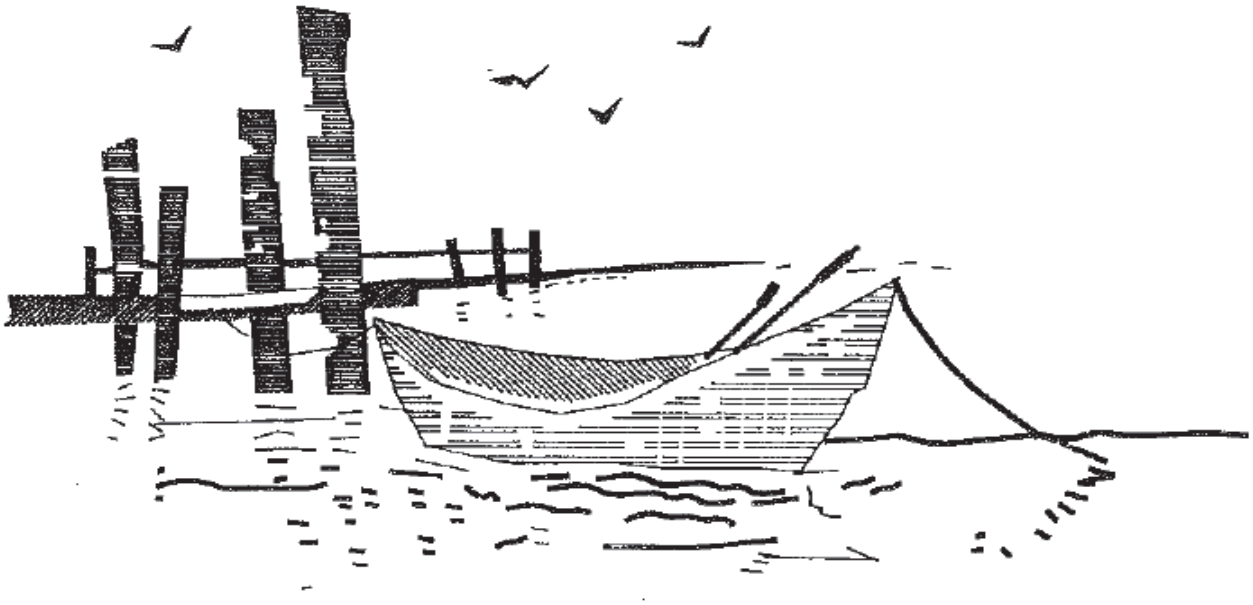
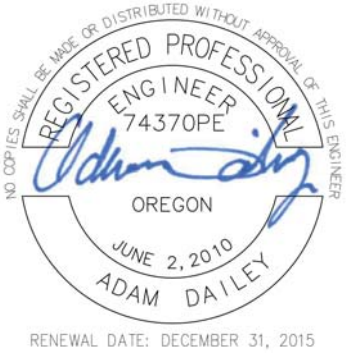
City of Nehalem

Water Master Plan

November 2015





RENEWAL DATE: DECEMBER 31, 2015

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Executive Summary

E.1 Purpose

The purpose of this water master plan is to provide the City of Nehalem with a comprehensive water utility planning document through the year 2035, and to identify potential improvements or management options needed for compliance with current and anticipated future regulatory requirements.

Nehalem's previous master plan was completed in 1995 and will be out of date on December 31, 2015.

E.2 Population and Growth

Estimated recent (2013) resident population is 983: 280 persons in Nehalem, and approximately 703 additional persons in the water service area. Because of the large percentage of second homes, at times the actual population served is likely much greater than census figures and population estimates indicate. Past population projections used a general planning figure of 1% average annual growth rate. 1% is used in this Master Plan and matches the recent growth of new connections and estimated population numbers.

Water use however has reduced by almost 50% over the last 10 years, and appears to be stabilizing.

