richland, WA 99354-1613
Sarah Nagel (509) 375-3131
tim.armstrong@testamericainc.com

Pace Analytical Services, Inc. - Pittsburgh
1638 Roseytown Rd, STE 2, 3, 4
Greenburg, PA 15601
Randal Hill (724) 850-5600
randal.hill@pacelabs.com

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Marti Ward (314) 298-8566
marti.ward@testamericainc.com

Underwriters Laboratories Inc.
110 South Hill Street
South Bend, IN 46617
Dale Piechocki (574) 233-4777
dale.r.piechocki@us.ul.com

Summit Environmental Technologies Inc
3310 Win St
Cuyahooga Falls, OH 44223
RonGibas (330) 253-8211
rgibas@settek.com

* Laboratories accredited as of January 4, 2012 on Washington State Department of Ecology's website.

Information About Your 2012 Water Quality Monitoring Report (WQMR)

March 2012

The Department of Health (DOH) developed the Water Quality Monitoring Report (WQMR) to help you track your system's annual water quality monitoring requirements. Information in your WQMR is specific to your system and its individual sources. The WQMR summarizes most of the microbiological and chemical sampling requirements that apply to each source (at the source, after treatment) and to the distribution system (at the tap). DOH uses the WQMR schedules for compliance and enforcement purposes, so please read it carefully.

Your system may have other monitoring requirements not listed on the WQMR. Other monitoring may be required for special investigations, complex treatment systems, or special operation and maintenance situations. Your 2012 WQMR focuses on the Safe Drinking Water Act monitoring requirements that are linked to your source's water quality, history, compliance, and waiver status.

The 2012 WQMR has five parts:

1. List of active sources
2. Sample collection information and calendars for 2012
3. Information on waivers
4. Summary of sampling requirements and waivers for 2011-2013 or current compliance interval
5. Special notices and regional office staff contacts

Part 1: Sources with Water Quality Monitoring Requirements

Part 1 lists your water system's active seasonal and permanent sources. This table does not list emergency, inter-tie, purchased water sources, or individual wells that make up a well field. These types of sources rarely have source-specific water quality monitoring requirements.

The table lists sources by key source information from your recent Water Facilities Inventory (WFI). The table also shows the susceptibility to contamination for each source based on the susceptibility assessment on file with the department, water quality data, and information from your WFI. *All active sources require a susceptibility assessment rating as part of the wellhead and watershed protection programs. DOH will not grant chemical monitoring waivers for sources that do not have a susceptibility assessment rating.*

Part 2: Monitoring Schedule for 2012

Part 2 shows your system's sampling schedule for 2012. DOH assigns requirements to a particular month to help you stay on track and in compliance. Sampling months are assigned based in part on your past sampling dates, and also to even out the workload for laboratories. The monthly scheduling format can help you budget for monitoring expenses. If you miss collecting a sample in a particular month, collect it as soon as possible.

In general, there are three sample types: distribution samples, finished water source samples, and raw water source samples. Most coliform, lead and copper, asbestos, and DBP samples are collected from the distribution system. Most chemical samples (IOCs, VOCs, SOCs, and radionuclides) are collected from the finished water source sample tap (collected at the entry point to the distribution system). Raw water samples come from the tap closest to the source prior to all treatment. The raw water taps may be considered for chemical samples when a source has no treatment and are used for Groundwater Rule triggered source monitoring following a positive coliform distribution sample.

Coliform Monitoring: The coliform monitoring portion of this section lists the number of routine coliform samples required each month. This is the same as you would see on your WFI. We include it on the WQMR as a convenience. Coliform samples are usually collected from a cold water household tap within the distribution system.

If the population of your system changes during the year, your coliform monitoring requirement could change. When that happens, you will receive an updated WFI with a new coliform sampling schedule. <u>Note: the coliform monitoring schedule on your most recent WFI provides the most accurate information.</u>

Lead and Copper Monitoring: These samples must be collected from indoor kitchen or bathroom cold water faucets after the water has sat unused in the pipes for at least 6 hours but no more than 12 hours. Any faucets that will be used for lead and copper samples should be flushed with cold water the *evening before* taking the sample.

Disinfection By-Product (DBP) Monitoring: DBPs are scheduled on the monthly calendar for systems (except most large surface water systems) which have continuous chlorination or ozonation. These requirements will also show in part 4 for most systems. Systems starting Stage 2 DBP monitoring in 2012 should follow their DBP monitoring plan.

Chemical Monitoring: This section lists source sampling requirements for organic and inorganic chemicals by month, source, and DOH test panel. It doesn't list test method because more than one method may be used for any given test panel. **Collect all chemical source samples as close to the source of water as possible, but *after* all treatment and before entering the distribution system.**

Part 3: Water Quality Monitoring Waivers

Part 3 provides general information about chemical monitoring waivers. Monitoring waivers can reduce or eliminate some monitoring requirements for systems with a waiver.

There are three categories of waivers:

1) ***Organic waivers*** reduce the monitoring requirements for volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs). **Organic waivers require a susceptibility assessment rating.**

2) ***Inorganic waivers*** reduce the monitoring requirements for inorganic chemicals (IOCs). **Many sources may still need to sample for individual IOC compounds (for example, arsenic) as a condition of their IOC waiver.** Any inorganic sampling requirements you have for 2012 will be listed in Part 2 of the WQMR. Eligibility for an IOC waiver depends on source-specific water quality history and susceptibility rating.

The annual sampling requirement for nitrate is never waived.

3) ***Statewide waivers*** reduce or eliminate the monitoring requirements for some test panels (as listed in Part 4). We have included insecticides as a state waiver. DOH grants statewide waivers when applicable. These waivers are granted based on water quality information gathered from across the state.

Part 4: Water Quality Monitoring Summary

Part 4 is useful for planning and budgeting for all your monitoring requirements. Part 4 provides an overview of the scope and frequency of water quality monitoring requirements for each of your sources for the 2011-2013 compliance period. The table identifies where and how often a sample must be collected and if any waivers have been granted. Information in Part 4 relates directly to the schedule in Part 2. Sample collection frequencies are listed according to test panel (for example, IOC, VOC, Herbicide). This section identifies the specific "test panel" and sample location required. If you have received a waiver for a specific test panel, it will show here.

Part 5: DOH Staff Contacts and Special Notes

Part 5 lists the name and phone number of your DOH regional office source monitoring and DBP staff. If you have questions about your <u>2012 WQMR</u> or notice any inaccuracies, call your regional office to have your records updated. In most cases, errors are resolved with a phone call and a revised WQMR will be mailed to you.

<u>IMPORTANT NOTE</u>:

We have changed the way we are granting organic waivers for the 2011-2013 monitoring period. This is the first time we've updated our waiver model since we first introduced it in 1994. Many conditions have changed in the state, and our waiver model needed an update. We developed the new model using our water quality data, data from Department of Agriculture, and source susceptibility information to waive source monitoring requirements to the maximum extent possible while still protecting public health.

DOH is no longer charging a waiver fee for most monitoring waivers, including organic and inorganic waivers. We will no longer send water systems a waiver options form. **We have granted all the waivers for which your sources currently qualify.**

Part 5 also contains *Special Notes* specific to your water system or individual sources. Please look for these Special Notes!

Washington State Department of
Health
Division of Environmental Health
Office of Drinking Water

Water Quality Monitoring Report for the Year 2012

System: OAK HARBOR, CITY OF **PWSID:** 62650 C **Report Date:** 03/15/2012
Contact: RICHARD A. TYHUIS **Group:** A - Comm **County:** ISLAND **Region:** NORTHWEST

Part 1: List of Active Sources with Water Quality Monitoring Requirements

DOH Source#	Name	Type	Use	Susceptibility Rating
S11	AGA866 WELL 8	Well	Permanent	Not Rated
S12	AGA865 WELL 9	Well	Permanent	Low
S14	AGA887 WELL 11	Well	Permanent	Low

Part 2: Sampling Schedule for the Year 2012

Coliform Sampling (Routine)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
	20	20	20	20	20	20	20	20	20	20	20	20

* Indicates the requirement is an exception from WAC 246-290.

- If the coliform (bacteriological) sampling schedule listed at the bottom of the current Water Facilities Inventory (WFI) form for your system is different from the schedule listed above, follow the schedule on the current WFI.
- Samples must be collected from representative points throughout the distribution system.
- Repeat samples are required following an unsatisfactory sample. In addition, collect a sample from each operating groundwater source.
- A minimum of 5 routine samples are required the month following one or more unsatisfactory samples in accordance with your system's Coliform Monitoring Plan.

Lead and Copper Distribution Sampling

- Lead and copper samples must be collected from indoor faucets within the distribution system after the water has sat unused in the pipes for at least 6 hours but no more than 12 hours.
- Sample faucets should be flushed with cold water the evening prior to collecting the sample.
- Part 2 indicates the month in which samples should be collected. Part 4 indicates the total number of sample required.
- If you are required to sample annually or once every 3 years, samples must be collected between June and September.

Chlorine Residual Sampling

- Systems that use continuous chlorination must take chlorine residual measurements daily (or at a reduced frequency approved by the department), and at the same time and location as routine and repeat coliform samples.

Disinfection Byproducts Sampling

Stage 2

- This is the year during which your system must transition from Stage 1DBP Rule monitoring for total trihalomethanes (TTHM) and haloacetic acids (HAA5) to Stage 2 DBP Rule monitoring requirements.
- Systems that provide water which has been treated using continuous chlorination treatment must collect samples for TTHM and for HAA5 from the distribution system at the frequency and locations identified in your individual Stage 2 disinfection byproducts monitoring plan. During the appropriate monitoring period collect the samples from the distribution system at the frequency and locations identified in your individual Stage 2 disinfection byproducts monitoring plan.

Water Quality Monitoring Report for the Year 2012

Chemical Sampling Requirements

- Source water chemical samples must be taken from a location as near to the source as possible, but after all treatment, and before entering the distribution system.
- Nitrate, nitrite and arsenic are included as part of a complete IOC.

Month	Source	Monitoring Requirement	Test Panel
January		*No source chemical sampling required this month*	
February		*No source chemical sampling required this month*	
March		*No source chemical sampling required this month*	
April		*No source chemical sampling required this month*	
May		*No source chemical sampling required this month*	
June	S11	NITRATE	NITRATE
June	S12	NITRATE	NITRATE
June	S14	NITRATE	NITRATE
July		*No source chemical sampling required this month*	
August		*No source chemical sampling required this month*	
September		*No source chemical sampling required this month*	
October		*No source chemical sampling required this month*	
November		*No source chemical sampling required this month*	
December		*No source chemical sampling required this month*	

Part 3: Waivers

- Automatically granted to all sources based on DOH assessment of source specific information, and regional and state conditions.
- Current susceptibility assessment is required for all sources to obtain a waiver. No waiver application, or fee required.
- State waivers granted for the **2011 - 2013** compliance period are listed in Part 4.

Part 4: Water Quality Monitoring Frequency

- Although waivers may be granted for your system, there may be some monitoring required as a condition of the waiver your system was granted.

Monitoring Group	Test Panel	Sample Location	Schedule/Status
Asbestos	ASB	Distribution	Collect 1 Asbestos sample in 2013
Bacteriological	Coli	Distribution	See routine sample schedule in part 2
Dioxin	Dioxin	All sources	State Waiver Thru Dec 2013
Endothall	Endo	All sources	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S11	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S12	State Waiver Thru Dec 2013

Water Quality Monitoring Report for the Year 2012

Monitoring Group	Test Panel	Sample Location	Schedule/Status
EDB and other soil fumigants	Fumigant	S14	State Waiver Thru Dec 2013
Glyphosphate	Glyphs	All sources	State Waiver Thru Dec 2013
Herbicides	Herbs	S11	Waiver granted - No sampling required thru Dec 2013
Herbicides	Herbs	S12	Waiver granted - No sampling required thru Dec 2013
Herbicides	Herbs	S14	Waiver granted - No sampling required thru Dec 2013
Insecticides	Insect	S11	Waiver granted - No sampling required thru Dec 2013
Insecticides	Insect	S12	Waiver granted - No sampling required thru Dec 2013
Insecticides	Insect	S14	Waiver granted - No sampling required thru Dec 2013
Inorganic Contaminants **	IOC	S11	1 complete IOC sample between Jan 2011 - Dec 2019
Inorganic Contaminants **	IOC	S12	1 complete IOC sample between Jan 2011 - Dec 2019
Inorganic Contaminants **	IOC	S14	1 complete IOC sample between Jan 2011 - Dec 2019
Lead/Copper *	LCR	Distribution	LCR 1 Set of 30 samples between Jan 2011 - Dec 2013
Nitrate *	NIT	S11	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S12	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S14	Collect 1 sample(s) every 1 year
General Pesticides	Pest1	S11	Waiver granted - No sampling required thru Dec 2013
General Pesticides	Pest1	S12	Waiver granted - No sampling required thru Dec 2013
General Pesticides	Pest1	S14	Waiver granted - No sampling required thru Dec 2013
Diquat	Diquat	All sources	State Waiver Thru Dec 2013
Volatile Organic Contaminants	VOC	S11	Waiver granted - No sampling required thru Dec 2013
Volatile Organic Contaminants	VOC	S12	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S14	Waiver granted - No sampling required thru Dec 2013

** These contaminant monitoring groups do not have waiver options under the SDWA.*

*** Your IOC waiver also requires that you sample more frequently for some analytes. You are required to collect a sample for these analytes **ONLY** when they are scheduled in Part 2.*

Water Quality Monitoring Report for the Year 2012

Part 5: Regional Water Quality Monitoring Contact

Northwest Regional Office

For further information call the Northwest Regional Office Steve Hulsman

Phone: (253) 395-6777

For questions regarding Disinfection ByProducts (DBP) monitoring, contact: Jolyn Leslie (253) 395-6762

Special Note

For Group A Community Systems Only: Your Consumer Confidence Report, summarizing the results of your 2011 water quality monitoring requirements is due before July 1, 2012 . For further information visit www.doh.wa.gov/ehp/dw/Our_Main_Pages/consumer.htm or contact the CCR Coordinator at your Regional Office.

RICHARD A. TYHUIS
OAK HARBOR, CITY OF
865 SE BARRINGTON DR
OAK HARBOR WA 98277

APPENDIX O

HYDRAULIC MODEL RESULTS

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
10	2.43	82	1,000	76	27	718	17	2,487	0	2,998	0
12	2.43	76	1,000	70	27	718	19	3,176	0	2,999	0
14	2.43	69	1,000	64	27	718	13	2,743	0	2,995	0
16	2.43	90	1,000	83	27	718	31	1,567	0	2,998	0
18	2.43	84	3,500	73	25	718	43	4,471	0	5,863	0
20	2.43	85	3,500	65	25	718	57	3,009	491	5,665	0
22	2.43	84	3,500	70	25	718	47	3,886	0	5,689	0
24	2.43	84	3,500	69	25	718	49	3,350	150	5,688	0
26	2.43	84	3,500	70	25	718	43	2,838	662	5,784	0
28	2.43	58	1,000	53	34	230		3,460	0	2,418	0
30	2.43	54	1,000	49	34	230		3,032	0	2,431	0
32	2.43	50	1,000	44	34	230		2,705	0	2,439	0
34	2.43	61	1,000	54	34	230		2,874	0	2,417	0
36	2.43	60	1,000	53	34	230		2,786	0	2,417	0
38	2.43	60	1,000	52	34	230		2,705	0	2,417	0
40	2.43	65	1,000	57	34	230		2,766	0	2,417	0
42	2.43	63	1,000	55	34	230		2,703	0	2,417	0
44	2.43	65	1,000	56	34	230	83	2,258	0	2,417	0
46	2.43	67	1,000	58	34	230		2,624	0	2,417	0
48	2.43	65	1,000	56	34	230		2,501	0	2,417	0
50	2.43	74	1,000	65	34	230	93	2,448	0	2,417	0
52	2.43	72	1,000	63	34	230	95	2,446	0	2,417	0
54	2.43	83	3,500	73	25	718	109	4,469	0	5,655	0
56	2.43	80	2,000	50	50	56	111	1,551	449	3,009	0
58	2.43	45	1,000	44	27	684		5,540	0	3,367	0
60	2.43	47	1,000	44	27	684	115	2,972	0	3,550	0
62	2.43	48	1,000	46	27	684	123	3,968	0	3,606	0
64	2.43	48	1,000	46	27	684	121	4,049	0	3,586	0
66	2.43	50	1,000	47	27	684	131	3,646	0	3,635	0
68	2.43	49	1,000	46	27	684	123	3,692	0	3,666	0
70	2.43	72	1,000	69	27	684	133	3,515	0	3,446	0
72	2.43	60	1,000	56	27	684	135	2,165	0	3,446	0
74	2.43	59	1,000	55	55	74		3,426	0	3,425	0
76	2.43	101	1,000	74	74	76	141	1,567	0	1,871	0
78	2.43	41	1,000	36	34	230		2,340	0	2,307	0
80	2.43	45	2,000	27	24	230		2,447	0	2,315	0
82	2.43	50	2,000	31	24	230		2,649	0	2,317	0
84	2.43	54	2,000	37	24	230		3,015	0	2,328	0
86	2.43	54	2,000	36	24	230		2,884	0	2,341	0
88	2.43	96	1,000	94	28	686	165	5,030	0	5,006	0
90	2.43	96	1,000	93	28	686	163	3,502	0	4,998	0
92	2.43	88	3,000	71	23	718	179	3,000	0	4,215	0
94	2.43	67	1,000	62	34	230		3,887	0	2,439	0
96	2.43	63	1,000	58	34	230		3,639	0	2,462	0
98	2.43	90	1,000	85	27	718	185	1,778	0	3,643	0
100	2.43	89	1,000	84	27	718	187	1,617	0	3,646	0
102	2.43	62	3,500	-60	-70	577	189	1,564	1,936	1,715	1,785
104	2.43	71	1,000	65	37	593	1265	2,372	0	3,400	0
106	2.43	53	1,000	49	49	106	195	2,117	0	2,835	0
108	2.43	63	1,000	51	51	613	1252	1,294	0	2,268	0
110	2.43	87	1,000	80	80	110	1595	1,603	0	3,452	0
112	2.43	39	1,000	35	35	112		2,203	0	2,203	0
114	2.43	57	1,000	51	51	114	203	2,705	0	2,867	0
116	2.43	100	3,500	68	25	718	205	1,824	1,676	5,708	0
128	2.43	65	2,500	50	26	550		4,368	0	3,074	0
134	2.43	63	1,000	59	36	593	263	2,712	0	2,602	0
136	2.43	64	1,000	59	39	535	265	2,610	0	2,687	0
138	2.43	64	1,000	61	37	593	267	4,025	0	3,200	0
140	2.43	64	1,000	55	55	140	269	1,302	0	2,307	0
142	2.43	67	1,000	62	37	593	1284	2,992	0	3,268	0
144	2.43	71	1,000	59	59	144	273	1,453	0	2,216	0
146	2.43	71	1,000	67	37	593	275	2,588	0	3,370	0
148	2.43	71	1,000	61	61	148	277	1,601	0	2,607	0
215	2.43	112	1,000	107	37	875	1637	4,447	0	2,727	0
216	2.43	48	2,000	41	24	684	921	4,405	0	3,129	0
217	2.43	70	1,000	67	27	684	1504	3,513	0	3,446	0
218	2.43	79	1,000	33	23	919	925	2,126	0	1,636	0
219	2.43	95	1,000	85	66	896		3,134	0	2,650	0
220	2.43	99	1,000	90	37	875		3,331	0	2,727	0
221	2.43	84	3,500	75	25	718	1423	6,546	0	5,937	0
222	2.43	86	2,000	73	33	593	930	3,525	0	3,560	0
228	2.43	74	1,000	70	27	684	923	4,393	0	3,446	0
229	2.43	62	1,000	58	35	230		3,940	0	2,889	0
230	2.43	39	2,000	23	23	230		2,232	0	2,231	0
232	2.43	80	3,500	64	37	577	1331	7,055	0	5,309	0
233	2.43	77	1,000	30	23	919		1,862	0	1,556	0
235	2.43	79	1,000	31	22	352		1,782	0	1,280	0
236	2.43	82	1,000	26	26	236		1,266	0	1,266	0
237	2.43	39	1,000	34	34	237	1518	1,758	0	1,973	0
238	2.43	50	1,000	47	37	237	129	2,994	0	3,542	0
239	2.43	51	1,000	50	27	684	1008	5,911	0	3,964	0
240	2.43	72	1,000	23	22	352		1,339	0	1,275	0
241	2.43	90	1,000	41	22	352		2,142	0	1,280	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
242	2.43	95	1,000	45	22	352		2,263	0	1,282	0
243	2.43	71	1,000	65	37	593		3,827	0	3,401	0
244	2.43	48	1,000	43	43	596	1299	2,443	0	2,544	0
245	2.43	46	1,000	42	42	245		3,043	0	3,040	0
246	2.43	93	3,500	62	62	246	1179	2,554	946	5,770	0
247	2.43	77	1,000	56	56	247	1095	879	121	1,749	0
248	2.43	67	1,000	61	27	718	1096	2,630	0	3,008	0
249	2.43	51	1,000	47	41	732		3,253	0	3,012	0
250	2.43	52	1,000	45	45	250	966	1,759	0	2,321	0
251	2.43	83	3,500	57	20	593	1309	4,666	0	3,492	8
252	2.43	70	1,000	70	28	686		9,379	0	6,666	0
253	2.43	78	1,000	77	28	686	1428	8,518	0	6,224	0
254	2.43	52	2,000	47	25	684		6,173	0	3,415	0
255	2.43	51	1,000	49	27	686	972	3,371	0	3,693	0
256	2.43	47	1,000	44	27	686	973	3,309	0	3,703	0
257	2.43	46	1,000	44	27	686	974	3,803	0	3,614	0
258	2.43	38	1,000	37	27	686		4,674	0	3,233	0
259	2.43	44	1,000	42	27	686	979	2,825	0	3,401	0
260	2.43	49	1,000	45	45	260	964	2,323	0	3,263	0
261	2.43	51	1,000	48	48	261	977	3,284	0	3,960	0
262	2.43	59	1,000	56	56	262	957	2,467	0	3,986	0
263	2.43	60	1,000	56	56	263	962	2,365	0	3,801	0
264	2.43	55	1,000	51	51	264	963	1,978	0	3,117	0
265	2.43	50	1,000	48	27	686	982	4,276	0	3,932	0
266	2.43	43	1,000	39	39	266	970	1,951	0	2,826	0
267	2.43	44	1,000	40	40	267	970	2,406	0	3,100	0
268	2.43	41	1,000	38	38	268	976	1,973	0	2,913	0
269	2.43	39	1,000	38	27	686		4,721	0	3,227	0
270	2.43	41	1,000	40	27	686		4,902	0	3,613	0
271	2.43	68	1,000	66	27	686	1477	4,387	0	4,236	0
272	2.43	67	1,000	64	27	686	959	1,866	0	4,280	0
273	2.43	68	1,000	65	28	686	955	3,116	0	4,612	0
274	2.43	82	1,000	81	28	686	1430	7,495	0	4,922	0
275	2.43	83	3,000	76	25	686	1440	5,737	0	4,924	0
276	2.43	85	3,000	78	25	686	1436	5,802	0	5,221	0
277	2.43	96	2,000	89	27	686	981	3,823	0	5,591	0
278	2.43	95	3,000	84	26	686	1456	6,429	0	5,579	0
279	2.43	88	3,000	80	25	686	956	5,385	0	5,259	0
280	2.43	61	1,000	59	28	686	1601	5,178	0	4,915	0
281	2.43	53	1,000	51	28	686	990	4,978	0	4,868	0
282	2.43	61	1,000	57	57	282	991	1,616	0	3,570	0
283	2.43	64	1,000	56	56	283	993	1,494	0	2,531	0
284	2.43	58	1,000	53	53	938	994	1,880	0	3,007	0
285	2.43	52	1,000	50	28	686	987	4,477	0	4,785	0
286	2.43	52	1,000	50	28	686	986	4,580	0	4,726	0
287	2.43	53	1,000	51	28	686	982	4,775	0	4,662	0
288	2.43	54	3,500	30	30	288	985	3,035	465	4,248	0
289	2.43	58	3,500	27	27	289	995	2,815	685	3,886	0
290	2.43	54	3,500	33	33	290	996	2,519	981	4,511	0
291	2.43	72	1,000	70	63	292	1003	3,028	0	5,281	0
292	2.43	65	1,000	61	61	292	999	2,384	0	3,903	0
293	2.43	92	1,000	89	28	686	997	3,018	0	5,454	0
294	2.43	76	1,000	73	73	294	1002	3,193	0	5,143	0
295	2.43	82	2,000	72	72	295	1588	2,918	0	5,415	0
296	2.43	89	1,000	85	85	296	1465	1,985	0	4,745	0
297	2.43	77	1,000	72	72	297	952	2,322	0	3,706	0
298	2.43	63	1,000	60	60	298	997	2,732	0	4,311	0
299	2.43	52	1,000	51	27	684	1009	6,338	0	4,284	0
300	2.43	41	1,000	28	28	300		1,282	0	1,282	0
301	2.43	44	1,000	37	34	300		2,000	0	1,861	0
302	2.43	48	1,000	42	36	300	1012	2,092	0	2,082	0
303	2.43	56	1,000	54	28	684	1004	4,935	0	5,134	0
304	2.43	59	1,000	57	39	300	1015	2,147	0	3,670	0
305	2.43	56	1,500	54	27	684	1016	5,853	0	4,792	0
306	2.43	45	1,000	44	28	684	1017	5,448	0	5,699	0
307	2.43	52	1,000	48	48	307	1005	2,386	0	3,022	0
308	2.43	63	1,000	61	28	684	1579	3,600	0	5,546	0
309	2.43	67	1,000	63	48	817	1580	1,865	0	3,012	0
310	2.43	59	1,000	52	45	817	1057	1,564	0	2,273	0
315	2.43	46	1,000	-6	-6	315		683	317	683	317
316	2.43	55	1,000	27	17	315	1804	879	121	947	53
318	2.43	47	1,000	26	24	317	1068	879	121	1,112	0
319	2.43	58	1,000	49	35	317	1577	869	131	1,730	0
320	2.43	105	2,000	97	27	686	1030	3,481	0	5,636	0
321	2.43	104	3,000	90	26	686	1715	3,955	0	5,654	0
322	2.43	92	1,000	88	88	322	1031	2,371	0	4,702	0
323	2.43	77	1,000	74	50	817	1582	3,805	0	5,057	0
324	2.43	83	1,000	73	73	324	1062	1,265	0	2,745	0
325	2.43	85	1,000	80	80	325	1035	2,113	0	4,206	0
326	2.43	77	1,000	74	27	718	1064	3,894	0	4,836	0
327	2.43	89	1,000	85	85	327	1035	2,342	0	4,533	0
328	2.43	91	1,000	84	84	328	1034	1,539	0	3,657	0
329	2.43	78	1,000	75	27	718	1064	3,436	0	4,259	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
330	2.43	78	1,000	75	27	718	1083	3,976	0	3,764	0
331	2.43	88	1,000	83	27	718	1084	2,179	0	3,683	0
332	2.43	92	1,000	87	27	718	1086	2,415	0	3,628	0
333	2.43	78	1,750	71	26	718	1083	4,209	0	3,540	0
334	2.43	65	1,000	62	27	718	1081	2,699	0	3,280	0
335	2.43	75	1,000	72	27	718	1087	3,154	0	3,307	0
336	2.43	68	3,000	30	21	718	1092	1,508	1,492	3,311	0
337	2.43	60	1,000	51	51	337	1091	1,640	0	2,242	0
338	2.43	61	1,000	56	56	338	1088	1,552	0	3,127	0
339	2.43	65	1,000	62	27	718	1080	3,581	0	3,220	0
340	2.43	99	3,000	72	17	875	1114	4,539	0	2,814	186
341	2.43	85	1,000	38	23	919		2,307	0	1,622	0
342	2.43	79	1,000	34	23	919		2,362	0	1,645	0
343	2.43	73	1,000	28	23	919		2,101	0	1,605	0
344	2.43	76	1,000	31	23	919		2,330	0	1,559	0
345	2.43	73	1,000	26	21	919		1,660	0	1,180	0
346	2.43	82	1,000	29	22	352		1,429	0	1,280	0
347	2.43	75	1,000	27	22	352		1,533	0	1,293	0
348	2.43	82	1,000	27	27	348	1027	876	124	1,265	0
349	2.43	81	1,000	30	23	352		1,599	0	1,391	0
350	2.43	97	1,000	47	24	818	1526	2,264	0	1,642	0
352	2.43	70	1,000	22	22	352		1,234	0	1,234	0
353	2.43	74	1,000	24	24	353		1,288	0	1,287	0
354	2.43	49	1,000	41	36	875		2,226	0	2,143	0
355	2.43	46	1,000	39	36	875		2,218	0	2,183	0
356	2.43	48	1,000	40	36	875		2,191	0	2,163	0
357	2.43	51	1,000	43	36	875	1126	2,336	0	2,142	0
358	2.43	51	1,000	44	35	875		2,437	0	2,132	0
359	2.43	47	1,000	40	36	875		2,195	0	2,153	0
360	2.43	67	1,000	59	35	875		2,718	0	2,122	0
361	2.43	68	1,000	61	35	875		2,945	0	2,108	0
362	2.43	71	1,000	63	35	875		3,107	0	2,108	0
363	2.43	55	1,000	49	35	875		2,727	0	2,096	0
364	2.43	55	1,000	49	36	875		2,727	0	2,141	0
365	2.43	88	3,500	65	31	577		6,459	0	4,354	0
366	2.43	58	1,000	52	36	875		2,992	0	2,204	0
367	2.43	52	1,000	45	36	875		2,550	0	2,191	0
368	2.43	57	1,000	50	36	875		2,685	0	2,157	0
369	2.43	60	1,000	53	36	875		2,914	0	2,207	0
370	2.43	71	1,000	66	36	875	1136	3,299	0	2,263	0
371	2.43	87	3,000	69	25	718	1051	3,520	0	5,137	0
372	2.43	84	1,000	79	28	718	1039	3,206	0	5,196	0
373	2.43	86	3,000	78	25	718	1039	7,376	0	5,587	0
374	2.43	101	2,000	55	54	423	1142	1,492	508	2,754	0
375	2.43	65	2,000	60	37	435	1706	6,448	0	6,347	0
376	2.43	65	1,000	62	37	550		4,420	0	3,039	0
377	2.43	47	1,000	43	36	550		2,680	0	2,449	0
378	2.43	52	1,000	49	47	546	1360	2,239	0	3,040	0
379	2.43	74	1,000	66	66	379	1617	2,691	0	3,481	0
380	2.43	56	1,000	52	27	718		3,925	0	3,125	0
381	2.43	41	1,000	37	37	381		2,819	0	2,819	0
382	2.43	39	1,000	35	35	382		2,797	0	2,797	0
383	2.43	49	1,000	46	27	718		3,705	0	3,065	0
384	2.43	58	1,000	55	27	718	1080	4,304	0	3,132	0
386	2.43	64	1,000	61	35	230		4,736	0	2,913	0
387	2.43	66	1,000	63	35	230		4,713	0	2,906	0
388	2.43	42	1,000	39	27	718		3,485	0	2,934	0
389	2.43	39	1,000	36	27	718		3,429	0	2,922	0
390	2.43	38	1,000	35	35	390		2,872	0	2,872	0
391	2.43	45	1,000	42	27	718		3,353	0	2,940	0
392	2.43	48	1,000	44	27	718		3,415	0	2,946	0
393	2.43	59	1,000	56	27	718	1099	3,379	0	2,946	0
394	2.43	50	2,000	38	24	718	1651	2,807	0	2,950	0
395	2.43	45	1,000	41	41	395		2,898	0	2,898	0
396	2.43	52	1,000	48	27	718		3,269	0	2,986	0
397	2.43	48	1,000	43	43	397		2,962	0	2,962	0
398	2.43	56	1,000	52	27	718	1106	3,418	0	2,957	0
399	2.43	61	1,000	56	27	718	1108	3,109	0	2,957	0
400	2.43	55	1,000	51	27	718	1100	3,197	0	2,956	0
401	2.43	58	1,000	54	27	718		3,556	0	2,958	0
402	2.43	52	1,000	47	27	718	1111	2,895	0	2,962	0
403	2.43	60	1,000	56	27	718		3,902	0	2,966	0
404	2.43	59	1,000	55	27	718	1112	3,381	0	2,981	0
405	2.43	74	3,000	63	22	718	1636	4,919	0	3,627	0
406	2.43	82	1,000	78	35	230		4,982	0	2,764	0
407	2.43	80	3,000	56	17	230		5,029	0	2,751	249
408	2.43	78	1,000	73	35	230	1135	3,904	0	2,584	0
409	2.43	66	1,000	61	28	718	1574	2,685	0	4,739	0
410	2.43	84	1,000	78	78	410	1048	2,934	0	4,636	0
411	2.43	70	1,000	64	60	659	1040	2,919	0	4,215	0
412	2.43	67	2,000	53	53	412	1042	2,930	0	4,231	0
413	2.43	58	1,000	51	51	413	1045	2,879	0	3,347	0
414	2.43	66	1,000	61	52	413	1042	3,747	0	3,989	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
415	2.43	68	1,000	62	52	413	1046	2,576	0	3,995	0
416	2.43	81	1,000	76	53	413	1567	2,895	0	4,777	0
417	2.43	84	1,000	77	77	417	1050	2,852	0	4,673	0
418	2.43	85	3,500	59	59	418	1420	2,221	1,279	5,547	0
419	2.43	86	3,500	77	25	718	47	6,329	0	5,593	0
420	2.43	88	3,000	72	25	718	1052	1,607	1,393	5,136	0
421	2.43	88	3,000	78	25	718	1052	3,535	0	5,247	0
422	2.43	89	3,500	76	24	718	1055	4,469	0	5,171	0
423	2.43	100	2,000	32	32	423		2,185	0	2,185	0
424	2.43	101	2,000	35	34	423	1144	1,562	438	2,237	0
425	2.43	101	2,000	50	49	423	1145	1,559	441	2,592	0
426	2.43	99	3,500	85	23	718	1140	4,585	0	4,654	0
427	2.43	93	3,500	83	24	718	1630	7,436	0	5,110	0
428	2.43	99	3,500	86	24	718	1139	5,323	0	5,105	0
429	2.43	62	2,000	57	37	435	929	2,711	0	6,440	0
430	2.43	59	1,000	55	55	430	928	2,858	0	5,360	0
431	2.43	58	1,000	53	53	431	1228	3,390	0	5,148	0
432	2.43	55	1,000	51	44	433	1229	3,344	0	4,600	0
433	2.43	49	1,000	44	44	433	1230	3,224	0	3,984	0
434	2.43	46	1,000	41	41	434	1232	3,011	0	3,759	0
435	2.43	41	2,000	33	33	435		3,900	0	3,900	0
436	2.43	69	2,000	63	37	435	1208	4,878	0	6,375	0
437	2.43	72	2,000	63	63	437	1209	2,706	0	5,678	0
438	2.43	64	2,000	52	52	438	1211	2,101	0	4,372	0
439	2.43	64	1,000	58	58	439	1226	2,739	0	4,582	0
440	2.43	61	1,000	55	55	440	1224	2,191	0	3,829	0
441	2.43	52	1,000	45	45	441	1218	1,874	0	2,893	0
442	2.43	45	2,000	37	34	435		4,238	0	4,180	0
443	2.43	57	1,000	50	50	443	1222	2,147	0	3,289	0
444	2.43	100	2,000	90	36	435	1216	3,429	0	5,117	0
445	2.43	68	1,000	63	63	445	1213	4,580	0	5,359	0
446	2.43	93	3,000	60	34	754	1616	3,082	0	3,876	0
447	2.43	77	3,000	53	36	754	1199	3,112	0	4,057	0
448	2.43	68	3,000	45	41	754	1205	3,305	0	4,576	0
449	2.43	81	3,500	56	39	754	1203	3,641	0	5,017	0
450	2.43	90	3,000	69	41	754	1201	3,010	0	4,660	0
451	2.43	97	3,000	73	42	754	1197	2,463	537	4,691	0
452	2.43	98	3,500	58	58	452	1180	2,920	580	5,076	0
453	2.43	100	3,500	43	43	453	1165	2,003	1,497	4,221	0
454	2.43	100	3,500	79	25	718	1168	2,348	1,152	5,768	0
455	2.43	94	3,500	76	25	718	1164	4,189	0	5,642	0
456	2.43	100	3,500	85	25	718	1164	5,507	0	5,693	0
457	2.43	93	3,500	72	25	718	1169	3,487	13	5,857	0
458	2.43	84	3,500	68	25	718	1172	5,137	0	5,957	0
459	2.43	84	3,500	60	60	459	1188	3,709	0	6,075	0
460	2.43	85	3,500	62	25	718	1178	3,370	130	6,246	0
461	2.43	73	3,500	57	25	718	1172	4,916	0	6,242	0
462	2.43	68	2,000	59	59	462	1189	3,777	0	5,864	0
463	2.43	70	3,500	46	46	463	1177	3,056	444	5,334	0
464	2.43	84	3,500	55	55	464	1187	3,027	473	5,526	0
465	2.43	93	3,500	28	28	465	1183	1,443	2,057	3,752	0
466	2.43	93	3,500	62	62	466	1184	2,552	948	5,640	0
467	2.43	93	3,500	72	26	718	1195	3,482	18	6,586	0
468	2.43	79	2,000	70	70	468	1194	3,181	0	6,290	0
469	2.43	69	2,000	62	37	435	1208	3,359	0	6,612	0
470	2.43	93	3,500	24	24	470	1192	1,861	1,639	3,597	0
471	2.43	64	3,000	49	49	471	1206	3,199	0	5,626	0
472	2.43	66	3,000	54	26	718	1190	5,364	0	6,460	0
473	2.43	71	3,000	55	55	473	1174	3,355	0	5,953	0
474	2.43	73	3,000	57	57	474	1175	3,888	0	6,224	0
475	2.43	81	3,000	57	26	718	1166	2,817	183	5,168	0
476	2.43	68	1,000	64	64	476	1149	4,183	0	6,066	0
477	2.43	66	1,000	61	61	477	1150	3,308	0	5,489	0
478	2.43	65	1,000	38	38	478	1750	909	91	1,370	0
479	2.43	70	1,000	33	33	479	382	744	256	1,192	0
480	2.43	76	1,000	65	58	929	1159	1,300	0	2,601	0
481	2.43	73	1,000	67	67	481	1151	3,095	0	4,961	0
482	2.43	73	1,000	61	61	482	1155	1,719	0	2,428	0
483	2.43	71	1,000	58	58	483	1158	1,758	0	2,379	0
484	2.43	81	1,000	69	69	484	1161	1,379	0	2,789	0
485	2.43	80	1,000	68	68	485	1160	1,221	0	2,741	0
486	2.43	82	1,000	77	28	718	1415	2,904	0	5,956	0
487	2.43	89	3,500	68	22	593	1853	4,862	0	3,708	0
488	2.43	94	3,500	54	23	593	1840	3,186	314	3,836	0
489	2.43	87	2,000	73	34	593	1240	3,245	0	3,836	0
490	2.43	95	3,500	76	24	593	1234	4,527	0	3,882	0
491	2.43	98	1,000	96	38	593	1233	5,668	0	4,322	0
492	2.43	102	2,000	96	36	593	1446	5,279	0	4,910	0
493	2.43	100	1,000	97	38	593	1237	3,756	0	4,898	0
494	2.43	98	1,000	96	38	593	1237	4,785	0	5,468	0
495	2.43	100	2,000	90	37	593	1238	2,916	0	5,375	0
496	2.43	101	2,000	91	36	593	1239	3,728	0	5,291	0
497	2.43	95	2,000	76	67	618	1399	2,754	0	4,008	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
498	2.43	88	2,000	68	68	498	1410	2,372	0	3,812	0
499	2.43	85	2,000	66	66	499	1243	1,866	134	3,849	0
500	2.43	78	2,000	63	35	593	1244	2,248	0	3,949	0
501	2.43	58	1,000	53	37	593		3,385	0	3,375	0
502	2.43	75	3,500	46	21	593	1244	4,005	0	3,560	0
503	2.43	55	2,000	22	22	503	1254	1,501	499	2,055	0
504	2.43	61	1,000	52	52	613	1252	1,307	0	2,441	0
505	2.43	65	1,000	59	50	503	1251	2,611	0	3,397	0
507	2.43	45	1,000	42	42	507		3,123	0	3,123	0
508	2.43	53	1,000	46	46	508		2,377	0	2,377	0
509	2.43	74	2,000	41	41	509	1247	1,704	296	2,615	0
510	2.43	81	3,500	57	20	593	1266	4,994	0	3,524	0
511	2.43	68	1,000	63	37	593	1262	3,249	0	3,381	0
512	2.43	70	3,250	36	21	593	1258	3,811	0	3,381	0
513	2.43	68	1,000	63	37	593		3,874	0	3,386	0
514	2.43	56	1,000	51	51	514		3,169	0	3,169	0
515	2.43	58	1,000	53	53	515		3,366	0	3,366	0
516	2.43	58	1,000	53	53	516	1260	2,626	0	3,183	0
517	2.43	71	1,000	68	37	593	1268	3,913	0	3,401	0
518	2.43	83	3,500	60	20	593	1267	5,486	0	3,516	0
519	2.43	84	3,500	63	20	593	1275	5,793	0	3,535	0
520	2.43	83	3,500	62	20	593	1277	4,914	0	3,523	0
521	2.43	78	1,000	53	53	521	1383	997	3	1,598	0
522	2.43	65	1,000	60	60	522	1283	1,753	0	3,191	0
523	2.43	67	1,000	62	37	593	1282	2,757	0	3,277	0
524	2.43	70	1,000	64	64	524	1280	1,837	0	2,931	0
525	2.43	71	1,000	64	64	525	1280	2,191	0	3,050	0
526	2.43	47	1,000	44	44	526		3,123	0	3,120	0
527	2.43	48	1,000	45	45	527		3,247	0	3,245	0
528	2.43	47	1,000	44	37	593		3,307	0	3,225	0
529	2.43	48	1,000	45	37	550		3,426	0	3,180	0
530	2.43	43	1,000	41	41	530		3,084	0	3,084	0
531	2.43	48	1,000	45	37	550		3,410	0	3,171	0
532	2.43	86	3,500	64	20	593		6,249	0	3,526	0
533	2.43	64	1,000	61	37	593	1294	3,392	0	3,279	0
534	2.43	44	1,000	41	41	534		3,052	0	3,052	0
535	2.43	42	1,000	38	38	535		2,334	0	2,332	0
536	2.43	64	1,000	61	37	593		4,305	0	3,214	0
537	2.43	63	1,000	61	37	593		4,448	0	3,285	0
538	2.43	85	3,500	64	20	593		6,340	0	3,493	7
539	2.43	86	3,500	64	20	593	1290	5,832	0	3,499	1
540	2.43	80	1,000	31	20	593	1291	1,730	0	3,456	0
541	2.43	76	1,000	65	65	541	1302	1,967	0	2,351	0
542	2.43	64	1,000	60	36	593	1296	2,949	0	2,751	0
543	2.43	65	1,000	62	37	550		4,385	0	3,066	0
544	2.43	63	1,000	59	36	593	1308	2,873	0	2,675	0
545	2.43	59	1,000	55	46	594	1308	3,038	0	2,816	0
546	2.43	51	1,000	47	47	546	938	2,350	0	2,916	0
547	2.43	52	1,000	48	48	547	1317	2,046	0	2,796	0
548	2.43	44	1,000	38	38	548		1,994	0	1,992	0
549	2.43	40	1,000	35	35	549		1,996	0	1,995	0
550	2.43	39	1,000	35	35	550		2,288	0	2,288	0
551	2.43	70	3,500	48	19	550		5,336	0	3,440	60
552	2.43	94	3,500	72	32	577	1322	4,317	0	4,467	0
554	2.43	81	3,500	49	22	577		4,991	0	3,628	0
555	2.43	87	3,500	-48	-48	555	380	1,567	1,933	2,399	1,101
556	2.43	87	3,500	61	27	577	1325	4,614	0	3,967	0
557	2.43	81	3,500	49	23	577	1948	3,539	0	3,696	0
558	2.43	83	3,500	46	25	577	1328	2,420	1,080	3,859	0
559	2.43	85	3,500	44	28	577	1329	2,685	815	4,090	0
560	2.43	81	3,500	43	43	560	1332	2,454	1,046	4,547	0
561	2.43	81	3,500	69	41	577	1426	6,194	0	6,386	0
562	2.43	77	3,500	49	45	563	1333	2,441	1,059	5,011	0
563	2.43	72	3,500	27	27	563	1334	2,448	1,052	3,792	0
564	2.43	77	3,500	17	17	565	1335	1,564	1,936	3,405	95
565	2.43	77	3,500	2	2	565		3,022	478	3,022	478
566	2.43	81	3,500	48	20	577	1948	3,367	133	3,518	0
567	2.43	77	3,500	20	20	567	1339	1,567	1,933	3,503	0
568	2.43	72	3,500	14	-5	577		3,311	189	2,568	932
569	2.43	92	3,500	-37	-39	869	1346	1,564	1,936	2,513	987
570	2.43	85	3,500	-26	-26	570	1341	1,567	1,933	2,617	883
571	2.43	72	3,500	13	-3	577	1344	2,303	1,197	2,616	884
572	2.43	72	3,500	13	-5	577	1342	2,407	1,093	2,573	927
573	2.43	72	3,500	17	-3	577		3,390	110	2,629	871
574	2.43	85	3,500	8	-7	577	1345	2,759	741	2,535	965
575	2.43	72	3,500	9	-10	577		3,162	338	2,453	1,047
576	2.43	72	3,500	2	-18	577		2,980	520	2,314	1,186
577	2.43	53	3,500	-118	-118	577		1,434	2,066	1,434	2,066
578	2.43	61	3,500	38	20	550		4,762	0	3,514	0
579	2.43	54	3,500	20	16	583	1353	2,313	1,187	3,278	222
580	2.43	48	3,500	10	8	581	1356	2,670	830	2,875	625
581	2.43	46	3,500	-33	-33	581	1355	1,567	1,933	1,955	1,545
582	2.43	56	3,500	30	18	550	1755	2,001	1,499	3,337	163