E.3 Existing Water System

The City of Nehalem owns and operates a municipal water supply system that serves the City and the surrounding area that closely matches the UGB. The oldest components of Nehalem's existing system date to the early 1950's; its earliest water right dates to 1911. Nehalem constructed a membrane microfiltration treatment facility to treat its surface water sources (Bob's Creek) to meet federal Surface Water Treatment Rules. This plant was constructed in 2000. Nehalem's system includes two ground level reservoirs and one above ground, 1.5 million gallon treated water reservoir. The 1.5 million gallon reservoir was constructed in 2002. The City also replaced nearly all of its existing waterlines in a construction projected that ended in 2008.

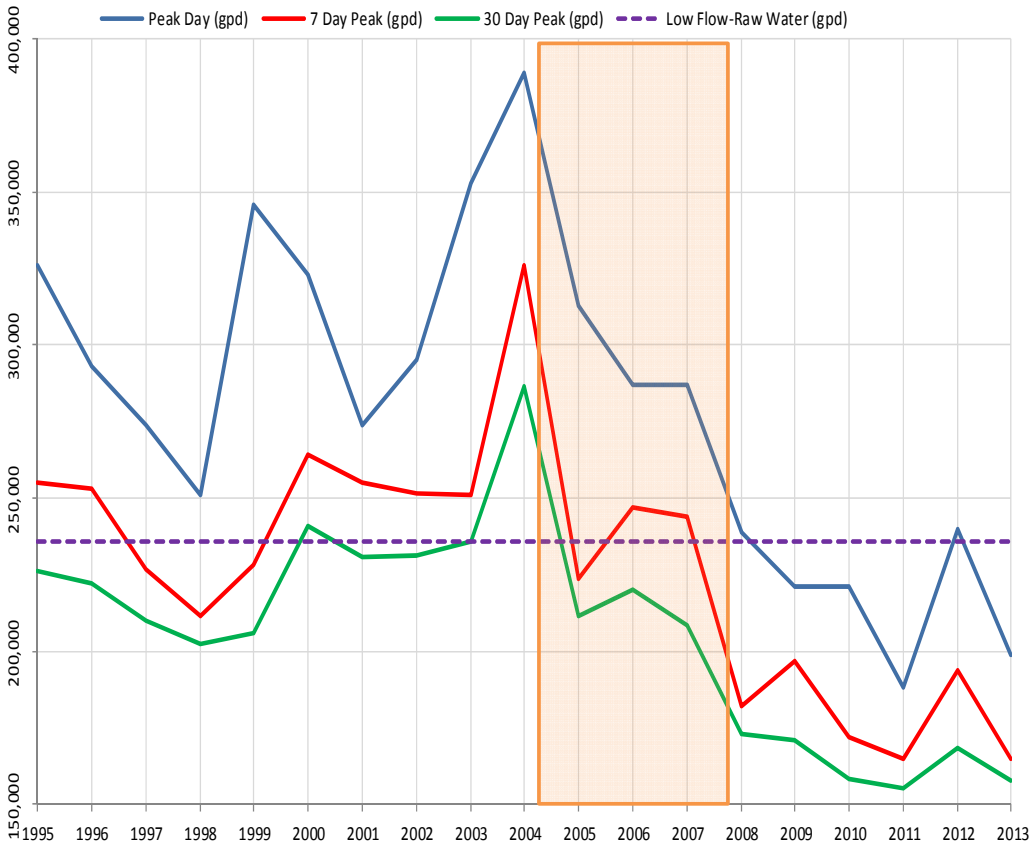
E.4 Water Requirements

Recent water production for the City of Nehalem is summarized in Table E.1 and Figure E.1.

Table E.1: Recent Water Production (2013)

Parameter	Demand (MG)	(mgd)	(gpm)
Annual	38.8	0.106	73.6
Maximum Month	4.88	0.157	109.0
3-Day Maximum	0.534	0.178	123.6
7-Day Maximum	1.155	0.165	114.6
14-Day Maximum	2.254	0.161	111.8
Peak Day	0.199	0.199	138.2