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
583	2.43	50	3,500	-6	-6	583	1357	1,567	1,933	2,529	971
584	2.43	53	3,000	34	22	550		3,998	0	3,146	0
585	2.43	67	3,500	30	19	550	1358	1,567	1,933	3,440	60
586	2.43	53	3,000	34	21	550		3,969	0	3,126	0
587	2.43	54	1,000	52	37	550		3,807	0	3,072	0
589	2.43	48	1,000	41	41	590	1364	1,541	0	2,079	0
591	2.43	42	1,000	38	35	593		2,458	0	2,331	0
592	2.43	41	1,000	33	33	592	1369	1,567	0	1,663	0
593	2.43	39	1,000	35	35	593		2,208	0	2,206	0
595	2.43	63	2,000	47	31	593	1942	3,059	0	3,023	0
597	2.43	48	1,000	34	34	596	1373	879	121	1,474	0
598	2.43	47	3,500	15	15	602		3,169	331	3,169	331
599	2.43	62	3,500	22	12	833	1760	3,519	0	3,112	388
600	2.43	61	3,500	17	7	833		3,348	152	2,912	588
601	2.43	62	3,500	3	3	601	1376	1,567	1,933	2,896	604
602	2.43	47	3,500	-55	-55	602	1799	1,564	1,936	1,659	1,841
603	2.43	47	1,000	44	37	593		3,265	0	3,231	0
604	2.43	46	1,000	43	37	550		3,294	0	3,209	0
605	2.43	72	1,000	64	64	605	1382	1,864	0	2,693	0
606	2.43	44	1,000	40	40	606	1385	1,398	0	2,492	0
607	2.43	46	1,000	42	42	607		3,065	0	3,062	0
608	2.43	50	2,500	23	23	608		2,657	0	2,657	0
611	2.43	64	1,000	50	50	613	1252	1,294	0	2,110	0
613	2.43	64	1,000	45	45	613	1252	1,294	0	1,710	0
614	2.43	71	1,000	-15	-15	614	1397	389	611	743	257
615	2.43	98	2,000	81	81	811	1400	2,467	0	4,567	0
616	2.43	91	2,000	46	46	616	1401	1,067	933	2,541	0
617	2.43	92	3,500	23	23	617	1406	2,000	1,500	3,569	0
618	2.43	85	2,000	65	65	618		3,778	0	3,777	0
619	2.43	91	3,500	27	27	619	1407	3,485	15	3,713	0
620	2.43	89	1,000	80	80	620	1409	1,567	0	3,149	0
621	2.43	76	2,000	54	54	621	1411	1,525	475	3,234	0
622	2.43	95	3,500	61	22	593	1412	2,594	906	3,736	0
623	2.43	95	3,500	51	22	593	1414	3,525	0	3,736	0
624	2.43	82	1,000	77	28	718	1422	2,882	0	5,953	0
625	2.43	84	3,500	70	25	718	1421	3,670	0	5,870	0
626	2.43	84	1,000	80	28	718	41	4,818	0	5,926	0
627	2.43	85	3,500	78	28	718	207	6,190	0	8,755	0
628	2.43	90	3,500	75	28	718	1427	2,448	1,052	8,687	0
629	2.43	83	3,500	50	50	629	1429	1,567	1,933	4,920	0
630	2.43	87	3,500	80	25	686	1431	7,191	0	5,363	0
631	2.43	87	1,000	86	28	686	1431	7,377	0	5,184	0
632	2.43	93	1,000	92	28	686	1432	3,160	0	5,111	0
633	2.43	100	1,000	98	28	686	1433	3,482	0	5,084	0
634	2.43	106	1,000	101	101	634	1434	1,567	0	4,459	0
635	2.43	102	1,000	100	28	686	165	2,663	0	5,029	0
636	2.43	89	3,000	82	25	686	1437	5,445	0	4,992	0
637	2.43	102	1,000	96	96	637	1439	1,567	0	4,242	0
638	2.43	87	3,000	80	25	686	1441	5,629	0	4,924	0
639	2.43	89	1,000	87	28	686	1442	2,527	0	4,969	0
640	2.43	72	3,000	37	37	640	1444	1,567	1,433	3,721	0
641	2.43	78	3,000	66	25	686	1443	4,181	0	5,106	0
642	2.43	102	1,000	100	38	593	1445	4,413	0	5,361	0
643	2.43	93	3,500	79	25	686	1447	5,368	0	5,457	0
644	2.43	95	1,000	93	28	686	1448	3,029	0	5,543	0
645	2.43	98	1,000	95	28	686	1453	3,430	0	5,604	0
646	2.43	102	1,000	98	98	646	1450	2,898	0	5,569	0
647	2.43	98	1,000	95	38	593	1452	2,239	0	5,557	0
648	2.43	95	1,000	92	92	648	1455	3,059	0	5,486	0
649	2.43	95	2,000	85	27	686	1462	2,546	0	5,617	0
650	2.43	93	3,000	81	26	686	1457	4,662	0	5,513	0
651	2.43	95	3,000	46	46	651	1458	1,567	1,433	3,782	0
652	2.43	95	3,500	66	25	686	1461	2,455	1,045	5,612	0
653	2.43	98	3,500	76	25	686	1459	3,162	338	5,605	0
654	2.43	102	3,000	89	26	686	1463	5,354	0	5,633	0
655	2.43	91	2,000	83	27	686	1587	3,506	0	5,682	0
656	2.43	91	1,000	88	88	656	1465	2,861	0	5,495	0
657	2.43	108	3,500	70	64	658	1468	2,446	1,054	5,278	0
658	2.43	102	3,500	39	39	658	1470	1,567	1,933	4,025	0
659	2.43	66	1,000	36	36	659	1471	881	119	1,296	0
660	2.43	84	1,000	78	28	718	1472	3,047	0	5,159	0
661	2.43	82	1,000	73	73	661	1474	1,567	0	3,517	0
662	2.43	90	3,500	40	40	662	1475	1,567	1,933	4,257	0
663	2.43	76	1,000	75	27	686	1476	4,636	0	4,342	0
664	2.43	78	2,000	72	26	686	1478	2,218	0	4,208	0
665	2.43	74	2,000	66	26	686	1479	2,695	0	4,170	0
666	2.43	76	2,000	65	26	686	1480	2,551	0	4,148	0
667	2.43	69	2,000	57	26	686	1482	3,514	0	4,143	0
668	2.43	66	2,000	55	48	675	1482	3,431	0	4,088	0
669	2.43	65	2,000	54	48	675	1484	2,604	0	4,125	0
670	2.43	59	2,000	49	26	686	1485	2,369	0	4,127	0
671	2.43	57	2,000	49	26	686	1486	2,753	0	4,099	0
672	2.43	52	2,000	46	26	686	1489	2,329	0	4,018	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
673	2.43	50	1,000	49	27	686	1488	5,102	0	3,876	0
674	2.43	71	2,000	56	56	674	1491	3,110	0	3,846	0
675	2.43	59	2,000	43	43	675	1494	3,132	0	3,284	0
676	2.43	39	1,000	38	27	686		4,702	0	3,186	0
677	2.43	39	2,000	18	18	677	1496	1,567	433	1,910	90
678	2.43	37	1,000	36	27	686		4,419	0	2,979	0
679	2.43	33	1,000	31	26	686		2,945	0	2,337	0
680	2.43	31	1,000	24	24	680		1,370	0	1,370	0
681	2.43	33	1,000	30	26	686	1500	2,446	0	2,337	0
682	2.43	33	1,000	30	30	682		2,257	0	2,256	0
683	2.43	33	1,000	30	26	684		2,356	0	1,907	0
684	2.43	28	1,000	22	22	684		1,205	0	1,205	0
685	2.43	28	1,000	22	22	685		1,198	0	1,198	0
686	2.43	28	1,000	23	23	686		1,240	0	1,240	0
687	2.43	90	2,000	47	21	684	1768	2,163	0	2,184	0
688	2.43	59	2,000	53	25	684	1503	4,513	0	3,446	0
689	2.43	80	2,000	73	25	684	1505	2,356	0	3,463	0
690	2.43	57	2,000	48	25	684	1507	3,600	0	3,471	0
691	2.43	54	2,000	50	25	684		6,388	0	3,536	0
692	2.43	63	2,000	52	25	684	1509	3,103	0	3,467	0
693	2.43	54	2,000	11	11	693	1512	881	1,119	1,767	233
694	2.43	59	2,000	50	25	684	1510	2,908	0	3,467	0
695	2.43	52	2,000	48	25	684	1513	6,161	0	3,635	0
696	2.43	52	2,000	43	25	684	1515	1,567	433	3,635	0
697	2.43	54	1,000	52	37	237	1516	2,395	0	3,694	0
698	2.43	77	1,000	30	23	919		1,788	0	1,599	0
699	2.43	79	1,000	32	23	919		1,948	0	1,588	0
700	2.43	90	1,000	43	23	919		2,621	0	1,573	0
701	2.43	72	1,000	23	22	352		1,344	0	1,270	0
702	2.43	88	1,000	42	23	919		2,608	0	1,567	0
703	2.43	92	1,000	45	23	919		2,519	0	1,567	0
704	2.43	97	1,000	48	23	919		2,490	0	1,566	0
705	2.43	95	1,000	47	23	919		2,591	0	1,565	0
706	2.43	86	1,000	38	23	919		2,252	0	1,560	0
707	2.43	41	1,000	35	35	820		2,125	0	2,125	0
708	2.43	41	1,000	35	35	708		2,127	0	2,127	0
709	2.43	41	1,000	37	37	709		2,553	0	2,553	0
710	2.43	41	1,000	37	37	710	1538	2,549	0	2,608	0
711	2.43	41	1,000	38	27	718	1541	2,209	0	2,930	0
712	2.43	39	1,000	36	27	718		3,339	0	2,927	0
713	2.43	82	1,000	32	22	352		1,794	0	1,286	0
714	2.43	86	1,000	36	22	352		1,825	0	1,286	0
715	2.43	82	1,000	31	22	352		1,626	0	1,299	0
716	2.43	79	1,000	30	22	352		1,641	0	1,286	0
717	2.43	86	1,000	35	22	352		1,820	0	1,286	0
718	2.43	28	1,000	27	27	718		2,723	0	2,722	0
719	2.43	54	1,000	50	35	230		3,910	0	2,907	0
720	2.43	54	1,000	50	35	230		3,858	0	2,896	0
721	2.43	52	1,000	48	35	230		3,565	0	2,889	0
722	2.43	56	1,000	52	35	230	1554	2,570	0	2,860	0
723	2.43	65	1,000	59	35	230	1555	2,292	0	2,860	0
724	2.43	54	1,000	50	35	230		3,462	0	2,800	0
725	2.43	56	1,000	52	35	230	1558	3,470	0	2,850	0
726	2.43	63	1,000	58	35	230	1561	2,587	0	2,861	0
727	2.43	41	1,000	37	37	727	1807	2,238	0	2,571	0
728	2.43	41	1,000	19	19	728	1565	881	119	985	15
729	2.43	54	1,000	50	41	730	1569	2,808	0	2,923	0
730	2.43	46	1,000	27	27	730	1570	881	119	1,195	0
731	2.43	54	1,000	49	41	732	1572	2,629	0	2,667	0
732	2.43	45	1,000	26	26	732	1573	881	119	1,167	0
733	2.43	65	1,000	62	27	718	103	2,980	0	4,411	0
734	2.43	69	1,000	65	27	718	1575	3,127	0	4,030	0
735	2.43	67	1,000	65	50	817	1579	2,051	0	4,792	0
736	2.43	80	1,000	78	50	817	1582	4,028	0	5,297	0
737	2.43	82	2,000	73	73	737	1583	2,862	0	5,599	0
738	2.43	85	2,000	75	75	738	1585	2,889	0	5,685	0
739	2.43	87	2,000	78	27	686	1586	4,093	0	5,738	0
740	2.43	89	2,000	81	27	686	1587	3,568	0	5,706	0
741	2.43	85	2,000	74	74	741	1591	2,751	0	5,347	0
742	2.43	54	1,000	52	52	742	1593	2,812	0	4,683	0
743	2.43	85	1,000	78	78	743	1594	1,822	0	3,354	0
744	2.43	50	1,000	47	27	686	1597	3,130	0	3,768	0
745	2.43	67	1,000	65	28	686	1598	4,803	0	5,001	0
746	2.43	63	1,000	58	58	746	1601	1,660	0	3,253	0
747	2.43	79	1,000	29	22	352		1,577	0	1,290	0
748	2.43	43	1,000	38	36	708		2,310	0	2,290	0
749	2.43	41	1,000	36	36	749		2,297	0	2,297	0
750	2.43	41	1,000	37	37	750		2,721	0	2,721	0
751	2.43	43	1,000	39	39	751	1611	2,518	0	2,619	0
752	2.43	50	1,000	46	27	718	1613	2,655	0	2,935	0
753	2.43	73	3,000	45	34	754	1615	2,702	298	3,838	0
754	2.43	60	1,000	53	53	754		3,466	0	3,466	0
755	2.43	97	3,500	82	22	718	1620	5,521	0	4,125	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
756	2.43	97	3,500	77	22	718	1621	2,355	1,145	4,088	0
757	2.43	92	3,500	69	21	718	1623	2,869	631	4,065	0
758	2.43	90	3,000	75	23	718	179	4,185	0	4,091	0
759	2.43	95	3,000	74	23	718	1624	3,049	0	3,988	0
760	2.43	95	3,000	75	23	718	1761	2,686	314	3,929	0
761	2.43	90	3,500	69	23	718	1629	2,577	923	4,754	0
762	2.43	92	3,500	77	23	718	1628	4,866	0	4,847	0
763	2.43	92	3,500	76	23	718	1630	3,073	427	4,916	0
764	2.43	88	3,500	53	23	718	1632	2,941	559	4,881	0
765	2.43	99	3,500	50	22	718	1634	1,567	1,933	4,125	0
766	2.43	95	3,000	83	23	718	1635	6,228	0	3,850	0
767	2.43	112	1,000	107	37	875	1744	4,261	0	2,768	0
768	2.43	84	3,000	54	17	230	1641	3,034	0	2,769	231
769	2.43	93	3,000	67	17	230	1638	5,388	0	2,775	225
770	2.43	80	3,000	53	17	230	1645	3,366	0	2,767	233
771	2.43	78	3,000	54	18	230		4,945	0	2,792	208
772	2.43	71	1,000	56	56	772	1646	881	119	1,946	0
773	2.43	54	1,000	47	34	875		2,474	0	1,905	0
774	2.43	76	1,000	65	65	896		2,556	0	2,554	0
775	2.43	69	2,000	55	25	230		4,041	0	2,411	0
776	2.43	50	2,000	39	24	718		3,557	0	2,944	0
777	2.43	63	2,000	53	24	718		4,828	0	2,936	0
778	2.43	71	1,000	67	35	230	1656	2,324	0	2,756	0
779	2.43	67	1,000	62	35	230		3,783	0	2,505	0
780	2.43	50	1,000	44	34	230		2,792	0	2,454	0
781	2.43	45	1,000	40	34	230		2,561	0	2,450	0
782	2.43	45	1,000	39	39	782		2,303	0	2,303	0
783	2.43	71	1,000	66	34	230	1661	3,218	0	2,470	0
784	2.43	58	2,000	44	25	230		3,515	0	2,355	0
785	2.43	58	1,000	52	34	230	1665	2,544	0	2,465	0
786	2.43	45	1,000	39	39	786		2,314	0	2,314	0
787	2.43	54	1,000	48	34	230		2,953	0	2,445	0
788	2.43	54	1,000	49	34	230		3,038	0	2,442	0
789	2.43	56	1,000	51	34	230		3,170	0	2,435	0
790	2.43	63	1,000	58	34	230		3,683	0	2,437	0
791	2.43	71	1,000	66	34	230		4,083	0	2,442	0
792	2.43	82	1,000	76	34	230	1674	2,475	0	2,442	0
793	2.43	82	1,000	76	34	230	1675	2,123	0	2,442	0
794	2.43	88	1,000	81	34	230	1676	2,876	0	2,442	0
795	2.43	89	1,000	81	34	230	1677	2,659	0	2,442	0
796	2.43	84	1,000	78	34	230	1679	2,856	0	2,442	0
797	2.43	80	1,000	74	34	230	1680	3,400	0	2,442	0
798	2.43	74	1,000	68	34	230	1681	2,730	0	2,442	0
799	2.43	74	1,000	69	34	230		4,166	0	2,448	0
800	2.43	61	1,000	56	34	230		3,570	0	2,424	0
801	2.43	67	1,000	61	34	230	1687	2,430	0	2,420	0
802	2.43	63	1,000	57	34	230		3,462	0	2,417	0
803	2.43	58	1,000	53	34	230		3,456	0	2,414	0
804	2.43	41	1,000	36	34	230		2,401	0	2,305	0
805	2.43	41	1,000	35	35	805		2,086	0	2,086	0
806	2.43	46	1,000	37	37	806		1,838	0	1,837	0
808	2.43	77	1,000	57	45	613	1252	1,294	0	1,710	0
809	2.43	89	1,000	74	74	809	1419	1,567	0	2,270	0
810	2.43	73	1,000	-75	-75	810	1398	392	608	563	437
811	2.43	98	1,000	90	90	811	1707	1,567	0	3,639	0
812	2.43	76	2,000	35	35	812	1416	1,567	433	2,414	0
813	2.43	79	3,250	72	26	718	1713	2,126	1,124	5,779	0
815	2.43	97	1,000	23	23	815	940	881	119	1,060	0
816	2.43	105	1,000	78	56	247	1566	881	119	1,749	0
817	2.43	52	1,000	39	39	817	949	1,567	0	1,660	0
818	2.43	70	1,000	24	24	818		1,519	0	1,519	0
819	2.43	72	1,000	23	23	819		1,246	0	1,246	0
820	2.43	41	1,000	28	28	820		1,329	0	1,329	0
833	2.43	52	3,500	-71	-71	833		1,668	1,832	1,668	1,832
836	2.43	48	2,000	32	32	836		2,676	0	2,676	0
837	2.43	41	2,000	28	22	684		2,634	0	2,335	0
838	2.43	62	2,000	-20	-20	838	1751	645	1,355	1,373	627
839	2.43	56	3,500	33	18	550		4,361	0	3,314	186
840	2.43	47	3,500	14	14	840		3,099	401	3,099	401
841	2.43	62	3,500	28	16	550		3,917	0	3,193	307
842	2.43	95	3,000	79	23	718	1762	2,192	808	3,882	0
844	2.43	90	2,000	53	21	684	1938	1,540	460	2,184	0
845	2.43	80	2,000	34	21	684		2,305	0	2,184	0
846	2.43	80	1,000	67	26	684		2,273	0	2,184	0
847	2.43	90	2,000	47	21	684	1771	2,198	0	2,184	0
848	2.43	84	1,000	68	68	848	1773	1,567	0	2,169	0
853	2.43	33	1,000	30	25	684		2,401	0	1,887	0
854	2.43	33	1,000	30	26	685		2,509	0	1,974	0
855	2.43	33	1,000	30	26	686		2,834	0	2,244	0
856	2.43	33	1,000	30	26	686		2,650	0	2,084	0
857	2.43	88	2,000	28	26	851	1796	1,564	436	2,119	0
858	2.43	97	2,000	31	26	851		2,175	0	2,119	0
862	2.43	47	3,500	-31	-31	602	1799	1,564	1,936	1,934	1,566

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
863	2.43	58	1,000	43	31	315	1803	876	124	1,353	0
864	2.43	46	1,000	42	27	718		3,253	0	2,944	0
868	2.43	43	2,000	31	23	684	1815	2,582	0	2,566	0
869	2.43	89	3,500	-68	-68	869	1818	1,567	1,933	2,249	1,251
875	2.43	42	1,000	33	33	875		1,738	0	1,737	0
880	2.43	95	3,500	75	23	593	1852	4,105	0	3,805	0
885	2.43	94	3,500	68	23	593	1838	1,972	1,528	3,794	0
887	2.43	94	3,500	59	23	593	1849	2,382	1,118	3,795	0
888	2.43	94	3,500	56	23	593	1843	2,655	845	3,807	0
889	2.43	76	1,000	67	35	875		2,808	0	2,108	0
890	2.43	76	1,000	54	54	890	1888	881	119	1,671	0
896	2.43	76	1,000	64	64	896		2,471	0	2,470	0
900	2.43	54	1,000	51	51	900	368	2,808	0	3,862	0
901	2.43	51	2,000	41	41	901	370	1,564	436	3,784	0
903	2.43	52	2,000	33	33	903	371	1,567	433	2,640	0
919	2.43	68	1,000	6	6	919		816	184	816	184
920	2.43	63	1,000	57	35	230	373	2,647	0	2,860	0
923	2.43	50	1,000	39	39	923	376	881	119	1,731	0
924	2.43	56	3,500	16	16	924	983	3,060	440	3,326	174
925	2.43	91	3,500	58	22	593	378	2,460	1,040	3,653	0
926	2.43	83	3,500	-4	-4	926	379	1,567	1,933	2,949	551
927	2.43	87	3,500	-3	-3	928	1324	1,562	1,938	2,990	510
928	2.43	87	3,500	-55	-55	928	381	1,567	1,933	2,339	1,161
929	2.43	69	1,000	48	48	929	1147	1,125	0	1,656	0
930	2.43	67	1,000	58	34	230		2,621	0	2,417	0
931	2.43	95	3,000	43	17	875	384	1,567	1,433	2,768	232
932	2.43	69	2,000	41	25	230	385	1,567	433	2,411	0
933	2.43	58	2,000	43	24	230		3,446	0	2,306	0
934	2.43	95	3,000	51	23	718	387	1,613	1,387	3,850	0
935	2.43	50	1,000	45	34	230		2,931	0	2,363	0
936	2.43	50	1,000	39	39	936	391	1,567	0	1,794	0
937	2.43	53	1,000	43	43	937		3,730	0	3,729	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
10	2.89	82	1,000	75	41	732	17	2,485	0	3,148	0
12	2.89	75	1,000	69	41	732	19	3,168	0	3,135	0
14	2.89	69	1,000	62	41	732	13	2,746	0	3,171	0
16	2.89	89	1,000	80	41	732	31	1,454	0	3,148	0
18	2.89	81	3,500	73	34	230	43	4,545	0	7,618	0
20	2.89	82	3,500	65	65	20	57	3,010	490	6,768	0
22	2.89	81	3,500	70	33	230	47	3,879	0	7,322	0
24	2.89	81	3,500	69	33	230	49	3,342	158	7,281	0
26	2.89	81	3,500	70	33	230	43	2,830	670	7,478	0
28	2.89	58	1,000	52	33	230		3,397	0	2,317	0
30	2.89	53	1,000	48	33	230		2,966	0	2,329	0
32	2.89	49	1,000	43	33	230		2,637	0	2,337	0
34	2.89	60	1,000	53	33	230		2,820	0	2,316	0
36	2.89	60	1,000	52	33	230		2,733	0	2,316	0
38	2.89	59	1,000	51	33	230		2,652	0	2,316	0
40	2.89	64	1,000	56	33	230		2,718	0	2,316	0
42	2.89	62	1,000	54	33	230		2,654	0	2,316	0
44	2.89	64	1,000	55	33	230	83	2,257	0	2,316	0
46	2.89	66	1,000	57	33	230		2,581	0	2,316	0
48	2.89	64	1,000	55	33	230		2,458	0	2,316	0
50	2.89	74	1,000	64	33	230	93	2,448	0	2,316	0
52	2.89	71	1,000	62	33	230	95	2,445	0	2,316	0
54	2.89	79	3,500	73	33	230	109	4,509	0	7,539	0
56	2.89	76	2,000	49	49	56	111	1,541	459	2,940	0
58	2.89	45	1,000	44	27	684		5,956	0	3,610	0
60	2.89	46	1,000	44	27	684	115	2,975	0	3,844	0
62	2.89	48	1,000	46	27	684	123	3,963	0	3,918	0
64	2.89	48	1,000	46	27	684	121	4,048	0	3,890	0
66	2.89	49	1,000	47	27	684	131	3,644	0	3,951	0
68	2.89	49	1,000	46	27	684	123	3,695	0	4,000	0
70	2.89	72	1,000	69	27	684	133	3,514	0	3,761	0
72	2.89	60	1,000	56	53	114	135	2,164	0	3,616	0
74	2.89	59	1,000	55	55	74		3,473	0	3,472	0
76	2.89	98	1,000	73	73	76	141	1,567	0	1,866	0
78	2.89	40	1,000	35	33	230		2,254	0	2,211	0
80	2.89	45	2,000	26	23	230		2,372	0	2,218	0
82	2.89	49	2,000	30	23	230		2,581	0	2,220	0
84	2.89	53	2,000	36	23	230		2,949	0	2,231	0
86	2.89	53	2,000	35	23	230		2,820	0	2,243	0
88	2.89	95	1,000	93	28	686	165	5,054	0	5,970	0
90	2.89	95	1,000	93	28	686	163	3,500	0	5,965	0
92	2.89	85	3,000	71	27	230	179	3,000	0	4,746	0
94	2.89	66	1,000	61	33	230		3,845	0	2,338	0
96	2.89	62	1,000	57	33	230		3,592	0	2,359	0
98	2.89	90	1,000	84	84	98	185	1,779	0	4,169	0
100	2.89	89	1,000	83	83	100	187	1,616	0	4,156	0
102	2.89	62	3,500	-57	-67	577	189	1,564	1,936	1,732	1,768
104	2.89	70	1,000	63	63	104	1265	1,677	0	3,227	0
106	2.89	84	1,000	77	28	684	195	1,567	0	3,251	0
108	2.89	61	1,000	50	50	613	1252	1,317	0	2,340	0
110	2.89	87	1,000	80	80	110	1595	1,617	0	3,555	0
112	2.89	70	1,000	66	28	684	201	2,786	0	4,133	0
114	2.89	56	1,000	51	51	114	203	2,704	0	2,895	0
116	2.89	97	3,500	67	67	116	205	1,828	1,672	5,784	0
128	3.23	96	2,500	86	28	684	237	4,200	0	7,900	0
134	2.89	94	1,000	90	28	684	287	3,613	0	5,488	0
136	2.89	95	1,000	91	28	684	289	3,905	0	5,327	0
138	2.89	94	1,000	91	28	684	289	3,980	0	5,509	0
140	2.89	94	1,000	91	28	684	291	3,145	0	5,657	0
142	2.89	97	1,000	94	28	684	293	3,718	0	5,691	0
144	2.89	101	1,000	97	28	684	1925	2,852	0	5,435	0
146	2.89	101	1,000	96	28	684	1926	2,760	0	5,009	0
148	2.89	70	1,000	59	59	148	277	1,544	0	2,516	0
215	2.89	112	1,000	106	36	875	1637	4,446	0	2,614	0
216	2.89	48	2,000	41	25	684	921	4,443	0	3,456	0
217	2.89	69	1,000	67	27	684	1504	3,511	0	3,761	0
218	2.89	79	1,000	33	23	919	925	2,124	0	1,573	0
219	2.89	95	1,000	84	64	896		3,102	0	2,609	0
220	2.89	99	1,000	88	36	875		3,298	0	2,614	0
221	2.89	81	3,500	74	34	230	1708	5,888	0	7,768	0
222	2.89	86	2,000	72	72	222	930	3,525	0	5,151	0
228	2.89	74	1,000	70	27	684	923	4,393	0	3,761	0
229	2.89	61	1,000	57	34	230		3,905	0	2,781	0
230	2.89	38	2,000	22	22	230		2,139	0	2,139	0
231	0	77	2,000	76	28	684		10,385	0	10,558	0
232	2.89	80	3,500	64	37	577	1331	7,055	0	5,254	0
233	2.89	77	1,000	30	23	919		1,830	0	1,494	0
235	2.89	79	1,000	30	22	352		1,751	0	1,234	0
236	2.89	81	1,000	26	22	352		1,248	0	1,235	0
237	2.89	39	1,000	33	33	237	1518	1,758	0	1,988	0
238	2.89	49	1,000	47	37	237	129	2,995	0	3,658	0
239	2.89	51	1,000	50	27	684	1008	5,924	0	4,446	0
240	2.89	71	1,000	23	22	352		1,300	0	1,230	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
241	2.89	90	1,000	41	22	352		2,117	0	1,235	0
242	2.89	94	1,000	45	22	352		2,239	0	1,236	0
243	2.89	70	1,000	63	63	243	193	3,186	0	3,225	0
244	2.89	78	1,000	73	28	684	1299	2,442	0	3,704	0
245	2.89	76	1,000	72	28	684	1274	4,702	0	5,071	0
246	2.89	89	3,500	61	61	246	1179	2,557	943	5,565	0
247	2.89	76	1,000	55	55	247	1095	878	122	1,716	0
248	2.89	66	1,000	60	40	732	1096	2,542	0	3,071	0
249	2.89	51	1,000	46	40	732		3,157	0	2,872	0
250	2.89	52	1,000	45	45	250	966	1,759	0	2,331	0
251	2.89	83	3,500	62	30	581	1309	4,221	0	4,479	0
252	2.89	70	1,000	70	28	686		9,717	0	7,986	0
253	2.89	78	1,000	77	28	686	1428	8,269	0	7,420	0
254	2.89	52	2,000	48	25	684		6,652	0	3,722	0
255	2.89	51	1,000	49	27	686	972	3,372	0	4,024	0
256	2.89	46	1,000	44	27	686	973	3,315	0	4,029	0
257	2.89	46	1,000	44	27	686	974	3,813	0	3,911	0
258	2.89	38	1,000	37	27	686		4,980	0	3,423	0
259	2.89	43	1,000	42	27	686	979	2,828	0	3,632	0
260	2.89	49	1,000	45	45	260	964	2,326	0	3,303	0
261	2.89	51	1,000	48	48	261	964	3,279	0	4,029	0
262	2.89	59	1,000	56	56	262	957	2,473	0	4,043	0
263	2.89	60	1,000	56	56	263	962	2,370	0	3,852	0
264	2.89	55	1,000	51	51	264	963	1,977	0	3,145	0
265	2.89	50	1,000	48	27	686	982	4,216	0	4,340	0
266	2.89	42	1,000	39	39	266	970	1,956	0	2,867	0
267	2.89	43	1,000	40	40	267	970	2,400	0	3,150	0
268	2.89	41	1,000	38	38	268	976	1,974	0	2,959	0
269	2.89	39	1,000	38	27	686		5,004	0	3,401	0
270	2.89	41	1,000	40	27	686		5,174	0	3,858	0
271	2.89	68	1,000	66	27	686	1477	4,417	0	4,680	0
272	2.89	67	1,000	64	64	272	959	1,866	0	4,722	0
273	2.89	68	1,000	65	27	686	955	3,123	0	5,345	0
274	2.89	82	1,000	81	28	686	1430	7,803	0	5,714	0
275	2.89	83	3,000	76	25	686	1440	5,835	0	5,906	0
276	2.89	85	3,000	78	26	686	1436	6,090	0	6,827	0
277	2.89	96	2,000	89	89	277	981	3,795	0	7,948	0
278	2.89	95	3,000	85	26	686	1456	6,519	0	8,397	0
279	2.89	88	3,000	80	26	686	956	5,489	0	6,968	0
280	2.89	61	1,000	59	28	686	1601	5,318	0	6,136	0
281	2.89	53	1,000	51	51	281	990	5,056	0	5,393	0
282	2.89	61	1,000	57	57	282	991	1,623	0	3,658	0
283	2.89	64	1,000	56	56	283	993	1,488	0	2,575	0
284	2.89	58	1,000	53	53	938	994	1,854	0	3,111	0
285	2.89	52	1,000	50	50	285	987	4,437	0	5,237	0
286	2.89	52	1,000	50	50	286	986	4,566	0	5,622	0
287	2.89	52	1,000	51	28	686	982	4,973	0	5,698	0
288	2.89	54	3,500	33	33	288	985	3,111	389	4,551	0
289	2.89	58	3,500	30	30	289	995	2,808	692	4,111	0
290	2.89	54	3,500	36	36	290	996	2,457	1,043	4,962	0
291	2.89	72	1,000	71	63	292	1003	2,770	0	6,560	0
292	2.89	65	1,000	62	62	292	999	2,367	0	4,320	0
293	2.89	92	1,000	89	89	293	997	3,115	0	6,613	0
294	2.89	76	1,000	73	73	294	1002	3,105	0	5,886	0
295	2.89	82	2,000	73	73	295	1588	2,971	0	5,901	0
296	2.89	89	1,000	85	85	296	1465	2,013	0	4,996	0
297	2.89	77	1,000	72	72	297	952	2,307	0	3,882	0
298	2.89	63	1,000	61	61	298	997	2,686	0	4,708	0
299	2.89	52	1,000	51	27	684	1009	6,402	0	4,934	0
300	2.89	41	1,000	28	28	300		1,283	0	1,283	0
301	2.89	44	1,000	37	34	300		2,012	0	1,871	0
302	2.89	48	1,000	42	36	300	1012	2,091	0	2,098	0
303	2.89	56	1,000	54	54	303	1004	4,149	0	6,869	0
304	2.89	59	1,000	57	39	300	1015	2,146	0	3,779	0
305	2.89	56	1,500	54	27	684	1016	6,213	0	5,751	0
306	2.89	45	1,000	44	28	684	1017	5,981	0	7,109	0
307	2.89	52	1,000	48	48	307	1005	2,299	0	3,309	0
308	2.89	63	1,000	62	28	684	1579	9,661	0	12,494	0
309	2.89	67	1,000	63	48	817	1580	1,827	0	3,135	0
310	2.89	59	1,000	52	45	817	1057	1,564	0	2,321	0
315	2.89	45	1,000	-7	-7	315		671	329	671	329
316	2.89	55	1,000	26	16	315	1804	878	122	930	70
318	2.89	46	1,000	25	23	317	1068	878	122	1,090	0
319	2.89	58	1,000	48	34	317	1577	867	133	1,692	0
320	2.89	105	2,000	96	93	658	1030	3,389	0	7,309	0
321	2.89	103	3,000	90	90	321	1715	3,872	0	8,616	0
322	2.89	92	1,000	88	88	322	1031	2,382	0	4,826	0
323	2.89	76	1,000	74	50	817	1582	3,623	0	5,655	0
324	2.89	83	1,000	73	73	324	1062	1,272	0	2,773	0
325	2.89	84	1,000	79	79	325	1035	2,117	0	4,295	0
326	2.89	76	1,000	74	50	817	1064	4,191	0	5,868	0
327	2.89	89	1,000	84	84	327	1035	2,340	0	4,638	0
328	2.89	90	1,000	84	84	328	1034	1,532	0	3,700	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
329	2.89	77	1,000	75	36	382	1064	3,225	0	5,140	0
330	2.89	78	1,000	75	36	382	1083	4,200	0	4,425	0
331	2.89	87	1,000	83	36	382	1084	2,172	0	4,314	0
332	2.89	91	1,000	86	36	382	1086	2,419	0	4,242	0
333	2.89	77	1,750	70	33	382	1083	3,989	0	4,118	0
334	2.89	65	1,000	61	36	382	1081	2,681	0	3,831	0
335	2.89	75	1,000	71	36	382	1087	3,094	0	3,805	0
336	2.89	68	3,000	30	26	337	1092	1,509	1,491	3,278	0
337	2.89	59	1,000	50	50	337	1091	1,640	0	2,215	0
338	2.89	61	1,000	55	55	338	1088	1,552	0	3,090	0
339	2.89	65	1,000	61	41	317	1080	3,620	0	3,762	0
340	2.89	98	3,000	70	17	230	1114	4,600	0	2,693	307
341	2.89	85	1,000	38	23	919		2,279	0	1,560	0
342	2.89	79	1,000	33	23	919		2,326	0	1,583	0
343	2.89	73	1,000	28	23	919		2,053	0	1,543	0
344	2.89	76	1,000	31	23	919		2,287	0	1,498	0
345	2.89	73	1,000	26	21	919		1,622	0	1,126	0
346	2.89	81	1,000	28	22	352		1,408	0	1,235	0
347	2.89	75	1,000	26	22	352		1,500	0	1,247	0
348	2.89	82	1,000	26	26	348	1027	876	124	1,248	0
349	2.89	80	1,000	30	23	352		1,575	0	1,343	0
350	2.89	96	1,000	47	24	818	1526	2,262	0	1,592	0
352	2.89	69	1,000	22	22	352		1,190	0	1,189	0
353	2.89	73	1,000	23	23	353		1,259	0	1,258	0
354	2.89	48	1,000	40	34	875		2,160	0	2,058	0
355	2.89	46	1,000	38	35	875		2,146	0	2,096	0
356	2.89	47	1,000	39	34	875		2,124	0	2,077	0
357	2.89	50	1,000	42	34	875		2,287	0	2,057	0
358	2.89	50	1,000	43	34	875		2,369	0	2,048	0
359	2.89	46	1,000	39	34	875		2,125	0	2,068	0
360	2.89	66	1,000	58	34	875		2,668	0	2,038	0
361	2.89	68	1,000	60	34	875		2,891	0	2,025	0
362	2.89	70	1,000	62	34	875		3,053	0	2,025	0
363	2.89	54	1,000	47	34	875		2,658	0	2,014	0
364	2.89	54	1,000	47	34	875		2,658	0	2,056	0
365	2.89	88	3,500	65	31	577		6,511	0	4,347	0
366	2.89	58	1,000	51	35	875		2,924	0	2,116	0
367	2.89	51	1,000	44	35	875		2,480	0	2,104	0
368	2.89	56	1,000	49	34	875		2,622	0	2,072	0
369	2.89	59	1,000	52	35	875		2,851	0	2,120	0
370	2.89	71	1,000	65	35	875	1136	3,290	0	2,172	0
371	2.89	84	3,000	69	69	371	1051	3,522	0	6,444	0
372	2.89	80	1,000	79	62	659	1039	3,203	0	6,689	0
373	2.89	82	3,000	78	34	230	946	7,509	0	7,357	0
374	2.89	98	2,000	54	54	423	1142	1,489	511	2,743	0
375	2.89	62	2,000	59	35	435		6,277	0	4,699	0
376	2.89	96	1,000	94	28	684		10,105	0	8,051	0
377	2.89	78	1,000	74	28	684	1313	3,014	0	4,686	0
378	2.89	83	1,000	80	28	684	1360	2,225	0	5,421	0
379	2.89	71	1,000	65	65	379	1617	2,692	0	3,286	0
380	2.89	55	1,000	51	41	730		3,840	0	3,342	0
381	2.89	40	1,000	36	36	381		2,722	0	2,722	0
382	2.89	38	1,000	34	34	382		2,683	0	2,683	0
383	2.89	49	1,000	45	37	381		3,621	0	3,156	0
384	2.89	58	1,000	54	41	317	1080	4,258	0	3,490	0
386	2.89	63	1,000	60	34	230		4,825	0	2,807	0
387	2.89	66	1,000	62	34	230		4,790	0	2,800	0
388	2.89	42	1,000	38	35	230		3,339	0	3,055	0
389	2.89	38	1,000	35	35	390		3,276	0	3,265	0
390	2.89	38	1,000	34	34	390		2,748	0	2,748	0
391	2.89	44	1,000	41	35	230		3,231	0	3,109	0
392	2.89	47	1,000	43	37	727		3,296	0	3,058	0
393	2.89	59	1,000	54	35	230	1099	3,374	0	3,053	0
394	2.89	49	2,000	36	29	230	1651	2,785	0	3,023	0
395	2.89	45	1,000	40	40	395		2,787	0	2,787	0
396	2.89	51	1,000	46	41	732		3,150	0	3,050	0
397	2.89	47	1,000	42	42	397		2,852	0	2,852	0
398	2.89	56	1,000	51	35	230		3,382	0	3,030	0
399	2.89	60	1,000	54	35	230	1108	3,106	0	3,027	0
400	2.89	55	1,000	50	35	230	1100	3,173	0	3,028	0
401	2.89	58	1,000	53	35	230		3,456	0	3,026	0
402	2.89	51	1,000	46	46	402	1111	2,910	0	2,985	0
403	2.89	59	1,000	54	35	230		3,892	0	2,991	0
404	2.89	59	1,000	54	35	230	1112	3,405	0	3,069	0
405	2.89	71	3,000	63	24	230	1636	4,928	0	3,675	0
406	2.89	82	1,000	77	34	230		5,023	0	2,644	0
407	2.89	79	3,000	54	16	230		5,075	0	2,632	368
408	2.89	77	1,000	72	34	230	1135	3,914	0	2,474	0
409	2.89	63	1,000	61	61	409	1574	2,679	0	5,417	0
410	2.89	81	1,000	78	78	410	1048	2,934	0	4,623	0
411	2.89	67	1,000	64	60	659	1040	2,917	0	4,205	0
412	2.89	64	2,000	53	53	412	1042	2,930	0	4,216	0
413	2.89	55	1,000	51	51	413	1045	2,879	0	3,336	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
414	2.89	63	1,000	60	52	413	1042	3,748	0	3,973	0
415	2.89	65	1,000	62	52	413	1046	2,574	0	3,979	0
416	2.89	78	1,000	75	53	413	1567	2,893	0	4,755	0
417	2.89	81	1,000	77	77	417	1050	2,853	0	4,661	0
418	2.89	82	3,500	58	58	418	1420	2,220	1,280	5,567	0
419	2.89	83	3,500	77	33	230	47	6,398	0	7,340	0
420	2.89	85	3,000	72	32	230	1052	1,614	1,386	6,521	0
421	2.89	85	3,000	78	32	230	1052	3,507	0	6,695	0
422	2.89	86	3,500	76	30	230	1055	4,486	0	6,491	0
423	2.89	97	2,000	31	31	423		2,178	0	2,178	0
424	2.89	98	2,000	35	34	423	1144	1,561	439	2,230	0
425	2.89	98	2,000	49	49	423	1145	1,558	442	2,583	0
426	2.89	96	3,500	85	28	230	1140	4,616	0	5,437	0
427	2.89	90	3,500	82	30	230	1630	7,284	0	6,317	0
428	2.89	95	3,500	86	30	230	1139	5,304	0	6,270	0
429	2.89	59	2,000	57	36	435	929	2,220	0	4,674	0
430	2.89	56	1,000	54	36	435	928	2,618	0	3,995	0
431	2.89	54	1,000	52	36	435	1228	2,972	0	3,656	0
432	2.89	52	1,000	49	35	435	1229	2,936	0	3,325	0
433	2.89	45	1,000	42	35	435	1230	2,845	0	3,128	0
434	2.89	42	1,000	39	35	435		2,900	0	2,876	0
435	2.89	37	2,000	26	26	435		2,557	0	2,557	0
436	2.89	66	2,000	61	35	435	1208	4,677	0	4,644	0
437	2.89	69	2,000	61	34	435	1209	2,620	0	4,317	0
438	2.89	61	2,000	50	50	438	1211	2,049	0	4,000	0
439	2.89	60	1,000	57	36	435	1226	2,574	0	3,709	0
440	2.89	57	1,000	53	53	440	1224	2,093	0	3,388	0
441	2.89	48	1,000	43	43	441	1218	1,937	0	2,539	0
442	2.89	42	2,000	31	27	435		2,970	0	2,695	0
443	2.89	53	1,000	49	49	443	1222	2,081	0	2,941	0
444	2.89	96	2,000	87	30	435	1216	4,242	0	3,304	0
445	2.89	64	1,000	62	36	435	1213	4,139	0	3,637	0
446	2.89	90	3,000	55	30	754	1616	3,088	0	3,498	0
447	2.89	74	3,000	48	31	754	1199	3,169	0	3,616	0
448	2.89	64	3,000	40	25	435	1205	3,444	0	3,548	0
449	2.89	77	3,500	50	22	435	1203	3,732	0	3,655	0
450	2.89	87	3,000	65	26	435	1201	3,053	0	3,682	0
451	2.89	94	3,000	68	27	435	1197	2,509	491	3,732	0
452	2.89	95	3,500	56	56	452	1180	2,901	599	4,944	0
453	2.89	97	3,500	42	42	453	1165	2,005	1,495	4,191	0
454	2.89	97	3,500	78	34	435	1168	2,333	1,167	6,621	0
455	2.89	91	3,500	76	34	435	1164	4,211	0	6,942	0
456	2.89	97	3,500	84	34	435	1164	5,495	0	6,787	0
457	2.89	89	3,500	71	34	435	1169	3,470	30	6,499	0
458	2.89	81	3,500	67	34	435	1163	5,149	0	6,369	0
459	2.89	81	3,500	59	33	435	1188	3,710	0	5,766	0
460	2.89	82	3,500	60	33	435	1178	3,369	131	5,885	0
461	2.89	70	3,500	56	33	435	1172	4,830	0	5,933	0
462	2.89	65	2,000	59	59	462	1189	3,787	0	5,524	0
463	2.89	67	3,500	45	45	463	1177	3,060	440	5,096	0
464	2.89	81	3,500	54	54	464	1187	3,029	471	5,316	0
465	2.89	90	3,500	27	27	465	1183	1,444	2,056	3,711	0
466	2.89	90	3,500	60	60	466	1184	2,548	952	5,428	0
467	2.89	90	3,500	69	31	435	1195	3,515	0	5,004	0
468	2.89	75	2,000	69	35	435	1194	3,180	0	4,824	0
469	2.89	66	2,000	61	35	435	1208	3,418	0	4,777	0
470	2.89	90	3,500	22	22	470	1192	1,866	1,634	3,554	0
471	2.89	61	3,000	48	33	435	1190	3,249	0	5,049	0
472	2.89	63	3,000	53	34	435	1190	5,697	0	5,442	0
473	2.89	68	3,000	54	54	473	1174	3,346	0	5,624	0
474	2.89	69	3,000	56	34	435	1175	3,894	0	5,872	0
475	2.89	78	3,000	56	56	475	1166	2,837	163	5,093	0
476	2.89	65	1,000	63	37	435	1149	4,164	0	5,342	0
477	2.89	62	1,000	61	61	477	1150	3,277	0	5,074	0
478	2.89	62	1,000	38	38	478	1750	910	90	1,363	0
479	2.89	67	1,000	33	33	479	382	743	257	1,189	0
480	2.89	73	1,000	65	58	929	1159	1,296	0	2,593	0
481	2.89	69	1,000	67	67	481	1151	3,115	0	4,778	0
482	2.89	70	1,000	60	60	482	1155	1,725	0	2,418	0
483	2.89	68	1,000	58	58	483	1158	1,755	0	2,372	0
484	2.89	78	1,000	69	69	484	1161	1,373	0	2,770	0
485	2.89	77	1,000	68	68	485	1160	1,213	0	2,730	0
486	2.89	79	1,000	77	65	929	1415	2,892	0	6,475	0
487	2.89	89	3,500	72	39	581	1853	4,950	0	6,559	0
488	2.89	94	3,500	58	58	488	1840	3,176	324	5,162	0
489	2.89	86	2,000	73	73	489	1240	3,230	0	4,852	0
490	2.89	95	3,500	80	40	581	1234	4,983	0	6,887	0
491	2.89	97	1,000	95	45	581	1234	5,810	0	7,795	0
492	2.89	101	2,000	96	27	686	1446	5,493	0	8,050	0
493	2.89	99	1,000	97	97	493	1237	3,782	0	7,625	0
494	2.89	97	1,000	95	28	686	1237	4,730	0	8,276	0
495	2.89	100	2,000	90	90	495	1238	2,909	0	6,515	0
496	2.89	100	2,000	91	91	496	1239	3,730	0	6,647	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
497	2.89	94	2,000	75	66	618	1399	2,750	0	4,122	0
498	2.89	88	2,000	68	68	498	1410	2,382	0	3,904	0
499	2.89	85	2,000	66	66	499	1243	1,872	128	4,006	0
500	2.89	77	2,000	62	62	500	1244	2,269	0	4,219	0
501	2.89	58	1,000	52	52	501	1259	3,105	0	3,339	0
502	2.89	74	3,500	51	51	502	1244	4,230	0	5,729	0
503	2.89	54	2,000	27	27	503	1254	1,452	548	2,285	0
504	2.89	61	1,000	52	51	613	1252	1,318	0	2,592	0
505	2.89	64	1,000	58	58	505	1251	2,889	0	3,856	0
507	2.89	75	1,000	72	28	684	1381	3,831	0	5,413	0
508	2.89	53	1,000	46	46	508	1745	2,945	0	3,026	0
509	2.89	74	2,000	40	40	509	1247	1,702	298	2,623	0
510	2.89	81	3,500	61	42	514	1266	5,165	0	6,469	0
511	2.89	67	1,000	62	50	514	1262	3,744	0	3,792	0
512	2.89	70	3,250	38	27	514	1249	4,029	0	3,703	0
513	2.89	68	1,000	62	50	514	1251	4,065	0	3,736	0
514	2.89	56	1,000	50	50	514		3,377	0	3,377	0
515	2.89	57	1,000	51	51	515		3,489	0	3,489	0
516	2.89	58	1,000	50	50	516	1260	1,985	0	2,884	0
517	2.89	70	1,000	65	65	517	1268	2,813	0	4,074	0
518	2.89	83	3,500	65	53	517	1267	5,533	0	6,510	0
519	2.89	83	3,500	68	38	581	1275	6,458	0	6,345	0
520	2.89	83	3,500	66	39	581	1277	5,123	0	6,402	0
521	2.89	78	1,000	51	51	521	1383	1,009	0	1,538	0
522	2.89	65	1,000	57	57	522	1283	1,390	0	2,715	0
523	2.89	67	1,000	55	55	523	1282	1,478	0	2,274	0
524	2.89	70	1,000	59	59	524	1280	1,897	0	2,400	0
525	2.89	70	1,000	59	59	525	1269	1,667	0	2,409	0
526	2.89	78	1,000	74	28	684	1273	4,322	0	4,879	0
527	2.89	78	1,000	74	28	684	1274	4,100	0	4,914	0
528	2.89	78	1,000	74	28	684	1377	4,027	0	5,348	0
529	2.89	78	1,000	75	28	684	1300	5,865	0	6,275	0
530	2.89	74	1,000	71	28	684		5,077	0	5,077	0
531	2.89	78	1,000	76	28	684	1301	5,731	0	6,312	0
532	2.89	86	3,500	69	36	581	1289	6,881	0	5,640	0
533	2.89	63	1,000	59	59	533	1294	3,078	0	3,720	0
534	2.89	75	1,000	71	28	684		4,890	0	4,890	0
535	2.89	73	1,000	68	28	684	1306	2,465	0	3,965	0
536	2.89	63	1,000	58	58	536	1295	2,670	0	3,555	0
537	2.89	63	1,000	59	59	537	1293	3,228	0	4,013	0
538	2.89	85	3,500	68	37	581	1276	6,691	0	6,031	0
539	2.89	86	3,500	69	37	581	1290	6,428	0	5,938	0
540	2.89	80	1,000	35	35	540	1291	1,716	0	4,092	0
541	2.89	76	1,000	53	53	541	1292	1,371	0	1,627	0
542	2.89	64	1,000	46	46	544	1296	1,142	0	1,662	0
543	2.89	96	1,000	94	28	684	1312	6,357	0	8,251	0
544	2.89	63	1,000	36	36	544		1,305	0	1,305	0
545	2.89	90	1,000	86	28	684	1311	3,652	0	5,531	0
546	2.89	81	1,000	78	28	684	938	2,341	0	5,096	0
547	2.89	83	1,000	79	28	684	1317	2,083	0	4,715	0
548	2.89	75	1,000	69	28	684	1365	2,083	0	3,413	0
549	2.89	71	1,000	66	28	684	1315	2,346	0	3,609	0
550	2.89	70	1,000	66	28	684	1314	3,656	0	4,404	0
551	2.89	70	3,500	46	22	581	1310	4,752	0	3,664	0
552	2.89	94	3,500	72	31	577	1322	4,320	0	4,401	0
554	2.89	81	3,500	53	26	577		5,406	0	3,877	0
555	2.89	87	3,500	64	31	577		6,340	0	4,357	0
556	2.89	87	3,500	62	28	577	1325	5,454	0	4,118	0
557	2.89	81	3,500	51	26	577	1948	3,236	264	3,900	0
558	2.89	83	3,500	48	28	577	1328	2,361	1,139	4,075	0
559	2.89	85	3,500	45	30	577	1329	2,630	870	4,303	0
560	2.89	81	3,500	43	43	560	1332	2,471	1,029	4,557	0
561	2.89	81	3,500	69	41	577	1426	6,181	0	6,354	0
562	2.89	76	3,500	49	45	563	1333	2,439	1,061	4,987	0
563	2.89	72	3,500	27	27	563	1334	2,448	1,052	3,775	0
564	2.89	76	3,500	17	17	565	1335	1,564	1,936	3,392	108
565	2.89	76	3,500	2	2	565		3,011	489	3,011	489
566	2.89	81	3,500	52	23	577	1948	3,838	0	3,722	0
567	2.89	76	3,500	23	23	567	1339	1,567	1,933	3,614	0
568	2.89	72	3,500	17	-2	577		3,411	89	2,639	861
569	2.89	91	3,500	-34	-36	869	1346	1,564	1,936	2,544	956
570	2.89	85	3,500	-23	-23	570	1341	1,567	1,933	2,654	846
571	2.89	72	3,500	16	0	577	1344	2,302	1,198	2,692	808
572	2.89	72	3,500	17	-2	577	1342	2,407	1,093	2,645	855
573	2.89	72	3,500	20	0	577	1340	3,493	7	2,707	793
574	2.89	85	3,500	11	-4	577	1345	2,758	742	2,603	897
575	2.89	72	3,500	12	-7	577		3,248	252	2,514	986
576	2.89	72	3,500	5	-15	577		3,051	449	2,364	1,136
577	2.89	52	3,500	-115	-115	577		1,442	2,058	1,442	2,058
578	2.89	61	3,500	37	22	581		4,568	0	3,675	0
579	2.89	54	3,500	18	14	583	1353	2,281	1,219	3,171	329
580	2.89	48	3,500	6	4	581	1356	2,747	753	2,741	759
581	2.89	46	3,500	-37	-37	581	1355	1,567	1,933	1,891	1,609

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
582	2.89	56	3,500	24	16	581	1755	2,089	1,411	3,270	230
583	2.89	50	3,500	-9	-9	583	1357	1,567	1,933	2,473	1,027
584	2.89	84	3,000	75	28	684	261	8,515	0	8,495	0
585	2.89	67	3,500	28	22	581	1358	1,567	1,933	3,664	0
586	2.89	84	3,000	74	28	684	1359	4,401	0	8,434	0
587	2.89	85	1,000	83	28	684	1361	6,957	0	8,029	0
589	2.89	78	1,000	73	28	684	1364	1,813	0	3,722	0
591	2.89	73	1,000	69	28	684	1306	3,347	0	4,380	0
592	2.89	72	1,000	64	28	684	1369	1,567	0	2,787	0
593	2.89	70	1,000	66	28	684	1367	2,880	0	4,109	0
595	2.89	94	2,000	82	28	684	1371	3,112	0	5,429	0
597	2.89	78	1,000	64	28	684	1373	878	122	2,137	0
598	2.89	74	3,500	57	25	919	1359	4,828	0	6,897	0
599	2.89	89	3,500	64	25	919	1760	3,518	0	5,621	0
600	2.89	89	3,500	59	25	919	1760	3,518	0	5,082	0
601	2.89	89	3,500	45	25	919	1376	1,567	1,933	4,471	0
602	2.89	74	3,500	-13	-13	602	1799	1,564	1,936	2,697	803
603	2.89	78	1,000	74	28	684	1377	3,532	0	5,311	0
604	2.89	76	1,000	73	28	684		5,899	0	5,899	0
605	2.89	71	1,000	60	60	605	1382	1,886	0	2,423	0
606	2.89	75	1,000	70	28	684	1385	1,389	0	3,820	0
607	2.89	76	1,000	72	28	684	1387	4,595	0	5,164	0
608	2.89	81	2,500	47	28	684	1389	2,443	57	4,005	0
611	2.89	61	1,000	49	49	613	1252	1,317	0	2,167	0
613	2.89	61	1,000	44	44	613	1252	1,317	0	1,710	0
614	2.89	68	1,000	-16	-16	614	1397	389	611	741	259
615	2.89	97	2,000	80	80	811	1400	2,454	0	4,706	0
616	2.89	91	2,000	45	45	616	1401	1,067	933	2,545	0
617	2.89	92	3,500	25	25	617	1406	1,999	1,501	3,634	0
618	2.89	84	2,000	64	64	618		3,870	0	3,870	0
619	2.89	91	3,500	30	30	619	1407	3,486	14	3,790	0
620	2.89	89	1,000	80	80	620	1409	1,567	0	3,188	0
621	2.89	76	2,000	53	53	621	1411	1,544	456	3,308	0
622	2.89	95	3,500	65	65	623	1412	2,607	893	5,808	0
623	2.89	95	3,500	55	55	623	1414	3,525	0	4,937	0
624	2.89	79	1,000	77	72	812	1422	2,869	0	6,560	0
625	2.89	81	3,500	70	70	625	1421	3,664	0	7,173	0
626	2.89	81	1,000	80	65	929	41	4,834	0	7,509	0
627	2.89	85	3,500	78	28	684	207	6,175	0	8,717	0
628	2.89	90	3,500	75	28	684	1427	2,448	1,052	8,669	0
629	2.89	83	3,500	50	50	629	1429	1,567	1,933	4,965	0
630	2.89	87	3,500	81	25	686	1431	6,883	0	6,315	0
631	2.89	87	1,000	86	28	686	1430	8,088	0	6,080	0
632	2.89	93	1,000	92	28	686	1432	3,160	0	6,014	0
633	2.89	100	1,000	98	28	686	1433	3,482	0	5,990	0
634	2.89	106	1,000	101	101	634	1434	1,567	0	4,484	0
635	2.89	102	1,000	99	28	686	165	2,664	0	5,962	0
636	2.89	89	3,000	82	25	686	1436	5,887	0	6,141	0
637	2.89	102	1,000	96	96	637	1439	1,567	0	4,262	0
638	2.89	87	3,000	80	25	686	1440	5,889	0	5,855	0
639	2.89	89	1,000	87	28	686	1442	2,526	0	5,932	0
640	2.89	71	3,000	38	38	640	1444	1,567	1,433	3,781	0
641	2.89	78	3,000	67	26	686	1443	4,223	0	6,536	0
642	2.89	102	1,000	100	28	686	1445	4,491	0	7,640	0
643	2.89	93	3,500	80	26	686	1447	5,388	0	7,803	0
644	2.89	95	1,000	92	92	644	1448	3,014	0	6,470	0
645	2.89	97	1,000	95	95	645	1453	3,436	0	7,118	0
646	2.89	102	1,000	98	98	646	1450	2,896	0	5,783	0
647	2.89	97	1,000	95	95	647	1452	2,269	0	7,721	0
648	2.89	95	1,000	92	92	648	1455	3,056	0	5,708	0
649	2.89	95	2,000	84	84	651	1462	2,536	0	5,990	0
650	2.89	93	3,000	82	26	686	1457	4,674	0	8,064	0
651	2.89	95	3,000	47	47	651	1458	1,567	1,433	3,836	0
652	2.89	95	3,500	68	68	652	1461	2,444	1,056	6,115	0
653	2.89	97	3,500	78	78	653	1459	3,139	361	7,479	0
654	2.89	102	3,000	90	26	686	1463	5,403	0	8,691	0
655	2.89	91	2,000	84	84	655	1587	3,388	0	7,327	0
656	2.89	91	1,000	88	88	656	1465	2,802	0	5,841	0
657	2.89	108	3,500	72	66	658	1468	2,366	1,134	5,470	0
658	2.89	102	3,500	40	40	658	1470	1,567	1,933	4,097	0
659	2.89	63	1,000	36	36	659	1471	881	119	1,294	0
660	2.89	81	1,000	78	76	661	1472	3,044	0	5,154	0
661	2.89	79	1,000	73	73	661	1474	1,567	0	3,512	0
662	2.89	87	3,500	40	40	662	1475	1,567	1,933	4,244	0
663	2.89	76	1,000	75	27	686	1476	4,700	0	4,838	0
664	2.89	78	2,000	72	26	686	1478	2,217	0	4,632	0
665	2.89	74	2,000	66	26	686	1479	2,694	0	4,577	0
666	2.89	76	2,000	65	26	686	1480	2,549	0	4,548	0
667	2.89	69	2,000	57	49	675	1482	3,514	0	4,462	0
668	2.89	66	2,000	55	48	675	1482	3,431	0	4,138	0
669	2.89	65	2,000	54	48	675	1484	2,602	0	4,178	0
670	2.89	59	2,000	49	49	670	1485	2,366	0	4,280	0
671	2.89	56	2,000	49	26	686	1486	2,747	0	4,483	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
672	2.89	52	2,000	46	26	686	1489	2,323	0	4,375	0
673	2.89	50	1,000	48	27	686	1488	5,037	0	4,185	0
674	2.89	71	2,000	56	56	674	1491	3,110	0	3,874	0
675	2.89	59	2,000	43	43	675	1494	3,132	0	3,305	0
676	2.89	39	1,000	38	27	686		4,982	0	3,353	0
677	2.89	39	2,000	18	18	677	1496	1,567	433	1,918	82
678	2.89	37	1,000	35	27	686		4,681	0	3,110	0
679	2.89	33	1,000	31	26	686	1499	3,004	0	2,384	0
680	2.89	30	1,000	24	24	680		1,371	0	1,371	0
681	2.89	33	1,000	30	26	684		2,831	0	2,338	0
682	2.89	33	1,000	30	26	684		2,787	0	2,284	0
683	2.89	33	1,000	30	26	684		2,812	0	2,225	0
684	2.89	28	1,000	23	23	684		1,263	0	1,263	0
685	2.89	28	1,000	22	22	685		1,227	0	1,227	0
686	2.89	28	1,000	23	23	686		1,251	0	1,251	0
687	2.89	90	2,000	50	26	843	1768	2,161	0	2,508	0
688	2.89	59	2,000	53	25	684	1503	4,508	0	3,761	0
689	2.89	80	2,000	73	25	684	1505	2,355	0	3,783	0
690	2.89	56	2,000	48	25	684	1507	3,598	0	3,793	0
691	2.89	54	2,000	50	25	684		6,875	0	3,876	0
692	2.89	63	2,000	52	25	684	1509	3,103	0	3,788	0
693	2.89	54	2,000	11	11	693	1512	881	1,119	1,771	229
694	2.89	59	2,000	50	25	684	1510	2,908	0	3,788	0
695	2.89	52	2,000	48	25	684	1513	6,162	0	4,002	0
696	2.89	52	2,000	44	25	684	1515	1,567	433	4,002	0
697	2.89	54	1,000	52	37	237	1516	2,393	0	3,825	0
698	2.89	77	1,000	29	23	919		1,757	0	1,537	0
699	2.89	79	1,000	32	23	919		1,918	0	1,525	0
700	2.89	90	1,000	43	23	919		2,592	0	1,511	0
701	2.89	71	1,000	23	22	352		1,305	0	1,225	0
702	2.89	88	1,000	41	23	919		2,577	0	1,505	0
703	2.89	92	1,000	44	23	919		2,493	0	1,505	0
704	2.89	96	1,000	48	23	919		2,468	0	1,504	0
705	2.89	94	1,000	46	23	919		2,566	0	1,503	0
706	2.89	86	1,000	38	23	919		2,225	0	1,498	0
707	2.89	41	1,000	34	34	820		2,048	0	2,048	0
708	2.89	41	1,000	34	34	708		2,051	0	2,051	0
709	2.89	41	1,000	36	36	709		2,455	0	2,455	0
710	2.89	41	1,000	36	36	710		2,507	0	2,507	0
711	2.89	41	1,000	37	37	711	1541	2,201	0	2,859	0
712	2.89	38	1,000	35	35	712		3,184	0	3,183	0
713	2.89	81	1,000	32	22	352		1,766	0	1,241	0
714	2.89	86	1,000	35	22	352		1,802	0	1,241	0
715	2.89	81	1,000	31	22	352		1,602	0	1,253	0
716	2.89	79	1,000	29	22	352		1,613	0	1,240	0
717	2.89	86	1,000	35	22	352		1,796	0	1,240	0
718	0	28	1,000	26	36	390		2,551	0	4,300	0
719	2.89	54	1,000	49	34	230		3,866	0	2,799	0
720	2.89	54	1,000	49	34	230		3,813	0	2,789	0
721	2.89	51	1,000	47	34	230		3,503	0	2,781	0
722	2.89	56	1,000	51	34	230	1554	2,565	0	2,751	0
723	2.89	64	1,000	58	34	230	1555	2,291	0	2,751	0
724	2.89	54	1,000	49	34	230		3,402	0	2,691	0
725	2.89	56	1,000	51	34	230		3,433	0	2,742	0
726	2.89	62	1,000	57	34	230	1561	2,583	0	2,753	0
727	2.89	41	1,000	36	36	727	1807	2,248	0	2,470	0
728	2.89	41	1,000	18	18	728	1565	881	119	961	39
729	2.89	54	1,000	49	40	730	1569	2,716	0	2,808	0
730	2.89	45	1,000	26	26	730	1570	881	119	1,162	0
731	2.89	54	1,000	48	39	732	1572	2,636	0	2,551	0
732	2.89	45	1,000	25	25	732	1573	881	119	1,132	0
733	2.89	62	1,000	62	36	230	103	3,177	0	4,976	0
734	2.89	69	1,000	65	65	734	1575	3,111	0	4,231	0
735	2.89	67	1,000	65	50	817	1579	1,810	0	5,507	0
736	2.89	80	1,000	78	50	817	1582	4,187	0	6,272	0
737	2.89	82	2,000	74	74	737	1583	2,866	0	6,085	0
738	2.89	84	2,000	76	76	738	1585	2,886	0	6,182	0
739	2.89	87	2,000	79	79	739	1586	4,171	0	7,070	0
740	2.89	89	2,000	82	82	740	1587	3,686	0	7,280	0
741	2.89	84	2,000	75	75	741	1591	2,760	0	5,738	0
742	2.89	54	1,000	52	52	742	1593	2,707	0	5,087	0
743	2.89	84	1,000	78	78	743	1594	1,807	0	3,455	0
744	2.89	50	1,000	47	47	923	1597	3,126	0	4,048	0
745	2.89	67	1,000	65	28	686	1598	4,768	0	6,304	0
746	2.89	63	1,000	58	58	746	1601	1,658	0	3,283	0
747	2.89	79	1,000	29	22	352		1,551	0	1,245	0
748	2.89	43	1,000	37	35	708		2,233	0	2,205	0
749	2.89	41	1,000	35	35	749		2,212	0	2,212	0
750	2.89	41	1,000	36	36	750		2,615	0	2,615	0
751	2.89	43	1,000	38	38	751	1611	2,518	0	2,528	0
752	2.89	49	1,000	45	34	230	1613	2,643	0	2,867	0
753	2.89	70	3,000	41	29	754	1615	2,707	293	3,472	0
754	2.89	57	1,000	52	52	754		3,205	0	3,205	0

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755	2.89	94	3,500	82	25	230	1620	5,542	0	4,688	0
756	2.89	94	3,500	77	25	230	1621	2,357	1,143	4,612	0
757	2.89	89	3,500	69	24	230	1623	2,867	633	4,583	0
758	2.89	87	3,000	75	27	230	179	4,193	0	4,617	0
759	2.89	92	3,000	74	27	230	1624	3,049	0	4,468	0
760	2.89	92	3,000	75	27	230	1761	2,685	315	4,364	0
761	2.89	87	3,500	68	28	230	1629	2,585	915	5,574	0
762	2.89	89	3,500	76	28	230	1628	4,866	0	5,762	0
763	2.89	89	3,500	75	29	230	1630	3,081	419	5,899	0
764	2.89	85	3,500	52	52	764	1632	2,942	558	5,032	0
765	2.89	96	3,500	50	50	765	1634	1,567	1,933	4,551	0
766	2.89	92	3,000	83	26	230	1635	6,254	0	4,105	0
767	2.89	112	1,000	106	36	875	1744	4,260	0	2,653	0
768	2.89	84	3,000	53	16	230	1641	3,027	0	2,648	352
769	2.89	92	3,000	66	16	230	1638	5,351	0	2,654	346
770	2.89	79	3,000	51	16	230	1645	3,370	0	2,648	352
771	2.89	77	3,000	52	16	230		4,997	0	2,674	326
772	2.89	71	1,000	55	55	772	1646	881	119	1,918	0
773	2.89	53	1,000	46	33	875		2,412	0	1,834	0
774	2.89	75	1,000	64	64	896		2,515	0	2,515	0
775	2.89	69	2,000	53	24	230		4,044	0	2,309	0
776	2.89	49	2,000	37	29	230		3,438	0	3,014	0
777	2.89	62	2,000	52	28	230		4,832	0	2,888	0
778	2.89	71	1,000	66	34	230	1656	2,315	0	2,649	0
779	2.89	66	1,000	61	33	230		3,743	0	2,401	0
780	2.89	49	1,000	43	33	230		2,721	0	2,352	0
781	2.89	45	1,000	39	33	230		2,485	0	2,348	0
782	2.89	45	1,000	38	38	782		2,235	0	2,235	0
783	2.89	71	1,000	65	33	230	1661	3,209	0	2,366	0
784	2.89	58	2,000	42	23	230		3,460	0	2,257	0
785	2.89	58	1,000	51	33	230	1665	2,544	0	2,363	0
786	2.89	45	1,000	38	38	786		2,246	0	2,246	0
787	2.89	53	1,000	47	33	230		2,889	0	2,343	0
788	2.89	53	1,000	48	33	230		2,972	0	2,340	0
789	2.89	56	1,000	50	33	230		3,106	0	2,333	0
790	2.89	62	1,000	57	33	230		3,636	0	2,335	0
791	2.89	71	1,000	65	33	230		4,099	0	2,340	0
792	2.89	82	1,000	75	33	230	1674	2,473	0	2,340	0
793	2.89	82	1,000	75	33	230	1675	2,122	0	2,340	0
794	2.89	87	1,000	80	33	230	1676	2,875	0	2,340	0
795	2.89	88	1,000	80	33	230	1677	2,659	0	2,340	0
796	2.89	84	1,000	76	33	230	1679	2,855	0	2,340	0
797	2.89	79	1,000	73	33	230	1680	3,398	0	2,340	0
798	2.89	73	1,000	66	33	230	1681	2,729	0	2,340	0
799	2.89	73	1,000	68	33	230		4,194	0	2,346	0
800	2.89	60	1,000	55	33	230		3,519	0	2,323	0
801	2.89	66	1,000	60	33	230	1687	2,430	0	2,319	0
802	2.89	62	1,000	56	33	230		3,405	0	2,316	0
803	2.89	58	1,000	52	33	230		3,392	0	2,314	0
804	2.89	40	1,000	35	33	230		2,312	0	2,209	0
805	2.89	40	1,000	34	34	805		2,011	0	2,011	0
806	2.89	46	1,000	36	36	806		1,787	0	1,787	0
808	2.89	73	1,000	55	44	613	1252	1,317	0	1,710	0
809	2.89	89	1,000	73	73	809	1419	1,567	0	2,269	0
810	2.89	70	1,000	-75	-75	810	1398	392	608	562	438
811	2.89	97	1,000	90	90	811	1707	1,567	0	3,698	0
812	2.89	73	2,000	35	35	812	1416	1,567	433	2,411	0
813	2.89	76	3,250	72	72	813	1713	2,101	1,149	7,661	0
815	2.89	96	1,000	23	23	815	940	881	119	1,052	0
816	2.89	105	1,000	76	55	247	1566	881	119	1,716	0
817	2.89	52	1,000	39	39	817	949	1,567	0	1,675	0
818	2.89	69	1,000	23	23	818		1,473	0	1,473	0
819	2.89	71	1,000	22	22	819		1,209	0	1,208	0
820	2.89	41	1,000	27	27	820		1,289	0	1,289	0
833	2.89	80	3,500	-29	-29	833	1735	2,448	1,052	2,527	973
836	2.89	78	2,000	54	28	684	1746	3,802	0	4,217	0
837	2.89	41	2,000	29	23	684		2,761	0	2,719	0
838	2.89	59	2,000	-20	-20	838	1751	646	1,354	1,365	635
839	2.89	56	3,500	27	18	581		3,888	0	3,380	120
840	2.89	74	3,500	56	25	919	1359	4,948	0	6,544	0
841	2.89	89	3,500	70	25	919	1359	5,280	0	6,651	0
842	2.89	92	3,000	79	26	230	1762	2,190	810	4,213	0
844	2.89	90	2,000	56	26	843	1938	1,537	463	2,508	0
845	2.89	80	2,000	37	37	845		2,400	0	2,400	0
846	2.89	80	1,000	67	67	851		2,363	0	2,362	0
847	2.89	90	2,000	50	26	843	1771	2,196	0	2,508	0
848	2.89	83	1,000	67	67	848	1773	1,567	0	2,140	0
853	2.89	33	1,000	30	26	684		2,775	0	2,171	0
854	2.89	33	1,000	30	26	685		2,750	0	2,152	0
855	2.89	33	1,000	30	26	686		2,909	0	2,302	0
856	2.89	33	1,000	30	26	686		2,787	0	2,181	0
857	2.89	88	2,000	31	29	851	1796	1,564	436	2,184	0
858	2.89	97	2,000	34	29	851		2,232	0	2,184	0

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862	2.89	74	3,500	12	12	602	1799	1,564	1,936	3,236	264
863	2.89	58	1,000	42	30	315	1803	876	124	1,326	0
864	2.89	45	1,000	41	37	727		3,136	0	2,828	0
868	2.89	43	2,000	32	24	684	1815	2,649	0	2,941	0
869	2.89	89	3,500	-65	-65	869	1818	1,567	1,933	2,270	1,230
875	2.89	41	1,000	32	32	875		1,674	0	1,674	0
876	0	45	1,000	32	32	875		1,447	0	1,672	0
877	0	46	1,000	32	32	875		1,467	0	1,672	0
878	0	43	1,000	32	32	875		1,507	0	1,672	0
879	0	45	1,000	32	32	875		1,492	0	1,672	0
880	2.89	94	3,500	79	39	581	1852	4,303	0	6,753	0
885	2.89	93	3,500	72	39	581	1838	1,966	1,534	6,742	0
887	2.89	94	3,500	63	63	887	1849	2,378	1,122	5,716	0
888	2.89	94	3,500	60	60	888	1843	2,649	851	5,339	0
889	2.89	75	1,000	65	34	875		2,764	0	2,025	0
890	2.89	75	1,000	52	52	890	1888	881	119	1,648	0
896	2.89	75	1,000	63	63	896		2,432	0	2,430	0
900	2.89	54	1,000	51	51	900	368	2,807	0	3,940	0
901	2.89	51	2,000	42	42	901	370	1,564	436	3,869	0
903	2.89	52	2,000	33	33	903	371	1,567	433	2,666	0
919	2.89	68	1,000	6	6	919		799	201	799	201
920	2.89	62	1,000	56	34	230	373	2,647	0	2,751	0
923	2.89	50	1,000	39	39	923	376	881	119	1,737	0
924	2.89	56	3,500	19	19	924	983	3,052	448	3,471	29
925	2.89	91	3,500	62	62	925	378	2,429	1,071	5,802	0
926	2.89	83	3,500	0	0	926	379	1,567	1,933	3,032	468
927	2.89	87	3,500	50	29	577	380	2,861	639	4,197	0
928	2.89	87	3,500	-2	-2	928	381	1,567	1,933	3,006	494
929	2.89	66	1,000	48	48	929	1147	1,124	0	1,651	0
930	2.89	66	1,000	57	33	230		2,579	0	2,316	0
931	2.89	94	3,000	42	16	875	384	1,567	1,433	2,653	347
932	2.89	69	2,000	40	24	230	385	1,567	433	2,309	0
933	2.89	58	2,000	42	23	230		3,382	0	2,210	0
934	2.89	92	3,000	50	50	934	387	1,613	1,387	3,974	0
935	2.89	49	1,000	44	33	230		2,857	0	2,264	0
936	2.89	49	1,000	38	38	936	391	1,567	0	1,750	0
937	3.23	84	1,000	65	28	684		3,683	0	3,683	0

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10	3.23	81	1,000	74	40	732	17	2,484	0	3,082	0
12	3.23	75	1,000	68	40	732	19	3,166	0	3,070	0
14	3.23	68	1,000	62	34	230	13	2,746	0	3,076	0
16	3.23	89	1,000	80	40	732	31	1,448	0	3,082	0
18	3.23	81	3,500	73	33	230	43	4,530	0	7,390	0
20	3.23	82	3,500	65	65	20	57	3,011	489	6,737	0
22	3.23	81	3,500	70	32	230	47	3,878	0	7,104	0
24	3.23	81	3,500	69	32	230	49	3,342	158	7,063	0
26	3.23	81	3,500	70	33	230	43	2,829	671	7,255	0
28	3.23	57	1,000	52	33	230		3,333	0	2,243	0
30	3.23	53	1,000	47	33	230		2,908	0	2,255	0
32	3.23	49	1,000	42	33	230		2,582	0	2,262	0
34	3.23	60	1,000	52	33	230		2,776	0	2,242	0
36	3.23	59	1,000	51	33	230		2,689	0	2,242	0
38	3.23	59	1,000	51	33	230		2,610	0	2,242	0
40	3.23	64	1,000	55	33	230		2,680	0	2,242	0
42	3.23	62	1,000	53	33	230		2,615	0	2,242	0
44	3.23	64	1,000	54	33	230	83	2,256	0	2,242	0
46	3.23	66	1,000	56	33	230		2,548	0	2,242	0
48	3.23	64	1,000	54	33	230		2,425	0	2,242	0
50	3.23	73	1,000	63	33	230	93	2,448	0	2,242	0
52	3.23	71	1,000	61	33	230	95	2,445	0	2,242	0
54	3.23	79	3,500	73	33	230	109	4,492	0	7,285	0
56	3.23	76	2,000	49	49	56	111	1,541	459	2,938	0
58	3.23	45	1,000	44	27	684		5,900	0	3,509	0
60	3.23	46	1,000	44	27	684	115	2,975	0	3,734	0
62	3.23	47	1,000	45	27	684	123	3,963	0	3,806	0
64	3.23	47	1,000	45	27	684	121	4,048	0	3,779	0
66	3.23	49	1,000	47	27	684	131	3,644	0	3,839	0
68	3.23	48	1,000	46	27	684	123	3,696	0	3,885	0
70	3.23	71	1,000	68	27	684	133	3,512	0	3,653	0
72	3.23	60	1,000	56	52	114	135	2,164	0	3,594	0
74	3.23	59	1,000	54	54	74		3,454	0	3,452	0
76	3.23	98	1,000	73	73	76	141	1,567	0	1,864	0
78	3.23	40	1,000	34	32	230		2,191	0	2,143	0
80	3.23	44	2,000	25	22	230		2,317	0	2,149	0
82	3.23	49	2,000	29	22	230		2,528	0	2,151	0
84	3.23	53	2,000	35	22	230		2,892	0	2,161	0
86	3.23	53	2,000	34	22	230		2,767	0	2,173	0
88	3.23	95	1,000	93	27	686	165	5,053	0	5,784	0
90	3.23	95	1,000	93	27	686	163	3,501	0	5,778	0
92	3.23	85	3,000	71	26	230	179	3,001	0	4,549	0
94	3.23	66	1,000	60	33	230		3,786	0	2,262	0
96	3.23	62	1,000	56	33	230		3,534	0	2,283	0
98	3.23	90	1,000	84	35	382	185	1,779	0	4,130	0
100	3.23	88	1,000	82	35	382	187	1,616	0	4,128	0
102	3.23	61	3,500	-58	-67	577	189	1,563	1,937	1,722	1,778
104	3.23	70	1,000	63	63	104	1265	1,678	0	3,209	0
106	3.23	84	1,000	76	28	684	195	1,567	0	3,246	0
108	3.23	60	1,000	50	50	613	1252	1,317	0	2,331	0
110	3.23	86	1,000	80	80	110	1595	1,618	0	3,544	0
112	3.23	70	1,000	66	28	684	201	2,785	0	4,124	0
114	3.23	56	1,000	51	51	114	203	2,704	0	2,879	0
116	3.23	97	3,500	67	67	116	205	1,827	1,673	5,771	0
128	3.23	96	2,500	86	28	684	237	4,193	0	7,872	0
134	3.23	94	1,000	90	28	684	287	3,615	0	5,470	0
136	3.23	95	1,000	91	28	684	289	3,907	0	5,309	0
138	3.23	94	1,000	91	28	684	289	3,978	0	5,491	0
140	3.23	94	1,000	90	28	684	291	3,144	0	5,637	0
142	3.23	97	1,000	93	28	684	293	3,717	0	5,671	0
144	3.23	101	1,000	97	28	684	1925	2,852	0	5,424	0
146	3.23	101	1,000	96	28	684	1926	2,760	0	4,999	0
148	3.23	70	1,000	59	59	148	277	1,546	0	2,508	0
215	3.23	111	1,000	105	36	875	1637	4,442	0	2,536	0
216	3.23	47	2,000	41	24	684	921	4,441	0	3,359	0
217	3.23	69	1,000	67	27	684	1504	3,509	0	3,653	0
218	3.23	79	1,000	32	23	919	925	2,123	0	1,530	0
219	3.23	94	1,000	83	36	875		3,078	0	2,536	0
220	3.23	98	1,000	88	36	875		3,272	0	2,536	0
221	3.23	81	3,500	74	33	230	1708	5,903	0	7,535	0
222	3.23	86	2,000	72	72	222	930	3,525	0	5,128	0
228	3.23	73	1,000	70	27	684	923	4,393	0	3,653	0
229	3.23	61	1,000	56	34	230		3,844	0	2,688	0
230	3.23	38	2,000	21	21	230		2,074	0	2,074	0
231	0	77	2,000	76	28	684		10,360	0	10,532	0
232	3.23	80	3,500	63	36	577	1331	7,046	0	5,221	0
233	3.23	77	1,000	29	22	919		1,807	0	1,450	0
235	3.23	78	1,000	30	22	352		1,729	0	1,203	0
236	3.23	81	1,000	26	22	352		1,235	0	1,203	0
237	3.23	39	1,000	33	33	237	1518	1,758	0	1,971	0
238	3.23	49	1,000	47	37	237	129	2,995	0	3,621	0
239	3.23	51	1,000	50	27	684	1008	5,910	0	4,312	0
240	3.23	71	1,000	23	22	352		1,273	0	1,197	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
241	3.23	90	1,000	40	22	352		2,100	0	1,203	0
242	3.23	94	1,000	44	22	352		2,223	0	1,205	0
243	3.23	70	1,000	63	63	243	193	3,187	0	3,207	0
244	3.23	78	1,000	73	28	684	1299	2,442	0	3,697	0
245	3.23	76	1,000	72	28	684	1274	4,699	0	5,055	0
246	3.23	89	3,500	61	61	246	1179	2,557	943	5,548	0
247	3.23	76	1,000	54	54	247	1095	878	122	1,703	0
248	3.23	66	1,000	59	40	732	1096	2,541	0	3,008	0
249	3.23	50	1,000	45	40	732		3,116	0	2,808	0
250	3.23	51	1,000	45	45	250	966	1,759	0	2,318	0
251	3.23	83	3,500	61	30	581	1309	4,224	0	4,432	0
252	3.23	70	1,000	70	28	686		9,676	0	7,715	0
253	3.23	78	1,000	77	28	686	1428	8,294	0	7,169	0
254	3.23	51	2,000	47	25	684		6,598	0	3,616	0
255	3.23	50	1,000	48	27	686	972	3,371	0	3,908	0
256	3.23	46	1,000	44	27	686	973	3,315	0	3,912	0
257	3.23	46	1,000	44	27	686	974	3,813	0	3,798	0
258	3.23	38	1,000	37	27	686		4,914	0	3,330	0
259	3.23	43	1,000	41	27	686	979	2,829	0	3,530	0
260	3.23	48	1,000	45	45	260	964	2,325	0	3,280	0
261	3.23	51	1,000	48	48	261	964	3,281	0	4,002	0
262	3.23	59	1,000	55	55	262	957	2,471	0	4,021	0
263	3.23	60	1,000	56	56	263	962	2,369	0	3,832	0
264	3.23	55	1,000	50	50	264	963	1,977	0	3,128	0
265	3.23	50	1,000	48	27	686	982	4,212	0	4,211	0
266	3.23	42	1,000	39	39	266	970	1,955	0	2,843	0
267	3.23	43	1,000	40	40	267	970	2,401	0	3,124	0
268	3.23	40	1,000	37	37	268	976	1,974	0	2,931	0
269	3.23	39	1,000	37	27	686		4,950	0	3,307	0
270	3.23	41	1,000	39	27	686		5,124	0	3,746	0
271	3.23	67	1,000	66	27	686	1477	4,410	0	4,551	0
272	3.23	67	1,000	64	27	686	959	1,865	0	4,644	0
273	3.23	67	1,000	65	27	686	955	3,122	0	5,192	0
274	3.23	82	1,000	81	27	686	1430	7,782	0	5,535	0
275	3.23	83	3,000	76	25	686	1440	5,828	0	5,724	0
276	3.23	85	3,000	78	26	686	1436	6,061	0	6,619	0
277	3.23	95	2,000	88	88	277	981	3,796	0	7,911	0
278	3.23	95	3,000	84	26	686	1456	6,514	0	8,146	0
279	3.23	88	3,000	80	26	686	956	5,483	0	6,762	0
280	3.23	61	1,000	59	27	686	1601	5,316	0	5,955	0
281	3.23	53	1,000	51	51	281	990	5,056	0	5,360	0
282	3.23	60	1,000	56	56	282	991	1,623	0	3,641	0
283	3.23	64	1,000	56	56	283	993	1,488	0	2,564	0
284	3.23	57	1,000	53	53	938	994	1,854	0	3,095	0
285	3.23	51	1,000	50	50	285	987	4,437	0	5,204	0
286	3.23	52	1,000	50	50	286	986	4,566	0	5,586	0
287	3.23	52	1,000	51	27	686	982	4,975	0	5,535	0
288	3.23	54	3,500	33	33	288	985	3,112	388	4,524	0
289	3.23	58	3,500	29	29	289	995	2,808	692	4,090	0
290	3.23	54	3,500	36	36	290	996	2,454	1,046	4,934	0
291	3.23	72	1,000	70	63	292	1003	2,764	0	6,531	0
292	3.23	65	1,000	62	62	292	999	2,366	0	4,301	0
293	3.23	92	1,000	89	89	293	997	3,115	0	6,593	0
294	3.23	76	1,000	73	73	294	1002	3,102	0	5,864	0
295	3.23	82	2,000	73	73	295	1588	2,975	0	5,876	0
296	3.23	88	1,000	85	85	296	1465	2,015	0	4,978	0
297	3.23	77	1,000	72	72	297	952	2,305	0	3,868	0
298	3.23	63	1,000	60	60	298	997	2,687	0	4,685	0
299	3.23	52	1,000	51	27	684	1009	6,390	0	4,781	0
300	3.23	41	1,000	27	27	300		1,274	0	1,274	0
301	3.23	44	1,000	37	34	300		1,999	0	1,857	0
302	3.23	47	1,000	42	35	300	1012	2,091	0	2,082	0
303	3.23	55	1,000	54	54	303	1004	4,144	0	6,831	0
304	3.23	58	1,000	56	39	300	1015	2,145	0	3,745	0
305	3.23	55	1,500	54	27	684	1016	6,193	0	5,570	0
306	3.23	44	1,000	44	27	684	1017	5,967	0	6,887	0
307	3.23	52	1,000	48	48	307	1005	2,299	0	3,292	0
308	3.23	63	1,000	62	28	684	1579	9,764	0	12,072	0
309	3.23	67	1,000	62	47	817	1580	1,823	0	3,109	0
310	3.23	59	1,000	52	44	817	1057	1,563	0	2,304	0
315	3.23	45	1,000	-8	-8	315		665	335	665	335
316	3.23	54	1,000	25	16	315	1804	878	122	919	81
318	3.23	46	1,000	25	23	317	1068	878	122	1,077	0
319	3.23	57	1,000	47	34	317	1577	865	135	1,667	0
320	3.23	105	2,000	96	93	658	1030	3,375	0	7,279	0
321	3.23	103	3,000	90	26	686	1715	3,856	0	8,475	0
322	3.23	92	1,000	87	87	322	1031	2,381	0	4,806	0
323	3.23	76	1,000	74	50	817	1582	3,607	0	5,599	0
324	3.23	82	1,000	72	72	324	1062	1,272	0	2,762	0
325	3.23	84	1,000	79	79	325	1035	2,116	0	4,273	0
326	3.23	76	1,000	74	50	817	1064	4,219	0	5,810	0
327	3.23	89	1,000	84	84	327	1035	2,342	0	4,615	0
328	3.23	90	1,000	83	83	328	1034	1,530	0	3,684	0

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329	3.23	77	1,000	74	36	382	1064	3,199	0	4,958	0
330	3.23	78	1,000	74	35	382	1083	4,232	0	4,273	0
331	3.23	87	1,000	82	35	382	1084	2,171	0	4,172	0
332	3.23	91	1,000	86	35	382	1086	2,420	0	4,103	0
333	3.23	77	1,750	69	32	382	1083	3,957	0	3,980	0
334	3.23	64	1,000	60	35	382	1081	2,685	0	3,709	0
335	3.23	75	1,000	71	35	382	1087	3,084	0	3,683	0
336	3.23	67	3,000	29	25	337	1092	1,509	1,491	3,241	0
337	3.23	59	1,000	49	49	337	1091	1,640	0	2,195	0
338	3.23	60	1,000	54	54	338	1088	1,552	0	3,061	0
339	3.23	64	1,000	61	35	382	1080	3,624	0	3,653	0
340	3.23	98	3,000	69	16	230	1114	4,586	0	2,601	399
341	3.23	84	1,000	37	23	919		2,259	0	1,516	0
342	3.23	79	1,000	33	23	919		2,301	0	1,539	0
343	3.23	72	1,000	27	23	919		2,020	0	1,500	0
344	3.23	76	1,000	31	22	919		2,257	0	1,454	0
345	3.23	73	1,000	26	21	919		1,596	0	1,088	0
346	3.23	81	1,000	28	22	352		1,393	0	1,203	0
347	3.23	74	1,000	26	22	352		1,477	0	1,215	0
348	3.23	82	1,000	26	26	348	1027	875	125	1,237	0
349	3.23	80	1,000	30	22	352		1,558	0	1,308	0
350	3.23	96	1,000	47	23	818	1526	2,260	0	1,558	0
352	3.23	69	1,000	21	21	352		1,159	0	1,158	0
353	3.23	73	1,000	23	23	353		1,239	0	1,239	0
354	3.23	48	1,000	40	34	875		2,118	0	2,005	0
355	3.23	45	1,000	38	34	875		2,100	0	2,041	0
356	3.23	47	1,000	39	34	875		2,082	0	2,022	0
357	3.23	50	1,000	42	34	875		2,244	0	2,003	0
358	3.23	50	1,000	42	34	875		2,324	0	1,995	0
359	3.23	46	1,000	38	34	875		2,081	0	2,013	0
360	3.23	66	1,000	57	34	875		2,633	0	1,985	0
361	3.23	67	1,000	59	34	875		2,852	0	1,972	0
362	3.23	70	1,000	61	34	875		3,012	0	1,972	0
363	3.23	54	1,000	47	34	875		2,611	0	1,962	0
364	3.23	54	1,000	47	34	875		2,611	0	2,002	0
365	3.23	88	3,500	65	30	577		6,496	0	4,313	0
366	3.23	57	1,000	51	34	875		2,874	0	2,060	0
367	3.23	50	1,000	43	34	875		2,432	0	2,048	0
368	3.23	56	1,000	48	34	875		2,578	0	2,018	0
369	3.23	59	1,000	52	34	875		2,805	0	2,063	0
370	3.23	70	1,000	64	34	875	1136	3,285	0	2,114	0
371	3.23	84	3,000	69	31	230	1051	3,522	0	6,308	0
372	3.23	80	1,000	79	36	230	1039	3,201	0	6,481	0
373	3.23	82	3,000	78	33	230	946	7,511	0	7,116	0
374	3.23	98	2,000	54	54	423	1142	1,487	513	2,740	0
375	3.23	62	2,000	59	35	435		6,250	0	4,666	0
376	3.23	96	1,000	94	28	684		10,082	0	8,022	0
377	3.23	78	1,000	74	28	684	1313	3,011	0	4,678	0
378	3.23	83	1,000	80	28	684	1360	2,224	0	5,413	0
379	3.23	71	1,000	65	65	379	1617	2,692	0	3,279	0
380	3.23	55	1,000	51	41	730		3,798	0	3,267	0
381	3.23	40	1,000	36	36	381		2,660	0	2,660	0
382	3.23	38	1,000	34	34	382		2,612	0	2,612	0
383	3.23	49	1,000	45	36	381		3,555	0	3,077	0
384	3.23	57	1,000	54	40	317	1080	4,251	0	3,420	0
386	3.23	63	1,000	59	34	230		4,755	0	2,713	0
387	3.23	65	1,000	61	34	230		4,724	0	2,706	0
388	3.23	42	1,000	38	34	230		3,248	0	2,954	0
389	3.23	38	1,000	34	34	390		3,176	0	3,163	0
390	3.23	37	1,000	33	33	390		2,672	0	2,671	0
391	3.23	44	1,000	40	34	230		3,155	0	3,006	0
392	3.23	47	1,000	42	34	230		3,225	0	2,966	0
393	3.23	58	1,000	54	34	230	1099	3,372	0	2,949	0
394	3.23	49	2,000	36	28	230	1651	2,783	0	2,920	0
395	3.23	45	1,000	39	39	395		2,727	0	2,727	0
396	3.23	51	1,000	46	40	732		3,092	0	2,979	0
397	3.23	47	1,000	41	41	397		2,794	0	2,794	0
398	3.23	55	1,000	50	34	230		3,325	0	2,925	0
399	3.23	60	1,000	54	34	230	1108	3,106	0	2,923	0
400	3.23	54	1,000	49	34	230	1100	3,170	0	2,923	0
401	3.23	57	1,000	52	34	230		3,400	0	2,921	0
402	3.23	51	1,000	45	34	230	1111	2,913	0	2,904	0
403	3.23	59	1,000	54	34	230		3,839	0	2,886	0
404	3.23	58	1,000	53	34	230	1112	3,412	0	2,961	0
405	3.23	71	3,000	63	23	230	1636	4,914	0	3,544	0
406	3.23	81	1,000	76	33	230		4,967	0	2,553	0
407	3.23	79	3,000	53	15	230		5,016	0	2,542	458
408	3.23	76	1,000	71	33	230	1135	3,906	0	2,392	0
409	3.23	62	1,000	61	61	409	1574	2,676	0	5,402	0
410	3.23	81	1,000	78	78	410	1048	2,934	0	4,616	0
411	3.23	67	1,000	64	60	659	1040	2,916	0	4,199	0
412	3.23	64	2,000	53	53	412	1042	2,930	0	4,209	0
413	3.23	55	1,000	51	51	413	1045	2,879	0	3,336	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
414	3.23	63	1,000	60	52	413	1042	3,748	0	3,964	0
415	3.23	65	1,000	62	52	413	1046	2,573	0	3,970	0
416	3.23	78	1,000	75	53	413	1567	2,891	0	4,743	0
417	3.23	81	1,000	77	77	417	1050	2,852	0	4,654	0
418	3.23	82	3,500	58	58	418	1420	2,220	1,280	5,558	0
419	3.23	83	3,500	77	32	230	47	6,392	0	7,116	0
420	3.23	85	3,000	72	31	230	1052	1,613	1,387	6,310	0
421	3.23	85	3,000	78	32	230	1052	3,508	0	6,473	0
422	3.23	86	3,500	76	30	230	1055	4,487	0	6,267	0
423	3.23	97	2,000	31	31	423		2,176	0	2,176	0
424	3.23	98	2,000	35	34	423	1144	1,560	440	2,228	0
425	3.23	98	2,000	49	49	423	1145	1,557	443	2,581	0
426	3.23	96	3,500	85	27	230	1140	4,616	0	5,211	0
427	3.23	90	3,500	82	29	230	1630	7,287	0	6,086	0
428	3.23	95	3,500	86	29	230	1139	5,303	0	6,041	0
429	3.23	59	2,000	56	35	435	929	2,208	0	4,637	0
430	3.23	56	1,000	54	36	435	928	2,615	0	3,969	0
431	3.23	54	1,000	52	36	435	1228	2,970	0	3,635	0
432	3.23	52	1,000	49	35	435	1229	2,934	0	3,307	0
433	3.23	45	1,000	42	35	435	1230	2,844	0	3,112	0
434	3.23	42	1,000	39	35	435		2,893	0	2,868	0
435	3.23	37	2,000	26	26	435		2,551	0	2,551	0
436	3.23	66	2,000	61	35	435	1208	4,671	0	4,611	0
437	3.23	69	2,000	61	34	435	1209	2,619	0	4,287	0
438	3.23	61	2,000	50	50	438	1211	2,048	0	3,988	0
439	3.23	60	1,000	57	36	435	1226	2,573	0	3,687	0
440	3.23	57	1,000	53	53	440	1224	2,092	0	3,376	0
441	3.23	48	1,000	43	43	441	1218	1,937	0	2,535	0
442	3.23	42	2,000	31	27	435		2,963	0	2,688	0
443	3.23	53	1,000	49	49	443	1222	2,080	0	2,937	0
444	3.23	96	2,000	87	30	435	1216	4,243	0	3,287	0
445	3.23	64	1,000	62	36	435	1213	4,135	0	3,616	0
446	3.23	90	3,000	55	29	754	1616	3,089	0	3,487	0
447	3.23	74	3,000	48	26	435	1199	3,167	0	3,600	0
448	3.23	64	3,000	40	25	435	1205	3,444	0	3,528	0
449	3.23	77	3,500	50	22	435	1203	3,731	0	3,634	0
450	3.23	87	3,000	65	26	435	1201	3,052	0	3,660	0
451	3.23	94	3,000	68	27	435	1197	2,510	491	3,709	0
452	3.23	95	3,500	56	56	452	1180	2,901	599	4,936	0
453	3.23	97	3,500	42	42	453	1165	2,005	1,495	4,188	0
454	3.23	97	3,500	78	34	435	1168	2,331	1,169	6,549	0
455	3.23	91	3,500	76	31	230	1164	4,212	0	6,715	0
456	3.23	97	3,500	84	34	435	1164	5,494	0	6,710	0
457	3.23	89	3,500	71	34	435	1169	3,470	30	6,429	0
458	3.23	81	3,500	67	34	435	1163	5,141	0	6,301	0
459	3.23	81	3,500	58	33	435	1188	3,709	0	5,719	0
460	3.23	82	3,500	60	33	435	1178	3,368	132	5,838	0
461	3.23	70	3,500	56	33	435	1172	4,824	0	5,885	0
462	3.23	65	2,000	59	59	462	1189	3,786	0	5,506	0
463	3.23	67	3,500	45	45	463	1177	3,060	440	5,082	0
464	3.23	81	3,500	54	54	464	1187	3,029	471	5,304	0
465	3.23	90	3,500	27	27	465	1183	1,444	2,056	3,709	0
466	3.23	90	3,500	60	60	466	1184	2,548	952	5,416	0
467	3.23	90	3,500	69	31	435	1195	3,515	0	4,966	0
468	3.23	75	2,000	68	35	435	1194	3,179	0	4,789	0
469	3.23	66	2,000	61	35	435	1208	3,420	0	4,742	0
470	3.23	90	3,500	22	22	470	1192	1,866	1,634	3,551	0
471	3.23	61	3,000	48	33	435	1190	3,249	0	5,011	0
472	3.23	63	3,000	53	33	435	1190	5,706	0	5,399	0
473	3.23	68	3,000	54	54	473	1174	3,346	0	5,607	0
474	3.23	69	3,000	56	34	435	1175	3,895	0	5,824	0
475	3.23	78	3,000	56	56	475	1166	2,838	162	5,084	0
476	3.23	65	1,000	63	37	435	1149	4,163	0	5,301	0
477	3.23	62	1,000	61	61	477	1150	3,278	0	5,057	0
478	3.23	62	1,000	38	38	478	1750	911	89	1,362	0
479	3.23	67	1,000	33	33	479	382	743	257	1,187	0
480	3.23	73	1,000	65	58	929	1159	1,294	0	2,590	0
481	3.23	69	1,000	67	67	481	1151	3,115	0	4,767	0
482	3.23	70	1,000	60	60	482	1155	1,725	0	2,416	0
483	3.23	68	1,000	58	58	483	1158	1,755	0	2,370	0
484	3.23	78	1,000	69	69	484	1161	1,372	0	2,768	0
485	3.23	77	1,000	68	68	485	1160	1,212	0	2,729	0
486	3.23	79	1,000	77	65	929	1415	2,889	0	6,453	0
487	3.23	88	3,500	72	38	581	1853	4,945	0	6,485	0
488	3.23	94	3,500	57	57	488	1840	3,175	325	5,137	0
489	3.23	86	2,000	72	72	489	1240	3,229	0	4,827	0
490	3.23	94	3,500	79	39	581	1234	4,967	0	6,808	0
491	3.23	97	1,000	95	45	581	1234	5,826	0	7,701	0
492	3.23	101	2,000	95	27	686	1446	5,480	0	7,794	0
493	3.23	99	1,000	96	96	493	1237	3,784	0	7,591	0
494	3.23	97	1,000	95	28	686	1237	4,723	0	7,999	0
495	3.23	100	2,000	90	90	495	1238	2,908	0	6,485	0
496	3.23	100	2,000	90	90	496	1239	3,728	0	6,615	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
497	3.23	94	2,000	75	66	618	1399	2,749	0	4,102	0
498	3.23	88	2,000	67	67	498	1410	2,379	0	3,887	0
499	3.23	84	2,000	66	66	499	1243	1,873	127	3,987	0
500	3.23	77	2,000	62	62	500	1244	2,267	0	4,195	0
501	3.23	58	1,000	51	51	501	1259	3,104	0	3,316	0
502	3.23	74	3,500	50	50	502	1244	4,234	0	5,696	0
503	3.23	54	2,000	27	27	503	1254	1,447	553	2,277	0
504	3.23	61	1,000	52	51	613	1252	1,318	0	2,581	0
505	3.23	64	1,000	58	58	505	1251	2,890	0	3,832	0
507	3.23	75	1,000	72	28	684	1381	3,825	0	5,395	0
508	3.23	52	1,000	46	46	508	1745	2,936	0	3,013	0
509	3.23	74	2,000	40	40	509	1247	1,702	298	2,615	0
510	3.23	81	3,500	61	42	514	1266	5,168	0	6,416	0
511	3.23	67	1,000	62	50	514	1262	3,750	0	3,763	0
512	3.23	70	3,250	38	27	514	1249	4,027	0	3,675	0
513	3.23	68	1,000	62	50	514	1251	4,062	0	3,707	0
514	3.23	55	1,000	49	49	514		3,353	0	3,353	0
515	3.23	57	1,000	51	51	515		3,464	0	3,464	0
516	3.23	58	1,000	50	50	516	1260	1,984	0	2,870	0
517	3.23	70	1,000	65	65	517	1268	2,813	0	4,048	0
518	3.23	83	3,500	64	38	581	1267	5,536	0	6,451	0
519	3.23	83	3,500	67	38	581	1275	6,457	0	6,275	0
520	3.23	83	3,500	66	38	581	1277	5,125	0	6,331	0
521	3.23	78	1,000	51	51	521	1383	1,009	0	1,535	0
522	3.23	65	1,000	56	56	522	1283	1,390	0	2,699	0
523	3.23	66	1,000	55	55	523	1282	1,478	0	2,265	0
524	3.23	70	1,000	59	59	524	1280	1,897	0	2,390	0
525	3.23	70	1,000	59	59	525	1269	1,666	0	2,399	0
526	3.23	78	1,000	74	28	684	1273	4,323	0	4,865	0
527	3.23	78	1,000	74	28	684	1274	4,101	0	4,899	0
528	3.23	77	1,000	74	28	684	1377	4,027	0	5,331	0
529	3.23	78	1,000	75	28	684	1300	5,854	0	6,256	0
530	3.23	74	1,000	70	28	684		5,060	0	5,060	0
531	3.23	78	1,000	75	28	684	1301	5,719	0	6,293	0
532	3.23	86	3,500	69	36	581	1289	6,885	0	5,580	0
533	3.23	63	1,000	58	58	533	1294	3,077	0	3,693	0
534	3.23	75	1,000	71	28	684		4,874	0	4,874	0
535	3.23	73	1,000	68	28	684	1306	2,464	0	3,957	0
536	3.23	63	1,000	58	58	536	1295	2,669	0	3,530	0
537	3.23	63	1,000	58	58	537	1293	3,225	0	3,983	0
538	3.23	85	3,500	68	37	581	1276	6,688	0	5,966	0
539	3.23	85	3,500	68	37	581	1290	6,430	0	5,874	0
540	3.23	79	1,000	35	35	540	1291	1,716	0	4,071	0
541	3.23	76	1,000	52	52	541	1292	1,371	0	1,623	0
542	3.23	64	1,000	46	45	544	1296	1,141	0	1,657	0
543	3.23	96	1,000	94	28	684	1312	6,358	0	8,222	0
544	3.23	63	1,000	36	36	544		1,298	0	1,298	0
545	3.23	90	1,000	86	28	684	1311	3,653	0	5,519	0
546	3.23	81	1,000	78	28	684	938	2,340	0	5,088	0
547	3.23	83	1,000	79	28	684	1317	2,082	0	4,707	0
548	3.23	75	1,000	69	28	684	1365	2,083	0	3,407	0
549	3.23	71	1,000	66	28	684	1315	2,345	0	3,602	0
550	3.23	70	1,000	66	28	684	1314	3,653	0	4,395	0
551	3.23	70	3,500	46	22	581	1310	4,754	0	3,630	0
552	3.23	93	3,500	71	31	577	1322	4,313	0	4,366	0
554	3.23	80	3,500	53	25	577		5,386	0	3,849	0
555	3.23	87	3,500	63	30	577		6,325	0	4,322	0
556	3.23	87	3,500	61	28	577	1325	5,450	0	4,083	0
557	3.23	80	3,500	50	25	577	1948	3,239	261	3,873	0
558	3.23	83	3,500	48	27	577	1328	2,362	1,138	4,040	0
559	3.23	85	3,500	45	30	577	1329	2,632	868	4,268	0
560	3.23	81	3,500	43	43	560	1332	2,469	1,031	4,539	0
561	3.23	81	3,500	69	40	577	1426	6,170	0	6,331	0
562	3.23	76	3,500	49	44	563	1333	2,438	1,062	4,968	0
563	3.23	72	3,500	26	26	563	1334	2,448	1,052	3,759	0
564	3.23	76	3,500	16	16	565	1335	1,563	1,937	3,379	121
565	3.23	76	3,500	2	2	565		3,001	499	3,001	499
566	3.23	80	3,500	51	23	577	1948	3,833	0	3,696	0
567	3.23	76	3,500	23	23	567	1339	1,567	1,933	3,599	0
568	3.23	71	3,500	17	-3	577		3,395	105	2,621	879
569	3.23	91	3,500	-34	-36	869	1346	1,563	1,937	2,535	965
570	3.23	84	3,500	-24	-24	570	1341	1,567	1,933	2,645	855
571	3.23	71	3,500	15	-1	577	1344	2,301	1,199	2,673	827
572	3.23	71	3,500	16	-2	577	1342	2,406	1,094	2,627	873
573	3.23	71	3,500	19	0	577		3,481	19	2,688	812
574	3.23	84	3,500	11	-4	577	1345	2,757	743	2,585	915
575	3.23	71	3,500	12	-8	577		3,233	267	2,496	1,004
576	3.23	71	3,500	4	-15	577		3,037	463	2,349	1,151
577	3.23	52	3,500	-115	-115	577		1,434	2,066	1,434	2,066
578	3.23	61	3,500	36	22	581		4,537	0	3,640	0
579	3.23	54	3,500	17	13	583	1353	2,280	1,220	3,147	353
580	3.23	48	3,500	6	4	581	1356	2,747	753	2,719	781
581	3.23	45	3,500	-37	-37	581	1355	1,567	1,933	1,876	1,624