Figure E.1: Water Production

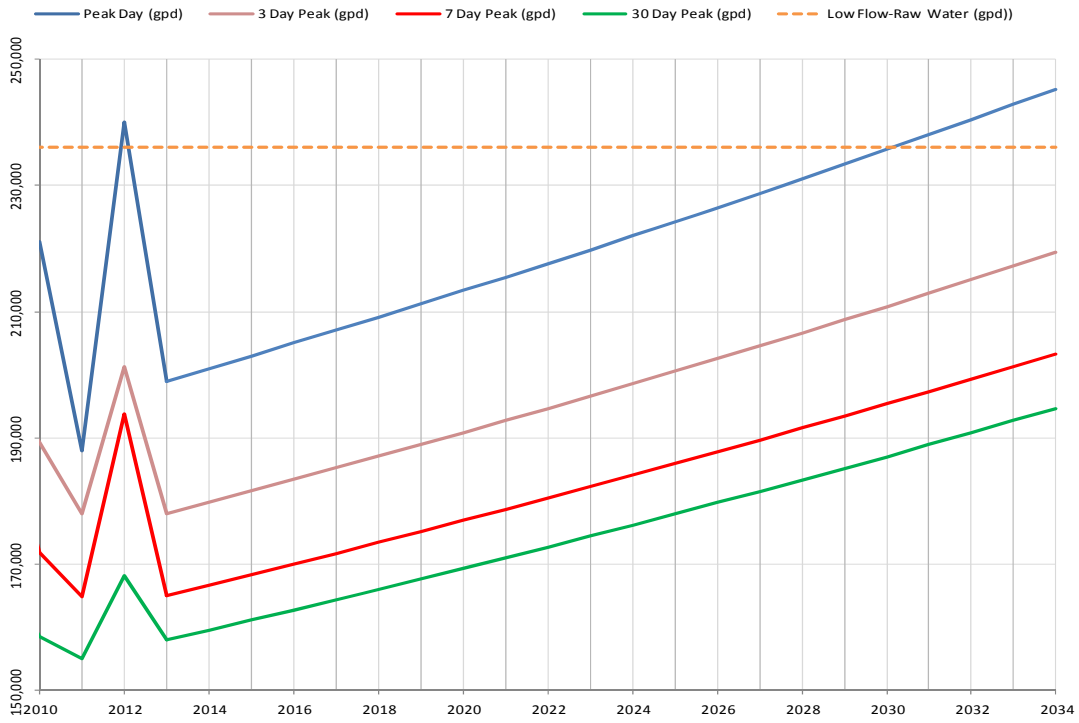


Future demands for the City of Nehalem are summarized in Table E.2 and projected in Figure E.2. Demand figures are based on recent demand (Table E.1) figures increased by one percent per year.

Table E.2: Future Water Demand (City of Nehalem)

	Year			
Parameter	**2019**	**2024**	**2029**	**2034**
Annual (MG)	41.327	43.340	45.551	47.874
Maximum Month (MG)	5.029	5.286	5.556	5.839
3-Day Maximum (mgd)	0.189	0.193	0.209	0.219
7-Day Maximum (mgd)	0.175	0.184	0.193	0.203
14-Day Maximum (mgd)	0.171	0.180	0.189	0.199
Peak Day (mgd)	0.211	0.222	0.233	0.245

Figure E.2: Future Water Demand (City of Nehalem)



E.5 Water Sources

Nehalem's developed surface water source includes one dam site on Bob's Creek. In addition, the City has had a continuous connection with the City of Manzanita's raw water from Anderson Creek. A 4-inch connection should be installed as described in the Capital Improvements Section. An opinion of probable cost for this connection is $50,000, including engineering, legal, and administrative costs. An existing agreement with the City of Manzanita details this connection in Appendix D.

In addition to this connection, the City should work towards a plan to construct a larger intertie with the City of Manzanita's raw water line. An opinion of probable cost for this works is $50,000 including engineering, legal, and administrative costs.

E.6 Treatment and Water Quality

A recently constructed membrane micro-filtration treatment facility is used to filter the City's surface water supply. Overall water quality is good to excellent. At this time, there are no specific treatment related improvement recommendations.

E.7 Water Storage

Nehalem's three storage reservoirs appear to be in good and excellent condition and well maintained. Existing capacity is sufficient for the City's projected year 2034 needs. Because of the relatively large amount of storage, water stagnation can be an issue when low flow is expected in Bob's Creek. Because of this, it is recommended that a mixing system be installed inside the 1.5 million gallon reservoir. An opinion of probable cost for this works is $45,000 including engineering and administrative costs.