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
582	3.23	56	3,500	24	16	581	1755	2,088	1,412	3,241	259
583	3.23	50	3,500	-9	-9	583	1357	1,567	1,933	2,457	1,043
584	3.23	84	3,000	75	28	684	261	8,490	0	8,467	0
585	3.23	67	3,500	27	22	581	1358	1,567	1,933	3,630	0
586	3.23	84	3,000	74	28	684	1359	4,395	0	8,410	0
587	3.23	85	1,000	83	28	684	1361	6,955	0	8,011	0
589	3.23	78	1,000	73	28	684	1364	1,812	0	3,716	0
591	3.23	73	1,000	69	28	684	1306	3,349	0	4,371	0
592	3.23	72	1,000	64	28	684	1369	1,567	0	2,783	0
593	3.23	70	1,000	66	28	684	1367	2,881	0	4,100	0
595	3.23	94	2,000	81	28	684	1371	3,114	0	5,421	0
597	3.23	78	1,000	64	28	684	1373	878	122	2,134	0
598	3.23	74	3,500	57	25	919	1359	4,820	0	6,879	0
599	3.23	89	3,500	64	25	919	1760	3,518	0	5,611	0
600	3.23	89	3,500	58	25	919	1760	3,518	0	5,074	0
601	3.23	89	3,500	45	25	919	1376	1,567	1,933	4,466	0
602	3.23	74	3,500	-14	-14	602	1799	1,563	1,937	2,694	806
603	3.23	77	1,000	74	28	684	1377	3,533	0	5,295	0
604	3.23	76	1,000	73	28	684		5,880	0	5,880	0
605	3.23	71	1,000	60	60	605	1382	1,886	0	2,411	0
606	3.23	75	1,000	70	28	684	1385	1,389	0	3,808	0
607	3.23	76	1,000	72	28	684	1387	4,590	0	5,146	0
608	3.23	81	2,500	47	28	684	1389	2,443	57	3,994	0
611	3.23	60	1,000	49	49	613	1252	1,317	0	2,159	0
613	3.23	60	1,000	43	43	613	1252	1,316	0	1,704	0
614	3.23	68	1,000	-16	-16	614	1397	388	612	740	260
615	3.23	97	2,000	80	80	811	1400	2,453	0	4,686	0
616	3.23	91	2,000	44	44	616	1401	1,067	933	2,538	0
617	3.23	92	3,500	24	24	617	1406	2,000	1,501	3,619	0
618	3.23	84	2,000	64	64	618		3,852	0	3,852	0
619	3.23	91	3,500	29	29	619	1407	3,486	14	3,773	0
620	3.23	88	1,000	80	80	620	1409	1,567	0	3,176	0
621	3.23	75	2,000	53	53	621	1411	1,542	458	3,292	0
622	3.23	95	3,500	64	64	623	1412	2,606	894	5,783	0
623	3.23	95	3,500	55	55	623	1414	3,525	0	4,915	0
624	3.23	79	1,000	77	72	812	1422	2,866	0	6,540	0
625	3.23	81	3,500	69	69	625	1421	3,669	0	7,140	0
626	3.23	81	1,000	80	65	929	41	4,824	0	7,461	0
627	3.23	85	3,500	77	28	684	207	6,164	0	8,689	0
628	3.23	89	3,500	74	28	684	1427	2,448	1,052	8,657	0
629	3.23	82	3,500	50	50	629	1429	1,567	1,933	4,951	0
630	3.23	87	3,500	80	25	686	1431	6,905	0	6,108	0
631	3.23	87	1,000	86	27	686	1430	8,110	0	5,884	0
632	3.23	93	1,000	91	27	686	1432	3,156	0	5,822	0
633	3.23	100	1,000	98	27	686	1433	3,480	0	5,799	0
634	3.23	106	1,000	100	100	634	1434	1,567	0	4,474	0
635	3.23	102	1,000	99	27	686	165	2,666	0	5,776	0
636	3.23	89	3,000	81	25	686	1436	5,904	0	5,951	0
637	3.23	102	1,000	96	96	637	1439	1,567	0	4,253	0
638	3.23	87	3,000	80	25	686	1440	5,896	0	5,674	0
639	3.23	89	1,000	87	27	686	1442	2,527	0	5,747	0
640	3.23	71	3,000	37	37	640	1444	1,567	1,433	3,768	0
641	3.23	78	3,000	67	25	686	1443	4,224	0	6,343	0
642	3.23	101	1,000	99	27	686	1445	4,483	0	7,398	0
643	3.23	93	3,500	80	26	686	1447	5,373	0	7,566	0
644	3.23	95	1,000	92	92	644	1448	3,014	0	6,438	0
645	3.23	97	1,000	94	94	645	1453	3,434	0	7,080	0
646	3.23	101	1,000	98	98	646	1450	2,896	0	5,759	0
647	3.23	97	1,000	95	95	647	1452	2,267	0	7,685	0
648	3.23	95	1,000	91	91	648	1455	3,058	0	5,681	0
649	3.23	95	2,000	84	84	651	1462	2,539	0	5,962	0
650	3.23	93	3,000	81	26	686	1457	4,664	0	7,817	0
651	3.23	95	3,000	47	47	651	1458	1,567	1,433	3,823	0
652	3.23	95	3,500	67	67	652	1461	2,446	1,054	6,086	0
653	3.23	97	3,500	77	77	653	1459	3,145	355	7,445	0
654	3.23	101	3,000	89	26	686	1463	5,399	0	8,421	0
655	3.23	91	2,000	83	83	655	1587	3,385	0	7,291	0
656	3.23	91	1,000	87	87	656	1465	2,799	0	5,817	0
657	3.23	108	3,500	72	65	658	1468	2,351	1,149	5,451	0
658	3.23	101	3,500	40	40	658	1470	1,567	1,933	4,086	0
659	3.23	63	1,000	36	36	659	1471	881	119	1,294	0
660	3.23	81	1,000	78	76	661	1472	3,044	0	5,148	0
661	3.23	79	1,000	73	73	661	1474	1,567	0	3,511	0
662	3.23	87	3,500	40	40	662	1475	1,567	1,933	4,242	0
663	3.23	76	1,000	74	27	686	1476	4,683	0	4,700	0
664	3.23	78	2,000	72	26	686	1478	2,214	0	4,500	0
665	3.23	74	2,000	66	26	686	1479	2,691	0	4,443	0
666	3.23	76	2,000	65	26	686	1480	2,548	0	4,411	0
667	3.23	68	2,000	57	26	686	1482	3,515	0	4,404	0
668	3.23	66	2,000	55	48	675	1482	3,431	0	4,116	0
669	3.23	65	2,000	54	48	675	1484	2,601	0	4,155	0
670	3.23	58	2,000	48	48	670	1485	2,365	0	4,256	0
671	3.23	56	2,000	49	26	686	1486	2,746	0	4,345	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
672	3.23	52	2,000	45	25	686	1489	2,323	0	4,241	0
673	3.23	50	1,000	48	27	686	1488	5,046	0	4,058	0
674	3.23	71	2,000	55	55	674	1491	3,110	0	3,859	0
675	3.23	58	2,000	43	43	675	1494	3,132	0	3,289	0
676	3.23	39	1,000	37	27	686		4,929	0	3,261	0
677	3.23	39	2,000	18	18	677	1496	1,567	433	1,901	99
678	3.23	37	1,000	35	27	686		4,613	0	3,028	0
679	3.23	32	1,000	30	26	686		2,988	0	2,324	0
680	3.23	30	1,000	24	24	680		1,349	0	1,349	0
681	3.23	32	1,000	30	26	684		2,783	0	2,280	0
682	3.23	32	1,000	30	26	684		2,740	0	2,227	0
683	3.23	32	1,000	30	26	684		2,764	0	2,170	0
684	3.23	28	1,000	22	22	684		1,238	0	1,238	0
685	3.23	28	1,000	22	22	685		1,203	0	1,203	0
686	3.23	28	1,000	22	22	686		1,226	0	1,226	0
687	3.23	90	2,000	49	25	843	1768	2,159	0	2,476	0
688	3.23	58	2,000	53	25	684	1503	4,505	0	3,654	0
689	3.23	80	2,000	73	25	684	1505	2,355	0	3,675	0
690	3.23	56	2,000	48	25	684	1507	3,596	0	3,684	0
691	3.23	54	2,000	50	25	684		6,824	0	3,765	0
692	3.23	63	2,000	52	25	684	1509	3,103	0	3,680	0
693	3.23	54	2,000	11	11	693	1512	881	1,119	1,763	237
694	3.23	58	2,000	49	25	684	1510	2,907	0	3,680	0
695	3.23	52	2,000	48	25	684	1513	6,155	0	3,886	0
696	3.23	52	2,000	43	25	684	1515	1,567	433	3,886	0
697	3.23	54	1,000	52	37	237	1516	2,392	0	3,782	0
698	3.23	77	1,000	29	22	919		1,737	0	1,493	0
699	3.23	79	1,000	31	22	919		1,897	0	1,482	0
700	3.23	90	1,000	43	22	919		2,572	0	1,467	0
701	3.23	71	1,000	23	22	352		1,277	0	1,192	0
702	3.23	87	1,000	41	22	919		2,556	0	1,461	0
703	3.23	92	1,000	44	22	919		2,475	0	1,460	0
704	3.23	96	1,000	48	22	919		2,453	0	1,459	0
705	3.23	94	1,000	46	22	919		2,549	0	1,458	0
706	3.23	85	1,000	38	22	919		2,206	0	1,454	0
707	3.23	40	1,000	34	34	820		2,002	0	2,002	0
708	3.23	40	1,000	34	34	708		2,005	0	2,005	0
709	3.23	40	1,000	35	35	709		2,396	0	2,395	0
710	3.23	40	1,000	35	35	710		2,446	0	2,446	0
711	3.23	40	1,000	36	36	711	1541	2,190	0	2,784	0
712	3.23	38	1,000	35	35	712		3,087	0	3,086	0
713	3.23	81	1,000	32	22	352		1,747	0	1,209	0
714	3.23	85	1,000	35	22	352		1,785	0	1,209	0
715	3.23	81	1,000	30	22	352		1,585	0	1,220	0
716	3.23	79	1,000	29	22	352		1,593	0	1,208	0
717	3.23	85	1,000	35	22	352		1,780	0	1,209	0
718	0	28	1,000	25	35	390		2,430	0	4,180	0
719	3.23	53	1,000	49	34	230		3,791	0	2,705	0
720	3.23	53	1,000	49	34	230		3,740	0	2,695	0
721	3.23	51	1,000	46	34	230		3,430	0	2,688	0
722	3.23	55	1,000	50	34	230	1554	2,561	0	2,658	0
723	3.23	64	1,000	58	34	230	1555	2,291	0	2,658	0
724	3.23	53	1,000	48	33	230		3,337	0	2,599	0
725	3.23	55	1,000	50	34	230		3,371	0	2,649	0
726	3.23	62	1,000	57	34	230	1561	2,580	0	2,660	0
727	3.23	40	1,000	35	35	727	1807	2,252	0	2,412	0
728	3.23	40	1,000	18	18	728	1565	881	119	948	52
729	3.23	53	1,000	48	40	730	1569	2,701	0	2,750	0
730	3.23	45	1,000	25	25	730	1570	881	119	1,147	0
731	3.23	53	1,000	47	39	732	1572	2,634	0	2,499	0
732	3.23	44	1,000	24	24	732	1573	881	119	1,117	0
733	3.23	62	1,000	62	35	230	103	3,437	0	4,805	0
734	3.23	69	1,000	64	64	734	1575	3,108	0	4,196	0
735	3.23	67	1,000	64	50	817	1579	1,791	0	5,450	0
736	3.23	80	1,000	77	50	817	1582	4,200	0	6,208	0
737	3.23	82	2,000	73	73	737	1583	2,870	0	6,055	0
738	3.23	84	2,000	75	75	738	1585	2,882	0	6,153	0
739	3.23	86	2,000	79	79	739	1586	4,172	0	7,036	0
740	3.23	88	2,000	81	81	740	1587	3,688	0	7,244	0
741	3.23	84	2,000	74	74	741	1591	2,761	0	5,713	0
742	3.23	54	1,000	52	52	742	1593	2,707	0	5,057	0
743	3.23	84	1,000	78	78	743	1594	1,805	0	3,444	0
744	3.23	50	1,000	47	27	686	1597	3,125	0	4,003	0
745	3.23	67	1,000	65	27	686	1598	4,767	0	6,118	0
746	3.23	63	1,000	58	58	746	1601	1,659	0	3,269	0
747	3.23	79	1,000	29	22	352		1,533	0	1,212	0
748	3.23	42	1,000	36	34	708		2,186	0	2,154	0
749	3.23	40	1,000	34	34	749		2,162	0	2,162	0
750	3.23	40	1,000	35	35	750		2,550	0	2,549	0
751	3.23	42	1,000	37	37	751		2,472	0	2,472	0
752	3.23	49	1,000	44	34	230	1613	2,654	0	2,770	0
753	3.23	70	3,000	40	29	754	1615	2,706	294	3,461	0
754	3.23	57	1,000	52	52	754		3,200	0	3,200	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
755	3.23	94	3,500	82	24	230	1620	5,524	0	4,489	0
756	3.23	94	3,500	77	24	230	1621	2,357	1,143	4,420	0
757	3.23	89	3,500	69	23	230	1623	2,867	633	4,389	0
758	3.23	87	3,000	75	26	230	179	4,190	0	4,422	0
759	3.23	92	3,000	74	26	230	1624	3,049	0	4,278	0
760	3.23	92	3,000	75	26	230	1761	2,684	316	4,181	0
761	3.23	87	3,500	68	27	230	1629	2,586	914	5,377	0
762	3.23	89	3,500	76	28	230	1628	4,863	0	5,554	0
763	3.23	89	3,500	75	28	230	1630	3,081	419	5,686	0
764	3.23	85	3,500	52	52	764	1632	2,942	558	5,025	0
765	3.23	96	3,500	50	24	230	1634	1,567	1,933	4,491	0
766	3.23	92	3,000	83	25	230	1635	6,240	0	3,924	0
767	3.23	111	1,000	106	36	875	1744	4,255	0	2,573	0
768	3.23	83	3,000	52	15	230	1641	3,026	0	2,558	442
769	3.23	92	3,000	65	15	230	1638	5,352	0	2,563	437
770	3.23	79	3,000	50	15	230	1645	3,371	0	2,557	443
771	3.23	77	3,000	51	15	230		4,938	0	2,582	418
772	3.23	70	1,000	54	54	772	1646	881	119	1,900	0
773	3.23	53	1,000	45	33	875		2,370	0	1,790	0
774	3.23	75	1,000	63	63	896		2,488	0	2,488	0
775	3.23	68	2,000	52	23	230		4,005	0	2,236	0
776	3.23	49	2,000	36	28	230		3,366	0	2,913	0
777	3.23	62	2,000	51	27	230		4,762	0	2,791	0
778	3.23	70	1,000	65	33	230	1656	2,310	0	2,559	0
779	3.23	66	1,000	60	33	230		3,688	0	2,322	0
780	3.23	49	1,000	43	33	230		2,664	0	2,276	0
781	3.23	44	1,000	38	33	230		2,425	0	2,272	0
782	3.23	44	1,000	37	37	782		2,185	0	2,185	0
783	3.23	70	1,000	64	33	230	1661	3,205	0	2,290	0
784	3.23	57	2,000	42	22	230		3,399	0	2,186	0
785	3.23	57	1,000	51	33	230	1665	2,544	0	2,286	0
786	3.23	44	1,000	37	37	786		2,196	0	2,196	0
787	3.23	53	1,000	47	33	230		2,834	0	2,267	0
788	3.23	53	1,000	47	33	230		2,914	0	2,265	0
789	3.23	55	1,000	49	33	230		3,048	0	2,258	0
790	3.23	62	1,000	56	33	230		3,576	0	2,260	0
791	3.23	70	1,000	65	33	230		4,056	0	2,265	0
792	3.23	81	1,000	75	33	230	1674	2,471	0	2,265	0
793	3.23	81	1,000	74	33	230	1675	2,121	0	2,265	0
794	3.23	87	1,000	79	33	230	1676	2,875	0	2,265	0
795	3.23	88	1,000	79	33	230	1677	2,659	0	2,265	0
796	3.23	83	1,000	76	33	230	1679	2,854	0	2,265	0
797	3.23	79	1,000	72	33	230	1680	3,397	0	2,265	0
798	3.23	73	1,000	66	33	230	1681	2,728	0	2,265	0
799	3.23	73	1,000	67	33	230		4,142	0	2,270	0
800	3.23	60	1,000	54	33	230		3,459	0	2,248	0
801	3.23	66	1,000	59	33	230	1687	2,429	0	2,245	0
802	3.23	62	1,000	56	33	230		3,348	0	2,242	0
803	3.23	57	1,000	52	33	230		3,329	0	2,240	0
804	3.23	40	1,000	34	32	230		2,246	0	2,140	0
805	3.23	40	1,000	33	33	805		1,959	0	1,959	0
806	3.23	45	1,000	35	35	806		1,753	0	1,753	0
808	3.23	73	1,000	55	43	613	1252	1,317	0	1,704	0
809	3.23	88	1,000	72	72	809	1419	1,567	0	2,263	0
810	3.23	70	1,000	-76	-76	810	1398	392	608	562	438
811	3.23	97	1,000	89	89	811	1707	1,567	0	3,684	0
812	3.23	73	2,000	35	35	812	1416	1,567	433	2,410	0
813	3.23	76	3,250	72	34	230	1713	2,098	1,152	7,574	0
815	3.23	96	1,000	23	23	815	940	881	119	1,047	0
816	3.23	104	1,000	76	54	247	1566	881	119	1,703	0
817	3.23	52	1,000	39	39	817	949	1,567	0	1,664	0
818	3.23	69	1,000	23	23	818		1,442	0	1,441	0
819	3.23	71	1,000	22	22	819		1,184	0	1,183	0
820	3.23	40	1,000	27	27	820		1,266	0	1,266	0
833	3.23	80	3,500	-29	-29	833	1735	2,448	1,052	2,525	975
836	3.23	78	2,000	54	28	684	1746	3,797	0	4,204	0
837	3.23	41	2,000	29	23	684		2,733	0	2,647	0
838	3.23	59	2,000	-20	-20	838	1751	646	1,354	1,364	636
839	3.23	56	3,500	26	18	581		3,860	0	3,349	151
840	3.23	74	3,500	56	25	919	1359	4,940	0	6,527	0
841	3.23	89	3,500	69	25	919	1359	5,271	0	6,636	0
842	3.23	92	3,000	79	25	230	1762	2,189	811	4,031	0
844	3.23	90	2,000	55	25	843	1938	1,533	467	2,476	0
845	3.23	80	2,000	36	36	845		2,389	0	2,389	0
846	3.23	80	1,000	67	67	851		2,352	0	2,351	0
847	3.23	90	2,000	49	25	843	1771	2,194	0	2,476	0
848	3.23	83	1,000	66	66	848	1773	1,567	0	2,122	0
853	3.23	32	1,000	30	26	684		2,728	0	2,118	0
854	3.23	32	1,000	30	26	685		2,703	0	2,100	0
855	3.23	32	1,000	30	26	686		2,859	0	2,245	0
856	3.23	32	1,000	30	26	686		2,740	0	2,128	0
857	3.23	88	2,000	30	28	851	1796	1,563	437	2,175	0
858	3.23	97	2,000	33	28	851		2,224	0	2,175	0

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862	3.23	74	3,500	11	11	602	1799	1,563	1,937	3,231	269
863	3.23	57	1,000	42	29	315	1803	875	125	1,309	0
864	3.23	45	1,000	40	36	727		3,066	0	2,755	0
868	3.23	43	2,000	31	24	684	1815	2,646	0	2,862	0
869	3.23	89	3,500	-65	-65	869	1818	1,567	1,933	2,263	1,237
875	3.23	41	1,000	31	31	875		1,636	0	1,636	0
876	0	44	1,000	31	31	875		1,421	0	1,632	0
877	0	45	1,000	32	31	875		1,442	0	1,632	0
878	0	43	1,000	31	31	875		1,477	0	1,632	0
879	0	44	1,000	32	31	875		1,464	0	1,632	0
880	3.23	94	3,500	78	39	581	1852	4,293	0	6,676	0
885	3.23	93	3,500	72	39	581	1838	1,965	1,535	6,665	0
887	3.23	94	3,500	63	63	887	1849	2,376	1,124	5,691	0
888	3.23	94	3,500	59	59	888	1843	2,648	852	5,327	0
889	3.23	75	1,000	65	34	875		2,733	0	1,972	0
890	3.23	75	1,000	52	52	890	1888	881	119	1,634	0
896	3.23	75	1,000	63	63	896		2,407	0	2,407	0
900	3.23	54	1,000	51	51	900	368	2,807	0	3,918	0
901	3.23	51	2,000	41	41	901	370	1,563	437	3,844	0
903	3.23	52	2,000	33	33	903	371	1,567	433	2,651	0
919	3.23	67	1,000	6	6	919		786	214	786	214
920	3.23	62	1,000	55	34	230	373	2,646	0	2,658	0
923	3.23	50	1,000	39	39	923	376	881	119	1,727	0
924	3.23	56	3,500	19	19	924	983	3,052	448	3,454	46
925	3.23	91	3,500	62	62	925	378	2,429	1,071	5,776	0
926	3.23	83	3,500	0	0	926	379	1,567	1,933	3,020	480
927	3.23	87	3,500	50	29	577	380	2,860	640	4,164	0
928	3.23	87	3,500	-2	-2	928	381	1,567	1,933	2,997	503
929	3.23	66	1,000	48	48	929	1147	1,124	0	1,650	0
930	3.23	66	1,000	56	33	230		2,545	0	2,242	0
931	3.23	94	3,000	41	14	875	384	1,567	1,433	2,574	426
932	3.23	68	2,000	39	23	230	385	1,567	433	2,236	0
933	3.23	57	2,000	41	22	230		3,320	0	2,142	0
934	3.23	92	3,000	50	25	230	387	1,613	1,387	3,924	0
935	3.23	49	1,000	43	32	230		2,794	0	2,193	0
936	3.23	49	1,000	37	37	936	391	1,567	0	1,721	0
937	3.23	84	1,000	65	28	684		3,669	0	3,669	0

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10	3.23	80	1,000	71	37	435	17	2,461	0	2,204	0
12	3.23	74	1,000	65	37	435		2,821	0	2,203	0
14	3.23	67	1,000	59	37	435		2,645	0	2,206	0
16	3.23	88	1,000	77	37	435	31	1,448	0	2,204	0
18	3.23	81	3,500	73	73	18	41	3,823	0	8,131	0
20	3.23	82	3,500	65	65	20	57	3,002	498	6,738	0
22	3.23	81	3,500	70	70	22	47	3,866	0	7,934	0
24	3.23	81	3,500	69	69	24	49	3,339	161	7,643	0
26	3.23	81	3,500	70	70	26	43	2,817	683	7,657	0
28	3.23	68	1,000	66	37	435		3,903	0	3,109	0
30	3.23	64	1,000	62	37	435	61	3,257	0	3,123	0
32	3.23	60	1,000	57	37	435		3,187	0	3,132	0
34	3.23	71	1,000	67	37	435		3,237	0	3,108	0
36	3.23	70	1,000	66	37	435		3,155	0	3,108	0
38	3.23	70	1,000	65	37	435		3,075	0	3,075	0
40	3.23	75	1,000	70	37	435		3,098	0	3,062	0
42	3.23	73	1,000	68	37	435		3,049	0	3,049	0
44	3.23	75	1,000	69	37	435	83	2,256	0	2,940	0
46	3.23	77	1,000	71	37	435		2,939	0	2,939	0
48	3.23	75	1,000	68	37	435	89	2,790	0	2,823	0
50	3.23	84	1,000	78	37	435	93	2,448	0	3,028	0
52	3.23	82	1,000	76	37	435	95	2,445	0	3,075	0
54	3.23	79	3,500	74	38	732	109	4,396	0	8,760	0
56	3.23	76	2,000	49	49	56	111	1,541	459	2,942	0
58	3.23	76	1,000	74	37	435	113	5,312	0	7,000	0
60	3.23	77	1,000	75	37	435	115	2,754	0	7,207	0
62	3.23	78	1,000	76	37	435	121	4,022	0	6,857	0
64	3.23	78	1,000	76	37	435	119	4,058	0	6,855	0
66	3.23	80	1,000	77	37	435	131	3,893	0	6,364	0
68	3.23	79	1,000	77	37	435	123	3,541	0	6,711	0
70	3.23	102	1,000	100	37	435	133	3,512	0	6,777	0
72	3.23	90	1,000	87	37	435	135	2,164	0	5,672	0
74	3.23	89	1,000	86	37	435	367	3,890	0	5,260	0
76	3.23	98	1,000	73	73	76	141	1,567	0	1,865	0
78	3.23	51	1,000	49	37	435		2,966	0	2,967	0
80	3.23	55	2,000	41	37	435	155	2,526	0	2,988	0
82	3.23	60	2,000	45	37	435		3,133	0	3,002	0
84	3.23	64	2,000	51	37	435		3,450	0	3,015	0
86	3.23	64	2,000	49	37	435	147	3,131	0	3,031	0
88	3.23	95	1,000	93	37	435	161	5,114	0	6,287	0
90	3.23	95	1,000	92	37	435	163	3,518	0	6,272	0
92	3.23	85	3,000	71	71	92	179	3,003	0	6,454	0
94	3.23	77	1,000	75	37	435		4,333	0	3,132	0
96	3.23	73	1,000	71	37	435	1685	3,914	0	3,155	0
98	3.23	89	1,000	81	37	435	185	1,795	0	3,965	0
100	3.23	88	1,000	80	37	435	187	1,604	0	3,952	0
102	3.23	62	3,500	-22	-32	577	189	1,563	1,937	2,082	1,418
104	3.23	70	1,000	63	37	435	1265	1,580	0	3,353	0
106	3.23	84	1,000	77	37	435	195	1,567	0	3,270	0
108	3.23	60	1,000	50	37	435	1393	1,554	0	2,365	0
110	3.23	86	1,000	79	37	435	1595	1,606	0	3,432	0
112	3.23	70	1,000	66	37	435	201	2,880	0	4,097	0
114	3.23	87	1,000	82	37	435	203	2,704	0	4,351	0
116	3.23	97	3,500	67	67	116	205	1,827	1,673	5,801	0
128	3.23	96	2,500	87	37	435	237	9,450	0	7,688	0
134	3.23	94	1,000	91	37	435	285	3,681	0	5,822	0
136	3.23	95	1,000	91	37	435	287	3,597	0	5,606	0
138	3.23	94	1,000	91	37	435	289	3,790	0	5,687	0
140	3.23	94	1,000	91	37	435	291	3,118	0	5,810	0
142	3.23	97	1,000	94	37	435	293	3,692	0	5,845	0
144	3.23	101	1,000	97	37	435	1925	2,844	0	5,506	0
146	3.23	101	1,000	96	37	435	1926	2,756	0	5,059	0
148	3.23	70	1,000	59	37	435	277	1,543	0	2,531	0
215	3.23	122	1,000	119	37	435	1637	4,449	0	3,439	0
216	3.23	78	2,000	77	37	435		12,544	0	9,726	0
217	3.23	100	1,000	98	37	435	1504	3,509	0	7,844	0
218	3.23	64	1,000	58	37	435	925	3,407	0	4,162	0
219	3.23	105	1,000	97	37	435		3,367	0	2,942	0
220	3.23	109	1,000	101	37	435	919	3,512	0	3,035	0
221	3.23	81	3,500	75	75	221	1423	6,197	0	8,387	0
222	3.23	86	2,000	72	37	435	930	3,525	0	5,150	0
228	3.23	104	1,000	101	37	435	923	4,393	0	6,580	0
229	3.23	72	1,000	71	37	435		4,502	0	3,585	0
230	3.23	49	2,000	37	37	230		2,904	0	2,904	0
231	0	77	2,000	75	37	435		12,438	0	9,723	0
232	3.23	80	3,500	64	37	435		8,550	0	7,340	0
233	3.23	62	1,000	55	37	435		3,266	0	3,267	0
235	3.23	64	1,000	58	37	435		4,825	0	3,794	0
236	3.23	66	1,000	58	37	435	943	2,411	0	2,978	0
237	3.23	69	1,000	63	37	435	1518	1,766	0	3,280	0
238	3.23	80	1,000	77	37	435	129	2,855	0	5,981	0
239	3.23	81	1,000	79	37	435	1513	4,682	0	7,060	0
240	3.23	56	1,000	50	37	435		3,721	0	3,671	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
241	3.23	75	1,000	68	37	435	942	3,239	0	3,780	0
242	3.23	79	1,000	72	37	435	1071	2,779	0	3,772	0
243	3.23	70	1,000	63	37	435	193	3,062	0	3,319	0
244	3.23	78	1,000	73	37	435	1299	2,442	0	3,753	0
245	3.23	76	1,000	72	37	435	1274	4,699	0	5,151	0
246	3.23	89	3,500	61	61	246	1179	2,557	943	5,591	0
247	3.23	75	1,000	52	52	247	1095	878	122	1,640	0
248	3.23	65	1,000	57	37	732	1096	2,524	0	2,197	0
249	3.23	49	1,000	42	37	732		2,347	0	2,069	0
250	3.23	51	1,000	40	37	435	966	1,709	0	1,759	0
251	3.23	83	3,500	63	33	581	1309	4,521	0	4,924	0
252	3.23	70	1,000	70	37	435	1425	8,922	0	8,329	0
253	3.23	78	1,000	77	37	435		9,215	0	7,577	0
254	3.23	82	2,000	81	37	435		12,753	0	9,808	0
255	3.23	81	1,000	78	37	435	972	3,482	0	6,252	0
256	3.23	77	1,000	74	37	435	973	3,007	0	5,830	0
257	3.23	76	1,000	74	37	435	974	3,416	0	6,301	0
258	3.23	69	1,000	67	37	435	980	6,195	0	7,585	0
259	3.23	74	1,000	72	37	435	979	2,614	0	6,995	0
260	3.23	48	1,000	40	37	435	964	1,668	0	1,958	0
261	3.23	51	1,000	44	37	435	961	2,363	0	2,408	0
262	3.23	59	1,000	53	37	435	957	1,959	0	2,951	0
263	3.23	60	1,000	54	37	435	1600	2,280	0	2,713	0
264	3.23	55	1,000	46	37	435	963	1,574	0	2,155	0
265	3.23	80	1,000	77	37	435	954	4,697	0	6,102	0
266	3.23	73	1,000	68	37	435	970	2,355	0	3,855	0
267	3.23	74	1,000	68	37	435	970	1,737	0	3,586	0
268	3.23	71	1,000	67	37	435	976	1,822	0	4,391	0
269	3.23	69	1,000	68	37	435	1495	4,241	0	6,608	0
270	3.23	71	1,000	68	37	435	978	2,448	0	5,127	0
271	3.23	68	1,000	65	37	435	959	3,554	0	4,142	0
272	3.23	67	1,000	63	37	435	959	1,788	0	4,028	0
273	3.23	68	1,000	64	37	435	955	2,823	0	4,395	0
274	3.23	82	1,000	80	37	435	1430	5,984	0	5,610	0
275	3.23	83	3,000	73	37	435	1437	5,520	0	6,048	0
276	3.23	85	3,000	75	37	435	1436	6,574	0	6,932	0
277	3.23	95	2,000	87	37	435	981	3,820	0	7,512	0
278	3.23	95	3,000	83	37	435	1456	6,581	0	8,729	0
279	3.23	88	3,000	77	37	435	956	5,051	0	6,499	0
280	3.23	61	1,000	57	37	435	1601	4,189	0	3,993	0
281	3.23	53	1,000	49	37	435	990	3,286	0	3,388	0
282	3.23	60	1,000	54	37	435	991	1,617	0	2,898	0
283	3.23	64	1,000	54	37	435	993	1,474	0	2,306	0
284	3.23	57	1,000	51	37	435	994	1,812	0	2,647	0
285	3.23	51	1,000	46	37	435		2,816	0	2,816	0
286	3.23	52	1,000	46	37	435		2,650	0	2,650	0
287	3.23	83	1,000	78	37	435	982	2,442	0	4,566	0
288	3.23	84	3,500	39	37	435	985	2,852	648	4,460	0
289	3.23	88	3,500	36	36	289	995	2,866	634	4,194	0
290	3.23	84	3,500	42	37	435	996	3,028	472	4,688	0
291	3.23	72	1,000	70	37	435	1003	2,555	0	6,000	0
292	3.23	65	1,000	61	37	435	999	2,331	0	4,085	0
293	3.23	92	1,000	88	37	435	1001	2,763	0	5,045	0
294	3.23	76	1,000	73	37	435	1002	3,084	0	5,522	0
295	3.23	82	2,000	71	37	435	1588	2,985	0	5,649	0
296	3.23	88	1,000	84	37	435	1465	2,011	0	4,812	0
297	3.23	77	1,000	71	37	435	952	2,330	0	3,604	0
298	3.23	63	1,000	58	37	435	997	1,963	0	3,441	0
299	3.23	82	1,000	79	37	435	1008	3,549	0	6,145	0
300	3.23	71	1,000	65	37	435	1924	2,713	0	4,280	0
301	3.23	74	1,000	68	37	435	1013	3,663	0	4,097	0
302	3.23	78	1,000	72	37	435	1012	2,948	0	4,119	0
303	3.23	86	1,000	80	37	435	1593	3,120	0	5,216	0
304	3.23	88	1,000	84	37	435	1015	2,721	0	5,468	0
305	3.23	85	1,500	80	37	435	1009	5,140	0	5,527	0
306	3.23	74	1,000	70	37	435	1016	3,558	0	4,935	0
307	3.23	82	1,000	50	37	435	1006	881	119	1,444	0
308	3.23	63	1,000	62	37	435	1579	8,321	0	12,549	0
309	3.23	67	1,000	61	37	435	1580	1,784	0	2,958	0
310	3.23	59	1,000	50	37	435	1057	1,563	0	2,222	0
315	3.23	75	1,000	38	37	435	1066	881	119	1,257	0
316	3.23	84	1,000	71	37	435	1949	1,673	0	2,331	0
318	3.23	76	1,000	63	37	435	1068	1,527	0	2,384	0
319	3.23	88	1,000	78	37	435	1577	1,490	0	3,081	0
320	3.23	105	2,000	94	37	435	1030	3,390	0	7,026	0
321	3.23	103	3,000	88	37	435	1715	3,854	0	8,235	0
322	3.23	92	1,000	86	37	435	1031	2,355	0	4,680	0
323	3.23	76	1,000	72	37	435	1582	3,392	0	5,488	0
324	3.23	82	1,000	70	37	435	1062	1,275	0	2,684	0
325	3.23	84	1,000	77	37	435	1035	2,085	0	4,224	0
326	3.23	76	1,000	71	37	435	1060	4,021	0	5,550	0
327	3.23	89	1,000	82	37	435	1035	2,378	0	4,566	0
328	3.23	90	1,000	81	37	435	1034	1,497	0	3,612	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
329	3.23	77	1,000	72	37	435	1064	2,945	0	4,836	0
330	3.23	77	1,000	72	37	435	1065	4,265	0	4,167	0
331	3.23	87	1,000	80	37	435	1084	2,162	0	4,084	0
332	3.23	91	1,000	83	37	435	1086	2,432	0	4,019	0
333	3.23	77	1,750	64	35	730	1083	3,577	0	3,893	0
334	3.23	64	1,000	56	37	435	1082	3,107	0	3,725	0
335	3.23	74	1,000	68	37	435	1087	2,870	0	3,340	0
336	3.23	67	3,000	27	23	337	1092	1,402	1,598	3,118	0
337	3.23	59	1,000	46	37	435	1091	1,635	0	2,060	0
338	3.23	60	1,000	50	37	435	1088	1,696	0	2,962	0
339	3.23	64	1,000	55	37	435	1081	3,402	0	3,715	0
340	3.23	109	3,000	83	29	875	1114	4,758	0	3,541	0
341	3.23	70	1,000	63	37	435	924	2,314	0	3,663	0
342	3.23	64	1,000	58	37	435	925	3,780	0	4,091	0
343	3.23	58	1,000	52	37	435		4,338	0	3,811	0
344	3.23	61	1,000	55	37	435		4,675	0	3,645	0
345	3.23	58	1,000	51	37	435	1020	2,797	0	2,717	0
346	3.23	66	1,000	59	37	435	1070	3,094	0	3,377	0
347	3.23	60	1,000	53	37	435	1748	2,742	0	3,459	0
348	3.23	67	1,000	58	37	435	1027	1,454	0	2,705	0
349	3.23	65	1,000	58	37	435		2,999	0	2,999	0
350	3.23	82	1,000	72	37	435	1526	2,274	0	3,094	0
352	3.23	55	1,000	48	37	435	1522	2,591	0	3,012	0
353	3.23	59	1,000	50	37	435	1543	2,188	0	2,458	0
354	3.23	59	1,000	54	37	435	1121	2,511	0	2,687	0
355	3.23	56	1,000	51	37	435		2,725	0	2,724	0
356	3.23	58	1,000	53	37	435	1124	2,593	0	2,663	0
357	3.23	60	1,000	56	37	435	1126	2,329	0	2,737	0
358	3.23	61	1,000	56	37	435		2,903	0	2,724	0
359	3.23	57	1,000	52	37	435		2,688	0	2,688	0
360	3.23	77	1,000	71	37	435		3,054	0	2,710	0
361	3.23	78	1,000	73	37	435		3,281	0	2,690	0
362	3.23	80	1,000	75	37	435		3,433	0	2,690	0
363	3.23	65	1,000	61	37	435		3,170	0	2,675	0
364	3.23	65	1,000	61	37	435		3,170	0	2,732	0
365	3.23	88	3,500	70	37	435		8,197	0	6,639	0
366	3.23	68	1,000	65	37	435		3,410	0	2,810	0
367	3.23	61	1,000	57	37	435		3,023	0	2,793	0
368	3.23	67	1,000	62	37	435		3,106	0	2,753	0
369	3.23	70	1,000	66	37	435	1133	3,156	0	2,814	0
370	3.23	81	1,000	78	37	435	1136	3,284	0	2,881	0
371	3.23	84	3,000	78	38	732	1038	5,051	0	8,420	0
372	3.23	80	1,000	79	79	372	1039	3,362	0	6,827	0
373	3.23	82	3,000	79	38	732	109	8,414	0	8,577	0
374	3.23	98	2,000	54	54	423	1142	1,487	513	2,742	0
375	3.23	62	2,000	59	35	435	1706	5,989	0	4,984	0
376	3.23	96	1,000	94	37	435		9,710	0	7,707	0
377	3.23	77	1,000	74	37	435	1313	3,024	0	4,592	0
378	3.23	83	1,000	80	37	435	1360	2,659	0	5,696	0
379	3.23	71	1,000	65	65	379	1617	2,692	0	3,291	0
380	3.23	54	1,000	47	37	730	1093	2,542	0	2,267	0
381	3.23	70	1,000	62	37	435	1077	2,645	0	3,211	0
382	3.23	68	1,000	61	37	435	1076	3,168	0	3,542	0
383	3.23	79	1,000	71	37	435	1078	3,102	0	3,521	0
384	3.23	88	1,000	80	37	435	1577	3,678	0	3,810	0
386	3.23	74	1,000	74	37	435		5,377	0	3,601	0
387	3.23	76	1,000	76	37	435		5,385	0	3,598	0
388	3.23	72	1,000	64	37	435	1539	3,522	0	3,834	0
389	3.23	68	1,000	62	37	435		4,886	0	3,820	0
390	3.23	68	1,000	61	37	435	1074	2,977	0	3,802	0
391	3.23	43	1,000	37	37	391		1,829	0	1,828	0
392	3.23	46	1,000	41	37	435		2,102	0	2,061	0
393	3.23	58	1,000	52	37	435		2,503	0	2,064	0
394	3.23	48	2,000	23	22	395		2,100	0	2,073	0
395	3.23	44	1,000	38	37	435		1,962	0	1,962	0
396	3.23	50	1,000	43	37	435		2,299	0	2,075	0
397	3.23	46	1,000	39	37	435		2,023	0	2,023	0
398	3.23	55	1,000	48	37	435		2,352	0	2,087	0
399	3.23	59	1,000	52	37	435		2,378	0	2,089	0
400	3.23	54	1,000	47	37	435		2,336	0	2,086	0
401	3.23	57	1,000	50	37	435		2,399	0	2,095	0
402	3.23	50	1,000	43	37	435		2,072	0	2,072	0
403	3.23	58	1,000	51	37	435		2,418	0	2,192	0
404	3.23	58	1,000	50	37	435		2,486	0	2,218	0
405	3.23	71	3,000	65	39	875	1029	4,449	0	5,589	0
406	3.23	92	1,000	90	37	435		5,666	0	3,496	0
407	3.23	90	3,000	67	28	875		5,744	0	3,478	0
408	3.23	87	1,000	85	37	435	1135	3,883	0	3,321	0
409	3.23	62	1,000	61	61	409	1574	2,725	0	5,544	0
410	3.23	81	1,000	78	78	410	1048	2,955	0	4,712	0
411	3.23	67	1,000	64	60	659	1040	2,918	0	4,260	0
412	3.23	64	2,000	53	53	412	1042	2,930	0	4,276	0
413	3.23	55	1,000	51	51	413	1045	2,879	0	3,374	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
414	3.23	63	1,000	60	52	413	1042	3,747	0	4,035	0
415	3.23	65	1,000	62	52	413	1046	2,574	0	4,042	0
416	3.23	78	1,000	75	53	413	1567	2,899	0	4,875	0
417	3.23	81	1,000	77	77	417	1050	2,790	0	4,768	0
418	3.23	82	3,500	59	59	418	1420	2,220	1,280	5,640	0
419	3.23	83	3,500	78	37	732	946	6,012	0	8,593	0
420	3.23	85	3,000	78	38	732	1052	2,585	415	8,374	0
421	3.23	85	3,000	78	38	732	1052	2,688	312	8,392	0
422	3.23	86	3,500	77	37	732	1055	4,634	0	8,257	0
423	3.23	97	2,000	31	31	423		2,178	0	2,178	0
424	3.23	98	2,000	35	34	423	1144	1,560	440	2,229	0
425	3.23	98	2,000	49	49	423	1145	1,557	443	2,583	0
426	3.23	96	3,500	85	37	732	1140	4,614	0	7,958	0
427	3.23	90	3,500	83	37	732	1630	7,201	0	8,171	0
428	3.23	95	3,500	86	36	435	1139	5,273	0	8,193	0
429	3.23	59	2,000	57	36	435	929	2,340	0	5,058	0
430	3.23	56	1,000	54	36	435	928	2,606	0	4,170	0
431	3.23	54	1,000	52	36	435	1228	2,956	0	3,765	0
432	3.23	52	1,000	49	35	435	1229	2,930	0	3,387	0
433	3.23	45	1,000	42	35	435	1230	2,841	0	3,168	0
434	3.23	42	1,000	39	35	435		2,911	0	2,890	0
435	3.23	37	2,000	26	26	435		2,566	0	2,566	0
436	3.23	66	2,000	61	35	435	1208	4,778	0	4,859	0
437	3.23	69	2,000	61	34	435	1209	2,620	0	4,481	0
438	3.23	61	2,000	50	50	438	1211	2,050	0	4,073	0
439	3.23	60	1,000	57	36	435	1226	2,575	0	3,821	0
440	3.23	57	1,000	53	53	440	1224	2,092	0	3,425	0
441	3.23	48	1,000	43	43	441	1218	1,938	0	2,544	0
442	3.23	42	2,000	31	27	435		2,981	0	2,705	0
443	3.23	53	1,000	49	49	443	1222	2,079	0	2,949	0
444	3.23	96	2,000	87	30	435	1216	4,218	0	3,344	0
445	3.23	64	1,000	62	36	435	1213	4,141	0	3,706	0
446	3.23	90	3,000	55	30	754	1616	3,088	0	3,523	0
447	3.23	74	3,000	48	32	754	1199	3,166	0	3,643	0
448	3.23	64	3,000	41	25	435	1205	3,440	0	3,608	0
449	3.23	77	3,500	50	22	435	1203	3,725	0	3,723	0
450	3.23	87	3,000	65	26	435	1201	3,051	0	3,752	0
451	3.23	94	3,000	69	27	435	1197	2,509	491	3,806	0
452	3.23	95	3,500	56	56	452	1180	2,901	599	4,961	0
453	3.23	97	3,500	42	42	453	1165	2,005	1,495	4,194	0
454	3.23	97	3,500	78	34	435	1168	2,331	1,169	6,740	0
455	3.23	91	3,500	76	34	435	1164	4,215	0	7,044	0
456	3.23	97	3,500	84	34	435	1164	5,494	0	6,909	0
457	3.23	89	3,500	71	34	435	1169	3,469	31	6,613	0
458	3.23	81	3,500	67	34	435	1163	5,151	0	6,475	0
459	3.23	81	3,500	59	59	459	1188	3,710	0	5,831	0
460	3.23	82	3,500	60	60	460	1178	3,368	132	6,021	0
461	3.23	70	3,500	56	33	435	1172	4,830	0	6,096	0
462	3.23	65	2,000	59	59	462	1189	3,787	0	5,575	0
463	3.23	67	3,500	45	45	463	1177	3,060	440	5,124	0
464	3.23	81	3,500	54	54	464	1187	3,029	471	5,340	0
465	3.23	90	3,500	27	27	465	1183	1,444	2,056	3,712	0
466	3.23	90	3,500	60	60	466	1184	2,548	952	5,456	0
467	3.23	90	3,500	70	31	435	1195	3,512	0	5,177	0
468	3.23	75	2,000	69	35	435	1194	3,177	0	5,005	0
469	3.23	66	2,000	61	35	435	1208	3,405	0	4,968	0
470	3.23	90	3,500	22	22	470	1192	1,866	1,634	3,555	0
471	3.23	61	3,000	48	48	471	1190	3,254	0	5,248	0
472	3.23	63	3,000	53	34	435	1190	5,599	0	5,662	0
473	3.23	68	3,000	54	54	473	1174	3,346	0	5,670	0
474	3.23	69	3,000	56	56	474	1175	3,893	0	5,915	0
475	3.23	78	3,000	56	56	475	1166	2,837	163	5,094	0
476	3.23	65	1,000	63	37	435	1149	4,164	0	5,545	0
477	3.23	62	1,000	61	61	477	1150	3,294	0	5,156	0
478	3.23	62	1,000	59	59	478	1750	2,397	0	4,797	0
479	3.23	67	1,000	61	61	479	1148	1,882	0	3,047	0
480	3.23	73	1,000	68	62	929	1159	1,834	0	3,807	0
481	3.23	69	1,000	67	67	481	1151	3,117	0	4,774	0
482	3.23	70	1,000	61	61	482	1156	1,743	0	2,444	0
483	3.23	68	1,000	64	64	483	1157	2,932	0	4,192	0
484	3.23	78	1,000	69	69	484	1161	1,370	0	2,771	0
485	3.23	77	1,000	68	68	485	1160	1,216	0	2,755	0
486	3.23	79	1,000	77	72	812	1415	3,170	0	7,068	0
487	3.23	88	3,500	72	37	435	1853	5,058	0	6,720	0
488	3.23	94	3,500	57	37	435	1840	3,168	332	5,123	0
489	3.23	86	2,000	72	37	435	1240	3,218	0	4,813	0
490	3.23	94	3,500	79	37	435	1234	5,293	0	7,113	0
491	3.23	97	1,000	94	37	435	1234	5,471	0	7,933	0
492	3.23	101	2,000	94	37	435	1446	5,725	0	8,506	0
493	3.23	99	1,000	96	37	435	1237	3,824	0	7,288	0
494	3.23	97	1,000	94	37	435	1237	4,646	0	7,849	0
495	3.23	100	2,000	88	37	435	1238	2,916	0	6,278	0
496	3.23	100	2,000	89	37	435	1239	3,743	0	6,402	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
497	3.23	94	2,000	74	37	435	1399	2,763	0	4,053	0
498	3.23	88	2,000	66	37	435	1410	2,364	0	3,847	0
499	3.23	84	2,000	65	37	435	1243	1,875	125	3,971	0
500	3.23	77	2,000	61	37	435	1244	2,253	0	4,174	0
501	3.23	58	1,000	51	37	435	1259	3,099	0	3,405	0
502	3.23	74	3,500	50	37	435	1244	4,330	0	5,736	0
503	3.23	54	2,000	28	28	503	1254	1,431	569	2,347	0
504	3.23	61	1,000	52	37	435	1252	1,322	0	2,635	0
505	3.23	64	1,000	58	37	435	1251	2,873	0	3,943	0
507	3.23	75	1,000	72	37	435	1381	3,805	0	5,505	0
508	3.23	52	1,000	47	37	435	1745	2,765	0	3,107	0
509	3.23	74	2,000	40	37	435	1247	1,702	298	2,640	0
510	3.23	81	3,500	61	37	435	1266	5,172	0	6,542	0
511	3.23	67	1,000	62	37	435	1262	3,753	0	3,923	0
512	3.23	70	3,250	39	28	514	1249	4,031	0	3,822	0
513	3.23	68	1,000	62	37	435	1251	4,118	0	3,859	0
514	3.23	55	1,000	50	37	435		3,459	0	3,459	0
515	3.23	57	1,000	51	37	435		3,573	0	3,573	0
516	3.23	58	1,000	50	37	435	1260	1,984	0	2,919	0
517	3.23	70	1,000	65	37	435	1268	2,856	0	4,100	0
518	3.23	83	3,500	65	37	435	1267	5,564	0	6,523	0
519	3.23	83	3,500	67	37	435	1275	6,806	0	6,400	0
520	3.23	83	3,500	66	37	435	1277	5,146	0	6,448	0
521	3.23	78	1,000	50	37	435	1383	1,009	0	1,530	0
522	3.23	65	1,000	56	37	435	1283	1,391	0	2,691	0
523	3.23	66	1,000	55	37	435	1282	1,479	0	2,251	0
524	3.23	70	1,000	58	37	435	1280	1,894	0	2,379	0
525	3.23	70	1,000	59	37	435	1269	1,664	0	2,388	0
526	3.23	78	1,000	74	37	435	1273	4,331	0	4,941	0
527	3.23	78	1,000	74	37	435	1274	4,124	0	4,977	0
528	3.23	77	1,000	74	37	435	1377	4,088	0	5,450	0
529	3.23	78	1,000	75	37	435	1300	5,850	0	6,405	0
530	3.23	74	1,000	71	37	435		5,178	0	5,178	0
531	3.23	78	1,000	76	37	435	1301	5,693	0	6,445	0
532	3.23	86	3,500	69	37	435	1309	6,988	0	6,144	0
533	3.23	63	1,000	58	37	435	1294	3,076	0	3,705	0
534	3.23	75	1,000	71	37	435		5,000	0	5,000	0
535	3.23	73	1,000	68	37	435	1306	2,468	0	4,075	0
536	3.23	63	1,000	58	37	435	1295	2,669	0	3,541	0
537	3.23	63	1,000	58	37	435	1293	3,224	0	4,001	0
538	3.23	84	3,500	68	37	435	1276	6,941	0	6,082	0
539	3.23	85	3,500	69	37	435	1290	6,684	0	6,125	0
540	3.23	79	3,500	35	35	540	1291	1,716	1,784	4,089	0
541	3.23	76	1,000	52	37	435	1292	1,371	0	1,618	0
542	3.23	64	1,000	45	37	435	1296	1,141	0	1,649	0
543	3.23	96	1,000	94	37	435	1312	6,241	0	7,815	0
544	3.23	63	1,000	36	36	544		1,293	0	1,292	0
545	3.23	90	1,000	87	37	435	285	4,595	0	5,832	0
546	3.23	81	1,000	78	37	435	938	2,885	0	5,474	0
547	3.23	83	1,000	80	37	435	1317	3,601	0	5,632	0
548	3.23	75	1,000	69	37	435	1365	2,182	0	3,298	0
549	3.23	71	1,000	66	37	435	1315	2,294	0	3,516	0
550	3.23	70	1,000	66	37	435	1314	3,678	0	4,316	0
551	3.23	70	3,500	50	26	581	1310	5,302	0	4,006	0
552	3.23	94	3,500	76	37	435	1322	5,937	0	6,694	0
554	3.23	81	3,500	61	37	435	1338	6,999	0	6,151	0
555	3.23	87	3,500	68	37	435		7,872	0	6,641	0
556	3.23	87	3,500	68	37	435	1325	6,994	0	6,410	0
557	3.23	81	3,500	59	37	435	1948	2,681	819	6,208	0
558	3.23	83	3,500	55	37	435	1328	2,200	1,300	5,694	0
559	3.23	85	3,500	50	37	435	1329	2,484	1,016	5,062	0
560	3.23	81	3,500	44	37	435	1332	2,557	943	4,711	0
561	3.23	81	3,500	68	37	435	1426	7,676	0	7,810	0
562	3.23	76	3,500	50	37	435	1333	2,438	1,062	5,299	0
563	3.23	72	3,500	27	27	563	1334	2,448	1,052	3,814	0
564	3.23	76	3,500	17	17	565	1335	1,563	1,937	3,414	86
565	3.23	76	3,500	3	3	565		3,008	492	3,008	492
566	3.23	81	3,500	62	37	577	1948	6,281	0	5,932	0
567	3.23	76	3,500	34	34	567	1339	1,567	1,933	4,107	0
568	3.23	72	3,500	51	32	577	1342	4,942	0	4,690	0
569	3.23	91	3,500	64	37	577	1818	2,497	1,003	5,793	0
570	3.23	85	3,500	66	37	435	1819	4,781	0	6,115	0
571	3.23	72	3,500	51	34	577	1344	3,556	0	4,990	0
572	3.23	72	3,500	51	32	577	1342	2,669	831	4,751	0
573	3.23	72	3,500	52	33	577		6,491	0	4,906	0
574	3.23	85	3,500	58	34	577	1346	4,240	0	4,981	0
575	3.23	72	3,500	47	28	577	1347	4,500	0	4,089	0
576	3.23	72	3,500	40	20	577	1349	3,519	0	3,511	0
577	3.23	52	3,500	-80	-80	577	191	1,567	1,933	1,583	1,917
578	3.23	61	3,500	41	26	581		5,026	0	4,039	0
579	3.23	54	3,500	22	18	583	1353	2,278	1,222	3,372	128
580	3.23	48	3,500	11	8	581	1356	2,756	744	2,895	605
581	3.23	45	3,500	-33	-33	581	1355	1,567	1,933	1,943	1,557

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
582	3.23	56	3,500	28	20	581	1755	2,108	1,392	3,522	0
583	3.23	50	3,500	-4	-4	583	1357	1,567	1,933	2,573	927
584	3.23	84	3,000	74	37	435	261	8,629	0	8,067	0
585	3.23	67	3,500	32	26	581	1358	1,567	1,933	4,006	0
586	3.23	84	3,000	73	37	435	1359	4,950	0	7,806	0
587	3.23	85	1,000	83	37	435	1362	7,002	0	7,700	0
589	3.23	78	1,000	72	37	435	1364	1,475	0	3,396	0
591	3.23	73	1,000	69	37	435	1306	3,243	0	4,462	0
592	3.23	72	1,000	64	37	435	1369	1,567	0	2,793	0
593	3.23	70	1,000	66	37	435	1367	2,755	0	4,138	0
595	3.23	94	2,000	82	37	435	1371	2,836	0	5,770	0
597	3.23	78	1,000	64	37	435	1373	878	122	2,144	0
598	3.23	74	3,500	55	37	435	1374	4,925	0	6,623	0
599	3.23	89	3,500	62	37	435	1760	3,518	0	5,424	0
600	3.23	89	3,500	57	37	435	1760	3,518	0	4,931	0
601	3.23	89	3,500	43	37	435	1376	1,567	1,933	4,378	0
602	3.23	74	3,500	-15	-15	602	1799	1,563	1,937	2,666	834
603	3.23	77	1,000	74	37	435	1377	3,507	0	5,399	0
604	3.23	76	1,000	73	37	435	1379	5,942	0	6,014	0
605	3.23	71	1,000	60	37	435	1382	1,886	0	2,399	0
606	3.23	75	1,000	70	37	435	1385	1,389	0	3,836	0
607	3.23	76	1,000	72	37	435	1387	4,596	0	5,248	0
608	3.23	80	2,500	47	37	435	1389	2,459	41	4,039	0
611	3.23	60	1,000	49	37	435	1252	1,321	0	2,185	0
613	3.23	60	1,000	43	37	435	1252	1,321	0	1,715	0
614	3.23	68	1,000	60	60	614	1397	1,563	0	2,686	0
615	3.23	97	2,000	79	37	435	1400	2,467	0	4,623	0
616	3.23	91	2,000	44	37	435	1401	1,067	933	2,515	0
617	3.23	92	3,500	23	23	617	1406	2,001	1,499	3,581	0
618	3.23	84	2,000	63	37	435		3,809	0	3,809	0
619	3.23	91	3,500	28	28	619	1407	3,486	14	3,736	0
620	3.23	88	1,000	79	37	435	1409	1,567	0	3,141	0
621	3.23	75	2,000	52	37	435	1411	1,532	468	3,261	0
622	3.23	95	3,500	64	37	435	1412	2,614	886	5,787	0
623	3.23	95	3,500	55	37	435	1414	3,525	0	4,917	0
624	3.23	79	1,000	78	72	812	1422	3,136	0	7,035	0
625	3.23	81	3,500	70	70	625	1421	3,636	0	7,345	0
626	3.23	81	1,000	80	72	812	41	5,156	0	7,981	0
627	3.23	85	3,500	75	37	435	207	6,164	0	9,131	0
628	3.23	89	3,500	75	37	435	1427	3,113	387	7,123	0
629	3.23	83	3,500	47	37	435	1429	1,567	1,933	4,665	0
630	3.23	87	3,500	77	37	435	1428	5,758	0	6,289	0
631	3.23	87	1,000	85	37	435	1431	5,968	0	6,045	0
632	3.23	93	1,000	91	37	435	1432	3,141	0	6,096	0
633	3.23	100	1,000	97	37	435	1433	3,473	0	6,123	0
634	3.23	106	1,000	100	37	435	1434	1,567	0	4,293	0
635	3.23	102	1,000	99	37	435	165	2,683	0	6,241	0
636	3.23	89	3,000	79	37	435	1436	5,416	0	6,368	0
637	3.23	102	1,000	95	37	435	1439	1,567	0	4,100	0
638	3.23	87	3,000	77	37	435	1440	5,635	0	6,088	0
639	3.23	89	1,000	86	37	435	1442	2,543	0	6,199	0
640	3.23	71	3,000	32	32	640	1444	1,567	1,433	3,499	0
641	3.23	78	3,000	62	37	435	1443	3,571	0	4,982	0
642	3.23	101	1,000	99	37	435	1445	4,615	0	8,002	0
643	3.23	93	3,500	77	37	435	1447	5,548	0	7,712	0
644	3.23	95	1,000	91	37	435	1448	3,034	0	6,181	0
645	3.23	97	1,000	94	37	435	1453	3,414	0	6,791	0
646	3.23	101	1,000	97	37	435	1450	2,899	0	5,611	0
647	3.23	97	1,000	94	37	435	1452	2,237	0	7,295	0
648	3.23	95	1,000	91	37	435	1455	3,065	0	5,531	0
649	3.23	95	2,000	83	37	435	1462	2,549	0	5,783	0
650	3.23	93	3,000	80	37	435	1457	4,703	0	8,072	0
651	3.23	95	3,000	45	37	435	1458	1,567	1,433	3,761	0
652	3.23	95	3,500	65	37	435	1461	2,457	1,043	5,893	0
653	3.23	97	3,500	75	37	435	1459	3,182	318	7,093	0
654	3.23	101	3,000	88	37	435	1463	5,369	0	8,597	0
655	3.23	91	2,000	82	37	435	1587	3,403	0	7,050	0
656	3.23	91	1,000	87	37	435	1465	2,811	0	5,606	0
657	3.23	108	3,500	70	63	658	1468	2,359	1,141	5,316	0
658	3.23	101	3,500	38	38	658	1470	1,567	1,933	4,016	0
659	3.23	63	1,000	36	36	659	1471	881	119	1,296	0
660	3.23	81	1,000	78	76	661	1473	2,968	0	5,523	0
661	3.23	79	1,000	73	73	661	1474	1,567	0	3,629	0
662	3.23	87	3,500	41	41	662	1475	1,567	1,933	4,272	0
663	3.23	76	1,000	73	37	435	1476	3,115	0	4,274	0
664	3.23	78	2,000	67	37	435	1478	2,092	0	4,055	0
665	3.23	74	2,000	61	37	435	1479	2,470	0	3,832	0
666	3.23	76	2,000	60	37	435	1480	2,512	0	3,569	0
667	3.23	69	2,000	52	37	435	1482	3,542	0	3,471	0
668	3.23	66	2,000	49	37	435	1482	3,360	0	3,308	0
669	3.23	65	2,000	49	37	435	1484	2,662	0	3,324	0
670	3.23	59	2,000	43	37	435	1485	2,432	0	3,361	0
671	3.23	56	2,000	43	37	435	1486	3,167	0	3,533	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
672	3.23	52	2,000	39	37	435	1489	2,744	0	3,348	0
673	3.23	50	1,000	46	37	435		3,358	0	3,358	0
674	3.23	71	2,000	50	37	435	1491	3,108	0	3,314	0
675	3.23	59	2,000	38	37	435		2,813	0	2,813	0
676	3.23	69	1,000	68	37	435	1498	5,164	0	6,582	0
677	3.23	69	2,000	60	37	435	1496	3,131	0	5,131	0
678	3.23	67	1,000	66	37	435	1497	6,006	0	6,599	0
679	3.23	63	1,000	61	37	435	1499	4,625	0	5,981	0
680	3.23	61	1,000	58	37	435	1775	3,076	0	4,721	0
681	3.23	63	1,000	61	37	435	1500	4,138	0	5,929	0
682	3.23	63	1,000	61	37	435	1502	4,480	0	5,922	0
683	3.23	63	1,000	61	37	435	1794	4,509	0	5,904	0
684	3.23	59	1,000	56	37	435	1783	2,928	0	4,584	0
685	3.23	59	1,000	56	37	435	1784	3,059	0	4,563	0
686	3.23	59	1,000	56	37	435	1787	2,994	0	4,567	0
687	3.23	63	2,000	55	37	435	1816	3,364	0	5,256	0
688	3.23	89	2,000	86	37	435	1503	4,400	0	9,928	0
689	3.23	111	2,000	106	37	435	1505	2,283	0	8,916	0
690	3.23	87	2,000	81	37	435	1507	3,739	0	7,842	0
691	3.23	85	2,000	82	37	435	1506	4,760	0	9,804	0
692	3.23	93	2,000	85	37	435	1509	3,118	0	6,636	0
693	3.23	85	2,000	44	37	435	1512	881	1,119	2,580	0
694	3.23	89	2,000	82	37	435	1510	2,875	0	7,248	0
695	3.23	82	2,000	78	37	435	1514	4,086	0	8,856	0
696	3.23	82	2,000	74	37	435	1515	1,567	433	6,325	0
697	3.23	84	1,000	82	37	435	1516	2,614	0	6,184	0
698	3.23	62	1,000	54	37	435		2,879	0	2,879	0
699	3.23	64	1,000	57	37	435	1521	2,630	0	3,032	0
700	3.23	75	1,000	68	37	435	1530	3,544	0	3,818	0
701	3.23	56	1,000	50	37	435		3,724	0	3,564	0
702	3.23	73	1,000	66	37	435	1528	3,493	0	3,877	0
703	3.23	77	1,000	70	37	435	1531	3,089	0	3,875	0
704	3.23	82	1,000	73	37	435	1716	2,637	0	3,687	0
705	3.23	79	1,000	72	37	435	1533	2,796	0	3,813	0
706	3.23	71	1,000	64	37	435	1534	3,775	0	3,635	0
707	3.23	71	1,000	64	37	435	1536	3,170	0	3,909	0
708	3.23	71	1,000	64	37	435	1602	4,028	0	3,902	0
709	3.23	71	1,000	64	37	435	1537	3,350	0	3,880	0
710	3.23	71	1,000	64	37	435	1946	3,805	0	3,874	0
711	3.23	71	1,000	64	37	435	1541	3,728	0	3,873	0
712	3.23	68	1,000	62	37	435	1541	4,626	0	3,834	0
713	3.23	66	1,000	60	37	435	1547	3,205	0	3,841	0
714	3.23	71	1,000	64	37	435	1945	3,352	0	3,868	0
715	3.23	66	1,000	59	37	435	1602	3,040	0	3,878	0
716	3.23	64	1,000	57	37	435		3,952	0	3,871	0
717	3.23	71	1,000	64	37	435	1946	3,794	0	3,873	0
718	0	58	1,000	52	37	435		4,004	0	3,826	0
719	3.23	64	1,000	64	37	435	243	3,793	0	3,612	0
720	3.23	64	1,000	64	37	435		4,561	0	3,593	0
721	3.23	62	1,000	61	37	435		4,195	0	3,585	0
722	3.23	66	1,000	65	37	435	1554	2,525	0	3,553	0
723	3.23	75	1,000	73	37	435	1555	2,291	0	3,553	0
724	3.23	64	1,000	63	37	435		3,997	0	3,493	0
725	3.23	66	1,000	65	37	435	1558	3,503	0	3,543	0
726	3.23	73	1,000	72	37	435	1561	2,547	0	3,555	0
727	3.23	71	1,000	48	37	435	1564	881	119	1,598	0
728	3.23	71	1,000	44	37	435	1565	881	119	1,456	0
729	3.23	53	1,000	45	37	730		2,506	0	2,080	0
730	3.23	44	1,000	33	33	730	1570	1,567	0	1,702	0
731	3.23	52	1,000	45	36	732		2,332	0	1,955	0
732	3.23	44	1,000	33	33	732	1573	1,567	0	1,635	0
733	3.23	62	1,000	62	40	732	103	3,597	0	5,710	0
734	3.23	69	1,000	62	37	435	1575	3,092	0	4,063	0
735	3.23	67	1,000	63	37	435	1579	1,504	0	5,244	0
736	3.23	80	1,000	76	37	435	1582	4,342	0	6,111	0
737	3.23	82	2,000	72	37	435	1583	2,920	0	5,949	0
738	3.23	84	2,000	74	37	435	1585	2,857	0	6,004	0
739	3.23	86	2,000	77	37	435	1586	4,185	0	6,814	0
740	3.23	88	2,000	80	37	435	1587	3,677	0	6,985	0
741	3.23	84	2,000	72	37	435	1591	2,760	0	5,502	0
742	3.23	84	1,000	79	37	435	1592	2,606	0	5,009	0
743	3.23	84	1,000	77	37	435	1594	1,824	0	3,328	0
744	3.23	80	1,000	77	37	435	1596	2,906	0	5,421	0
745	3.23	67	1,000	64	37	435	1599	3,958	0	4,332	0
746	3.23	63	1,000	56	37	435	1601	1,590	0	2,887	0
747	3.23	64	1,000	57	37	435		3,901	0	3,896	0
748	3.23	73	1,000	66	37	435	1605	3,121	0	3,898	0
749	3.23	71	1,000	63	37	435	1608	2,838	0	3,290	0
750	3.23	71	1,000	63	37	435	1610	2,711	0	3,884	0
751	3.23	73	1,000	65	37	435	1611	2,230	0	3,437	0
752	3.23	79	1,000	70	37	435	1614	2,960	0	3,279	0
753	3.23	70	3,000	41	29	754	1615	2,706	294	3,495	0
754	3.23	57	1,000	52	52	754		3,210	0	3,210	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
755	3.23	94	3,500	82	48	875	1620	5,695	0	7,242	0
756	3.23	94	3,500	77	48	875	1621	2,358	1,142	7,113	0
757	3.23	89	3,500	69	69	757	1623	2,867	633	6,438	0
758	3.23	87	3,000	75	75	758	179	4,144	0	6,921	0
759	3.23	92	3,000	74	74	759	1624	3,047	0	6,120	0
760	3.23	92	3,000	75	75	760	1761	2,685	315	6,216	0
761	3.23	87	3,500	68	68	761	1629	2,587	913	6,731	0
762	3.23	89	3,500	77	36	732	1628	4,885	0	7,830	0
763	3.23	89	3,500	75	75	763	1630	3,077	423	7,794	0
764	3.23	85	3,500	53	53	764	1632	2,942	558	5,067	0
765	3.23	96	3,500	50	50	765	1634	1,567	1,933	4,609	0
766	3.23	92	3,000	83	47	875	1635	6,436	0	6,480	0
767	3.23	122	1,000	119	37	435	1744	4,265	0	3,487	0
768	3.23	94	3,000	65	29	875	1641	3,021	0	3,505	0
769	3.23	103	3,000	78	29	875	1638	5,458	0	3,503	0
770	3.23	90	3,000	64	29	875	1645	3,370	0	3,506	0
771	3.23	88	3,000	65	29	230		5,638	0	3,542	0
772	3.23	81	1,000	68	37	435	1646	881	119	2,176	0
773	3.23	64	1,000	59	37	435		2,906	0	2,418	0
774	3.23	86	1,000	76	37	435		2,837	0	2,837	0
775	3.23	79	2,000	68	37	435		4,530	0	3,115	0
776	3.23	48	2,000	23	22	395		2,093	0	2,073	0
777	3.23	92	2,000	69	37	435	1654	3,525	0	3,834	0
778	3.23	81	1,000	80	37	435	1656	2,294	0	3,452	0
779	3.23	77	1,000	75	37	435	1657	4,067	0	3,202	0
780	3.23	60	1,000	57	37	435		3,275	0	3,149	0
781	3.23	55	1,000	53	37	435		3,107	0	3,107	0
782	3.23	55	1,000	52	37	435	1660	2,790	0	2,827	0
783	3.23	81	1,000	79	37	435	1661	3,214	0	3,165	0
784	3.23	68	2,000	57	37	435		3,981	0	3,048	0
785	3.23	68	1,000	65	37	435	1665	2,545	0	3,071	0
786	3.23	55	1,000	52	37	435	1667	2,836	0	2,840	0
787	3.23	64	1,000	61	37	435		3,383	0	3,139	0
788	3.23	64	1,000	62	37	435		3,466	0	3,136	0
789	3.23	66	1,000	64	37	435	1672	3,530	0	3,128	0
790	3.23	73	1,000	71	37	435		4,130	0	3,129	0
791	3.23	81	1,000	79	37	435		4,540	0	3,134	0
792	3.23	92	1,000	89	37	435	1674	2,471	0	3,134	0
793	3.23	92	1,000	89	37	435	1675	2,121	0	3,134	0
794	3.23	98	1,000	94	37	435	1676	2,875	0	3,134	0
795	3.23	99	1,000	94	37	435	1677	2,659	0	3,134	0
796	3.23	94	1,000	90	37	435	1679	2,854	0	3,134	0
797	3.23	90	1,000	87	37	435	1680	3,397	0	3,134	0
798	3.23	83	1,000	80	37	435	1681	2,728	0	3,134	0
799	3.23	83	1,000	81	37	435		4,620	0	3,141	0
800	3.23	70	1,000	68	37	435		4,014	0	3,115	0
801	3.23	77	1,000	74	37	435	1687	2,429	0	3,112	0
802	3.23	73	1,000	70	37	435		3,853	0	3,108	0
803	3.23	68	1,000	66	37	435		3,897	0	3,106	0
804	3.23	51	1,000	49	37	435		3,032	0	2,987	0
805	3.23	51	1,000	48	37	435	1693	2,445	0	2,668	0
806	3.23	56	1,000	50	37	435		2,257	0	2,257	0
808	3.23	73	1,000	55	37	435	1701	1,321	0	1,715	0
809	3.23	88	1,000	72	37	435	1419	1,567	0	2,248	0
810	3.23	70	1,000	60	60	810	1398	1,567	0	2,413	0
811	3.23	97	1,000	89	37	435	1707	1,567	0	3,643	0
812	3.23	73	2,000	36	36	812	1416	1,567	433	2,430	0
813	3.23	76	3,250	72	72	813	1713	2,127	1,123	7,830	0
815	3.23	81	1,000	69	37	435	1950	1,663	0	2,467	0
816	3.23	104	1,000	73	52	247	1566	881	119	1,640	0
817	3.23	52	1,000	37	37	817	949	1,567	0	1,613	0
818	3.23	54	1,000	49	37	435	1743	2,293	0	3,874	0
819	3.23	56	1,000	50	37	435	249	2,785	0	3,558	0
820	3.23	71	1,000	64	37	435	1947	2,359	0	3,728	0
833	3.23	80	3,500	-31	-31	833	1735	2,448	1,052	2,502	998
836	3.23	78	2,000	54	37	435	1746	3,827	0	4,282	0
837	3.23	72	2,000	62	37	435	1749	2,557	0	5,161	0
838	3.23	59	2,000	54	54	838	1751	2,120	0	5,239	0
839	3.23	56	3,500	31	22	581		4,169	0	3,655	0
840	3.23	74	3,500	47	37	435	1758	5,463	0	6,289	0
841	3.23	89	3,500	50	37	435	1759	5,888	0	6,404	0
842	3.23	92	3,000	79	48	875	1762	2,190	810	6,608	0
844	3.23	63	2,000	54	37	435	1771	3,365	0	4,871	0
845	3.23	53	2,000	43	37	435	1769	3,104	0	3,984	0
846	3.23	53	1,000	50	37	435	1780	3,088	0	4,755	0
847	3.23	63	2,000	56	37	435	1953	2,985	0	5,708	0
848	3.23	94	1,000	79	37	435	1773	1,567	0	2,372	0
853	3.23	63	1,000	61	37	435		6,524	0	5,849	0
854	3.23	63	1,000	61	37	435	1785	5,198	0	5,809	0
855	3.23	63	1,000	61	37	435	1928	4,104	0	5,886	0
856	3.23	63	1,000	61	37	435	1788	5,107	0	5,821	0
857	3.23	61	2,000	53	37	435	1796	2,306	0	5,127	0
858	3.23	69	2,000	60	37	435	11	3,686	0	5,230	0

Node ID	Static Demand (gpm)	Static Pressure (psi)	Min. Fire Flow Requirement (gpm)	Residual Pressure at Required FF (psi)	Min. System Pressure at Required FF (psi)	Critical Node	Critical Pipe	Available Flow w/ Velocity Limitations (gpm)	FF Deficiency based on Velocity (gpm)	Available Flow w/ Pressure Limitations (gpm)	FF Deficiency based on Pressure (gpm)
862	3.23	74	3,500	6	6	602	1799	1,563	1,937	3,090	410
863	3.23	88	1,000	76	37	435	1803	1,292	0	2,823	0
864	3.23	44	1,000	39	37	435		2,049	0	2,039	0
868	3.23	73	2,000	67	37	435	1815	3,126	0	6,276	0
869	3.23	89	3,500	74	37	435	1817	4,901	0	6,472	0
875	3.23	51	1,000	45	37	435		2,206	0	2,206	0
876	0	55	1,000	45	37	435		1,879	0	2,203	0
877	0	56	1,000	46	37	435		1,888	0	2,203	0
878	0	54	1,000	45	37	435	1828	1,567	0	2,203	0
879	0	55	1,000	46	37	435		1,921	0	2,203	0
880	3.23	94	3,500	78	37	435	1852	4,448	0	6,968	0
885	3.23	93	3,500	71	37	435	1838	1,966	1,534	6,899	0
887	3.23	94	3,500	62	37	435	1849	2,375	1,125	5,678	0
888	3.23	94	3,500	59	37	435	1843	2,645	855	5,306	0
889	3.23	86	1,000	79	37	435		3,099	0	2,690	0
890	3.23	86	1,000	66	37	435	1888	881	119	1,875	0
896	3.23	86	1,000	76	37	435		2,744	0	2,744	0
900	3.23	84	1,000	79	37	435	368	2,788	0	4,744	0
901	3.23	81	2,000	69	37	435	370	1,563	437	5,127	0
903	3.23	82	2,000	61	37	435	371	1,567	433	3,638	0
919	3.23	53	1,000	31	31	919	372	881	119	1,271	0
920	3.23	73	1,000	70	37	435	373	2,646	0	3,553	0
923	3.23	80	1,000	69	37	435	376	881	119	2,486	0
924	3.23	86	3,500	26	26	924	983	3,077	423	3,715	0
925	3.23	91	3,500	62	37	435	378	2,416	1,084	5,806	0
926	3.23	83	3,500	2	2	926	379	1,567	1,933	3,060	440
927	3.23	87	3,500	56	37	435	380	2,906	594	5,572	0
928	3.23	87	3,500	4	4	928	381	1,567	1,933	3,124	376
929	3.23	66	1,000	54	54	929	382	1,241	0	2,101	0
930	3.23	77	1,000	71	37	435		2,936	0	2,936	0
931	3.23	105	3,000	55	29	875	384	1,567	1,433	3,487	0
932	3.23	79	2,000	54	37	435	385	1,567	433	3,045	0
933	3.23	68	2,000	57	37	435		3,891	0	2,991	0
934	3.23	92	3,000	50	50	934	387	1,613	1,387	4,049	0
935	3.23	60	1,000	58	37	435		3,416	0	3,051	0
936	3.23	60	1,000	52	37	435	391	1,567	0	2,163	0
937	3.23	84	1,000	67	37	435	1921	3,326	0	3,772	0

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
10	3.98	109	296	81
12	3.98	124	296	75
14	3.98	139	296	68
16	3.98	92	296	88
18	3.98	49	247	86
20	3.98	46	246	87
22	3.98	49	246	86
24	3.98	49	246	86
26	3.98	49	247	86
28	3.98	164	296	57
30	3.98	174	296	53
32	3.98	184	296	48
34	3.98	158	296	60
36	3.98	160	296	59
38	3.98	161	296	58
40	3.98	149	296	64
42	3.98	154	296	61
44	3.98	149	296	64
46	3.98	144	296	66
48	3.98	149	296	64
50	3.98	127	296	73
52	3.98	133	296	70
54	3.98	52	246	84
56	3.98	59	246	81
58	3.98	195	298	45
60	3.98	192	298	46
62	3.98	189	298	47
64	3.98	189	298	47
66	3.98	185	298	49
68	3.98	187	298	48
70	3.98	134	298	71
72	3.98	161	298	59
74	3.98	163	298	59
76	3.98	9	246	103
78	3.98	204	296	40
80	3.98	194	296	44
82	3.98	184	296	48
84	3.98	174	296	53
86	3.98	174	296	53
88	3.98	79	298	95
90	3.98	79	298	95
92	3.98	39	246	90
94	3.98	144	296	66
96	3.98	154	296	61
98	3.98	91	297	89
100	3.98	94	297	88
102	3.98	177	318	61
104	3.98	136	297	70
106	3.98	176	297	52
108	3.98	159	297	60
110	3.98	99	297	86
112	3.98	209	297	38
114	3.98	169	298	56
116	3.98	12	246	101
122	3.98	137	298	70
126	3.98	116	297	79
128	3.98	149	297	64
134	3.98	153	297	62
136	3.98	151	297	63
138	3.98	152	297	63
140	3.98	152	297	63
142	3.98	145	297	66
144	3.98	136	297	70
146	3.98	136	297	70
148	3.98	136	297	70
150	3.98	143	297	67
152	3.98	137	297	69
154	3.98	142	297	67
170	3.98	154	299	63
215	3.98	40	296	111
216	3.98	189	298	47
217	3.98	139	298	69
218	3.98	219	396	77
219	3.98	79	296	94
220	3.98	70	296	98
221	3.98	49	247	86
222	3.98	100	297	85
228	3.98	129	298	73
229	3.98	156	296	61
230	3.98	209	296	38
232	3.98	136	323	81
233	3.98	224	396	74
235	3.98	220	395	76
236	3.98	214	395	79
237	3.98	209	298	39

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
238	3.98	185	298	49
239	3.98	182	298	51
240	3.98	237	395	69
241	3.98	194	395	87
242	3.98	184	395	92
243	3.98	136	297	70
244	3.98	189	297	47
245	3.98	194	297	45
246	3.98	29	246	94
247	3.98	121	296	76
248	3.98	145	296	65
249	3.98	181	296	50
250	3.98	180	298	51
251	3.98	107	297	83
252	3.98	138	300	70
253	3.98	121	300	77
254	3.98	180	298	51
255	3.98	182	298	50
256	3.98	192	298	46
257	3.98	193	298	46
258	3.98	211	298	38
259	3.98	199	298	43
260	3.98	187	298	48
261	3.98	182	298	50
262	3.98	163	298	59
263	3.98	161	298	59
264	3.98	172	298	55
265	3.98	184	298	49
266	3.98	201	298	42
267	3.98	199	298	43
268	3.98	206	298	40
269	3.98	209	298	39
270	3.98	205	298	41
271	3.98	143	298	67
272	3.98	145	298	66
273	3.98	143	298	67
274	3.98	110	298	82
275	3.98	108	298	82
276	3.98	103	298	84
277	3.98	78	297	95
278	3.98	79	297	94
279	3.98	96	297	87
280	3.98	158	298	60
281	3.98	176	298	53
282	3.98	159	298	60
283	3.98	151	298	64
284	3.98	166	298	57
285	3.98	180	298	51
286	3.98	179	298	51
287	3.98	178	298	52
288	3.98	175	298	53
289	3.98	166	298	57
290	3.98	175	298	53
291	3.98	132	297	72
292	3.98	149	297	64
293	3.98	87	297	91
294	3.98	124	297	75
295	3.98	109	297	81
296	3.98	94	297	88
297	3.98	121	297	76
298	3.98	153	297	63
299	3.98	179	298	52
300	3.98	204	299	41
301	3.98	197	299	44
302	3.98	189	299	47
303	3.98	171	298	55
304	3.98	164	299	58
305	3.98	171	299	55
306	3.98	196	299	45
307	3.98	179	298	51
308	3.98	154	298	62
309	3.98	144	297	66
310	3.98	162	297	58
315	3.98	194	297	44
316	3.98	172	297	54
317	3.98	196	297	44
318	3.98	192	297	46
319	3.98	165	297	57
320	3.98	57	297	104
321	3.98	60	297	103
322	3.98	86	297	91
323	3.98	122	297	76
324	3.98	108	297	82
325	3.98	104	297	84
326	3.98	122	297	76

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
327	3.98	93	297	88
328	3.98	90	297	90
329	3.98	120	297	77
330	3.98	119	297	77
331	3.98	97	297	87
332	3.98	88	297	91
333	3.98	120	297	77
334	3.98	149	297	64
335	3.98	125	297	74
336	3.98	142	297	67
337	3.98	161	297	59
338	3.98	158	297	60
339	3.98	149	297	64
340	3.98	71	296	97
341	3.98	206	396	82
342	3.98	219	396	77
343	3.98	234	396	70
344	3.98	226	396	73
345	3.98	233	396	70
346	3.98	214	395	79
347	3.98	229	395	72
348	3.98	212	395	80
349	3.98	216	395	78
350	3.98	179	396	94
351	3.98	244	396	66
352	3.98	241	395	67
353	3.98	232	395	71
354	3.98	186	296	48
355	3.98	192	296	45
356	3.98	189	296	46
357	3.98	182	296	49
358	3.98	181	296	50
359	3.98	191	296	45
360	3.98	144	296	66
361	3.98	141	296	67
362	3.98	136	296	69
363	3.98	172	296	54
364	3.98	172	296	54
365	3.98	117	322	89
366	3.98	164	296	57
367	3.98	180	296	50
368	3.98	168	296	55
369	3.98	161	296	59
370	3.98	134	296	70
371	3.98	42	246	89
372	3.98	50	246	85
373	3.98	45	246	87
374	3.98	10	246	102
375	3.98	92	246	67
376	3.98	149	297	64
377	3.98	191	297	46
378	3.98	178	297	52
379	3.98	71	246	76
380	3.98	170	296	55
381	3.98	205	296	40
382	3.98	210	296	37
383	3.98	185	296	48
384	3.98	165	297	57
386	3.98	151	296	63
387	3.98	146	296	65
388	3.98	201	296	41
389	3.98	210	297	38
390	3.98	211	296	37
391	3.98	195	296	44
392	3.98	189	296	46
393	3.98	162	296	58
394	3.98	184	296	49
395	3.98	194	296	44
396	3.98	179	296	51
397	3.98	189	296	46
398	3.98	169	296	55
399	3.98	159	296	59
400	3.98	171	296	54
401	3.98	164	296	57
402	3.98	179	296	51
403	3.98	161	296	58
404	3.98	162	296	58
405	3.98	71	247	76
406	3.98	109	296	81
407	3.98	114	296	79
408	3.98	120	296	76
409	3.98	91	246	67
410	3.98	48	246	86
411	3.98	80	246	72
412	3.98	88	246	69

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
413	3.98	109	246	60
414	3.98	89	246	68
415	3.98	86	246	69
416	3.98	56	246	82
417	3.98	49	246	86
418	3.98	47	247	87
419	3.98	44	246	88
420	3.98	40	246	89
421	3.98	40	246	89
422	3.98	36	246	91
423	3.98	11	246	102
424	3.98	9	246	103
425	3.98	10	246	102
426	3.98	14	246	101
427	3.98	27	246	95
428	3.98	15	246	100
429	3.98	100	246	63
430	3.98	107	246	60
431	3.98	110	246	59
432	3.98	115	246	57
433	3.98	131	246	50
434	3.98	138	246	47
435	3.98	149	246	42
436	3.98	84	246	70
437	3.98	77	246	73
438	3.98	95	246	65
439	3.98	96	246	65
440	3.98	103	246	62
441	3.98	124	246	53
442	3.98	139	246	46
443	3.98	112	246	58
444	3.98	13	246	101
445	3.98	87	246	69
446	3.98	28	246	95
447	3.98	65	246	78
448	3.98	87	246	69
449	3.98	57	246	82
450	3.98	34	246	92
451	3.98	18	246	99
452	3.98	16	246	100
453	3.98	11	246	102
454	3.98	12	246	101
455	3.98	26	246	95
456	3.98	12	246	101
457	3.98	29	246	94
458	3.98	49	246	85
459	3.98	49	246	86
460	3.98	47	246	86
461	3.98	74	246	75
462	3.98	85	246	70
463	3.98	80	246	72
464	3.98	49	246	86
465	3.98	28	246	95
466	3.98	28	246	95
467	3.98	27	246	95
468	3.98	61	246	80
469	3.98	84	246	70
470	3.98	27	246	95
471	3.98	94	246	66
472	3.98	90	246	68
473	3.98	78	246	73
474	3.98	75	246	74
475	3.98	56	246	82
476	3.98	85	246	70
477	3.98	91	246	67
478	3.98	93	246	66
479	3.98	80	246	72
480	3.98	68	246	78
481	3.98	75	246	74
482	3.98	73	246	75
483	3.98	79	246	73
484	3.98	56	246	82
485	3.98	57	246	82
486	3.98	54	247	83
487	3.98	94	297	88
488	3.98	82	297	93
489	3.98	99	297	86
490	3.98	80	297	94
491	3.98	74	297	97
492	3.98	65	297	101
493	3.98	70	297	99
494	3.98	74	297	97
495	3.98	68	297	99
496	3.98	67	297	100
497	3.98	81	297	94

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
498	3.98	95	297	88
499	3.98	103	297	84
500	3.98	120	297	77
501	3.98	165	297	57
502	3.98	127	297	74
503	3.98	173	297	54
504	3.98	158	297	60
505	3.98	150	297	64
507	3.98	196	297	44
508	3.98	177	297	52
509	3.98	128	297	73
510	3.98	112	297	80
511	3.98	143	297	67
512	3.98	137	297	69
513	3.98	142	297	67
514	3.98	170	297	55
515	3.98	166	297	57
516	3.98	165	297	57
517	3.98	136	297	70
518	3.98	107	297	82
519	3.98	106	297	83
520	3.98	107	297	82
521	3.98	119	297	77
522	3.98	149	297	64
523	3.98	145	297	66
524	3.98	137	297	69
525	3.98	136	297	70
526	3.98	190	297	46
527	3.98	189	297	47
528	3.98	191	297	46
529	3.98	189	297	47
530	3.98	199	297	43
531	3.98	189	297	47
532	3.98	100	297	85
533	3.98	152	297	63
534	3.98	197	297	43
535	3.98	202	297	41
536	3.98	152	297	63
537	3.98	153	297	62
538	3.98	103	297	84
539	3.98	101	297	85
540	3.98	115	297	79
541	3.98	123	297	75
542	3.98	151	297	63
543	3.98	149	297	64
544	3.98	153	297	62
545	3.98	163	297	58
546	3.98	182	297	50
547	3.98	179	297	51
548	3.98	197	297	43
549	3.98	206	297	40
550	3.98	209	297	38
551	3.98	137	298	70
552	3.98	104	322	95
554	3.98	134	321	81
555	3.98	119	321	88
556	3.98	119	322	88
557	3.98	134	321	81
558	3.98	129	322	83
559	3.98	124	322	86
560	3.98	134	322	82
561	3.98	134	323	82
562	3.98	144	323	77
563	3.98	154	323	73
564	3.98	144	323	77
565	3.98	144	323	77
566	3.98	134	321	81
567	3.98	144	321	77
568	3.98	154	319	72
569	3.98	109	319	91
570	3.98	124	319	85
571	3.98	154	319	72
572	3.98	154	319	72
573	3.98	154	319	72
574	3.98	124	319	85
575	3.98	154	319	71
576	3.98	154	318	71
577	3.98	199	318	52
578	3.98	159	298	60
579	3.98	174	298	54
580	3.98	189	298	47
581	3.98	194	298	45
582	3.98	169	298	56
583	3.98	184	298	49
584	3.98	176	297	53

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
585	3.98	144	298	67
586	3.98	176	297	53
587	3.98	174	297	53
589	3.98	189	297	47
590	3.98	189	297	47
591	3.98	201	297	42
592	3.98	204	297	40
593	3.98	209	297	38
594	3.98	184	297	49
595	3.98	154	297	62
596	3.98	189	297	47
597	3.98	189	297	47
598	3.98	199	297	43
599	3.98	164	297	58
600	3.98	165	297	57
601	3.98	164	297	58
602	3.98	199	297	43
603	3.98	191	297	46
604	3.98	194	297	45
605	3.98	134	297	71
606	3.98	197	297	43
607	3.98	194	297	45
608	3.98	184	297	49
611	3.98	159	297	60
612	3.98	154	297	62
613	3.98	159	297	60
614	3.98	79	246	73
615	3.98	74	297	97
616	3.98	89	297	90
617	3.98	86	297	91
618	3.98	104	297	84
619	3.98	89	297	90
620	3.98	94	297	88
621	3.98	124	297	75
622	3.98	79	297	95
623	3.98	79	297	95
624	3.98	54	247	83
625	3.98	49	247	86
626	3.98	49	247	86
627	3.98	124	323	86
628	3.98	114	323	91
629	3.98	109	299	82
630	3.98	99	299	87
631	3.98	99	299	87
632	3.98	84	299	93
633	3.98	69	299	99
634	3.98	54	299	106
635	3.98	64	298	102
636	3.98	94	298	88
637	3.98	64	298	102
638	3.98	99	298	86
639	3.98	94	298	88
640	3.98	134	298	71
641	3.98	119	298	77
642	3.98	64	297	101
643	3.98	84	297	92
644	3.98	79	297	95
645	3.98	74	297	97
646	3.98	64	297	101
647	3.98	74	297	97
648	3.98	79	297	94
649	3.98	79	297	94
650	3.98	84	297	92
651	3.98	79	297	94
652	3.98	79	297	94
653	3.98	74	297	97
654	3.98	64	297	101
655	3.98	89	297	90
656	3.98	89	297	90
657	3.98	49	296	107
658	3.98	64	296	101
659	3.98	89	246	68
660	3.98	49	246	86
661	3.98	54	246	83
662	3.98	34	246	92
663	3.98	124	298	75
664	3.98	119	298	78
665	3.98	129	298	73
666	3.98	124	298	75
667	3.98	141	298	68
668	3.98	147	298	65
669	3.98	149	298	65
670	3.98	164	298	58
671	3.98	169	298	56
672	3.98	179	298	52

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
673	3.98	184	298	49
674	3.98	135	298	71
675	3.98	164	298	58
676	3.98	209	298	39
677	3.98	209	298	39
678	3.98	214	298	36
679	3.98	224	298	32
680	3.98	229	298	30
681	3.98	224	298	32
682	3.98	224	298	32
683	3.98	224	298	32
684	3.98	234	298	28
685	3.98	234	298	28
686	3.98	234	298	28
687	3.98	225	382	68
688	3.98	164	298	58
689	3.98	114	298	80
690	3.98	169	298	56
691	3.98	174	298	54
692	3.98	154	298	62
693	3.98	174	298	54
694	3.98	164	298	58
695	3.98	179	298	52
696	3.98	179	298	52
697	3.98	174	298	54
698	3.98	224	396	74
699	3.98	219	396	76
700	3.98	194	396	87
701	3.98	237	395	69
702	3.98	199	396	85
703	3.98	189	396	89
704	3.98	179	396	94
705	3.98	184	396	92
706	3.98	204	396	83
707	3.98	204	296	40
708	3.98	204	296	40
709	3.98	204	296	40
710	3.98	204	296	40
711	3.98	204	296	40
712	3.98	209	296	38
713	3.98	214	395	79
714	3.98	204	395	83
715	3.98	214	395	79
716	3.98	219	395	76
717	3.98	204	395	83
718	3.98	234	298	28
719	3.98	174	296	53
720	3.98	174	296	53
721	3.98	179	296	51
722	3.98	169	296	55
723	3.98	149	296	64
724	3.98	174	296	53
725	3.98	169	296	55
726	3.98	154	296	62
727	3.98	204	296	40
728	3.98	204	296	40
729	3.98	174	296	53
730	3.98	194	296	44
731	3.98	174	296	53
732	3.98	194	296	44
733	3.98	92	246	67
734	3.98	139	297	68
735	3.98	144	297	66
736	3.98	114	297	79
737	3.98	109	297	81
738	3.98	104	297	84
739	3.98	99	297	86
740	3.98	94	297	88
741	3.98	104	297	84
742	3.98	174	298	54
743	3.98	104	297	84
744	3.98	184	298	49
745	3.98	144	298	67
746	3.98	154	298	62
747	3.98	219	395	76
748	3.98	199	296	42
749	3.98	204	296	40
750	3.98	204	296	40
751	3.98	199	296	42
752	3.98	184	296	49
753	3.98	74	246	75
754	3.98	104	246	62
755	3.98	19	246	99
756	3.98	19	246	99
757	3.98	29	246	94

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
758	3.98	34	246	92
759	3.98	24	246	96
760	3.98	24	246	96
761	3.98	34	246	92
762	3.98	29	246	94
763	3.98	29	246	94
764	3.98	39	246	90
765	3.98	14	246	101
766	3.98	24	247	96
767	3.98	40	296	111
768	3.98	104	296	83
769	3.98	84	296	92
770	3.98	114	296	79
771	3.98	119	296	77
772	3.98	134	296	70
773	3.98	174	296	53
774	3.98	124	296	74
775	3.98	139	296	68
776	3.98	184	296	49
777	3.98	154	296	62
778	3.98	134	296	70
779	3.98	144	296	66
780	3.98	184	296	48
781	3.98	194	296	44
782	3.98	194	296	44
783	3.98	134	296	70
784	3.98	164	296	57
785	3.98	164	296	57
786	3.98	194	296	44
787	3.98	174	296	53
788	3.98	174	296	53
789	3.98	169	296	55
790	3.98	154	296	61
791	3.98	134	296	70
792	3.98	109	296	81
793	3.98	109	296	81
794	3.98	96	296	87
795	3.98	94	296	87
796	3.98	104	296	83
797	3.98	114	296	79
798	3.98	129	296	72
799	3.98	129	296	72
800	3.98	159	296	59
801	3.98	144	296	66
802	3.98	154	296	61
803	3.98	164	296	57
804	3.98	204	296	40
805	3.98	204	296	40
806	3.98	192	296	45
808	3.98	129	297	73
809	3.98	94	297	88
810	3.98	74	246	75
811	3.98	74	297	97
812	3.98	67	247	78
813	3.98	60	246	81
814	3.98	172	395	97
815	3.98	179	395	94
816	3.98	56	296	104
817	3.98	179	297	51
818	3.98	242	396	67
819	3.98	237	395	69
820	3.98	204	296	40
823	3.98	210	395	80
824	3.98	211	395	80
836	3.98	189	297	47
837	3.98	204	298	41
838	3.98	99	246	64
839	3.98	169	298	56
840	3.98	199	297	43
841	3.98	164	297	58
842	3.98	24	247	96
843	3.98	214	298	36
844	3.98	225	382	68
845	3.98	247	382	59
846	3.98	248	382	58
847	3.98	224	382	69
848	3.98	105	296	83
849	3.98	229	382	66
850	3.98	244	382	60
851	3.98	248	382	58
852	3.98	248	382	58
853	3.98	224	298	32
854	3.98	224	298	32
855	3.98	224	298	32
856	3.98	224	298	32

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
857	3.98	229	382	66
858	3.98	209	382	75
860	3.98	229	382	66
862	3.98	199	297	43
863	3.98	165	297	57
864	3.98	194	296	44
868	3.98	200	298	42
869	3.98	114	319	89
875	3.98	203	296	40
880	3.98	81	297	94
885	3.98	83	297	93
887	3.98	82	297	93
888	3.98	82	297	93
889	3.98	124	296	74
890	3.98	124	296	74
896	3.98	124	296	74
900	3.98	174	299	54
901	3.98	181	298	51
903	3.98	179	298	52
919	3.98	245	396	65
920	3.98	154	296	62
923	3.98	184	298	49
924	3.98	169	298	56
925	3.98	89	297	90
926	3.98	107	297	83
927	3.98	119	321	88
928	3.98	119	321	88
929	3.98	83	246	71
930	3.98	144	296	66
931	3.98	80	296	93
932	3.98	139	296	68
933	3.98	164	296	57
934	3.98	24	247	96
935	3.98	184	296	48
936	3.98	184	296	48
938	3.98	166	298	57

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
10	4.74	109	295	80
12	4.74	124	295	74
14	4.74	139	295	68
16	4.74	92	295	88
18	4.74	49	235	81
20	4.74	46	235	82
22	4.74	49	235	81
24	4.74	49	235	81
26	4.74	49	235	81
28	4.74	164	295	57
30	4.74	174	295	52
32	4.74	184	295	48
34	4.74	158	295	59
36	4.74	160	295	58
38	4.74	161	295	58
40	4.74	149	295	63
42	4.74	154	295	61
44	4.74	149	295	63
46	4.74	144	295	65
48	4.74	149	295	63
50	4.74	127	295	73
52	4.74	133	295	70
54	4.74	52	235	79
56	4.74	59	235	76
58	4.74	195	299	45
60	4.74	192	299	46
62	4.74	189	299	47
64	4.74	189	299	47
66	4.74	185	299	49
68	4.74	187	299	48
70	4.74	134	299	71
72	4.74	161	299	60
74	4.74	163	299	59
76	4.74	9	235	98
78	4.74	204	295	39
80	4.74	194	295	44
82	4.74	184	295	48
84	4.74	174	295	52
86	4.74	174	295	52
88	4.74	79	299	95
90	4.74	79	299	95
92	4.74	39	235	85
94	4.74	144	295	65
96	4.74	154	295	61
98	4.74	91	296	89
100	4.74	94	296	88
102	4.74	177	321	62
104	4.74	136	297	70
106	4.74	176	368	83
108	4.74	159	297	60
110	4.74	99	298	86
112	4.74	209	372	71
114	4.74	169	299	56
116	4.74	12	235	97
122	4.74	137	299	70
126	4.74	116	371	111
128	775	149	371	96
134	4.74	153	371	95
136	4.74	151	370	95
138	4.74	152	370	94
140	4.74	152	369	94
142	4.74	145	369	97
144	4.74	136	368	101
146	4.74	136	368	101
148	4.74	136	297	70
150	4.74	143	297	67
152	4.74	137	297	69
154	4.74	142	297	67
170	4.74	154	299	63
215	4.74	40	295	110
216	4.74	189	299	47
217	4.74	139	299	69
218	4.74	219	401	79
219	4.74	79	295	93
220	4.74	70	295	97
221	4.74	49	235	81
222	4.74	100	297	85
228	4.74	129	299	73
229	4.74	156	295	60
230	4.74	209	295	37
232	4.74	136	323	81
233	4.74	224	401	77
235	4.74	220	400	78
236	4.74	214	400	81
237	4.74	209	299	39

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
238	4.74	185	299	49
239	4.74	182	299	51
240	4.74	237	400	71
241	4.74	194	400	89
242	4.74	184	400	94
243	4.74	136	297	70
244	4.74	189	369	78
245	4.74	194	366	75
246	4.74	29	235	89
247	4.74	121	295	75
248	4.74	145	295	65
249	4.74	181	295	49
250	4.74	180	298	51
251	4.74	107	298	83
252	4.74	138	300	70
253	4.74	121	300	78
254	4.74	180	299	51
255	4.74	182	298	50
256	4.74	192	298	46
257	4.74	193	298	46
258	4.74	211	298	38
259	4.74	199	298	43
260	4.74	187	298	48
261	4.74	182	298	50
262	4.74	163	298	59
263	4.74	161	298	60
264	4.74	172	298	55
265	4.74	184	298	50
266	4.74	201	298	42
267	4.74	199	298	43
268	4.74	206	298	40
269	4.74	209	298	39
270	4.74	205	298	41
271	4.74	143	299	67
272	4.74	145	298	67
273	4.74	143	298	67
274	4.74	110	299	82
275	4.74	108	298	83
276	4.74	103	298	84
277	4.74	78	297	95
278	4.74	79	297	95
279	4.74	96	298	88
280	4.74	158	298	61
281	4.74	176	298	53
282	4.74	159	298	60
283	4.74	151	298	64
284	4.74	166	298	57
285	4.74	180	298	51
286	4.74	179	298	52
287	4.74	178	298	52
288	4.74	175	299	54
289	4.74	166	299	58
290	4.74	175	299	54
291	4.74	132	299	72
292	4.74	149	299	65
293	4.74	87	299	92
294	4.74	124	299	76
295	4.74	109	298	82
296	4.74	94	298	88
297	4.74	121	298	77
298	4.74	153	299	63
299	4.74	179	299	52
300	4.74	204	299	41
301	4.74	197	299	44
302	4.74	189	299	48
303	4.74	171	299	55
304	4.74	164	299	58
305	4.74	171	299	55
306	4.74	196	299	45
307	4.74	179	299	52
308	4.74	154	299	63
309	4.74	144	298	67
310	4.74	162	298	59
315	4.74	194	296	44
316	4.74	172	296	54
317	4.74	196	296	43
318	4.74	192	296	45
319	4.74	165	296	57
320	4.74	57	297	104
321	4.74	60	297	103
322	4.74	86	297	92
323	4.74	122	297	76
324	4.74	108	297	82
325	4.74	104	297	84
326	4.74	122	297	76

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
327	4.74	93	297	88
328	4.74	90	297	90
329	4.74	120	297	77
330	4.74	119	296	77
331	4.74	97	296	87
332	4.74	88	296	90
333	4.74	120	296	76
334	4.74	149	296	64
335	4.74	125	296	74
336	4.74	142	296	67
337	4.74	161	296	59
338	4.74	158	296	60
339	4.74	149	296	64
340	4.74	71	295	97
341	4.74	206	401	84
342	4.74	219	401	79
343	4.74	234	401	72
344	4.74	226	401	76
345	4.74	233	401	73
346	4.74	214	400	81
347	4.74	229	400	74
348	4.74	212	400	82
349	4.74	216	400	80
350	4.74	179	401	96
351	4.74	244	401	68
352	4.74	241	401	69
353	4.74	232	401	73
354	4.74	186	295	47
355	4.74	192	295	44
356	4.74	189	295	46
357	4.74	182	295	49
358	4.74	181	295	49
359	4.74	191	295	45
360	4.74	144	295	65
361	4.74	141	295	67
362	4.74	136	295	69
363	4.74	172	295	53
364	4.74	172	295	53
365	4.74	117	323	89
366	4.74	164	295	57
367	4.74	180	295	50
368	4.74	168	295	55
369	4.74	161	295	58
370	4.74	134	295	70
371	4.74	42	235	84
372	4.74	50	235	80
373	4.74	45	235	82
374	4.74	10	235	98
375	4.74	92	235	62
376	4.74	149	373	97
377	4.74	191	373	79
378	4.74	178	374	85
379	4.74	71	235	71
380	4.74	170	296	54
381	4.74	205	296	39
382	4.74	210	296	37
383	4.74	185	296	48
384	4.74	165	296	57
386	4.74	151	295	62
387	4.74	146	295	65
388	4.74	201	295	41
389	4.74	210	296	37
390	4.74	211	296	37
391	4.74	195	295	43
392	4.74	189	295	46
393	4.74	162	295	58
394	4.74	184	295	48
395	4.74	194	295	44
396	4.74	179	295	50
397	4.74	189	295	46
398	4.74	169	295	55
399	4.74	159	295	59
400	4.74	171	295	54
401	4.74	164	295	57
402	4.74	179	295	50
403	4.74	161	295	58
404	4.74	162	295	58
405	4.74	71	235	71
406	4.74	109	295	80
407	4.74	114	295	78
408	4.74	120	295	76
409	4.74	91	235	62
410	4.74	48	235	81
411	4.74	80	235	67
412	4.74	88	235	64

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
413	4.74	109	235	55
414	4.74	89	235	63
415	4.74	86	235	65
416	4.74	56	235	78
417	4.74	49	235	81
418	4.74	47	235	82
419	4.74	44	235	83
420	4.74	40	235	85
421	4.74	40	235	85
422	4.74	36	235	86
423	4.74	11	235	97
424	4.74	9	235	98
425	4.74	10	235	98
426	4.74	14	235	96
427	4.74	27	235	90
428	4.74	15	235	95
429	4.74	100	235	59
430	4.74	107	235	56
431	4.74	110	235	54
432	4.74	115	235	52
433	4.74	131	235	45
434	4.74	138	235	42
435	4.74	149	235	37
436	4.74	84	235	65
437	4.74	77	235	69
438	4.74	95	235	61
439	4.74	96	235	60
440	4.74	103	235	57
441	4.74	124	235	48
442	4.74	139	235	42
443	4.74	112	235	53
444	4.74	13	235	96
445	4.74	87	235	64
446	4.74	28	235	90
447	4.74	65	235	74
448	4.74	87	235	64
449	4.74	57	235	77
450	4.74	34	235	87
451	4.74	18	235	94
452	4.74	16	235	95
453	4.74	11	235	97
454	4.74	12	235	97
455	4.74	26	235	91
456	4.74	12	235	97
457	4.74	29	235	89
458	4.74	49	235	81
459	4.74	49	235	81
460	4.74	47	235	81
461	4.74	74	235	70
462	4.74	85	235	65
463	4.74	80	235	67
464	4.74	49	235	81
465	4.74	28	235	90
466	4.74	28	235	90
467	4.74	27	235	90
468	4.74	61	235	75
469	4.74	84	235	65
470	4.74	27	235	90
471	4.74	94	235	61
472	4.74	90	235	63
473	4.74	78	235	68
474	4.74	75	235	69
475	4.74	56	235	78
476	4.74	85	235	65
477	4.74	91	235	62
478	4.74	93	235	62
479	4.74	80	235	67
480	4.74	68	235	73
481	4.74	75	235	69
482	4.74	73	235	70
483	4.74	79	235	68
484	4.74	56	235	78
485	4.74	57	235	77
486	4.74	54	235	79
487	4.74	94	297	88
488	4.74	82	297	93
489	4.74	99	297	86
490	4.74	80	297	94
491	4.74	74	297	97
492	4.74	65	298	101
493	4.74	70	297	99
494	4.74	74	297	97
495	4.74	68	297	99
496	4.74	67	297	100
497	4.74	81	297	94

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
498	4.74	95	297	88
499	4.74	103	297	84
500	4.74	120	297	77
501	4.74	165	297	57
502	4.74	127	297	74
503	4.74	173	297	54
504	4.74	158	297	60
505	4.74	150	297	64
507	4.74	196	368	74
508	4.74	177	297	52
509	4.74	128	297	73
510	4.74	112	297	80
511	4.74	143	297	67
512	4.74	137	297	69
513	4.74	142	297	67
514	4.74	170	297	55
515	4.74	166	297	57
516	4.74	165	297	57
517	4.74	136	297	70
518	4.74	107	297	82
519	4.74	106	297	83
520	4.74	107	297	82
521	4.74	119	297	77
522	4.74	149	297	64
523	4.74	145	297	66
524	4.74	137	297	69
525	4.74	136	297	70
526	4.74	190	368	77
527	4.74	189	368	77
528	4.74	191	369	77
529	4.74	189	369	78
530	4.74	199	369	74
531	4.74	189	369	78
532	4.74	100	297	86
533	4.74	152	297	63
534	4.74	197	369	75
535	4.74	202	370	73
536	4.74	152	297	63
537	4.74	153	297	62
538	4.74	103	297	84
539	4.74	101	297	85
540	4.74	115	297	79
541	4.74	123	297	75
542	4.74	151	297	63
543	4.74	149	374	97
544	4.74	153	297	62
545	4.74	163	373	91
546	4.74	182	374	83
547	4.74	179	374	84
548	4.74	197	373	76
549	4.74	206	373	72
550	4.74	209	373	71
551	4.74	137	299	70
552	4.74	104	323	95
554	4.74	134	322	82
555	4.74	119	323	88
556	4.74	119	322	88
557	4.74	134	322	82
558	4.74	129	322	84
559	4.74	124	322	86
560	4.74	134	323	82
561	4.74	134	323	82
562	4.74	144	323	78
563	4.74	154	323	73
564	4.74	144	323	78
565	4.74	144	323	78
566	4.74	134	322	82
567	4.74	144	322	77
568	4.74	154	321	72
569	4.74	109	321	92
570	4.74	124	321	85
571	4.74	154	321	72
572	4.74	154	321	72
573	4.74	154	321	72
574	4.74	124	321	85
575	4.74	154	321	72
576	4.74	154	321	72
577	4.74	199	321	53
578	4.74	159	299	61
579	4.74	174	299	54
580	4.74	189	299	47
581	4.74	194	299	45
582	4.74	169	299	56
583	4.74	184	299	50
584	4.74	176	375	86

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
585	4.74	144	299	67
586	4.74	176	375	86
587	4.74	174	374	87
589	4.74	189	373	80
590	4.74	189	373	80
591	4.74	201	371	74
592	4.74	204	372	73
593	4.74	209	372	70
594	4.74	184	373	82
595	4.74	154	374	95
596	4.74	189	369	78
597	4.74	189	369	78
598	4.74	199	375	76
599	4.74	164	375	91
600	4.74	165	375	91
601	4.74	164	375	91
602	4.74	199	375	76
603	4.74	191	369	77
604	4.74	194	369	76
605	4.74	134	297	71
606	4.74	197	368	74
607	4.74	194	366	75
608	4.74	184	363	78
611	4.74	159	297	60
612	4.74	154	297	62
613	4.74	159	297	60
614	4.74	79	235	68
615	4.74	74	297	97
616	4.74	89	297	90
617	4.74	86	297	92
618	4.74	104	297	84
619	4.74	89	297	90
620	4.74	94	297	88
621	4.74	124	297	75
622	4.74	79	297	95
623	4.74	79	297	95
624	4.74	54	235	79
625	4.74	49	235	81
626	4.74	49	235	81
627	4.74	124	323	86
628	4.74	114	323	91
629	4.74	109	299	82
630	4.74	99	299	87
631	4.74	99	299	87
632	4.74	84	299	93
633	4.74	69	299	100
634	4.74	54	299	106
635	4.74	64	299	102
636	4.74	94	298	89
637	4.74	64	299	102
638	4.74	99	299	86
639	4.74	94	299	89
640	4.74	134	298	71
641	4.74	119	298	78
642	4.74	64	298	101
643	4.74	84	298	93
644	4.74	79	297	95
645	4.74	74	297	97
646	4.74	64	297	101
647	4.74	74	297	97
648	4.74	79	297	95
649	4.74	79	297	95
650	4.74	84	298	93
651	4.74	79	297	95
652	4.74	79	297	95
653	4.74	74	297	97
654	4.74	64	297	101
655	4.74	89	298	90
656	4.74	89	298	90
657	4.74	49	297	108
658	4.74	64	297	101
659	4.74	89	235	63
660	4.74	49	235	81
661	4.74	54	235	78
662	4.74	34	235	87
663	4.74	124	299	76
664	4.74	119	299	78
665	4.74	129	299	73
666	4.74	124	299	76
667	4.74	141	299	68
668	4.74	147	299	66
669	4.74	149	299	65
670	4.74	164	299	58
671	4.74	169	299	56
672	4.74	179	298	52

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
673	4.74	184	298	50
674	4.74	135	299	71
675	4.74	164	299	58
676	4.74	209	298	39
677	4.74	209	298	39
678	4.74	214	298	37
679	4.74	224	298	32
680	4.74	229	298	30
681	4.74	224	298	32
682	4.74	224	298	32
683	4.74	224	298	32
684	4.74	234	298	28
685	4.74	234	298	28
686	4.74	234	298	28
687	4.74	225	381	67
688	4.74	164	299	58
689	4.74	114	299	80
690	4.74	169	299	56
691	4.74	174	299	54
692	4.74	154	299	63
693	4.74	174	299	54
694	4.74	164	299	58
695	4.74	179	299	52
696	4.74	179	299	52
697	4.74	174	299	54
698	4.74	224	401	77
699	4.74	219	401	79
700	4.74	194	401	90
701	4.74	237	400	71
702	4.74	199	401	87
703	4.74	189	401	92
704	4.74	179	401	96
705	4.74	184	401	94
706	4.74	204	401	85
707	4.74	204	295	40
708	4.74	204	295	40
709	4.74	204	295	40
710	4.74	204	295	40
711	4.74	204	295	40
712	4.74	209	296	38
713	4.74	214	400	81
714	4.74	204	400	85
715	4.74	214	400	81
716	4.74	219	400	79
717	4.74	204	400	85
719	4.74	174	295	52
720	4.74	174	295	52
721	4.74	179	295	50
722	4.74	169	295	55
723	4.74	149	295	63
724	4.74	174	295	52
725	4.74	169	295	55
726	4.74	154	295	61
727	4.74	204	295	40
728	4.74	204	296	40
729	4.74	174	295	53
730	4.74	194	295	44
731	4.74	174	295	52
732	4.74	194	295	44
733	4.74	92	235	62
734	4.74	139	297	68
735	4.74	144	298	67
736	4.74	114	298	80
737	4.74	109	298	82
738	4.74	104	298	84
739	4.74	99	298	86
740	4.74	94	298	88
741	4.74	104	298	84
742	4.74	174	299	54
743	4.74	104	298	84
744	4.74	184	298	50
745	4.74	144	298	67
746	4.74	154	298	63
747	4.74	219	400	79
748	4.74	199	295	42
749	4.74	204	295	40
750	4.74	204	295	40
751	4.74	199	295	42
752	4.74	184	295	48
753	4.74	74	235	70
754	4.74	104	235	57
755	4.74	19	235	94
756	4.74	19	235	94
757	4.74	29	235	89
758	4.74	34	235	87

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
759	4.74	24	235	92
760	4.74	24	235	92
761	4.74	34	235	87
762	4.74	29	235	89
763	4.74	29	235	89
764	4.74	39	235	85
765	4.74	14	235	96
766	4.74	24	235	92
767	4.74	40	295	110
768	4.74	104	295	83
769	4.74	84	295	91
770	4.74	114	295	78
771	4.74	119	295	76
772	4.74	134	295	70
773	4.74	174	295	52
774	4.74	124	295	74
775	4.74	139	295	67
776	4.74	184	295	48
777	4.74	154	295	61
778	4.74	134	295	70
779	4.74	144	295	65
780	4.74	184	295	48
781	4.74	194	295	44
782	4.74	194	295	44
783	4.74	134	295	70
784	4.74	164	295	57
785	4.74	164	295	57
786	4.74	194	295	44
787	4.74	174	295	52
788	4.74	174	295	52
789	4.74	169	295	54
790	4.74	154	295	61
791	4.74	134	295	70
792	4.74	109	295	80
793	4.74	109	295	80
794	4.74	96	295	86
795	4.74	94	295	87
796	4.74	104	295	83
797	4.74	114	295	78
798	4.74	129	295	72
799	4.74	129	295	72
800	4.74	159	295	59
801	4.74	144	295	65
802	4.74	154	295	61
803	4.74	164	295	57
804	4.74	204	295	39
805	4.74	204	295	39
806	4.74	192	295	45
808	4.74	129	297	73
809	4.74	94	297	88
810	4.74	74	235	70
811	4.74	74	297	97
812	4.74	67	235	73
813	4.74	60	235	76
814	4.74	172	400	99
815	4.74	179	400	96
816	4.74	56	295	104
817	4.74	179	298	51
818	4.74	242	401	69
819	4.74	237	400	71
820	4.74	204	295	40
823	4.74	210	400	83
824	4.74	211	400	82
836	4.74	189	359	74
837	4.74	204	298	41
838	4.74	99	235	59
839	4.74	169	299	56
840	4.74	199	375	76
841	4.74	164	375	91
842	4.74	24	235	92
843	4.74	214	298	37
844	4.74	225	381	67
845	4.74	247	381	58
846	4.74	248	381	57
847	4.74	224	381	68
848	4.74	105	295	82
849	4.74	229	380	66
850	4.74	244	380	59
851	4.74	248	380	57
852	4.74	248	380	57
853	4.74	224	298	32
854	4.74	224	298	32
855	4.74	224	298	32
856	4.74	224	298	32
857	4.74	229	380	66

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
858	4.74	209	380	74
860	4.74	229	380	66
862	4.74	199	375	76
863	4.74	165	296	57
864	4.74	194	295	44
868	4.74	200	298	43
869	4.74	114	321	90
875	4.74	203	295	40
880	4.74	81	297	94
885	4.74	83	297	93
887	4.74	82	297	93
888	4.74	82	297	93
889	4.74	124	295	74
890	4.74	124	295	74
896	4.74	124	295	74
900	4.74	174	299	54
901	4.74	181	299	51
903	4.74	179	299	52
919	4.74	245	401	67
920	4.74	154	295	61
923	4.74	184	298	50
924	4.74	169	299	56
925	4.74	89	297	90
926	4.74	107	298	83
927	4.74	119	322	88
928	4.74	119	322	88
929	4.74	83	235	66
930	4.74	144	295	65
931	4.74	80	295	93
932	4.74	139	295	67
933	4.74	164	295	57
934	4.74	24	235	92
935	4.74	184	295	48
936	4.74	184	295	48
937	1,000	177	333	68
938	4.74	166	298	57

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
10	5.3	109	293	80
12	5.3	124	293	73
14	5.3	139	293	67
16	5.3	92	293	87
18	5.3	49	235	81
20	5.3	46	235	82
22	5.3	49	235	81
24	5.3	49	235	81
26	5.3	49	235	81
28	5.3	164	293	56
30	5.3	174	293	52
32	5.3	184	293	47
34	5.3	158	293	59
36	5.3	160	293	58
38	5.3	161	293	57
40	5.3	149	293	62
42	5.3	154	293	60
44	5.3	149	293	62
46	5.3	144	293	65
48	5.3	149	293	62
50	5.3	127	293	72
52	5.3	133	293	69
54	5.3	52	235	79
56	5.3	59	235	76
58	5.3	195	298	45
60	5.3	192	298	46
62	5.3	189	298	47
64	5.3	189	298	47
66	5.3	185	298	49
68	5.3	187	298	48
70	5.3	134	298	71
72	5.3	161	298	59
74	5.3	163	298	58
76	5.3	9	235	98
78	5.3	204	293	39
80	5.3	194	293	43
82	5.3	184	293	47
84	5.3	174	293	52
86	5.3	174	293	52
88	5.3	79	298	95
90	5.3	79	298	95
92	5.3	39	235	85
94	5.3	144	293	65
96	5.3	154	293	60
98	5.3	91	295	89
100	5.3	94	295	87
102	5.3	177	319	62
104	5.3	136	296	69
106	5.3	176	353	77
108	5.3	159	296	59
110	5.3	99	297	86
112	5.3	209	358	64
114	5.3	169	298	56
116	5.3	12	235	97
122	5.3	137	298	70
126	5.3	116	357	104
128	775	149	357	90
134	5.3	153	357	88
136	5.3	151	356	89
138	5.3	152	355	88
140	5.3	152	355	88
142	5.3	145	354	91
144	5.3	136	354	94
146	5.3	136	354	94
148	5.3	136	296	69
150	5.3	143	296	66
152	5.3	137	296	69
154	5.3	142	296	67
170	5.3	154	299	63
215	5.3	40	293	110
216	5.3	189	298	47
217	5.3	139	298	69
218	5.3	219	400	78
219	5.3	79	293	93
220	5.3	70	293	97
221	5.3	49	235	81
222	5.3	100	296	85
228	5.3	129	298	73
229	5.3	156	293	60
230	5.3	209	293	36
232	5.3	136	322	81
233	5.3	224	400	76
235	5.3	220	400	78
236	5.3	214	400	80
237	5.3	209	298	39

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
238	5.3	185	298	49
239	5.3	182	298	50
240	5.3	237	400	70
241	5.3	194	400	89
242	5.3	184	400	93
243	5.3	136	296	69
244	5.3	189	355	72
245	5.3	194	352	68
246	5.3	29	235	89
247	5.3	121	293	75
248	5.3	145	293	64
249	5.3	181	294	49
250	5.3	180	298	51
251	5.3	107	297	82
252	5.3	138	300	70
253	5.3	121	300	77
254	5.3	180	298	51
255	5.3	182	298	50
256	5.3	192	298	46
257	5.3	193	298	45
258	5.3	211	298	38
259	5.3	199	298	43
260	5.3	187	298	48
261	5.3	182	298	50
262	5.3	163	298	58
263	5.3	161	298	59
264	5.3	172	298	54
265	5.3	184	298	49
266	5.3	201	298	42
267	5.3	199	298	43
268	5.3	206	298	40
269	5.3	209	298	38
270	5.3	205	298	40
271	5.3	143	298	67
272	5.3	145	298	66
273	5.3	143	298	67
274	5.3	110	298	82
275	5.3	108	298	82
276	5.3	103	297	84
277	5.3	78	296	95
278	5.3	79	297	94
279	5.3	96	297	87
280	5.3	158	298	60
281	5.3	176	298	53
282	5.3	159	298	60
283	5.3	151	298	64
284	5.3	166	298	57
285	5.3	180	298	51
286	5.3	179	298	51
287	5.3	178	298	52
288	5.3	175	298	53
289	5.3	166	298	57
290	5.3	175	298	53
291	5.3	132	298	72
292	5.3	149	298	65
293	5.3	87	298	91
294	5.3	124	298	75
295	5.3	109	297	81
296	5.3	94	297	88
297	5.3	121	298	77
298	5.3	153	298	63
299	5.3	179	298	52
300	5.30	204	298	41
301	5.3	197	298	44
302	5.3	189	298	47
303	5.3	171	298	55
304	5.3	164	298	58
305	5.3	171	298	55
306	5.3	196	299	44
307	5.3	179	299	52
308	5.3	154	299	63
309	5.3	144	297	66
310	5.3	162	297	58
315	5.3	194	295	44
316	5.3	172	295	53
317	5.3	196	295	43
318	5.3	192	295	45
319	5.3	165	295	56
320	5.3	57	296	104
321	5.3	60	296	102
322	5.3	86	296	91
323	5.3	122	296	76
324	5.3	108	296	82
325	5.3	104	296	83
326	5.3	122	296	75

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
327	5.3	93	296	88
328	5.3	90	296	89
329	5.3	120	296	76
330	5.3	119	295	77
331	5.3	97	295	86
332	5.3	88	295	90
333	5.3	120	295	76
334	5.3	149	295	63
335	5.3	125	295	74
336	5.3	142	295	66
337	5.3	161	295	58
338	5.3	158	295	59
339	5.3	149	295	63
340	5.3	71	293	96
341	5.3	206	400	84
342	5.3	219	400	78
343	5.3	234	400	72
344	5.3	226	400	75
345	5.3	233	400	72
346	5.3	214	400	80
347	5.3	229	400	74
348	5.3	212	400	81
349	5.3	216	400	80
350	5.3	179	400	96
351	5.3	244	400	67
352	5.3	241	400	69
353	5.3	232	400	73
354	5.3	186	293	46
355	5.3	192	293	44
356	5.3	189	293	45
357	5.3	182	293	48
358	5.3	181	293	49
359	5.3	191	293	44
360	5.3	144	293	65
361	5.3	141	293	66
362	5.3	136	293	68
363	5.3	172	293	52
364	5.3	172	293	52
365	5.3	117	322	89
366	5.3	164	293	56
367	5.3	180	293	49
368	5.3	168	293	54
369	5.3	161	293	57
370	5.3	134	293	69
371	5.3	42	235	84
372	5.3	50	235	80
373	5.3	45	235	82
374	5.3	10	235	98
375	5.3	92	235	62
376	5.3	149	359	91
377	5.3	191	358	73
378	5.3	178	360	79
379	5.3	71	235	71
380	5.3	170	294	54
381	5.3	205	294	39
382	5.3	210	294	37
383	5.3	185	294	47
384	5.3	165	295	56
386	5.3	151	293	62
387	5.3	146	293	64
388	5.3	201	294	40
389	5.3	210	294	37
390	5.3	211	294	36
391	5.3	195	294	43
392	5.3	189	294	45
393	5.3	162	294	57
394	5.3	184	294	47
395	5.3	194	294	43
396	5.3	179	293	50
397	5.3	189	294	45
398	5.3	169	293	54
399	5.3	159	293	58
400	5.3	171	293	53
401	5.3	164	293	56
402	5.3	179	293	50
403	5.3	161	293	57
404	5.3	162	293	57
405	5.3	71	235	71
406	5.3	109	293	80
407	5.3	114	293	78
408	5.3	120	293	75
409	5.3	91	235	62
410	5.3	48	235	81
411	5.3	80	235	67
412	5.3	88	235	64

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)	ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)	ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
413	5.3	109	235	55	498	5.3	95	296	87	585	5.3	144	298	67
414	5.3	89	235	63	499	5.3	103	296	84	586	5.3	176	360	80
415	5.3	86	235	65	500	5.3	120	296	76	587	5.3	174	360	80
416	5.3	56	235	78	501	5.3	165	296	57	589	5.3	189	359	74
417	5.3	49	235	81	502	5.3	127	296	73	590	5.3	189	359	74
418	5.3	47	235	82	503	5.3	173	296	53	591	5.3	201	357	68
419	5.3	44	235	83	504	5.3	158	296	60	592	5.3	204	357	66
420	5.3	40	235	85	505	5.3	150	296	63	593	5.3	209	357	64
421	5.3	40	235	85	507	5.3	196	353	68	594	5.3	184	359	76
422	5.3	36	235	86	508	5.3	177	296	52	595	5.3	154	359	89
423	5.3	11	235	97	509	5.3	128	296	73	596	5.3	189	355	72
424	5.3	9	235	98	510	5.3	112	296	80	597	5.3	189	355	72
425	5.3	10	235	98	511	5.3	143	296	66	598	5.3	199	360	70
426	5.3	14	235	96	512	5.3	137	296	69	599	5.3	164	360	85
427	5.3	27	235	90	513	5.3	142	296	67	600	5.3	165	360	85
428	5.3	15	235	95	514	5.3	170	296	55	601	5.3	164	360	85
429	5.3	100	235	59	515	5.3	166	296	56	602	5.3	199	360	70
430	5.3	107	235	56	516	5.3	165	296	57	603	5.3	191	354	71
431	5.3	110	235	54	517	5.3	136	296	69	604	5.3	194	354	69
432	5.3	115	235	52	518	5.3	107	296	82	605	5.3	134	296	70
433	5.3	131	235	45	519	5.3	106	296	82	606	5.3	197	353	68
434	5.3	138	235	42	520	5.3	107	296	82	607	5.3	194	352	68
435	5.3	149	235	37	521	5.3	119	296	77	608	5.3	184	349	71
436	5.3	84	235	65	522	5.3	149	296	64	611	5.3	159	296	59
437	5.3	77	235	68	523	5.3	145	296	66	612	5.3	154	296	61
438	5.3	95	235	61	524	5.3	137	296	69	613	5.3	159	296	59
439	5.3	96	235	60	525	5.3	136	296	69	614	5.3	79	235	68
440	5.3	103	235	57	526	5.3	190	354	71	615	5.3	74	296	96
441	5.3	124	235	48	527	5.3	189	353	71	616	5.3	89	296	90
442	5.3	139	235	42	528	5.3	191	354	71	617	5.3	86	296	91
443	5.3	112	235	53	529	5.3	189	355	72	618	5.3	104	296	83
444	5.3	13	235	96	530	5.3	199	355	67	619	5.3	89	296	90
445	5.3	87	235	64	531	5.3	189	355	72	620	5.3	94	296	88
446	5.3	28	235	90	532	5.3	100	297	85	621	5.3	124	296	75
447	5.3	65	235	74	533	5.3	152	296	63	622	5.3	79	297	94
448	5.3	87	235	64	534	5.3	197	355	68	623	5.3	79	297	94
449	5.3	57	235	77	535	5.3	202	356	67	624	5.3	54	235	78
450	5.3	34	235	87	536	5.3	152	296	63	625	5.3	49	235	81
451	5.3	18	235	94	537	5.3	153	296	62	626	5.3	49	235	81
452	5.3	16	235	95	538	5.3	103	296	84	627	5.3	124	323	86
453	5.3	11	235	97	539	5.3	101	296	85	628	5.3	114	323	90
454	5.3	12	235	97	540	5.3	115	296	79	629	5.3	109	299	82
455	5.3	26	235	91	541	5.3	123	296	75	630	5.3	99	299	87
456	5.3	12	235	97	542	5.3	151	296	63	631	5.3	99	298	86
457	5.3	29	235	89	543	5.3	149	360	91	632	5.3	84	298	93
458	5.3	49	235	81	544	5.3	153	296	62	633	5.3	69	298	99
459	5.3	49	235	81	545	5.3	163	359	85	634	5.3	54	298	106
460	5.3	47	235	81	546	5.3	182	360	77	635	5.3	64	298	101
461	5.3	74	235	70	547	5.3	179	359	78	636	5.3	94	298	88
462	5.3	85	235	65	548	5.3	197	358	70	637	5.3	64	298	101
463	5.3	80	235	67	549	5.3	206	358	66	638	5.3	99	298	86
464	5.3	49	235	81	550	5.3	209	358	65	639	5.3	94	298	88
465	5.3	28	235	90	551	5.3	137	298	70	640	5.3	134	297	71
466	5.3	28	235	90	552	5.3	104	322	94	641	5.3	119	297	77
467	5.3	27	235	90	554	5.3	134	321	81	642	5.3	64	297	101
468	5.3	61	235	75	555	5.3	119	322	88	643	5.3	84	297	92
469	5.3	84	235	65	556	5.3	119	322	88	644	5.3	79	297	94
470	5.3	27	235	90	557	5.3	134	321	81	645	5.3	74	297	96
471	5.3	94	235	61	558	5.3	129	321	83	646	5.3	64	297	101
472	5.3	90	235	63	559	5.3	124	322	86	647	5.3	74	297	96
473	5.3	78	235	68	560	5.3	134	322	81	648	5.3	79	297	94
474	5.3	75	235	69	561	5.3	134	322	82	649	5.3	79	296	94
475	5.3	56	235	78	562	5.3	144	322	77	650	5.3	84	297	92
476	5.3	85	235	65	563	5.3	154	322	73	651	5.3	79	296	94
477	5.3	91	235	62	564	5.3	144	322	77	652	5.3	79	296	94
478	5.3	93	235	62	565	5.3	144	322	77	653	5.3	74	296	96
479	5.3	80	235	67	566	5.3	134	321	81	654	5.3	64	296	101
480	5.3	68	235	73	567	5.3	144	321	77	655	5.3	89	297	90
481	5.3	75	235	69	568	5.3	154	320	72	656	5.3	89	297	90
482	5.3	73	235	70	569	5.3	109	320	91	657	5.3	49	296	107
483	5.3	79	235	68	570	5.3	124	320	85	658	5.3	64	296	101
484	5.3	56	235	78	571	5.3	154	320	72	659	5.3	89	235	63
485	5.3	57	235	77	572	5.3	154	320	72	660	5.3	49	235	81
486	5.3	54	235	78	573	5.3	154	320	72	661	5.3	54	235	78
487	5.3	94	296	88	574	5.3	124	320	85	662	5.3	34	235	87
488	5.3	82	296	93	575	5.3	154	319	72	663	5.3	124	298	75
489	5.3	99	296	86	576	5.3	154	319	72	664	5.3	119	298	78
490	5.3	80	296	94	577	5.3	199	319	52	665	5.3	129	298	73
491	5.3	74	297	96	578	5.3	159	298	60	666	5.3	124	298	75
492	5.3	65	297	101	579	5.3	174	298	54	667	5.3	141	298	68
493	5.3	70	297	98	580	5.3	189	298	47	668	5.3	147	298	65
494	5.3	74	297	96	581	5.3	194	298	45	669	5.3	149	298	64
495	5.3	68	296	99	582	5.3	169	298	56	670	5.3	164	298	58
496	5.3	67	296	99	583	5.3	184	298	50	671	5.3	169	298	56
497	5.3	81	296	93	584	5.3	176	360	80	672	5.3	179	298	51

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
673	5.3	184	298	49
674	5.3	135	298	71
675	5.3	164	298	58
676	5.3	209	298	38
677	5.3	209	298	38
678	5.3	214	298	36
679	5.3	224	298	32
680	5.3	229	298	30
681	5.3	224	298	32
682	5.3	224	298	32
683	5.3	224	298	32
684	5.3	234	298	28
685	5.3	234	298	28
686	5.3	234	298	28
687	5.3	225	431	89
688	5.3	164	298	58
689	5.3	114	298	80
690	5.3	169	298	56
691	5.3	174	298	54
692	5.3	154	298	62
693	5.3	174	298	54
694	5.3	164	298	58
695	5.3	179	298	52
696	5.3	179	298	52
697	5.3	174	298	54
698	5.3	224	400	76
699	5.3	219	400	78
700	5.3	194	400	89
701	5.3	237	400	70
702	5.3	199	400	87
703	5.3	189	400	91
704	5.3	179	400	96
705	5.3	184	400	93
706	5.3	204	400	85
707	5.3	204	294	39
708	5.3	204	294	39
709	5.3	204	294	39
710	5.3	204	294	39
711	5.3	204	294	39
712	5.3	209	294	37
713	5.3	214	400	80
714	5.3	204	400	85
715	5.3	214	400	80
716	5.3	219	400	78
717	5.3	204	400	85
718	5.3	234	296	27
719	5.3	174	293	52
720	5.3	174	293	52
721	5.3	179	293	50
722	5.3	169	293	54
723	5.3	149	293	63
724	5.3	174	293	52
725	5.3	169	293	54
726	5.3	154	293	60
727	5.3	204	294	39
728	5.3	204	294	39
729	5.3	174	294	52
730	5.3	194	294	43
731	5.3	174	294	52
732	5.3	194	294	43
733	5.3	92	235	62
734	5.3	139	296	68
735	5.3	144	297	66
736	5.3	114	297	79
737	5.3	109	297	81
738	5.3	104	297	84
739	5.3	99	297	86
740	5.3	94	297	88
741	5.3	104	297	84
742	5.3	174	298	54
743	5.3	104	297	84
744	5.3	184	298	49
745	5.3	144	297	66
746	5.3	154	298	62
747	5.3	219	400	78
748	5.3	199	294	41
749	5.3	204	294	39
750	5.3	204	294	39
751	5.3	199	294	41
752	5.3	184	294	47
753	5.3	74	235	70
754	5.3	104	235	57
755	5.3	19	235	94
756	5.3	19	235	94
757	5.3	29	235	89

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
758	5.3	34	235	87
759	5.3	24	235	91
760	5.3	24	235	91
761	5.3	34	235	87
762	5.3	29	235	89
763	5.3	29	235	89
764	5.3	39	235	85
765	5.3	14	235	96
766	5.3	24	235	92
767	5.3	40	293	110
768	5.3	104	293	82
769	5.3	84	293	91
770	5.3	114	293	78
771	5.3	119	293	75
772	5.3	134	293	69
773	5.3	174	293	52
774	5.3	124	293	73
775	5.3	139	293	67
776	5.3	184	294	47
777	5.3	154	294	60
778	5.3	134	293	69
779	5.3	144	293	65
780	5.3	184	293	47
781	5.3	194	293	43
782	5.3	194	293	43
783	5.3	134	293	69
784	5.3	164	293	56
785	5.3	164	293	56
786	5.3	194	293	43
787	5.3	174	293	52
788	5.3	174	293	52
789	5.3	169	293	54
790	5.3	154	293	60
791	5.3	134	293	69
792	5.3	109	293	80
793	5.3	109	293	80
794	5.3	96	293	85
795	5.3	94	293	86
796	5.3	104	293	82
797	5.3	114	293	78
798	5.3	129	293	71
799	5.3	129	293	71
800	5.3	159	293	58
801	5.3	144	293	65
802	5.3	154	293	60
803	5.3	164	293	56
804	5.3	204	293	39
805	5.3	204	293	39
806	5.3	192	293	44
808	5.3	129	296	72
809	5.3	94	296	88
810	5.3	74	235	70
811	5.3	74	296	96
812	5.3	67	235	73
813	5.3	60	235	76
814	5.3	172	400	99
815	5.3	179	400	96
816	5.3	56	293	103
817	5.3	179	297	51
818	5.3	242	400	68
819	5.3	237	400	70
820	5.3	204	294	39
823	5.3	210	400	82
824	5.3	211	400	82
836	5.3	189	345	68
837	5.3	204	298	41
838	5.3	99	235	59
839	5.3	169	298	56
840	5.3	199	360	70
841	5.3	164	360	85
842	5.3	24	235	92
843	5.3	214	298	36
844	5.3	225	431	89
845	5.3	247	431	80
846	5.3	248	431	79
847	5.3	224	431	90
848	5.3	105	293	81
849	5.3	229	431	88
850	5.3	244	431	81
851	5.3	248	431	79
852	5.3	248	431	79
853	5.3	224	298	32
854	5.3	224	298	32
855	5.3	224	298	32
856	5.3	224	298	32

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
857	5.3	229	431	88
858	5.3	209	431	96
860	5.3	229	431	88
862	5.3	199	360	70
863	5.3	165	295	56
864	5.3	194	294	43
868	5.3	200	298	42
869	5.3	114	320	89
875	5.3	203	293	39
880	5.3	81	296	93
885	5.3	83	296	92
887	5.3	82	296	93
888	5.3	82	296	93
889	5.3	124	293	73
890	5.3	124	293	73
896	5.3	124	293	73
900	5.3	174	298	54
901	5.3	181	298	51
903	5.3	179	298	52
919	5.3	245	400	67
920	5.3	154	293	60
923	5.3	184	298	49
924	5.3	169	298	56
925	5.3	89	297	90
926	5.3	107	297	82
927	5.3	119	322	88
928	5.3	119	322	88
929	5.3	83	235	66
930	5.3	144	293	65
931	5.3	80	293	92
932	5.3	139	293	67
933	5.3	164	293	56
934	5.3	24	235	92
935	5.3	184	293	47
936	5.3	184	293	47
937	1,000	177	318	61
938	5.3	166	298	57

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
10	5.3	109	289	78
12	5.3	124	289	72
14	5.3	139	289	65
16	5.3	92	289	85
18	5.3	49	235	81
20	5.3	46	235	82
22	5.3	49	235	81
24	5.3	49	235	81
26	5.3	49	235	81
28	5.3	164	321	68
30	5.3	174	321	64
32	5.3	184	321	59
34	5.3	158	321	71
36	5.3	160	321	70
38	5.3	161	321	69
40	5.3	149	321	75
42	5.3	154	321	72
44	5.3	149	321	75
46	5.3	144	321	77
48	5.3	149	321	75
50	5.3	127	321	84
52	5.3	133	321	81
54	5.3	52	235	79
56	5.3	59	235	76
58	5.3	195	368	75
60	5.3	192	367	76
62	5.3	189	367	77
64	5.3	189	367	77
66	5.3	185	367	79
68	5.3	187	367	78
70	5.3	134	368	102
72	5.3	161	368	90
74	5.3	163	368	89
76	5.3	9	235	98
78	5.3	204	321	51
80	5.3	194	321	55
82	5.3	184	321	59
84	5.3	174	321	64
86	5.3	174	321	64
88	5.3	79	298	95
90	5.3	79	298	95
92	5.3	39	235	85
94	5.3	144	321	77
96	5.3	154	321	72
98	5.3	91	294	88
100	5.3	94	294	87
102	5.3	177	321	62
104	5.3	136	296	69
106	5.3	176	353	77
108	5.3	159	295	59
110	5.3	99	297	86
112	5.3	209	357	64
114	5.3	169	368	86
116	5.3	12	235	97
122	5.3	137	298	70
126	5.3	116	357	105
128	775	149	357	90
134	5.3	153	357	88
136	5.3	151	356	89
138	5.3	152	355	88
140	5.3	152	355	88
142	5.3	145	355	91
144	5.3	136	354	95
146	5.3	136	354	94
148	5.3	136	296	69
150	5.3	143	296	66
152	5.3	137	295	69
154	5.3	142	295	67
170	5.3	154	299	63
215	5.3	40	321	122
216	5.3	189	369	78
217	5.3	139	368	99
218	5.3	219	362	62
219	5.3	79	321	105
220	5.3	70	321	109
221	5.3	49	235	81
222	5.3	100	295	85
228	5.3	129	368	104
229	5.3	156	322	72
230	5.3	209	321	49
232	5.3	136	322	81
233	5.3	224	362	60
235	5.3	220	361	61
236	5.3	214	361	64
237	5.3	209	367	68

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
238	5.3	185	367	79
239	5.3	182	366	80
240	5.3	237	361	54
241	5.3	194	361	72
242	5.3	184	361	77
243	5.3	136	296	69
244	5.3	189	355	72
245	5.3	194	352	68
246	5.3	29	235	89
247	5.3	121	290	73
248	5.3	145	290	63
249	5.3	181	290	47
250	5.3	180	297	51
251	5.3	107	297	82
252	5.3	138	300	70
253	5.3	121	300	78
254	5.3	180	368	82
255	5.3	182	367	80
256	5.3	192	367	76
257	5.3	193	367	76
258	5.3	211	368	68
259	5.3	199	368	73
260	5.3	187	297	48
261	5.3	182	297	50
262	5.3	163	297	58
263	5.3	161	297	59
264	5.3	172	297	54
265	5.3	184	367	79
266	5.3	201	367	72
267	5.3	199	367	73
268	5.3	206	368	70
269	5.3	209	368	69
270	5.3	205	368	71
271	5.3	143	298	67
272	5.3	145	298	66
273	5.3	143	298	67
274	5.3	110	298	82
275	5.3	108	298	82
276	5.3	103	297	84
277	5.3	78	296	94
278	5.3	79	296	94
279	5.3	96	297	87
280	5.3	158	297	60
281	5.3	176	297	52
282	5.3	159	297	60
283	5.3	151	297	63
284	5.3	166	297	57
285	5.3	180	297	51
286	5.3	179	297	51
287	5.3	178	366	82
288	5.3	175	366	83
289	5.3	166	366	87
290	5.3	175	366	83
291	5.3	132	298	72
292	5.3	149	298	65
293	5.3	87	297	91
294	5.3	124	298	75
295	5.3	109	296	81
296	5.3	94	296	88
297	5.3	121	297	76
298	5.3	153	297	62
299	5.3	179	366	81
300	5.3	204	363	69
301	5.3	197	364	72
302	5.3	189	364	76
303	5.3	171	365	84
304	5.3	164	365	87
305	5.3	171	365	84
306	5.3	196	364	73
307	5.3	179	364	80
308	5.3	154	299	63
309	5.3	144	296	66
310	5.3	162	296	58
315	5.3	194	361	72
316	5.3	172	361	82
317	5.3	196	361	72
318	5.3	192	361	74
319	5.3	165	361	85
320	5.3	57	296	104
321	5.3	60	296	102
322	5.3	86	296	91
323	5.3	122	296	75
324	5.3	108	296	81
325	5.3	104	295	83
326	5.3	122	295	75

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
327	5.3	93	295	88
328	5.3	90	295	89
329	5.3	120	295	76
330	5.3	119	294	76
331	5.3	97	294	86
332	5.3	88	294	89
333	5.3	120	294	75
334	5.3	149	293	63
335	5.3	125	293	73
336	5.3	142	293	65
337	5.3	161	293	57
338	5.3	158	293	59
339	5.3	149	293	63
340	5.3	71	321	108
341	5.3	206	362	68
342	5.3	219	362	62
343	5.3	234	362	56
344	5.3	226	362	59
345	5.3	233	362	56
346	5.3	214	361	64
347	5.3	229	361	57
348	5.3	212	361	65
349	5.3	216	361	63
350	5.3	179	362	79
351	5.3	244	362	51
352	5.3	241	362	52
353	5.3	232	362	56
354	5.3	186	321	58
355	5.3	192	321	56
356	5.3	189	321	57
357	5.3	182	321	60
358	5.3	181	321	61
359	5.3	191	321	56
360	5.3	144	321	77
361	5.3	141	321	78
362	5.3	136	321	80
363	5.3	172	321	65
364	5.3	172	321	65
365	5.3	117	322	89
366	5.3	164	321	68
367	5.3	180	321	61
368	5.3	168	321	66
369	5.3	161	321	70
370	5.3	134	321	81
371	5.3	42	235	84
372	5.3	50	235	80
373	5.3	45	235	82
374	5.3	10	235	98
375	5.3	92	235	62
376	5.3	149	358	90
377	5.3	191	357	72
378	5.3	178	358	78
379	5.3	71	235	71
380	5.3	170	291	53
381	5.3	205	361	68
382	5.3	210	361	65
383	5.3	185	361	76
384	5.3	165	361	85
386	5.3	151	322	74
387	5.3	146	322	76
388	5.3	201	360	69
389	5.3	210	361	65
390	5.3	211	361	65
391	5.3	195	289	41
392	5.3	189	289	43
393	5.3	162	289	55
394	5.3	184	289	46
395	5.3	194	289	41
396	5.3	179	289	48
397	5.3	189	289	43
398	5.3	169	289	52
399	5.3	159	289	56
400	5.3	171	289	51
401	5.3	164	289	54
402	5.3	179	289	48
403	5.3	161	289	56
404	5.3	162	289	55
405	5.3	71	235	71
406	5.3	109	321	92
407	5.3	114	321	90
408	5.3	120	321	87
409	5.3	91	235	62
410	5.3	48	235	81
411	5.3	80	235	67
412	5.3	88	235	64

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
413	5.3	109	235	55
414	5.3	89	235	63
415	5.3	86	235	65
416	5.3	56	235	78
417	5.3	49	235	81
418	5.3	47	235	82
419	5.3	44	235	83
420	5.3	40	235	85
421	5.3	40	235	85
422	5.3	36	235	86
423	5.3	11	235	97
424	5.3	9	235	98
425	5.3	10	235	98
426	5.3	14	235	96
427	5.3	27	235	90
428	5.3	15	235	95
429	5.3	100	235	59
430	5.3	107	235	56
431	5.3	110	235	54
432	5.3	115	235	52
433	5.3	131	235	45
434	5.3	138	235	42
435	5.3	149	235	37
436	5.3	84	235	65
437	5.3	77	235	68
438	5.3	95	235	61
439	5.3	96	235	60
440	5.3	103	235	57
441	5.3	124	235	48
442	5.3	139	235	42
443	5.3	112	235	53
444	5.3	13	235	96
445	5.3	87	235	64
446	5.3	28	235	90
447	5.3	65	235	74
448	5.3	87	235	64
449	5.3	57	235	77
450	5.3	34	235	87
451	5.3	18	235	94
452	5.3	16	235	95
453	5.3	11	235	97
454	5.3	12	235	97
455	5.3	26	235	91
456	5.3	12	235	97
457	5.3	29	235	89
458	5.3	49	235	81
459	5.3	49	235	81
460	5.3	47	235	81
461	5.3	74	235	70
462	5.3	85	235	65
463	5.3	80	235	67
464	5.3	49	235	81
465	5.3	28	235	90
466	5.3	28	235	90
467	5.3	27	235	90
468	5.3	61	235	75
469	5.3	84	235	65
470	5.3	27	235	90
471	5.3	94	235	61
472	5.3	90	235	63
473	5.3	78	235	68
474	5.3	75	235	69
475	5.3	56	235	78
476	5.3	85	235	65
477	5.3	91	235	62
478	5.3	93	235	62
479	5.3	80	235	67
480	5.3	68	235	73
481	5.3	75	235	69
482	5.3	73	235	70
483	5.3	79	235	68
484	5.3	56	235	78
485	5.3	57	235	77
486	5.3	54	235	78
487	5.3	94	296	88
488	5.3	82	296	93
489	5.3	99	296	85
490	5.3	80	296	94
491	5.3	74	296	96
492	5.3	65	296	100
493	5.3	70	296	98
494	5.3	74	296	96
495	5.3	68	296	99
496	5.3	67	296	99
497	5.3	81	296	93

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
498	5.3	95	296	87
499	5.3	103	296	84
500	5.3	120	296	76
501	5.3	165	296	57
502	5.3	127	296	73
503	5.3	173	295	53
504	5.3	158	295	60
505	5.3	150	295	63
507	5.3	196	353	68
508	5.3	177	295	51
509	5.3	128	295	73
510	5.3	112	296	80
511	5.3	143	296	66
512	5.3	137	295	69
513	5.3	142	295	67
514	5.3	170	295	54
515	5.3	166	295	56
516	5.3	165	296	57
517	5.3	136	296	69
518	5.3	107	296	82
519	5.3	106	296	82
520	5.3	107	296	82
521	5.3	119	296	77
522	5.3	149	296	64
523	5.3	145	296	65
524	5.3	137	296	69
525	5.3	136	296	69
526	5.3	190	354	71
527	5.3	189	353	71
528	5.3	191	355	71
529	5.3	189	355	72
530	5.3	199	355	68
531	5.3	189	355	72
532	5.3	100	296	85
533	5.3	152	296	62
534	5.3	197	355	69
535	5.3	202	356	67
536	5.3	152	296	62
537	5.3	153	296	62
538	5.3	103	296	84
539	5.3	101	296	85
540	5.3	115	296	78
541	5.3	123	296	75
542	5.3	151	296	63
543	5.3	149	358	91
544	5.3	153	296	62
545	5.3	163	358	84
546	5.3	182	358	76
547	5.3	179	358	77
548	5.3	197	357	70
549	5.3	206	357	66
550	5.3	209	357	64
551	5.3	137	298	70
552	5.3	104	322	94
554	5.3	134	322	81
555	5.3	119	322	88
556	5.3	119	322	88
557	5.3	134	322	81
558	5.3	129	322	84
559	5.3	124	322	86
560	5.3	134	322	82
561	5.3	134	322	82
562	5.3	144	322	77
563	5.3	154	322	73
564	5.3	144	322	77
565	5.3	144	322	77
566	5.3	134	322	81
567	5.3	144	322	77
568	5.3	154	322	73
569	5.3	109	322	92
570	5.3	124	322	86
571	5.3	154	322	73
572	5.3	154	322	73
573	5.3	154	322	73
574	5.3	124	322	86
575	5.3	154	321	73
576	5.3	154	321	72
577	5.3	199	321	53
578	5.3	159	298	60
579	5.3	174	298	54
580	5.3	189	298	47
581	5.3	194	298	45
582	5.3	169	298	56
583	5.3	184	298	49
584	5.3	176	359	79

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
585	5.3	144	298	67
586	5.3	176	359	79
587	5.3	174	358	80
589	5.3	189	358	73
590	5.3	189	358	73
591	5.3	201	357	67
592	5.3	204	357	66
593	5.3	209	357	64
594	5.3	184	358	75
595	5.3	154	358	88
596	5.3	189	355	72
597	5.3	189	355	72
598	5.3	199	359	69
599	5.3	164	359	84
600	5.3	165	359	84
601	5.3	164	359	84
602	5.3	199	359	69
603	5.3	191	355	71
604	5.3	194	355	70
605	5.3	134	296	70
606	5.3	197	353	68
607	5.3	194	352	68
608	5.3	184	349	71
611	5.3	159	295	59
612	5.3	154	295	61
613	5.3	159	295	59
614	5.3	79	235	68
615	5.3	74	296	96
616	5.3	89	296	90
617	5.3	86	296	91
618	5.3	104	296	83
619	5.3	89	296	90
620	5.3	94	296	87
621	5.3	124	296	74
622	5.3	79	296	94
623	5.3	79	296	94
624	5.3	54	235	78
625	5.3	49	235	81
626	5.3	49	235	81
627	5.3	124	322	86
628	5.3	114	322	90
629	5.3	109	299	82
630	5.3	99	299	87
631	5.3	99	298	86
632	5.3	84	298	93
633	5.3	69	298	99
634	5.3	54	298	106
635	5.3	64	298	101
636	5.3	94	297	88
637	5.3	64	298	101
638	5.3	99	298	86
639	5.3	94	298	88
640	5.3	134	297	70
641	5.3	119	297	77
642	5.3	64	296	101
643	5.3	84	296	92
644	5.3	79	296	94
645	5.3	74	296	96
646	5.3	64	296	101
647	5.3	74	296	96
648	5.3	79	296	94
649	5.3	79	296	94
650	5.3	84	296	92
651	5.3	79	296	94
652	5.3	79	296	94
653	5.3	74	296	96
654	5.3	64	296	101
655	5.3	89	296	90
656	5.3	89	296	90
657	5.3	49	296	107
658	5.3	64	296	100
659	5.3	89	235	63
660	5.3	49	235	81
661	5.3	54	235	78
662	5.3	34	235	87
663	5.3	124	298	75
664	5.3	119	298	78
665	5.3	129	298	73
666	5.3	124	298	75
667	5.3	141	298	68
668	5.3	147	298	65
669	5.3	149	298	65
670	5.3	164	298	58
671	5.3	169	298	56
672	5.3	179	298	52

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
673	5.3	184	298	49
674	5.3	135	298	71
675	5.3	164	298	58
676	5.3	209	368	69
677	5.3	209	368	69
678	5.3	214	368	67
679	5.3	224	368	62
680	5.3	229	368	60
681	5.3	224	368	62
682	5.3	224	368	62
683	5.3	224	368	62
684	5.3	234	368	58
685	5.3	234	368	58
686	5.3	234	368	58
687	5.3	225	368	62
688	5.3	164	368	89
689	5.3	114	368	110
690	5.3	169	368	86
691	5.3	174	368	84
692	5.3	154	368	93
693	5.3	174	368	84
694	5.3	164	368	88
695	5.3	179	367	82
696	5.3	179	367	82
697	5.3	174	366	83
698	5.3	224	362	60
699	5.3	219	362	62
700	5.3	194	362	73
701	5.3	237	361	54
702	5.3	199	362	71
703	5.3	189	362	75
704	5.3	179	362	79
705	5.3	184	362	77
706	5.3	204	362	69
707	5.3	204	360	68
708	5.3	204	360	68
709	5.3	204	360	68
710	5.3	204	360	68
711	5.3	204	360	68
712	5.3	209	360	66
713	5.3	214	361	64
714	5.3	204	361	68
715	5.3	214	361	64
716	5.3	219	361	62
717	5.3	204	361	68
718	5.3	234	361	55
719	5.3	174	322	64
720	5.3	174	322	64
721	5.3	179	322	62
722	5.3	169	322	66
723	5.3	149	322	75
724	5.3	174	322	64
725	5.3	169	322	66
726	5.3	154	322	73
727	5.3	204	361	68
728	5.3	204	361	68
729	5.3	174	290	50
730	5.3	194	290	42
731	5.3	174	290	50
732	5.3	194	290	41
733	5.3	92	235	62
734	5.3	139	294	67
735	5.3	144	297	66
736	5.3	114	296	79
737	5.3	109	296	81
738	5.3	104	296	83
739	5.3	99	296	85
740	5.3	94	296	88
741	5.3	104	296	83
742	5.3	174	365	83
743	5.3	104	297	83
744	5.3	184	367	79
745	5.3	144	297	66
746	5.3	154	297	62
747	5.3	219	361	62
748	5.3	199	360	70
749	5.3	204	360	68
750	5.3	204	360	68
751	5.3	199	360	70
752	5.3	184	360	76
753	5.3	74	235	70
754	5.3	104	235	57
755	5.3	19	235	94
756	5.3	19	235	94
757	5.3	29	235	89

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
758	5.3	34	235	87
759	5.3	24	235	92
760	5.3	24	235	92
761	5.3	34	235	87
762	5.3	29	235	89
763	5.3	29	235	89
764	5.3	39	235	85
765	5.3	14	235	96
766	5.3	24	235	92
767	5.3	40	321	122
768	5.3	104	321	94
769	5.3	84	321	103
770	5.3	114	321	90
771	5.3	119	321	88
772	5.3	134	321	81
773	5.3	174	321	64
774	5.3	124	321	85
775	5.3	139	321	79
776	5.3	184	289	46
777	5.3	154	359	89
778	5.3	134	322	81
779	5.3	144	321	77
780	5.3	184	321	59
781	5.3	194	321	55
782	5.3	194	321	55
783	5.3	134	321	81
784	5.3	164	321	68
785	5.3	164	321	68
786	5.3	194	321	55
787	5.3	174	321	64
788	5.3	174	321	64
789	5.3	169	321	66
790	5.3	154	321	72
791	5.3	134	321	81
792	5.3	109	321	92
793	5.3	109	321	92
794	5.3	96	321	98
795	5.3	94	321	98
796	5.3	104	321	94
797	5.3	114	321	90
798	5.3	129	321	83
799	5.3	129	321	83
800	5.3	159	321	70
801	5.3	144	321	77
802	5.3	154	321	72
803	5.3	164	321	68
804	5.3	204	321	51
805	5.3	204	321	51
806	5.3	192	321	56
808	5.3	129	295	72
809	5.3	94	296	87
810	5.3	74	235	70
811	5.3	74	296	96
812	5.3	67	235	73
813	5.3	60	235	76
814	5.3	172	361	82
815	5.3	179	361	79
816	5.3	56	290	101
817	5.3	179	296	51
818	5.3	242	362	52
819	5.3	237	362	54
820	5.3	204	360	68
823	5.3	210	361	66
824	5.3	211	361	65
836	5.3	189	345	68
837	5.3	204	368	71
838	5.3	99	235	59
839	5.3	169	298	56
840	5.3	199	359	69
841	5.3	164	359	84
842	5.3	24	235	92
843	5.3	214	368	67
844	5.3	225	368	62
845	5.3	247	368	52
846	5.3	248	368	52
847	5.3	224	368	62
848	5.3	105	321	94
849	5.3	229	368	60
850	5.3	244	368	54
851	5.3	248	368	52
852	5.3	248	368	52
853	5.3	224	368	62
854	5.3	224	368	62
855	5.3	224	368	62
856	5.3	224	368	62

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
857	5.3	229	368	60
858	5.3	209	368	69
860	5.3	229	368	60
862	5.3	199	359	69
863	5.3	165	361	85
864	5.3	194	289	41
868	5.3	200	368	73
869	5.3	114	322	90
875	5.3	203	321	51
880	5.3	81	296	93
885	5.3	83	296	92
887	5.3	82	296	93
888	5.3	82	296	93
889	5.3	124	321	85
890	5.3	124	321	85
896	5.3	124	321	85
900	5.3	174	365	83
901	5.3	181	366	80
903	5.3	179	366	81
919	5.3	245	362	51
920	5.3	154	322	73
923	5.3	184	367	79
924	5.3	169	366	85
925	5.3	89	296	90
926	5.3	107	297	82
927	5.3	119	322	88
928	5.3	119	322	88
929	5.3	83	235	66
930	5.3	144	321	77
931	5.3	80	321	104
932	5.3	139	321	79
933	5.3	164	321	68
934	5.3	24	235	92
935	5.3	184	321	59
936	5.3	184	321	59
937	1,000	177	324	64
938	5.3	166	297	57

APPENDIX P

WATER CONSERVATION PROGRAM

City of Oak Harbor
WATER CONSERVATION PLAN

Vision

We will be recognized for providing efficient, economical and individualized customer service, while maintaining water utilities to provide a safe, abundant water supply at the lowest possible cost to our water customers through effective management of resources and purchasing procedures.

Mission Statement

The Mission of the Water Division is first and foremost to provide safe, uninterrupted, quality water to all of our customers. We will strive to have a trusting, positive, alliance with our customers so they feel confident with our program.

Conservation

- Efficient water use.
- Protection of water as a valuable resource.
- Reduction in per capita consumption.
- Meeting utility growth requirements.
- Sufficient water for current and future customers.
- A regional approach to water quality and conservation.

Making more efficient use of existing water resources through conservation has proven to be economical and an environmentally responsible way to meet our growing demand for water, thanks to wise water use by our customers and our conservation programs.

This Long Range Conservation Plan is our strategy for continuing to manage and protect water resources for our service area. The City of Oak Harbor is committed to aggressively pursuing conservation, both as stewards of a valuable and limited natural resource and as the most readily available and least costly water resource for the next several years. Conserving our water supply also has wider environmental impacts, since the Skagit River provides a critical fish and wildlife habitat. The Skagit is the largest river basin draining into Puget Sound.

This Conservation Plan represents our vision and mission. We have included conservation adjustments to rate structure, plumbing code changes and education programs. In addition, we will be researching and testing new technologies and new programs, with the goal of implementing those that prove to be worthwhile.

We believe this plan outlines an efficient, financially sound, and practical approach to conserving water. Water conservation helps us manage our system in an environmentally sustainable way and makes good business sense in an era of limited resources.

Currently, the City of Oak Harbor owns and operates the primary water supply system for a region that encompasses a population of nearly 16,698 people and is served directly by the City of Oak Harbor Water Division. Water from the Anacortes Water Treatment Plant is pumped through 24 inch and 10 inch diameter transmission lines to the City of Oak Harbor. The water passes through a booster pump station where fluoride is added. By the time the water reaches you, the customer, it has traveled through approximately 82 miles of water mains. In addition to supplying residential and commercial customers, the City also supplies water to Naval Air Station Whidbey Island, Deception Pass State Park and North Whidbey Water District.

The City has three reservoirs capable of storing three million gallons of water. We also maintain three deep wells in the City that are used as an emergency source or when Anacortes WTP cannot supply water to the City. There are also two inter-tie connections with the NAS Whidbey water system, providing the City access to additional water that could be shared if an emergency were to occur. The City of Oak Harbor, as a water purveyor, is required to meet State and Federal water quality standards.

A Water Conservation Plan is composed of water conservation methods that the public water system implements in order to reduce water demand. These activities need to be adjusted to suit the needs of the water system and the customers they serve.

Conservation methods can be divided into two categories: internal and external. Internal measures are activities that are undertaken by the water system, such as leak detection and repairs. External measures are developed by the water system, but rely directly on the involvement of the public. External measures require the public to take action to reduce their water use.

External measures can be further divided into substantive measures and delivery measures. Substantive measures result in a reduction in water demand. Delivery measures are the means used to inform the public about these substantive measures and create public awareness about water conservation. There will often be overlap among these categories, and some measures could fit into any category. For example, residential water audits could include the installation of water saving devices, which will result in reduced demand, in addition to presenting customers with information on other conservation measures.

INTERNAL MEASURES

1. Require Meters: The installation of individual service meters and master source meters for all water use, including public facilities, is required. All water systems have master source meters or individual service meters in order to collect accurate water use data for planning. All new service meters are sized based on the 1997 Addition Uniform Plumbing Code published by IAPMO. The City has 4,400 water meters. The Water Division routinely replaces service meters that show signs of inaccuracy and failure, replacing approximately 10% per year. In addition, the City has a meter testing and repair program. Approximately 250 service meters were replaced in 2000. Approximately 450 service meters per year are scheduled for replacement in 2001 and 2002. The City has six hydrant meters and three water stations to account for water system flushing and past-unmetered consumption. Meters are essential for the implementation of other measures, such as leak detection, showing consumption history on customer's bills, customer audits and curtailment.

2. Water bill showing consumption history: The utility bill shows the increase or decrease in water use compared to the same period in the previous year. This allows customers to track their own conservation progress and allows the utility to monitor reductions and increases in per capita use.

3. Rate setting to encourage conservation: The City of Oak Harbor has historically used an inverted block water rate structure. In March 1998 the City changed to a meter charge with a flat rate based on consumption to encourage economic incentive to conserve water.

4. Unaccounted for water/leak detection: The amount of water lost through the delivery system is calculated bi-monthly. A system audit compares the amount of water taken from a system's source of supply to the amount of water sold. If more water is supplied by the system than is sold by the system, leaks, unmetered uses, and/or meter malfunctions are occurring. The City of Oak Harbor Water Division conducts a regular and systematic program of locating and repairing leaks in system mains, testing and repairing meters. All five of our source meters are read on the first working day of each month. The City uses the historical data gathered from these readings to calculate the average day, peak day and overall peak water demands. In support of future water audits, the City is continuing its meter replacement program that will ensure high reliability and accuracy of mainline meter readings. Our water loss for 2000 was approximately 2.1 percent.

EXTERNAL MEASURES – SUBSTANTIVE

1. Large-scale irrigation: Public systems could require or encourage the application of current technology to water use practices of large urban irrigation operations such as nurseries and parks. Drought resist plants, moisture sensors, flow timers, low volume sprinklers, drip irrigation and other practices to increase irrigation efficiency could be installed.

2. Recycle/Reuse: Recycling is the use of the same water for the same purpose, such as industrial cooling process. Public water system and industrial/manufacturing should examine water reuse and recycling in an approach to reducing water demands.

3. Single family/multi family retrofit kits: Public water systems can distribute kits containing inexpensive, easily installed water saving devices to single family residential homes and owners or managers of apartment buildings and condominiums. Kits can include:

   - Toilet dams, bags or bottles that displace water in the toilet tank to reduce the amount of water used per flush.
   - Flushing devices for use on standard gravity-flush toilets that give the customer the option of low water consumption flush.
   - Toilet tank leak detection dye tablets.
   - Showerhead flow restrictors or low flow showerheads that reduce the amount of water that flows through the showerhead.
   - Faucet aerators that mix air into the flow of water, thereby directing and reducing the flow.
   - Water conservation literature for education.

   Kits are purchased by the City of Oak Harbor and distributed to the public for free or at a nominal cost. These items, along with other conservation products, can be purchased by the customer at most local hardware stores.

CUSTOMER ASSISTANCE

The City provides limited leak detection assistance to its customers, both from the City Utilities Office and from the Water Division in the field. Free dye tablets are available to customers to check for toilet tank leaks, as are copies of a step-by step checklist that customers can follow to determine if they have a leak in their service line or plumbing. This service has been available since 1995.

PROGRAM PROMOTION

City of Oak Harbor Water Division may find it necessary to promote the general concept of water conservation and the reason to pursue water conservation to their customers first before promoting individual conservation measures. The Water Division publicizes the need for conservation through local television channel 10, radio public service announcements, newspaper articles, City web page, door hangers, public signage, billing inserts and speaking engagements at schools, clubs, and organizations.

Informing customers that by pursuing conservation activities that will result in permanent reduction in water use, such as converting lawns to low water landscapes or changing from inefficient plumbing fixtures to efficient ones, can save the additional costs in the form of higher rates incurred from obtaining new supplies or facility expansion to meet demands.

EMPLOYEE OUTREACH

One aspect of customer assistance and program promotion is training all water system employees about water conservation so that they will be prepared to perform public outreach. Water system employees are in contact with the public every day. Public outreach can be part of their job. Everyone who works for a water system should know about the conservation measures the Water Division is promoting and should be able to share information and water conservation strategies to our customers.

RESOLUTION NO. 2001-08

RESOLUTION OUTLINING THE CITY OF OAK HARBOR'S WATER SHORTAGE RESPONSE PLAN

BE IT RESOLVED by the City Council of the City of Oak Harbor as follows:

INDEX

Section One. **Non-essential water uses.** Water uses regulated or prohibited under this article (hereinafter referred to as the "Water Shortage Plan" or the "Plan") are considered to be non-essential and continuation of such uses during times of water shortage or other emergency water supply conditions are deemed to constitute a waste of water which subjects the offender(s) to penalties as defined in this Plan.

Section Two. **Public education and notification.**

(1) City will provide public notification. The City, by and through its Department of Public Works, shall periodically provide the public with information about the Plan, including information about the conditions under which each stage of the Plan is to be initiated or terminated, and the drought response measures to be implemented in each stage.

(2) Drought conditions - Responses requiring notification. When drought contingency measures appear to be necessary, the public will be notified through available news media, and additional information on water conservation methods will be distributed. In the event that a trigger condition is reached, the public will be kept fully informed of the status of the drought condition through all available media.

(3) Trigger conditions requiring notification. When a trigger condition has been reached and the City of Anacortes Water Department informs the City of Oak Harbor that drought contingency measures may be necessary, the Mayor or his/her designee will order the initiation of a public notification process. The public notification process will include, but is not limited to the following:

(a) A notice of drought condition will be posted at City Hall, the Post Office, and the Library.

(b) The notice will be circulated to local newspapers and radio stations via Public Service Announcement.

(c) Information regarding the contingency measures for the drought condition will be mailed to all water customers by means of utility bill inserts or door-to-door and posted on the City's web page.

(4) When temporary emergency water shortage, due to major water system component failure or supply source contamination, measures appear to be necessary the public will be notified through available media and/or door-to-door as deemed appropriate by the Mayor or his/her designee.

Section Three. **Authorization.** The Mayor, or his/her designee, is hereby authorized and directed to implement the applicable provisions of the Plan upon determination that such implementation is necessary to protect public health, safety, and welfare. The Mayor or his/her designee shall have the authority to initiate or terminate drought or other water supply emergency response measures as described in this Plan.

Section Four. **Application**. The provisions of this Plan shall apply to all persons, customers, and property using water provided by the City of Oak Harbor. The terms "person" and "customer" as used in the Plan include individuals, corporations, partnerships, associations, and all other legal entities including the U.S. Navy, North Whidbey Water District and Deception Pass State Park.

Section Five. **Definitions**. For the purposes of this Plan, the following definitions shall apply:

(1) *Aesthetic water use* means water use for ornamental or decorative purposes such as fountains, reflecting pools, and water gardens.

(2) *Commercial and institutional water use* means water use, which is integral to the operations of commercial and non-profit establishments and governmental entities such as retail establishments, hotels and motels, restaurants, and office buildings.

(3) *Conservation* means those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water or increase the recycling and reuse of water so that a supply is conserved and made available for future or alternative uses.

(4) *Customer* means any person, company, or organization using water supplied by the City of Oak Harbor.

(5) *Domestic water use* means water use for personal needs or for household or sanitary purposes such as drinking, bathing, heating, cooking, sanitation, or for cleaning a residence, business, industry, or institution.

(6) *Even number address* means street addresses ending in 0, 2, 4, 6, or 8, and locations without addresses.

(7) *Odd numbered address* means street addresses ending in 1, 3, 5, 7, or 9.

(8) *Industrial water use* means the use of water in processes designed to convert materials of lower value into forms having greater usability and value.

(9) *Landscape irrigation use* means water used for the irrigation and maintenance of landscaped areas, whether publicly or privately owned, including residential and commercial lawns, gardens, golf courses, parks, and rights-of-way and medians.

(10) *Non-essential water use* means water uses that are not essential nor required for the protection of public, health, safety, and welfare, including:

(a) Irrigation of landscape areas, including parks, athletic fields, and golf courses, except as otherwise provided under this Plan.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle.

(c) Use of water to wash down any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas.

(d) Use of water to wash down buildings or structures for purposes other than immediate fire protection.

(e) Flushing gutters or permitting water to run or accumulate in any gutter or street.

(f) Use of water to fill, refill, or add to any indoor or outdoor swimming pools or Jacuzzi-type pools.

(g) Use of water in a fountain or pond for aesthetic or scenic purposes except where necessary to support aquatic life.

(h) Failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s).

(i) Use of water from hydrants for construction purposes or any other purposes other than fire fighting.

Section Six. Triggering criteria for initiation and termination of drought response stages.
The City of Oak Harbor purchases 99.8 percent of its potable water from the City of Anacortes. Availability of water from the City of Anacortes is based on the height of the Skagit River at the water treatment plant. Therefore, the emergency water management triggering measures will be the same as those of the City of Anacortes. Also, triggering criteria may be initiated as a result of short-term deficiencies and/or emergencies specific to the City of Oak Harbor.
The following are the triggering criteria for initiation and termination of drought response stages:

(1) **Stage 1: Water Treatment Plant Capacity Reduction *(Potential for Future Drought Conditions Exist)*.** A Stage 1 drought response will be implemented when there is a potential for future drought conditions due to a reduction in the water treatment plant capacity or in the water source capacity.

(a) Triggering Criteria. River height flow less than 10 feet and 10400 cubic feet per second (cfs) and above 9 feet and 8050 cubic feet per second (cfs); the raw water conditions are such that the treatment plant is unable to produce water of high quality.

(b) Response.

(i) Install conservation condition signs.

(ii) Accelerate public information efforts to teach and encourage reduced water use.

(iii) Request voluntary conservation action by customers.

(iv) Notify major water users and work with them to achieve voluntary water use reduction.

(v) Request a reduction in landscape watering by City government.

(c) Termination Criteria. All initiated actions will remain in effect until the conditions that triggered Stage 1 have been alleviated.

(2) **Stage 2: Limited Supply Capacity *(Drought is Highly Likely in the Immediate Future)*.** A Stage 2 drought response will be implemented when drought conditions are highly likely in the immediate future due to a reduction in the water source capacity, the quality of the water source has been diminished, or there are other limitations on the ability of the treatment plan to produce high quality water.

(a) Triggering Criteria. River height flow less than 9 feet and 8050 cfs and above 8 feet and 5760 cfs; the raw water conditions are such that the treatment plant is unable to produce water of high quality; the raw water source level is reduced, requiring the plant flow to be reduced; or structural/operational problems within the treatment plant requiring flow reduction.

(b) Response.

(i) Install conservation condition signs.

(ii) Start aggressive public information efforts regarding water supply conditions and conservation efforts. Efforts will include but not be limited to providing water conservation literature to the public.

(iii) Cease all flushing and flow testing of pipes.

(iv) Reduce irrigation of all City parks, greenbelts and facility landscaping.

(v) Cease all "wet" fire drills.

(vi) Request voluntary restriction of hosing off of paved areas, sidewalks, buildings or windows; operation of ornamental fountains, draining of swimming pools followed by refilling, washing or rinsing of vehicles by hose without a shutoff valve, using water in such a manner as to allow runoff or other water waste.

(vii) Mandatory restrictions on landscape watering for commercial and residential and government services bearing odd numbered addresses to water on odd numbered days and even numbered addresses to water on even numbered days. Where there are no numbers, a number will be assigned and/or watering will be conducted on even numbered days.

(viii) Allow watering between 8:00 p.m. and 9:00 a.m. Prohibit watering outside these hours.

(d) Enforcement. Violations of restrictions will result in a warning, and then a citation may be issued with a fine not to exceed $250.00 per incident as per ordinance.

(e) Termination Criteria. All initiated actions will remain in effect until the conditions that triggered Stage 2 have been alleviated.

(3) **Stage 3: Severe/Critical Water Supply Shortage** ***(Drought Condition Emergency Exists).*** A Stage 3 drought response will be implemented when a drought condition emergency exists due to a severe reduction in the water source or quality of the water source or in the event of catastrophic damage to the treatment plant.

(a) Triggering Criteria. River level below 8 feet or 5760 cfs; the raw water source is extremely poor; or catastrophic damage (earthquake, flood etc.) has occurred.

(b) Response.

(i) The City shall take all measures necessary to reduce water consumption and use and obtain additional water supplies from surrounding purveyors to the extent possible.

(ii) Cease all municipal park irrigation.

(iii) Prohibit all residential, commercial and government lawn watering.

(iv) Eliminate all flushing and flow testing of pipes except to protect public health.

(v) Notify Oak Harbor School District to cease irrigation of school property and playgrounds immediately.

(vi) Eliminate water service to all public restrooms and non-essential facilities.

(vii) Mandatory curtailment of all non-essential water use.

(viii) Establish customer categories for water allocation.

(ix) Require commercial and residential water users to reduce water consumption by a percentage.

(x) Impose mandatory maximum water rationing for different customer categories.

(xi) Coordinate with law enforcement officials and City crews for enforcing mandatory water restrictions.

(xii) Notify the public of the seriousness of the situation. Public notification will include both mass media and/or door-to-door. Notification will inform customers of their customer class, rationed water consumption, enforcement measures and effective means of reducing water usage.

(c) Enforcement. Violations of restrictions will result in a warning, and then a citation may be issued with a fine not to exceed $250.00 per incident as per ordinance.

(d) Termination Criteria. All initiated actions will remain in effect until the conditions that triggered Stage 3 have been alleviated.

(4) **Stage 4: Temporary Emergency Water Shortage**. A Stage 4 drought response will be implemented when there is a temporary water shortage due to failure of the water distribution system or there are supply contamination concerns that require special precautions.

(a) System outage due to major water system components failure.

(i) Triggering Criteria. System outage or restrictions due to major water system components failure in the City's transmission/distribution system.

(ii) Response.

(A) Initiate or continue implementation of appropriate restrictions from previous conditions as directed by the Mayor or his/her designee.

(B) Affected commercial and residential water users will be required to reduce water consumption by a percentage determined by the Mayor or his/her designee.

(b) Supply source contamination special precautions.

(i) Triggering Criteria. Water system contamination caused by low distribution pressures (below 20 psi), repeated unacceptable microbiological samples, or failure to maintain adequate chlorine residuals. In the event of such contamination, the affected area shall be isolated from the distribution system immediately and special precautions shall be taken in accordance with Washington State Board of Health Drinking Water Regulations (WAC 246-290).

(ii) Response.

(A) Water customers in the affected area shall be notified immediately with a "Boil Water Notice" and a letter explaining the situation and containing recommendations to the water customer regarding the use of bottled water. Hand deliver "Boil Water Notices" to all water customers affected.

(B) Prohibit all water usage for human consumption in the affected area for 24 to 36 hours, as determined by the Mayor or his/her designee.

(c) Enforcement. Violations of restrictions will result in a warning, and then a citation may be issued with a fine not to exceed $250.00 per incident as per ordinance.

(d) Termination Criteria. All initiated actions will remain in effect until the conditions that triggered Stage 4 have been alleviated. If Stage 4 is initiated because of water supply contamination, all initiated actions will remain in effect until the Mayor or his/her designee determines that conditions exist which will allow removal of Stage 4 actions.

Section Seven. Variances.

(1) The Mayor or his/her designee may, in writing, grant temporary variances for existing water uses otherwise prohibited under this Plan if it is determined that failure to grant such a variance would cause an emergency condition adversely affecting the health, sanitation, or fire protection for the public or the person requesting such variance, and if one or more of the following conditions are met:

(a) Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect.

(b) Alternative methods can be implemented which will achieve the same level of reduction in water use.

(2) Persons requesting an exemption from the provisions of this article shall file a petition for a variance with the City within 5 days after the Plan or a particular drought response stage has been invoked. All petitions for variances shall be reviewed by the Mayor, or his/her designee, and shall include the following:

(a) Name and address of the petitioner(s).

(b) Purpose of water use.

(c) Specific provision(s) of the Plan from which the petitioner is requesting relief.

(d) Detailed statement as to how the specific provision of the Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this article.

(e) Description of the relief requested.

(f) Period of time for which the variance is sought.

(g) Alternative water use restrictions or other measures the petitioner is taking or proposes to take to meet the intent of this Plan and the compliance date.

(h) Other pertinent information as may be required by the Mayor or his/her designee.

(3) Variances granted by the Mayor or his/her designee shall be subject to the following conditions, unless waived or modified by the Mayor or his/her designee:

(a) Variances granted shall include a timetable for compliance.

(b) Variances granted shall expire when the Plan is no longer in effect, unless the petitioner has failed to meet specified requirements.

(c) No variance shall be retroactive or otherwise justify any violation of the Plan occurring prior to the issuance of the variance.

Section Eight. Notification.

(1) Public Works Superintendent's Duty. The Public Works Superintendent shall notify the Mayor if any of the water shortage response stages are implemented. Notification by telephone is adequate to provide immediate information about the shortage, however a formal notification by memorandum is required. The information in the notification shall include:

(a) Nature and extent of the water shortage.

(b) Identification of the stage of response.

(c) Proposed or initiated conservation measures.

(d) Corrective measures being taken.

(e) Expected duration of the water shortage.

(2) Notice requirements. Public notification of a water shortage, by mass media and/or door-to-door, will be essential and shall include the seriousness of the situation and the necessary conservation measures that must be taken. It will also include their customer class, rationed water consumption, enforcement measures and effective means of reducing water usage.

(3) Notification mediums.

(a) Mass Media. Television and radio broadcasting stations, newspapers, paid advertisements, public service announcements, and City web page. (A listing of all local television and radio broadcasting and newspaper publishers is provided in Table 1.)

(b) Material Distribution. Direct mailing of newsletters and conservation brochures, and/or an area-wide distribution of conservation brochures, posters, and other printed material.

(c) Customer Contact. Direct contact of consumers, especially large water users, to coordinate water conservation.

(d) Interdepartmental Coordination. Communication within City of Oak Harbor Departments regarding water conservation measures to be taken.

(4) Notification Responses. The following is an outline of the appropriate notification medium that should be utilized for each stage of the Response Plan.

(a) **Stage 1: Water Treatment Plant Capacity Reduction** ***(Potential for Future Drought Conditions Exist)*** Public notification is not necessary at this stage.

(i) Interdepartmental coordination.

(A) Interdepartmental Coordination: the Water Division shall request all City departments to reduce watering lawns and shrubs within the City.

(b) **Stage 2: Limited Supply Capacity** ***(Drought is Highly Likely in the Immediate Future)***

(i) Mass Media.

(A) News releases shall be distributed to the local television and radio broadcasting stations and newspaper publishers to inform the public of the water shortage and ask for voluntary reduction in outdoor water use.

(B) Information will be provided on methods of outdoor water conservation to newspaper publishers.

(ii) Material Distribution.

(A) Make water conservation brochures available to the public and post water conservation posters around the City.

(iii) Customer Contact.

(A) Negotiate with major customers to cut back their demands on the water system.

(iv) Interdepartmental Coordination.

(A) Instruct the Parks Division to restrict watering within parks and all public greenbelts.

(c) **Stage 3: Severe/Critical Water Supply Shortage** ***(Drought Condition Emergency Exists)***

(i) Mass Media.

(A) News releases shall be distributed to the various television and radio broadcasting stations and newspaper publishers to inform the public of the water storage, explaining mandatory restrictions of outdoor water use, outlining fines and enforcement measures, and encouraging indoor water conservation.

(B) Provide information on methods of both indoor and outdoor water conservation to newspaper publishers.

(ii) Material Distribution.

(A) Make water conservation brochures available to the public and post water conservation posters around the City.

(iii) Customer Contact.

(A) Contact large water use customers and encourage them to develop water conservation measures.

(iv) Interdepartmental Coordination.

(A) Instruct the Parks Division to restrict watering within parks and all public greenbelts.

(B) Coordinate with local Police and Fire Departments, and City water crews for enforcement of mandatory water restrictions.

(C) Advise the Fire Department of any possible reduction in fire-fighting capabilities.

(d) **Stage 4: Temporary Emergency Water Shortage**

(i) Mass Media.

(A) News releases shall be distributed to the various television and radio broadcasting stations and newspaper publishers to inform the public of the water shortage, explaining water rationing and customer classes, outlining fines and enforcement measures, and providing information on water conservation.

(B) Use the public service announcement to keep the public informed of the situation and any changes that occur.

(ii) Material Distribution.

(A) Make water conservation brochures available to the public and post water conservation posters around the City.

(iii) Customer Contact.

(A) Conduct public meetings to explain the water shortage situation and to answer any questions.

(B) Contact large industrial water users require reduction of water consumption by a percentage determined by the Mayor or his/her designee.

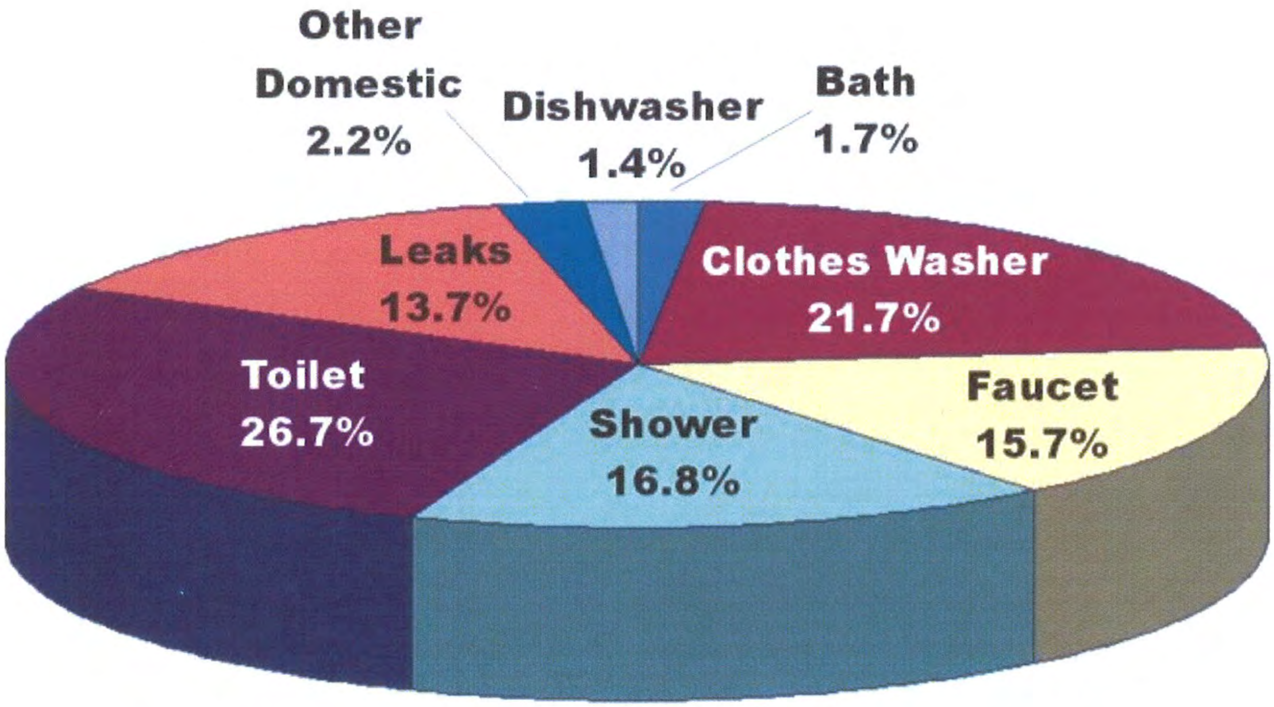
(C) Eliminate service to non-essential water users.

(iv) Interdepartmental Coordination.

(A) Instruct the Parks Division to restrict all irrigation and to close all public restrooms.

(B) Coordinate with local Police and Fire Departments, and City water crews for the enforcement of mandatory water restrictions and water rationing.

(C) Advise the Fire Department of a possible reduction in system pressures and fire fighting capabilities.



Typical Household Water Use

(Indoor)

After "Residential End Uses of Water," by permission.

City of Oak Harbor Water Division
WATER AUDIT APPROACH

STEP 1 - QUANTIFY THE WATER SUPPLY

- Identify all water sources.
- Quantify water from each source.
- Estimate potential range in master meter inaccuracy.
- Verify and adjust source quantities.

STEP 2 - QUANTIFY AUTHORIZED METERED WATER USE

- Identify metered uses by customer class.
- Quantify metered uses by customer class.
- Estimate potential range in customer meter inaccuracy.
- Verify and adjust metered use quantities.

STEP 3 - QUANTIFY AUTHORIZED UNMETERED USES

- Identify authorized unmetered uses.
- Estimate authorized unmetered uses (if possible).

STEP 4 - QUANTIFY WATER LOSSES

- Identify potential water losses.
- Estimate losses by type of loss.

STEP 5 - EVALUATE LEAK DETECTION PROGRAM RESULTS

- Review leaks found and repaired annually.
- Evaluate cost of leak detection survey compared with potential revenue from water recovered (include estimated or actual cost of repairs).

STEP 6 - ANALYZE WATER AUDIT RESULTS AND CONSIDER CORRECTIVE MEASURES

- Summarize water use and unaccounted-for water use by year.
- Identify potential utility management water savings.
- Compare benefits to costs of water system improvements and other measures to reduce annual water loss and unaccounted-for water use.

Source: Adapted from Water and Revenue Losses. AWWA Research Foundation

RESOLUTION NO. 2001-08

RESOLUTION OUTLINING THE CITY OF OAK HARBOR'S WATER SHORTAGE RESPONSE PLAN

BE IT RESOLVED by the City Council of the City of Oak Harbor as follows:

INDEX

Section One. **Non-essential water uses**. Water uses regulated or prohibited under this article (hereinafter referred to as the "Water Shortage Plan" or the "Plan") are considered to be non-essential and continuation of such uses during times of water shortage or other emergency water supply conditions are deemed to constitute a waste of water which subjects the offender(s) to penalties as defined in this Plan.

Section Two. **Public education and notification**.

(1) City will provide public notification. The City, by and through its Department of Public Works, shall periodically provide the public with information about the Plan, including information about the conditions under which each stage of the Plan is to be initiated or terminated, and the drought response measures to be implemented in each stage.

(2) Drought conditions - Responses requiring notification. When drought contingency measures appear to be necessary, the public will be notified through available news media, and additional information on water conservation methods will be distributed. In the event that a trigger condition is reached, the public will be kept fully informed of the status of the drought condition through all available media.

(3) Trigger conditions requiring notification. When a trigger condition has been reached and the City of Anacortes Water Department informs the City of Oak Harbor that drought contingency measures may be necessary, the Mayor or his/her designee will order the initiation of a public notification process. The public notification process will include, but is not limited to the following:

(a) A notice of drought condition will be posted at City Hall, the Post Office, and the Library.

(b) The notice will be circulated to local newspapers and radio stations via Public Service Announcement.

(c) Information regarding the contingency measures for the drought condition will be mailed to all water customers by means of utility bill inserts or door-to-door and posted on the City's web page.

(4) When temporary emergency water shortage, due to major water system component failure or supply source contamination, measures appear to be necessary the public will be notified through available media and/or door-to-door as deemed appropriate by the Mayor or his/her designee.

Section Three. **Authorization**. The Mayor, or his/her designee, is hereby authorized and directed to implement the applicable provisions of the Plan upon determination that such implementation is necessary to protect public health, safety, and welfare. The Mayor or his/her designee shall have the authority to initiate or terminate drought or other water supply emergency response measures as described in this Plan.

Section Four. **Application**. The provisions of this Plan shall apply to all persons, customers, and property using water provided by the City of Oak Harbor. The terms "person" and "customer" as used in the Plan include individuals, corporations, partnerships, associations, and all other legal entities including the U.S. Navy, North Whidbey Water District and Deception Pass State Park.

Section Five. **Definitions**. For the purposes of this Plan, the following definitions shall apply:

(1) *Aesthetic water use* means water use for ornamental or decorative purposes such as fountains, reflecting pools, and water gardens.

(2) *Commercial and institutional water use* means water use, which is integral to the operations of commercial and non-profit establishments and governmental entities such as retail establishments, hotels and motels, restaurants, and office buildings.

(3) *Conservation* means those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water or increase the recycling and reuse of water so that a supply is conserved and made available for future or alternative uses.

(4) *Customer* means any person, company, or organization using water supplied by the City of Oak Harbor.

(5) *Domestic water use* means water use for personal needs or for household or sanitary purposes such as drinking, bathing, heating, cooking, sanitation, or for cleaning a residence, business, industry, or institution.

(6) *Even number address* means street addresses ending in 0, 2, 4, 6, or 8, and locations without addresses.

(7) *Odd numbered address* means street addresses ending in 1, 3, 5, 7, or 9.

(8) *Industrial water use* means the use of water in processes designed to convert materials of lower value into forms having greater usability and value.

(9) *Landscape irrigation use* means water used for the irrigation and maintenance of landscaped areas, whether publicly or privately owned, including residential and commercial lawns, gardens, golf courses, parks, and rights-of-way and medians.

(10) *Non-essential water use* means water uses that are not essential nor required for the protection of public, health, safety, and welfare, including:

(a) Irrigation of landscape areas, including parks, athletic fields, and golf courses, except as otherwise provided under this Plan.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle.

(c) Use of water to wash down any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas.

(d) Use of water to wash down buildings or structures for purposes other than immediate fire protection.

(e) Flushing gutters or permitting water to run or accumulate in any gutter or street.

(f) Use of water to fill, refill, or add to any indoor or outdoor swimming pools or Jacuzzi-type pools.

(g) Use of water in a fountain or pond for aesthetic or scenic purposes except where necessary to support aquatic life.

(h) Failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s).

(i) Use of water from hydrants for construction purposes or any other purposes other than fire fighting.

Section Six. **Triggering criteria for initiation and termination of drought response stages**.
The City of Oak Harbor purchases 99.8 percent of its potable water from the City of Anacortes. Availability of water from the City of Anacortes is based on the height of the Skagit River at the water treatment plant. Therefore, the emergency water management triggering measures will be the same as those of the City of Anacortes. Also, triggering criteria may be initiated as a result of short-term deficiencies and/or emergencies specific to the City of Oak Harbor.
The following are the triggering criteria for initiation and termination of drought response stages:

(1) **Stage 1: Water Treatment Plant Capacity Reduction *(Potential for Future Drought Conditions Exist)***. A Stage 1 drought response will be implemented when there is a potential for future drought conditions due to a reduction in the water treatment plant capacity or in the water source capacity.

(a) Triggering Criteria. River height flow less than 10 feet and 10400 cubic feet per second (cfs) and above 9 feet and 8050 cubic feet per second (cfs); the raw water conditions are such that the treatment plant is unable to produce water of high quality.

(b) Response.

(i) Install conservation condition signs.

(ii) Accelerate public information efforts to teach and encourage reduced water use.

(iii) Request voluntary conservation action by customers.

(C) Notify major water users and work with them to achieve voluntary water use reduction.

(v) Request a reduction in landscape watering by City government.

(c) Termination Criteria. All initiated actions will remain in effect until the conditions that triggered Stage 1 have been alleviated.

(2) **Stage 2: Limited Supply Capacity *(Drought is Highly Likely in the Immediate Future)***. A Stage 2 drought response will be implemented when drought conditions are highly likely in the immediate future due to a reduction in the water source capacity, the quality of the water source has been diminished, or there are other limitations on the ability of the treatment plan to produce high quality water.

(a) Triggering Criteria. River height flow less than 9 feet and 8050 cfs and above 8 feet and 5760 cfs; the raw water conditions are such that the treatment plant is unable to produce water of high quality; the raw water source level is reduced, requiring the plant flow to be reduced; or structural/operational problems within the treatment plant requiring flow reduction.

(b) Response.

(i) Install conservation condition signs.

(ii) Start aggressive public information efforts regarding water supply conditions and conservation efforts. Efforts will include but not be limited to providing water conservation literature to the public.

(iii) Cease all flushing and flow testing of pipes.

(iv) Reduce irrigation of all City parks, greenbelts and facility landscaping.

(v) Cease all "wet" fire drills.

(vi) Request voluntary restriction of hosing off of paved areas, sidewalks, buildings or windows; operation of ornamental fountains, draining of swimming pools followed by refilling, washing or rinsing of vehicles by hose without a shutoff valve, using water in such a manner as to allow runoff or other water waste.

(C) Mandatory restrictions on landscape watering for commercial and residential and government services bearing odd numbered addresses to water on odd numbered days and even numbered addresses to water on even numbered days. Where there are no numbers, a number will be assigned and/or watering will be conducted on even numbered days.

(viii) Allow watering between 8:00 p.m. and 9:00 a.m. Prohibit watering outside these hours.

(d) Enforcement. Violations of restrictions will result in a warning, and then a citation may be issued with a fine not to exceed $250.00 per incident as per ordinance.

(e) Termination Criteria. All initiated actions will remain in effect until the conditions that triggered Stage 2 have been alleviated.

(3) **Stage 3: Severe/Critical Water Supply Shortage *(Drought Condition Emergency Exists)***. A Stage 3 drought response will be implemented when a drought condition emergency exists due to a severe reduction in the water source or quality of the water source or in the event of catastrophic damage to the treatment plant.

(a) Triggering Criteria. River level below 8 feet or 5760 cfs; the raw water source is extremely poor; or catastrophic damage (earthquake, flood etc.) has occurred.

(b) Response.

(i) The City shall take all measures necessary to reduce water consumption and use and obtain additional water supplies from surrounding purveyors to the extent possible.

(ii) Cease all municipal park irrigation.

(iii) Prohibit all residential, commercial and government lawn watering.

(iv) Eliminate all flushing and flow testing of pipes except to protect public health.

(v) Notify Oak Harbor School District to cease irrigation of school property and playgrounds immediately.

(vi) Eliminate water service to all public restrooms and non-essential facilities.

(vii) Mandatory curtailment of all non-essential water use.

(viii) Establish customer categories for water allocation.

(ix) Require commercial and residential water users to reduce water consumption by a percentage.

(x) Impose mandatory maximum water rationing for different customer categories.

(xi) Coordinate with law enforcement officials and City crews for enforcing mandatory water restrictions.

(xii) Notify the public of the seriousness of the situation. Public notification will include both mass media and/or door-to-door. Notification will inform customers of their customer class, rationed water consumption, enforcement measures and effective means of reducing water usage.

(c) Enforcement. Violations of restrictions will result in a warning, and then a citation may be issued with a fine not to exceed $250.00 per incident as per ordinance.

(d) Termination Criteria. All initiated actions will remain in effect until the conditions that triggered Stage 3 have been alleviated.

(4) **Stage 4: Temporary Emergency Water Shortage**. A Stage 4 drought response will be implemented when there is a temporary water shortage due to failure of the water distribution system or there are supply contamination concerns that require special precautions.

(a) System outage due to major water system components failure.

(i) Triggering Criteria. System outage or restrictions due to major water system components failure in the City's transmission/distribution system.

(ii) Response.

(A) Initiate or continue implementation of appropriate restrictions from previous conditions as directed by the Mayor or his/her designee.

(B) Affected commercial and residential water users will be required to reduce water consumption by a percentage determined by the Mayor or his/her designee.

(b) Supply source contamination special precautions.

(i) Triggering Criteria. Water system contamination caused by low distribution pressures (below 20 psi), repeated unacceptable microbiological samples, or failure to maintain adequate chlorine residuals. In the event of such contamination, the affected area shall be isolated from the distribution system immediately and special precautions shall be taken in accordance with Washington State Board of Health Drinking Water Regulations (WAC 246-290).

(ii) Response.

(A) Water customers in the affected area shall be notified immediately with a "Boil Water Notice" and a letter explaining the situation and containing recommendations to the water customer regarding the use of bottled water. Hand deliver "Boil Water Notices" to all water customers affected.

(B) Prohibit all water usage for human consumption in the affected area for 24 to 36 hours, as determined by the Mayor or his/her designee.

(c) Enforcement. Violations of restrictions will result in a warning, and then a citation may be issued with a fine not to exceed $250.00 per incident as per ordinance.

(d) Termination Criteria. All initiated actions will remain in effect until the conditions that triggered Stage 4 have been alleviated. If Stage 4 is initiated because of water supply contamination, all initiated actions will remain in effect until the Mayor or his/her designee determines that conditions exist which will allow removal of Stage 4 actions.

<u>Section Seven</u>. Variances.

(1) The Mayor or his/her designee may, in writing, grant temporary variances for existing water uses otherwise prohibited under this Plan if it is determined that failure to grant such a variance would cause an emergency condition adversely affecting the health, sanitation, or fire protection for the public or the person requesting such variance, and if one or more of the following conditions are met:

(a) Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect.

(b) Alternative methods can be implemented which will achieve the same level of reduction in water use.

(2) Persons requesting an exemption from the provisions of this article shall file a petition for a variance with the City within 5 days after the Plan or a particular drought response stage has been invoked. All petitions for variances shall be reviewed by the Mayor, or his/her designee, and shall include the following:

(a) Name and address of the petitioner(s).

(b) Purpose of water use.

(c) Specific provision(s) of the Plan from which the petitioner is requesting relief.

(d) Detailed statement as to how the specific provision of the Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this article.

(e) Description of the relief requested.

(f) Period of time for which the variance is sought.

(g) Alternative water use restrictions or other measures the petitioner is taking or proposes to take to meet the intent of this Plan and the compliance date.

(h) Other pertinent information as may be required by the Mayor or his/her designee.

(3) Variances granted by the Mayor or his/her designee shall be subject to the following conditions, unless waived or modified by the Mayor or his/her designee:

(a) Variances granted shall include a timetable for compliance.

(b) Variances granted shall expire when the Plan is no longer in effect, unless the petitioner has failed to meet specified requirements.

(c) No variance shall be retroactive or otherwise justify any violation of the Plan occurring prior to the issuance of the variance.

<u>Section Eight</u>. Notification.

(C) <u>Public Works Superintendent's Duty</u>. The Public Works Superintendent shall notify the Mayor if any of the water shortage response stages are implemented. Notification by telephone is adequate to provide immediate information about the shortage, however a formal notification by memorandum is required. The information in the notification shall include:

(a) Nature and extent of the water shortage.

(b) Identification of the stage of response.

(c) Proposed or initiated conservation measures.

(d) Corrective measures being taken.

(e) Expected duration of the water shortage.

(2) <u>Notice requirements</u>. Public notification of a water shortage, by mass media and/or door-to-door, will be essential and shall include the seriousness of the situation and the necessary conservation measures that must be taken. It will also include their customer class, rationed water consumption, enforcement measures and effective means of reducing water usage.

(3) <u>Notification mediums</u>.

(a) <u>Mass Media</u>. Television and radio broadcasting stations, newspapers, paid advertisements, public service announcements, and City web page. (A listing of all local television and radio broadcasting and newspaper publishers is provided in Table 1.)

(b) <u>Material Distribution</u>. Direct mailing of newsletters and conservation brochures, and/or an area-wide distribution of conservation brochures, posters, and other printed material.

(c) <u>Customer Contact</u>. Direct contact of consumers, especially large water users, to coordinate water conservation.

(d) <u>Interdepartmental Coordination</u>. Communication within City of Oak Harbor Departments regarding water conservation measures to be taken.

(4) <u>Notification Responses</u>. The following is an outline of the appropriate notification medium that should be utilized for each stage of the Response Plan.

(C) **Stage 1: Water Treatment Plant Capacity Reduction *(Potential for Future Drought Conditions Exist)*** Public notification is not necessary at this stage.

(i) <u>Interdepartmental coordination</u>.

(A) Interdepartmental Coordination: the Water Division shall request all City departments to reduce watering lawns and shrubs within the City.

(b) **Stage 2: Limited Supply Capacity *(Drought is Highly Likely in the Immediate Future)***

(i) Mass Media.

(A) News releases shall be distributed to the local television and radio broadcasting stations and newspaper publishers to inform the public of the water shortage and ask for voluntary reduction in outdoor water use.

(B) Information will be provided on methods of outdoor water conservation to newspaper publishers.

(ii) Material Distribution.

(A) Make water conservation brochures available to the public and post water conservation posters around the City.

(iii) Customer Contact.

(A) Negotiate with major customers to cut back their demands on the water system.

(iv) Interdepartmental Coordination.

(A) Instruct the Parks Division to restrict watering within parks and all public greenbelts.

(c) **Stage 3: Severe/Critical Water Supply Shortage *(Drought Condition Emergency Exists)***

(i) Mass Media.

(A) News releases shall be distributed to the various television and radio broadcasting stations and newspaper publishers to inform the public of the water storage, explaining mandatory restrictions of outdoor water use, outlining fines and enforcement measures, and encouraging indoor water conservation.

(B) Provide information on methods of both indoor and outdoor water conservation to newspaper publishers.

(ii) Material Distribution.

(A) Make water conservation brochures available to the public and post water conservation posters around the City.

(iii) Customer Contact.

(A) Contact large water use customers and encourage them to develop water conservation measures.

(iv) Interdepartmental Coordination.

(A) Instruct the Parks Division to restrict watering within parks and all public greenbelts.

(B) Coordinate with local Police and Fire Departments, and City water crews for enforcement of mandatory water restrictions.

(C) Advise the Fire Department of any possible reduction in fire-fighting capabilities.

(d) **Stage 4: Temporary Emergency Water Shortage**

(i) Mass Media.

(A) News releases shall be distributed to the various television and radio broadcasting stations and newspaper publishers to inform the public of the water shortage, explaining water rationing and customer classes, outlining fines and enforcement measures, and providing information on water conservation.

(B) Use the public service announcement to keep the public informed of the situation and any changes that occur.

(ii) Material Distribution.

(A) Make water conservation brochures available to the public and post water conservation posters around the City.

(iii) Customer Contact.

(A) Conduct public meetings to explain the water shortage situation and to answer any questions.

(B) Contact large industrial water users require reduction of water consumption by a percentage determined by the Mayor or his/her designee.

(C) Eliminate service to non-essential water users.

(iv) Interdepartmental Coordination.

(A) Instruct the Parks Division to restrict all irrigation and to close all public restrooms.

(B) Coordinate with local Police and Fire Departments, and City water crews for the enforcement of mandatory water restrictions and water rationing.

(C) Advise the Fire Department of a possible reduction in system pressures and fire fighting capabilities.

TABLE 1

TELEVISION AND RADIO
BROADCASTING STATIONS

KOMO-TV	206-404-4000
KING-TV	206-448-5555
KIRO-TV	206-728-7777
KVOS-TV	360-671-4500
KAPS Radio	360-424-7676
KBRC Radio	360-424-1430
KING Radio	206-448-3981
KLKI Radio	360-293-3141
KIRO Radio	206-726-7000
KOMO Radio	206-223-5700

NON-BROADCASTING MEDIA

Whidbey News Times	360-675-6611
Skagit Valley Herald	360-424-3251
Anacortes American	360-293-3122
Department of Health	253-395-6751
Department of Ecology	425-649-7000
Island County Health Department	360-679-7350
Island County Emergency Services	360-678-4422
Skagit County Health Department	360-336-9380
Skagit County Emergency Services	360-428-3250
Oak Harbor Police/Fire Departments	360-679-5551
Oak Harbor Public Works	360-240-6443
Oak Harbor's Channel 10	360-679-5551
Oak Harbor's Web Page	www.oakharbor.org

PASSED and approved by the City Council this 7th day of August, 2001.

THE CITY OF OAK HARBOR

Patricia Cohen
Mayor

Attest:

Rosemary Morrison
City Clerk

Approved as to Form:

Phillip Bleyhl
City Attorney

APPENDIX Q

WATER USE EFFICIENCY PROGRAM INFORMATION

CITY OF OAK HARBOR
RESOLUTION NO. 08-01

A RESOLUTION ESTABLISHING WATER EFFICIENCY GOALS FOR THE CITY OF OAK HARBOR WATER UTILITY.

BE IT RESOLVED by the City Council of the City of Oak Harbor as follows:

WHEREAS, the City of Oak Harbor has made a commitment to water efficiency since the early 1990's; and

WHEREAS, the City of Oak Harbor Water Utility and its customers have improved their water use efficiency since that time; and

WHEREAS, the City desires to comply with changes to the Washington Administrative Code (WAC) 246-290 requiring Oak Harbor to establish water efficiency goals every six years as part of its Water System Plan; and

WHEREAS, water efficiency goals must describe measurable outcomes in terms of reduced or maintained water production or usage; and

WHEREAS, the City provided a public forum for water customers and for the public to participate and comment on the water efficiency goals; and

WHEREAS, the City Council has reviewed and considered all comments received.

NOW THEREFORE, the City of Oak Harbor Mayor and Council resolve as follows:

The following are the water efficiency goals for the City of Oak Harbor Water Utility:

1. Continue maintaining distribution leakage at or below 10%.
2. Maintain family household water use at 64 gallons per person per day on a three year average; and reduce irrigation usage.

Water Efficiency Goals may be changed in accordance with Washington Administrative Code 246-290.

Effective Date. This Resolution shall take effect and be in force immediately upon its passage.

PASSED and approved by the City of Oak Harbor Mayor and Council this 15th day of January, 2008.

THE CITY OF OAK HARBOR

Mayor

Attest:

City Clerk

Approved as to Form:

City Attorney

APPENDIX R

WELLHEAD PROTECTION PROGRAM

CITY OF OAK HARBOR, WA

Wellhead Protection Program

WA DOH ID #62650C

A. REQUIREMENT FOR PROGRAM

Section 1428 of the 1986 Amendments to the Federal Safe Drinking Water Act mandates that every state develop a wellhead protection program. The Washington Department of Health is designated lead agency for wellhead protection program development and administration. The Safe Drinking Water Act requires that all federally defined public water systems (Group A systems) using groundwater as their source implement a wellhead protection program. The minimum elements of a program required by the Washington Department of Health are:

- Make a susceptibility assessment of each well to contamination through poor construction, lack of a confining layer (e.g., clay), etc.

- Calculate the delineation for each well of the time of travel boundaries (1, 5, and 10 year) of a potential contaminant in groundwater. The 10 year travel boundary is the wellhead protection area (WHPA) boundary.

- Make a vulnerability assessment of all actual and potential groundwater contamination sources located within the delineated WHPA boundary.

- Develop a wellhead protection management program that includes the following:

  ... public education to increase awareness of the threats of groundwater contamination; the program must include all owners/operators of actual or potential sources of contamination within the WHPA boundaries,

  ... monitoring for activities that contribute to the risk of groundwater contamination, e.g., underground commercial storage tanks, hazardous waste transportation and disposal, etc.

  ... water conservation to reduce the rate of [potential] contaminant transportation in groundwater

... regulations to control the application, transportation and disposal of hazardous wastes (chemicals and sewerage) that may contaminant groundwater, and other activities that may increase the susceptibility of aquifer contamination (e.g., private wells, septic tanks)

... water quality monitoring of the raw water supply to provide early warning of groundwater contamination.

- Develop a contingency plan for alternate water supplies.

- Inclusion of public participation while the program is developing.

B. DESCRIPTION OF GROUNDWATER SOURCES

The City operates three wells, designated Wells No. 8, 9 and 11, in the area of Heller Road and Whidbey Avenue. The wells lie in a north-south alignment, within a distance between the most northerly and southerly wells of 2,400 feet. The wells draw water from the same aquifer, but are not designated a well field under WA DOH criteria because of the lack of a common tap for collection of a water sample. The wells can be described as follows:

	Well No. 8	Well No. 9	Well No. 11
WA DOH Source No.	SO11	SO12	SO14
Surface elevation:	340 ft	312 ft	297 ft
Depth:	250 ft	245 ft	160 ft
Static level:	191 ft	175 ft	172 ft
Date of Construction:	1961	1961	1977
Casing:	8-inch	10-inch	8-inch
Production rate:	166 gpm	160 gpm	160 gpm

The aquifer supplying the wells consists primarily of sand and gravel, interspersed with several thin lenses of clay, having one clay layer exceeding 30 feet in thickness immediately above the water bearing strata.
All three wells area operated as standby (emergency) sources.

C. PROGRAM OBJECTIVE

The objectives of the wellhead protection program are:

1) to reasonably reduce the risk of contamination of the groundwater supplying the City of Oak Harbor's well sources, and

2) with other utilities, cooperate and support the Island County aquifer protection program.

D. RELATED PROGRAMS

The above noted components of a wellhead protection program overlap the activities of other City and Island County programs. These activities can be summarized as follows:

- The disposal of chemicals in public sewers is regulated by the City through Ordinance (No. 14.01-14.20). The regulation of matter to be excluded from public sewers is mandated, in part, by the National Pollutant Discharge Elimination System (NPDES) permit for the operation of the City's wastewater treatment plant.

- Illicit discharge to stormwater drainage systems is regulated by the City through the Stormwater Management Ordinance (No. 12:30.330).

- The disposal of hazardous chemicals in general, is regulated by Island County, Chapter 8.08A I.C.C. through the exercise of the Board of Health function established through Chapter 70.05 of the Revised Code of Washington. The regulations include collection and storage household hazardous wastes and moderate-risk waste .

- Groundwater resource (aquifer) protection regulations are enforced by Island County, Chapter 8.09. I.C.C.

- On-site sewerage disposal systems are regulated by Island County, Chapter 8.07B I.C.C. and by the City through the Sewer Ordinance (No. 14.04.200).

E. PROGRAM OPERATION

Management and Inspection

The above regulation of the disposal of hazardous wastes and other matter, include the common activities of inspection, education and enforcement. For efficiency, and greater public understanding of the need to comply with regulations, the City will coordinate whenever possible all related regulatory actions involving private property owners.

The wellhead protection program management is assigned to Public Works Superintendent.

The wellhead protection program management is coordinated with the private property inspection done by the City's Building Inspector. The Building Inspector monitors for building activities that contribute to the risk of groundwater contamination, such as the installation or removal of underground storage tanks.

Hazardous waste disposal activities are coordinated with Island County, Solid Waste Coordinator of Hazardous Waste.

Transportation of hazardous waste is coordinated with the City's Fire Department.

For activities under Island County jurisdiction within the City limits, the coordination includes joint inspection with County staff, and/or the County's timely reporting of activities to the City.

Public Involvement and Education

Because of the very limited extent of the wellhead protection area, compared with the total area of the City, development of the wellhead protection program included direct public involvement only through the pubic attendance at City Council meetings.

Enforcement of regulations will be preceded by public education. Because the repeated inspection of all property in the wellhead protection area is not cost effective, public education will be the primary means of obtaining compliance with regulations. For example, the residential "best management practices" in the *Stormwater Program Guidance Manual for the Puget Sound Basin* recommends public education for "good housekeeping" practices.

Public education will be divided into the following three tasks:

1) Island County Cooperative Extension/Washington State University Beach Watchers Program

   The City will utilize the existing public education program developed by the WSU Beach Watchers. This program combines the topics of prevention of contamination of stormwater and groundwater.

The program completed to date, and to be continued by the WSU Beach Watchers, includes the following:

- ✎ The development of an educational display that features photographs depicting different forms of pollutants. It gives solutions and alternatives to use of common household "hazardous" chemicals. The display was first used at the Penn Cove Water Festival in May, 1995. It will continue to be used at other public events.

- ✎ Because the display is too big for some places, a smaller table-top display was also developed. The smaller display has been set up at libraries, local banks, etc.

- ✎ Several brochures have been developed or were obtained for distribution at the above displays. These include:

  ... Construction Best Management Practices
  ... Stormwater Runoff Information
  ... Informational Quiz (for schools)
  ... Business & Household Hazardous Waste (County's Solid Waste Program)

- ✎ A series of evening lectures by the WSU Beach Watcher's "Home-Asyst" program included presentations on watershed and wellhead protection, and hazardous waste disposal.

2) Distribution of General Information Brochures

Brochures pertaining to the prevention of groundwater contamination will be periodically included with utility bills. (*see Attachment `A'*)

3) Distribution of Notification Letters

All property owners in the wellhead protection area boundaries will receive a letter notifying them of the presence of the wells and the need to prevent groundwater contamination. (*see Attachment `B'*)

<u>Delineation and Inventory</u>

The wellhead protection areas were delineated using the "Calculated Fixed Radius" method set forth in the WA Department of Health "*Ground Water Contamination Susceptibility Assessment Survey Forms*", (*see Attachment `C'*). For the City's operating wells, designated Wells No. 8, 9 and 11, the delineation area for inspection for sources of contamination is limited to a small area of the City (*see map, attachment `D'*). The land use in the wellhead protection area is entirely single family residential and municipal (*see map, attachment `E'*).

Because of the limited size of the delineated wellhead protection area initially calculated by the fixed radius method, and the predominant single family residential land use within and surrounding the area, a more detailed delineation (e.g., using the EPA analytical model GPTRAC to define the capture zone) was not scheduled for the foreseeable future. A more detailed delineation is planned only when the use of the wells is changed from standby to supplemental supply.

The inventory of potential sources of groundwater contamination in and around the delineated wellhead protection areas was made using the WA DOH "*Ground Water Contamination Susceptibility Assessment Survey Forms*" (*see attachment `C'*). The "other" potential sources (Part V of the form) within the five year time of travel were identified as

- parks with playground equipment
- abandoned private well near Well No. 8

Water Quality Monitoring

The wells are operated at least once per month for a period of 4 hours or longer.

The WA Department of Health susceptibility rating for the wells is low for Synthetic Organic Compounds (SOC). The monitoring requirement for the 1993-1995 Compliance period was 1 quarter of Volatile Organic Chemicals (VOC) monitoring. No VOCs were detected at levels above the MCL in the first set of samples.

Contingency Plan

The City's primary source of water is from a surface supply purchased from the City of Anacortes. The production from the City's wells is for standby (emergency) use only. The present surface water supply is adequate to meet the maximum day demand of the City.

The contingency plan for the detection of a contaminant in a well supply, includes the following:

1) if necessary, implement the City's Water Shortage Response Plan to reduce water demand;

2) assess the impact of the contaminant on water quality; determine if water treatment will allow the continued use of the contaminated well, and if necessary;

3) proceed with the acquisition of a replacement well, utilizing condemnation procedures if required.

The aquifer in the service area southwest and northeast of City has adequate recharge for additional sources of withdrawal to replace a City well. If necessary, the City has the resources to obtain short-term financing for the level of expenditure needed to either install water treatment or replace a well.

Spill Response Plan

The Oak Harbor Fire Department is the lead agency in spill response. The Fire Department has information of the delineated wellhead protection area, and includes in their response procedures contacting the Water Department. Their incident and spill response plans address the protection of the wells (*see Attachment `F'*).

F. PROGRAM SCHEDULE

Task	Scheduled Completion
Public participation	completed
Susceptibility assessment	completed
Initial delineation of WHPA	completed
Refined delineation of WHPA	not scheduled until well use increases from standby to supplemental status
Initial vulnerability assessment	completed
Detailed vulnerability assessment	completed
Education program development	in progress
Monitoring	ongoing
Contingency plan	completed
Development of regulations	completed
Spill response	completed

G. REFERENCE MATERIAL

The following publications should be retained by the City as references for its wellhead protection program:

- *"Wellhead Protection Program"*, December 1993, Washington Department of Health
- *"Protecting Local Ground-Water Supplies Through Wellhead Protection"*, May 1991, US Environmental Protection Agency (publication EPA 570/9-91-007)

List of Attachments

A Brochures for public education

B Form letter, notifying residents in WHPA of presence of wells, and need to prevent groundwater contamination

C Completed "*Ground Water Contamination Susceptibility Assessment Survey Forms*", with list of potential groundwater contaminant sources for each well

D Map of wellhead protection areas with delineation for each well using the "Calculated Fixed Radius" method

E Land use map for area within and around wellhead protection areas

F Portion of the Fire Department's incident and spill response plan pertaining to the protection of the City's wells

... sample form letter ...

Dear Water Customer,

PROTECTION OF CITY WELLS

Although you may be aware that the City of Oak Harbor purchases water from the City of Anacortes, you may not be aware that the City operates wells to supplement this supply. One of the City's wells is located within 1,000 feet of your property.

To prevent contamination of the groundwater supplying the wells, it is important that residents take care to properly dispose of all hazardous wastes. Hazardous wastes include household cleaning products, paint, anti-freeze, weed and bug killers, old batteries, to name a few.

To reduce the risk of chemicals contaminating groundwater:

- avoid applying hazardous chemicals outside during rainy weather,
- follow the instructions on the use of chemicals, and use only enough to get the job done,
- try to use non-toxic alternatives whenever possible,
- properly store all chemicals to prevent spillage, and
- properly dispose of all containers and unused portions.

Your care in the use and disposal of household chemicals will help protect the water you drink, and will also help reduce the pollution of the stormwater runoff into Puget Sound.

For more information about the use and disposal of hazardous chemicals, please contact:

Island County Solid Waste
Attention Jerry Mingo
(360) 678-3328

For more information about our wellhead protection program, please feel free to call Mr. Rich Tyhuis at 679-5551.

Your cooperation will be most appreciated.

B

APPENDIX S

EMERGENCY RESPONSE MANUAL

EMERGENCY RESPONSE PLAN

INTRODUCTION

The City has created a DRAFT Emergency Response Plan ("Plan") for use during emergencies relating to the water system. The Plan contains valuable information about the water system, instructions on notifying the appropriate authorities during various types of emergencies, and recommendations for actions to be taken to minimize the effect of the emergency on the remaining portions of the water system. The City is currently in the process of modifying the DRAFT Plan and tailoring it to its specific needs. After completion, the Plan will be reviewed and approved by the appropriate City administration prior to finalization.

The City maintains several copies of the Plan at its Public Works Facility, and copies are also distributed to various utility departments within the City. The section below highlights some of the topics covered in the Plan.

PLAN TOPICS

The DRAFT Emergency Response Plan covers the following topics:

- How to use this Plan
- Who has a copy of the Plan
- Water system description
- Responding to willful/deliberate acts
- Emergency response team command
- Locate request procedure
- Public drinking water program emergency notification form
- Water distribution system emergencies
- Water source emergencies
- Water treatment emergencies

APPENDIX T

DETAILED COST ESTIMATES

City of Oak Harbor
Preliminary Project Cost Estimate
Pressure Zone Modification Project S-1
Well No. 9 Replacement

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1 LS	$ 15,000	$ 15,000
2.	Sitework	1 LS	$ 10,000	$ 10,000
3.	Drilling for 8-inch casing	300 LF	$ 55	$ 16,500
4.	8-inch casing	300 LF	$ 45	$ 13,500
5.	Well screen	1 LS	$ 10,000	$ 10,000
6.	Pump testing	1 LS	$ 15,000	$ 15,000
7.	Submersible Pump	1 EA	$ 25,000	$ 25,000
8.	Piping, valves, and appurtenances	1 LS	$ 6,000	$ 6,000
9.	Electrical	1 LS	$ 20,000	$ 20,000
	Subtotal			**$ 131,000**
	Archaeological Mitigation (10%)			$ 13,000
	Subtotal:			**$ 144,000**
	Contingency (20%)			$ 29,000
	Subtotal:			**$ 173,000**
	Tax rate (9.4%)			16,000
	Subtotal:			**$ 189,000**
	Engineering & Administrative Services (25%):			$ 47,000
	Total Estimated Construction Cost:			**$ 236,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Pressure Zone Modification Project S-3
Eastside Reservoir Demolition

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1 LS	$ 15,000	$ 15,000
2.	Sitework	1 LS	$ 5,000	$ 5,000
3.	Demolition of Existing Structure	1 LS	$ 10,000	$ 10,000
4.	Material Removal and Wastehauling	900 TN	$ 20	$ 18,000
5.	Landscape Restoration	1 LS	$ 5,000	$ 5,000
	Subtotal			**$ 53,000**
	Archaeological Mitigation (15%)			$ 8,000
	Subtotal:			**$ 61,000**
	Contingency (20%)			$ 12,000
	Subtotal:			**$ 73,000**
	Tax rate (9.4%)			7,000
	Subtotal:			**$ 80,000**
	Engineering & Administrative Services (25%):			$ 20,000
	Total Estimated Construction Cost:			**$ 100,000**

City of Oak Harbor
Preliminary Project Cost Estimate
Pressure Zone Modification Project S-4
Emergency Supply Well

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1 LS	$ 15,000	$ 15,000
2.	Sitework	1 LS	$ 10,000	$ 10,000
3.	Drilling for 12-inch casing	300 LF	$ 63	$ 18,900
4.	12-inch casing	300 LF	$ 53	$ 15,900
5.	Well screen	1 LS	$ 13,000	$ 13,000
6.	Pump testing	1 LS	$ 15,000	$ 15,000
7.	Submersible Pump	1 EA	$ 30,000	$ 30,000
8.	Piping, valves, and appurtenances	1 LS	$ 8,000	$ 8,000
9.	Electrical	1 LS	$ 20,000	$ 20,000
	Subtotal			**$ 146,000**
	Archaeological Mitigation (25%)			$ 37,000
	Subtotal:			**$ 183,000**
	Contingency (20%)			$ 37,000
	Subtotal:			**$ 220,000**
	Tax rate (9.4%)			21,000
	Subtotal:			**$ 241,000**
	Engineering & Administrative Services (25%):			$ 60,000

City of Oak Harbor
Preliminary Project Cost Estimate
Booster Station Project BS-1
Ault Field Booster Station Surge Protection Analysis

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1 LS	$ 12,000	$ 12,000
2.	Surge Suppression Study	1 LS	$ 20,000	$ 20,000
3.	Hydro-pneumatic surge protector	1 EA	$ 60,000	$ 60,000
4.	Piping, Valves, and Appurtenances	1 LS	$ 10,000	$ 10,000
5.	Electrical & Telemetry	1 LS	$ 25,000	$ 25,000
	Subtotal			**$ 127,000**
	Contingency (20%)			$ 25,000
	Subtotal:			**$ 152,000**
	Tax rate (9.4%)			$ 14,000
	Subtotal:			**$ 166,000**
	Engineering & Administrative Services (25%)			$ 42,000
	Total Estimated Construction Cost:			**$ 208,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Booster Station Project BS-2
Ault Field Booster Station Pump Replacement

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1 LS	$ 6,000	$ 6,000
2.	Pumps	2 EA	$ 20,000	$ 40,000
3.	Piping & Fittings	1 LS	$ 5,000	$ 5,000
4.	Electrical	1 LS	$ 15,000	$ 15,000
	Subtotal			**$ 66,000**
	Contingency (20%)			$ 13,000
	Subtotal:			**$ 79,000**
	Tax rate (9.4%)			$ 7,000
	Total Estimated Construction Cost:			**$ 86,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Booster Station Project BS-3
North Booster Pump Station

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$ 113,000	$ 113,000
2	Excavation Safety Systems	1 LS	$ 5,000	$ 5,000
3	Clearing and Grubbing	1 LS	$ 10,000	$ 10,000
4	Temporary Erosion and Sedimentation Control	1 LS	$ 10,000	$ 10,000
5	Unsuitable Excavation	1 LS	$ 20,000	$ 20,000
6	Earthwork	1 LS	$ 15,000	$ 15,000
7	Booster Station Building	1 LS	$ 350,000	$ 350,000
8	Site & Booster Station Piping	1 LS	$ 220,000	$ 220,000
9	Vertical in-Line Pump	1 EA	$ 12,000	$ 12,000
10	Horizontal Split Case Pump	3 EA	$ 30,000	$ 90,000
11	Surfacing Restoration & Landscaping	1 LS	$ 10,000	$ 10,000
12	Electrical	1 LS	$ 300,000	$ 300,000
13	Telemetry	1 LS	$ 70,000	$ 70,000
14	Auxilliary Generator Assembly	1 LS	$ 20,000	$ 20,000
15	Testing, Commissioning, and Training	1 LS	$ 25,000	$ 25,000
	Subtotal			**$ 1,270,000**
	Archaeological Mitigation (15%)			$ 191,000
	Subtotal:			**$ 1,461,000**
	Contingency (20%)			$ 292,000
	Subtotal:			**$ 1,753,000**
	Tax rate (9.4%)			165,000
	Subtotal:			**$ 1,918,000**
	Engineering & Administrative Services (25%):			$ 480,000
	Total Estimated Construction Cost:			**$ 2,398,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Transmission Project T-1
Cross City Transmission Main

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Minor Changes	1	MC	$30,000.00	$30,000.00
2.	Survey	1	LS	$10,000.00	$10,000.00
3.	SPCC Plan	1	LS	$3,000.00	$3,000.00
4.	Mobilization, Cleanup, and Demobilization	1	LS	$250,000.00	$250,000.00
5.	Project Temporary Traffic Control	1	LS	$50,000.00	$50,000.00
6.	Clearing and Grubbing	1	LS	$5,000.00	$5,000.00
7.	Removal of Structure and Obstruction	1	LS	$25,000.00	$25,000.00
8.	Control Density Fill	10	CY	$200.00	$2,000.00
9.	Locate Existing Utilities	1	LS	$10,000.00	$10,000.00
10.	Crushed Surfacing Top Course	3,000	TN	$22.00	$66,000.00
11.	WMA Cl. 1/2" PG 58-22, Trench Repair	1,200	TN	$110.00	$132,000.00
12.	Temporary HMA Cl. 1/2" PG 58-22	500	TN	$150.00	$75,000.00
13.	DI Water Pipe, 8 in. Diam.	100	LF	$50.00	$5,000.00
14.	DI Water Pipe, 18 in. Diam.	8,200	LF	$90.00	$738,000.00
15.	Additional Fittings	2,000	LB	$3.00	$6,000.00
16.	Connection to Existing Water Main	4	EA	$5,000.00	$20,000.00
17.	Removal of Unsuitable Material (Trench)	100	CY	$75.00	$7,500.00
18.	Bank Run Gravel for Trench Backfill	18,000	TN	$20.00	$360,000.00
19.	Trench Excavation Safety Systems	1	LS	$25,000.00	$25,000.00
20.	Plug Existing Pipe	6	EA	$200.00	$1,200.00
21.	Gate Valves, 8 In.	2	EA	$1,500.00	$3,000.00
22.	Butterfly Valve 18 In.	6	EA	$4,000.00	$24,000.00
23.	Comb. Air Relief/Vacuum Assembly	3	EA	$4,000.00	$12,000.00
24.	Jack and Bore State Route 20	1	LS	$50,000.00	$50,000.00
25.	Steel Casing Pipe, 36 In. Diam.	450	LF	$550.00	$247,500.00
26.	DI Carrier Pipe, 18 In. DIPS Diam.	450	LF	$150.00	$67,500.00
27.	Metering Vault	1	LS	$50,000.00	$50,000.00
28.	Erosion/Water Pollution Control	1	LS	$10,000.00	$10,000.00
29.	Seeding and Fertilizing	6,000	SY	$3.00	$18,000.00
30.	Sod Installation	50	SY	$6.00	$300.00
31.	Topsoil, Type A	500	CY	$45.00	$22,500.00
32.	Wetland Mitigation	1	LS	$20,000.00	$20,000.00
33.	Cement Concrete Traffic Curb and Gutter	30	LF	$35.00	$1,050.00
34.	Cement Concrete Driveway Entrance	12	SY	$35.00	$420.00
35.	Paint Line	10,000	LF	$0.75	$7,500.00
36.	Plastic Stop Line	100	LF	$7.00	$700.00
37.	Project Documentation	1	LS	$2,000.00	$2,000.00

Subtotal	**$ 2,357,000**
Archaeological Mitigation (15%)	$ 354,000
Subtotal:	**$ 2,711,000**
Contingency (20%)	$ 542,000
Subtotal:	**$ 3,253,000**
Tax rate (9.4%)	306,000
Total Estimated Construction Cost:	**$ 3,559,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Transmission Project T-2
North-End Trunk Main: Phase I & II

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Minor Changes	1	MC	$25,000.00	$25,000.00
2.	Survey	1	LS	$5,000.00	$5,000.00
3.	SPCC Plan	1	LS	$3,000.00	$3,000.00
4.	Mobilization, Cleanup, and Demobilization	1	LS	$120,000.00	$120,000.00
5.	Project Temporary Traffic Control	1	LS	$10,000.00	$10,000.00
6.	Clearing and Grubbing	1	LS	$10,000.00	$10,000.00
7.	Removal of Structure and Obstruction	1	LS	$10,000.00	$10,000.00
8.	Control Density Fill	10	CY	$200.00	$2,000.00
9.	Locate Existing Utilities	1	LS	$5,000.00	$5,000.00
10.	Crushed Surfacing Top Course	7,500	TN	$22.00	$165,000.00
11.	WMA Cl. 1/2" PG 58-22, Trench Repair	600	TN	$110.00	$66,000.00
12.	Temporary HMA Cl. 1/2" PG 58-22	50	TN	$150.00	$7,500.00
13.	Plug Existing Pipe	2	EA	$200.00	$400.00
14.	DI Water Pipe, 12 in. Diam.	500	LF	$70.00	$35,000.00
15.	DI Water Pipe, 18 in. Diam.	4,000	LF	$90.00	$360,000.00
16.	Additional Fittings	2,000	LB	$3.00	$6,000.00
17.	Connection to Existing Water Main	3	EA	$5,000.00	$15,000.00
18.	Removal of Unsuitable Material (Trench)	50	CY	$75.00	$3,750.00
19.	Bank Run Gravel for Trench Backfill	8000	TN	$20.00	$160,000.00
20.	Trench Excavation Safety Systems	1	LS	$15,000.00	$15,000.00
21.	Gate Valves, 12 In.	2	EA	$2,500.00	$5,000.00
22.	Butterfly Valve 18 In.	2	EA	$4,000.00	$8,000.00
23.	Fire Hydrant Assembly	2	EA	$5,500.00	$11,000.00
24.	Water Service Connection	6	EA	$1,000.00	$6,000.00
25.	HDPE Pipe 24 In. Diam.	100	LF	$400.00	$40,000.00
26.	Erosion/Water Pollution Control	1	LS	$5,000.00	$5,000.00
27.	Seeding and Fertilizing	4,000	SY	$3.00	$12,000.00
28.	Topsoil, Type A	800	CY	$45.00	$36,000.00
29.	Wetland Mitigation	1	LS	$20,000.00	$20,000.00
30.	Paint Line	3000	LF	$0.75	$2,250.00
31.	Plastic Stop Line	60	LF	$7.00	$420.00
32.	Project Documentation	1	LS	$1,000.00	$1,000.00

Subtotal	**$**	**1,170,000**
Archaeological Mitigation (15%)	$	176,000
Subtotal:	**$**	**1,346,000**
Contingency (20%)	$	269,000
Subtotal:	**$**	**1,615,000**
Tax rate (9.4%)		152,000
Total Estimated Construction Cost:	**$**	**1,767,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Transmission Project T-3
West 384 Zone Extension: Phase I

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Minor Changes	1	MC	$30,000.00	$30,000.00
2.	Survey	1	LS	$10,000.00	$10,000.00
3.	SPCC Plan	1	LS	$5,000.00	$5,000.00
4.	Mobilization, Cleanup, and Demobilization	1	LS	$140,000.00	$140,000.00
5.	Project Temporary Traffic Control	1	LS	$15,000.00	$15,000.00
6.	Clearing and Grubbing	1	LS	$15,000.00	$15,000.00
7.	Removal of Structure and Obstruction	1	LS	$15,000.00	$15,000.00
8.	Control Density Fill	10	CY	$200.00	$2,000.00
9.	Locate Existing Utilities	1	LS	$10,000.00	$10,000.00
10.	Crushed Surfacing Top Course	2,000	TN	$22.00	$44,000.00
11.	WMA Cl. 1/2" PG 58-22, Trench Repair	800	TN	$110.00	$88,000.00
12.	Temporary HMA Cl. 1/2" PG 58-22	350	TN	$150.00	$52,500.00
13.	DI Water Pipe, 24 in. Diam.	5,300	LF	$120.00	$636,000.00
14.	Additional Fittings	6,000	LB	$3.00	$18,000.00
15.	Connection to Existing Water Main	4	EA	$5,000.00	$20,000.00
16.	Removal of Unsuitable Material (Trench)	150	CY	$75.00	$11,250.00
17.	Bank Run Gravel for Trench Backfill	13000	TN	$20.00	$260,000.00
18.	Trench Excavation Safety Systems	1	LS	$20,000.00	$20,000.00
19.	Butterfly Valve 24 In.	4	EA	$6,500.00	$26,000.00
20.	Fire Hydrant Assembly	2	EA	$5,500.00	$11,000.00
21.	Erosion/Water Pollution Control	1	LS	$15,000.00	$15,000.00
22.	Seeding and Fertilizing	4,000	SY	$3.00	$12,000.00
23.	Topsoil, Type A	500	CY	$45.00	$22,500.00
24.	Paint Line	5000	LF	$0.75	$3,750.00
25.	Plastic Stop Line	100	LF	$7.00	$700.00
26.	Project Documentation	1	LS	$1,000.00	$1,000.00

Subtotal	**$**	**1,484,000**
Archaeological Mitigation (10%)	$	148,000
Subtotal:	**$**	**1,632,000**
Contingency (20%)	$	326,000
Subtotal:	**$**	**1,958,000**
Tax rate (9.4%)		184,000
Subtotal:	**$**	**2,142,000**
Engineering & Administrative Services (25%):	$	536,000
Total Estimated Construction Cost:	**$**	**2,678,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Transmission Project T-5
Westside Water Main Extension

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Minor Changes	1	MC	$50,000.00	$50,000.00
2.	Survey	1	LS	$20,000.00	$20,000.00
3.	SPCC Plan	1	LS	$5,000.00	$5,000.00
4.	Mobilization, Cleanup, and Demobilization	1	LS	$300,000.00	$300,000.00
5.	Project Temporary Traffic Control	1	LS	$100,000.00	$100,000.00
6.	Clearing and Grubbing	1	LS	$20,000.00	$20,000.00
7.	Removal of Structure and Obstruction	1	LS	$25,000.00	$25,000.00
8.	Control Density Fill	50	CY	$200.00	$10,000.00
9.	Locate Existing Utilities	1	LS	$15,000.00	$15,000.00
10.	Crushed Surfacing Top Course	6,000	TN	$22.00	$132,000.00
11.	WMA Cl. 1/2" PG 58-22, Trench Repair	2,400	TN	$110.00	$264,000.00
12.	Temporary HMA Cl. 1/2" PG 58-22	1,000	TN	$150.00	$150,000.00
13.	DI Water Pipe, 18 in. Diam.	16,500	LF	$110.00	$1,815,000.00
14.	Additional Fittings	15,000	LB	$3.00	$45,000.00
15.	Connection to Existing Water Main	6	EA	$5,000.00	$30,000.00
16.	Removal of Unsuitable Material (Trench)	200	CY	$75.00	$15,000.00
17.	Bank Run Gravel for Trench Backfill	30,000	TN	$20.00	$600,000.00
18.	Trench Excavation Safety Systems	1	LS	$50,000.00	$50,000.00
19.	Plug Existing Pipe	10	EA	$200.00	$2,000.00
20.	Butterfly Valve 18 In.	15	EA	$4,000.00	$60,000.00
21.	Comb. Air Relief/Vacuum Assembly	5	EA	$4,000.00	$20,000.00
22.	Erosion/Water Pollution Control	1	LS	$20,000.00	$20,000.00
23.	Seeding and Fertilizing	10,000	SY	$3.00	$30,000.00
24.	Sod Installation	250	SY	$6.00	$1,500.00
25.	Topsoil, Type A	1,000	CY	$45.00	$45,000.00
26.	Wetland Mitigation	1	LS	$20,000.00	$20,000.00
27.	Paint Line	15,000	LF	$0.75	$11,250.00
28.	Plastic Stop Line	500	LF	$7.00	$3,500.00
29.	Project Documentation	1	LS	$5,000.00	$5,000.00

Subtotal	**$ 3,864,000**
Archaeological Mitigation (20%)	$ 773,000
Subtotal:	**$ 4,637,000**
Contingency (20%)	$ 927,000
Subtotal:	**$ 5,564,000**
Tax rate (9.4%)	523,000
Subtotal:	**$ 6,087,000**
Engineering & Administrative Services (25%):	$ 1,522,000
Total Estimated Construction Cost:	**$ 7,609,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Transmission Project T-6
Campbell Lake Transsmission Main Replacement

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Minor Changes	1	MC	$30,000.00	$30,000.00
2.	Survey	1	LS	$10,000.00	$10,000.00
3.	SPCC Plan	1	LS	$5,000.00	$5,000.00
4.	Mobilization, Cleanup, and Demobilization	1	LS	$140,000.00	$140,000.00
5.	Project Temporary Traffic Control	1	LS	$15,000.00	$15,000.00
6.	Clearing and Grubbing	1	LS	$15,000.00	$15,000.00
7.	Removal of Structure and Obstruction	1	LS	$15,000.00	$15,000.00
8.	Control Density Fill	50	CY	$200.00	$10,000.00
9.	Locate Existing Utilities	1	LS	$10,000.00	$10,000.00
10.	Crushed Surfacing Top Course	1,600	TN	$22.00	$35,200.00
11.	WMA Cl. 1/2" PG 58-22, Trench Repair	600	TN	$110.00	$66,000.00
12.	Temporary HMA Cl. 1/2" PG 58-22	250	TN	$150.00	$37,500.00
13.	HDPE Water Pipe, 24 in. Diam.	3,100	LF	$110.00	$341,000.00
14.	Additional Fittings	1	LS	$4,000.00	$4,000.00
15.	Connection to Existing Water Main	2	EA	$5,000.00	$10,000.00
16.	Removal of Unsuitable Material (Trench)	150	CY	$75.00	$11,250.00
17.	Bank Run Gravel for Trench Backfill	9,900	TN	$20.00	$198,000.00
18.	Trench Excavation Safety Systems	1	LS	$15,000.00	$15,000.00
19.	Butterfly Valve 24 In.	4	EA	$6,500.00	$26,000.00
20.	Erosion/Water Pollution Control	1	LS	$20,000.00	$20,000.00
21.	Seeding and Fertilizing	3,000	SY	$3.00	$9,000.00
22.	Topsoil, Type A	400	CY	$45.00	$18,000.00
23.	Paint Line	3,000	LF	$0.75	$2,250.00
24.	Project Documentation	1	LS	$1,000.00	$1,000.00

Subtotal..	**$**	**1,044,000**
Archaeological Mitigation (15%)..	$	157,000
Subtotal:..	**$**	**1,201,000**
Contingency (20%)..	$	240,000
Subtotal:..	**$**	**1,441,000**
Tax rate (9.4%)..		135,000
Subtotal:..	**$**	**1,576,000**
Engineering & Administrative Services (25%):........................	$	394,000
Total Estimated Construction Cost:..	**$**	**1,970,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project DS-1
NE Regatta Drive Pipeline

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1	LS	$ 6,000	$ 6,000
2.	Locate Existing Utilities	1	LS	$ 1,000	$ 1,000
3.	Erosion Control	1	LS	$ 1,000	$ 1,000
4.	Trench Safety Systems	1	LS	$ 1,000	$ 1,000
5.	8-inch Ductile Iron Water Pipe	300	LF	$ 75	$ 22,500
6.	Additional Fittings	100	LB	$ 4	$ 400
7.	8-inch Gate Valves	2	EA	$ 1,200	$ 2,400
8.	Fire Hydrants	2	EA	$ 5,000	$ 10,000
9.	Gravel Backfill	150	CY	$ 20	$ 3,000
10.	Foundation Gravel	20	TN	$ 30	$ 600
11.	HMA Cl. B PG 58-22	20	TN	$ 120	$ 2,400
12.	Cold Mix Asphalt	10	TN	$ 110	$ 1,100
13.	Sawcutting	600	LF	$ 3	$ 1,800
14.	Crushed Surfacing, Base Course	30	TN	$ 25	$ 750
15.	Crushed Surfacing, Top Course	20	TN	$ 22	$ 440
16.	Connections to Existing System	2	EA	$ 3,000	$ 6,000
17.	3/4" Service Connections, Complete	0	EA	$ 1,500	$ -
18.	Traffic Control	16	HRS	$ 95	$ 1,520

Subtotal	**$ 62,000**
Archaeological Mitigation (15%)	$ 9,000
Subtotal:	**$ 71,000**
Contingency (20%)	$ 14,000
Subtotal:	**$ 85,000**
Tax rate (9.4%)	8,000
Subtotal:	**$ 93,000**
Engineering & Administrative Services (25%):	$ 23,000
Total Estimated Construction Cost:	**$ 116,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project DS-2
Glencoe Street Fireflow Improvements

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1	LS	$ 43,000	$ 43,000
2.	Locate Existing Utilities	1	LS	$ 8,000	$ 8,000
3.	Erosion Control	1	LS	$ 8,000	$ 8,000
4.	Trench Safety Systems	1	LS	$ 4,800	$ 4,800
5.	8-inch Ductile Iron Water Pipe	2,400	LF	$ 75	$ 180,000
6.	Additional Fittings	1,100	LB	$ 4	$ 4,400
7.	8-inch Gate Valves	4	EA	$ 1,200	$ 5,280
8.	Fire Hydrants	6	EA	$ 5,000	$ 29,000
9.	Gravel Backfill	1,170	CY	$ 20	$ 23,400
10.	Foundation Gravel	130	TN	$ 30	$ 3,900
11.	HMA Cl. B PG 58-22	190	TN	$ 120	$ 22,800
12.	Cold Mix Asphalt	110	TN	$ 110	$ 12,100
13.	Sawcutting	4,800	LF	$ 3	$ 14,400
14.	Crushed Surfacing, Base Course	220	TN	$ 25	$ 5,500
15.	Crushed Surfacing, Top Course	150	TN	$ 22	$ 3,300
16.	Connections to Existing System	5	EA	$ 3,000	$ 15,000
17.	3/4" Service Connections, Complete	54	EA	$ 1,500	$ 81,000
18.	Traffic Control	128	HRS	$ 95	$ 12,160
	Subtotal				**$ 476,000**
	Archaeological Mitigation (20%)				$ 95,000
	Subtotal:				**$ 571,000**
	Contingency (20%)				$ 114,000
	Subtotal:				**$ 685,000**
	Tax rate (9.4%)				64,000
	Subtotal:				**$ 749,000**
	Engineering & Administrative Services (25%):				$ 187,000
	Total Estimated Construction Cost:				**$ 936,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project DS-3
SW 10th Court Pipe Replacement

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1	LS	$ 9,000	$ 9,000
2.	Locate Existing Utilities	1	LS	$ 2,000	$ 2,000
3.	Erosion Control	1	LS	$ 2,000	$ 2,000
4.	Trench Safety Systems	1	LS	$ 1,000	$ 1,000
5.	8-inch Ductile Iron Water Pipe	480	LF	$ 75	$ 36,000
6.	Additional Fittings	200	LB	$ 4	$ 800
7.	8-inch Gate Valves	3	EA	$ 1,200	$ 3,000
8.	Fire Hydrants	1	EA	$ 5,000	$ 5,000
9.	Gravel Backfill	230	CY	$ 20	$ 4,600
10.	Foundation Gravel	30	TN	$ 30	$ 900
11.	HMA Cl. B PG 58-22	40	TN	$ 120	$ 4,800
12.	Cold Mix Asphalt	20	TN	$ 110	$ 2,200
13.	Sawcutting	960	LF	$ 3	$ 2,880
14.	Crushed Surfacing, Base Course	40	TN	$ 25	$ 1,000
15.	Crushed Surfacing, Top Course	30	TN	$ 22	$ 660
16.	Connections to Existing System	1	EA	$ 3,000	$ 3,000
17.	3/4" Service Connections, Complete	15	EA	$ 1,500	$ 22,500
18.	Traffic Control	24	HRS	$ 95	$ 2,280
	Subtotal				**$ 104,000**
	Archaeological Mitigation (10%)				$ 10,000
	Subtotal:				**$ 114,000**
	Contingency (20%)				$ 23,000
	Subtotal:				**$ 137,000**
	Tax rate (9.4%)				13,000
	Subtotal:				**$ 150,000**
	Engineering & Administrative Services (25%):				$ 38,000
	Total Estimated Construction Cost:				**$ 188,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project DS-4
SW 11th Court Pipe Replacement

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1	LS	$ 9,000	$ 9,000
2.	Locate Existing Utilities	1	LS	$ 2,000	$ 2,000
3.	Erosion Control	1	LS	$ 2,000	$ 2,000
4.	Trench Safety Systems	1	LS	$ 1,000	$ 1,000
5.	8-inch Ductile Iron Water Pipe	480	LF	$ 75	$ 36,000
6.	Additional Fittings	200	LB	$ 4	$ 800
7.	8-inch Gate Valves	3	EA	$ 1,200	$ 3,000
8.	Fire Hydrants	1	EA	$ 5,000	$ 5,000
9.	Gravel Backfill	230	CY	$ 20	$ 4,600
10.	Foundation Gravel	30	TN	$ 30	$ 900
11.	HMA Cl. B PG 58-22	40	TN	$ 120	$ 4,800
12.	Cold Mix Asphalt	20	TN	$ 110	$ 2,200
13.	Sawcutting	960	LF	$ 3	$ 2,880
14.	Crushed Surfacing, Base Course	40	TN	$ 25	$ 1,000
15.	Crushed Surfacing, Top Course	30	TN	$ 22	$ 660
16.	Connections to Existing System	1	EA	$ 3,000	$ 3,000
17.	3/4" Service Connections, Complete	15	EA	$ 1,500	$ 22,500
18.	Traffic Control	24	HRS	$ 95	$ 2,280

Subtotal	**$ 104,000**
Archaeological Mitigation (10%)	$ 10,000
Subtotal:	**$ 114,000**
Contingency (20%)	$ 23,000
Subtotal:	**$ 137,000**
Tax rate (9.4%)	13,000
Subtotal:	**$ 150,000**
Engineering & Administrative Services (25%):	$ 38,000
Total Estimated Construction Cost:	**$ 188,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project DS-5
Erin Park Main Road Extension

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1	LS	$ 28,000	$ 28,000
2.	Locate Existing Utilities	1	LS	$ 5,000	$ 5,000
3.	Erosion Control	1	LS	$ 5,000	$ 5,000
4.	Trench Safety Systems	1	LS	$ 2,900	$ 2,900
5.	12-inch Ductile Iron Water Pipe	1,450	LF	$ 95	$ 137,750
6.	Additional Fittings	700	LB	$ 4	$ 2,800
7.	12-inch Gate Valves	5	EA	$ 2,500	$ 12,500
8.	Fire Hydrants	4	EA	$ 5,000	$ 19,500
9.	Gravel Backfill	830	CY	$ 20	$ 16,600
10.	Foundation Gravel	90	TN	$ 30	$ 2,700
11.	HMA Cl. B PG 58-22	130	TN	$ 120	$ 15,600
12.	Cold Mix Asphalt	70	TN	$ 110	$ 7,700
13.	Sawcutting	2,900	LF	$ 3	$ 8,700
14.	Crushed Surfacing, Base Course	130	TN	$ 28	$ 3,640
15.	Crushed Surfacing, Top Course	90	TN	$ 25	$ 2,250
16.	Connections to Existing System	2	EA	$ 3,000	$ 6,000
17.	3/4" Service Connections, Complete	15	EA	$ 1,500	$ 22,500
18.	Traffic Control	76	HRS	$ 95	$ 7,220

Subtotal......................................	**$ 306,000**
Archaeological Mitigation (15%)......................................	$ 46,000
Subtotal:......................................	**$ 352,000**
Contingency (20%)......................................	$ 70,000
Subtotal:......................................	**$ 422,000**
Tax rate (9.4%)......................................	40,000
Subtotal:......................................	**$ 462,000**
Engineering & Administrative Services (25%):......................................	$ 116,000
Total Estimated Construction Cost:......................................	**$ 578,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project DS-8
Heller Reservoir Extension

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1.	Mobilization, Cleanup, and Demobilization	1	LS	$	35,000	$	35,000
2.	Locate Existing Utilities	1	LS	$	7,000	$	7,000
3.	Erosion Control	1	LS	$	7,000	$	7,000
4.	Trench Safety Systems	1	LS	$	4,000	$	4,000
5.	16-inch Ductile Iron Water Pipe	2,000	LF	$	105	$	210,000
6.	Additional Fittings	1,200	LB	$	4	$	4,800
7.	16-inch Butterfly Valves	4	EA	$	4,000	$	16,000
8.	Gravel Backfill	1,300	CY	$	20	$	26,000
9.	Foundation Gravel	150	TN	$	30	$	4,500
10.	HMA Cl. B PG 58-22	210	TN	$	120	$	25,200
11.	Cold Mix Asphalt	90	TN	$	110	$	9,900
12.	Sawcutting	4,000	LF	$	3	$	12,000
13.	Crushed Surfacing, Base Course	180	TN	$	25	$	4,500
14.	Crushed Surfacing, Top Course	120	TN	$	22	$	2,640
15.	Connections to Existing System	2	EA	$	3,000	$	6,000
16.	Traffic Control	108	HRS	$	95	$	10,260
	Subtotal					**$**	**385,000**
	Archaeological Mitigation (10%)					$	39,000
	Subtotal:					**$**	**424,000**
	Contingency (20%)					$	85,000
	Subtotal:					**$**	**509,000**
	Tax rate (9.4%)						48,000
	Subtotal:					**$**	**557,000**
	Engineering & Administrative Services (25%):					$	139,000
	Total Estimated Construction Cost:					**$**	**696,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project PZ-1
O'Leary Way Water Main

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1	LS	$	28,000	$ 28,000
2.	Locate Existing Utilities	1	LS	$	5,000	$ 5,000
3.	Erosion Control	1	LS	$	5,000	$ 5,000
4.	Trench Safety Systems	1	LS	$	3,800	$ 3,800
5.	8-inch Ductile Iron Water Pipe	1,900	LF	$	75	$ 142,500
6.	Additional Fittings	900	LB	$	4	$ 3,600
7.	8-inch Gate Valves	4	EA	$	1,200	$ 4,800
8.	Fire Hydrants	5	EA	$	5,000	$ 25,000
9.	Gravel Backfill	930	CY	$	20	$ 18,600
10.	Foundation Gravel	100	TN	$	30	$ 3,000
11.	HMA Cl. B PG 58-22	150	TN	$	120	$ 18,000
12.	Cold Mix Asphalt	90	TN	$	110	$ 9,900
13.	Sawcutting	3,800	LF	$	3	$ 11,400
14.	Crushed Surfacing, Base Course	170	TN	$	25	$ 4,250
15.	Crushed Surfacing, Top Course	120	TN	$	22	$ 2,640
16.	Connections to Existing System	3	EA	$	3,000	$ 9,000
17.	Traffic Control	100	HRS	$	95	$ 9,500

Subtotal	**$ 304,000**
Archaeological Mitigation (20%)	$ 61,000
Subtotal:	**$ 365,000**
Contingency (20%)	$ 73,000
Subtotal:	**$ 438,000**
Tax rate (9.4%)	41,000
Subtotal:	**$ 479,000**
Engineering & Administrative Services (25%):	$ 120,000
Total Estimated Construction Cost:	**$ 599,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project PZ-2
North O'Leary Way Water Main

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1	LS	$ 25,000	$ 25,000
2.	Locate Existing Utilities	1	LS	$ 5,000	$ 5,000
3.	Erosion Control	1	LS	$ 5,000	$ 5,000
4.	Trench Safety Systems	1	LS	$ 2,400	$ 2,400
5.	8-inch Ductile Iron Water Pipe	1,200	LF	$ 95	$ 114,000
6.	Additional Fittings	500	LB	$ 4	$ 2,000
7.	8-inch Gate Valves	3	EA	$ 1,200	$ 3,840
8.	Fire Hydrants	4	EA	$ 5,000	$ 20,000
9.	Gravel Backfill	590	CY	$ 20	$ 11,800
10.	Foundation Gravel	70	TN	$ 30	$ 2,100
11.	HMA Cl. B PG 58-22	100	TN	$ 120	$ 12,000
12.	Cold Mix Asphalt	60	TN	$ 110	$ 6,600
13.	Sawcutting	2,400	LF	$ 3	$ 7,200
14.	Crushed Surfacing, Base Course	110	TN	$ 25	$ 2,750
15.	Crushed Surfacing, Top Course	70	TN	$ 22	$ 1,540
16.	Connections to Existing System	2	EA	$ 3,000	$ 6,000
17.	3/4" Service Connections, Complete	25	EA	$ 1,500	$ 37,500
18.	Traffic Control	64	HRS	$ 95	$ 6,080
	Subtotal				**$ 271,000**
	Archaeological Mitigation (15%)				$ 41,000
	Subtotal:				**$ 312,000**
	Contingency (20%)				$ 62,000
	Subtotal:				**$ 374,000**
	Tax rate (9.4%)				35,000
	Subtotal:				**$ 409,000**
	Engineering & Administrative Services (25%):				$ 102,000
	Total Estimated Construction Cost:				**$ 511,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project PZ-3
South End NASWI Connection

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1	LS	$ 42,000	$ 42,000
2.	Locate Existing Utilities	1	LS	$ 8,000	$ 8,000
3.	Erosion Control	1	LS	$ 8,000	$ 8,000
4.	Trench Safety Systems	1	LS	$ 2,400	$ 2,400
5.	12-inch Ductile Iron Water Pipe	1,200	LF	$ 75	$ 90,000
6.	Additional Fittings	600	LB	$ 4	$ 2,400
7.	12-inch Gate Valves	2	EA	$ 2,500	$ 5,000
8.	Pressure Reducing Valve Station, Complete	1	LS	$ 200,000	$ 225,000
9.	Fire Hydrants	4	EA	$ 5,000	$ 20,000
10.	Gravel Backfill	680	CY	$ 20	$ 13,600
11.	Foundation Gravel	80	TN	$ 30	$ 2,400
12.	HMA Cl. B PG 58-22	110	TN	$ 120	$ 13,200
13.	Cold Mix Asphalt	60	TN	$ 110	$ 6,600
14.	Sawcutting	2,400	LF	$ 3	$ 7,200
15.	Crushed Surfacing, Base Course	110	TN	$ 25	$ 2,750
16.	Crushed Surfacing, Top Course	70	TN	$ 22	$ 1,540
17.	Connections to Existing System	1	EA	$ 3,000	$ 3,000
18.	Traffic Control	64	HRS	$ 95	$ 6,080
	Subtotal				**$ 459,000**
	Archaeological Mitigation (20%)				$ 92,000
	Subtotal:				**$ 551,000**
	Contingency (20%)				$ 110,000
	Subtotal:				**$ 661,000**
	Tax rate (9.4%)				62,000
	Subtotal:				**$ 723,000**
	Engineering & Administrative Services (25%):				$ 181,000
	Total Estimated Construction Cost:				**$ 904,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project PZ-4
West 384 Zone Development

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1.	Mobilization, Cleanup, and Demobilization	1	LS	$	16,000	$	16,000
2.	Locate Existing Utilities	1	LS	$	3,000	$	3,000
3.	Erosion Control	1	LS	$	3,000	$	3,000
4.	Trench Safety Systems	1	LS	$	1,600	$	1,600
5.	8-inch Ductiles Iron Water Pipe	780	LF	$	75	$	58,500
6.	Additional Fittings	400	LB	$	4	$	1,600
7.	8-inch Gate Valves	3	EA	$	1,200	$	3,360
8.	Fire Hydrants	2	EA	$	5,000	$	10,000
9.	Fireflow Checkvalve Installations	1	EA	$	35,000	$	35,000
10.	Gravel Backfill	380	CY	$	20	$	7,600
11.	Foundation Gravel	40	TN	$	30	$	1,200
12.	HMA Cl. B PG 58-22	60	TN	$	120	$	7,200
13.	Cold Mix Asphalt	40	TN	$	110	$	4,400
14.	Sawcutting	1,560	LF	$	3	$	4,680
15.	Crushed Surfacing, Base Course	70	TN	$	25	$	1,750
16.	Crushed Surfacing, Top Course	50	TN	$	22	$	1,100
17.	Connections to Existing System	3	EA	$	3,000	$	9,000
18.	Traffic Control	40	HRS	$	95	$	3,800

Subtotal...	**$**	**173,000**
Archaeological Mitigation (15%)..	$	26,000
Subtotal:...	**$**	**199,000**
Contingency (20%)..	$	40,000
Subtotal:...	**$**	**239,000**
Tax rate (9.4%)...		22,000
Subtotal:...	**$**	**261,000**
Engineering & Administrative Services (25%):...	$	65,000
Total Estimated Construction Cost:..	**$**	**326,000**

** ENR CCI for Seattle, November 2013: 10,143

City of Oak Harbor
Preliminary Project Cost Estimate
Distribution System Project PZ-5
West 322 Zone Development

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization, Cleanup, and Demobilization	1	LS	$ 23,000	$ 23,000
2.	Locate Existing Utilities	1	LS	$ 2,000	$ 2,000
3.	Erosion Control	1	LS	$ 2,000	$ 2,000
4.	Trench Safety Systems	1	LS	$ 5,000	$ 5,000
5.	PRV Installations	2	EA	$ 90,000	$ 180,000
6.	Fireflow Check Valve Installation	1	EA	$ 35,000	$ 35,000
7.	Gravel Backfill	100	CY	$ 20	$ 2,000
8.	Foundation Gravel	15	TN	$ 30	$ 450
9.	HMA Cl. B PG 58-22	10	TN	$ 120	$ 1,200
10.	Crushed Surfacing, Base Course	10	TN	$ 28	$ 280
11.	Crushed Surfacing, Top Course	10	TN	$ 25	$ 250
12.	Connections to Existing System	2	EA	$ 3,000	$ 6,000
	Subtotal				**$ 257,000**
	Archaeological Mitigation (15%)				$ 39,000
	Subtotal:				**$ 296,000**
	Contingency (20%)				$ 59,000
	Subtotal:				**$ 355,000**
	Tax rate (9.4%)				33,000
	Subtotal:				**$ 388,000**
	Engineering & Administrative Services (25%):				$ 97,000
	Total Estimated Construction Cost:				**$ 485,000**

** ENR CCI for Seattle, November 2013: 10,143