Although the existing settling ponds are covered we recommend constructing a new roof system over these basins to prevent debris settling on the existing covers. An opinion of probable cost for this works is $80,000 including engineering, legal, and administrative costs.

In addition, the reservoir site is on a steep ridge line with the lined basins to the north and a very steep slope inclined at roughly 1H:1V to heights of over 30 feet above slopes of roughly 1.5H:1V for slopes greater than 60 feet to the south. This slope has been over-steepened as the headscarp to an actively regressing landslide that has progressed over many years. The slide repair has assessed by Geotech Solutions, Inc. and recommendations for supporting the existing structure has been outlined in Appendix C. An opinion of probable cost for this works is $100,000 including engineering, legal, and administrative costs.

E.8 Transmission and Distribution

The City of Nehalem has essentially reconstructed its entire water system over the past decade. The City has some older pipes that can be replaced and/or increased in size, but this is limited to only a few locations. The City should budget a replacement budget of approximately $15,000 a year to replace waterlines valves and appurtenances, create looped systems and/or increase the size of existing pipelines.

E.9 Financing

For the budget year ending June 30, 2015, the City's Water Fund had net revenue of $267,735. Over the past 4 fiscal years, the City has increased the water fund balance an average of $31,000 each year.

E.10 Water Rates

The last water rate increase was adopted in June 2010. Current base residential rate (includes 4,000 gallons) is $36.60 per month within the City and $44.60 per month outside the City limits. Current annual water rate revenue is approximately $483,658. No rate increase is recommended at this time.

E.11 Water Rate Impacts

Implementation of the improvements are not anticipated to result in water rate increases based on utilizing existing and anticipated cash reserves.

E.12 SDC Recommendations

The City adopted a SDC Methodology in May 2009. The report provides for periodic updates to account for inflation according to the ENR Construction Cost Index. SDCs were last updated and adopted by Resolution No. 2009-01. The current water system SDC is $3,235 per EDU. At the end of fiscal year 2014-2015 the SDC fund had a balance of $161,858. Over the past 4 fiscal years, the City has received an average of $14,580 in SDC fees each year.

It has been 5 years since SCDs were last evaluated for the system. SDCs should be updated to reflect new construction and recommended improvements associated with this Master Plan.

E.13 Recommended Capital Improvements and Schedule

Suggested CIPs with project estimates and a running balance of SDCs and the Water Fund are located in Table E.3 (see next page):

Table E.3: Suggested CIPs and Fund Balances

Fiscal Year 20xx	Improvement	Project Estimate	Running Balance	
			Water Fund (WF)	SDC
14-15			$267,735	$161,857
15-16	Treatment Plant Slope Failure (SDC)	$50,000	$298,735	$126,437
16-17	Uppertown Waterline (WF) 4" Raw Water, Anderson Connection (SDC) Waterline Replacement (WF)	$200,000 $50,000 $15,000	$114,735	$91,017
17-18	Reservoir Mixer (SDC) Waterline Replacement (WF)	$45,000 $15,000	$130,735	$60,597
18-19	Reservoir Roofs (SDC) Waterline Replacement (WF)	$80,000 $15,000	$146,735	-$4,823
19-20	Waterline Replacement (WF)	$15,000	$162,735	$9,757
20-21	Waterline Replacement (WF)	$15,000	$178,735	$24,337
21-22	Waterline Replacement (WF)	$15,000	$194,735	$38,917
22-23	Waterline Replacement (WF)	$15,000	$210,735	$53,497
23-24	Waterline Replacement (WF)	$15,000	$226,735	$68,077
24-25	Waterline Replacement (WF)	$15,000	$242,735	$82,657
25-26	Waterline Replacement (WF)	$15,000	$258,735	$97,237
26-27	Waterline Replacement (WF)	$15,000	$274,735	$111,817
27-28	Waterline Replacement (WF)	$15,000	$290,735	$126,397
28-29	Waterline Replacement (WF)	$15,000	$306,735	$140,977
29-30	Waterline Replacement (WF)	$15,000	$322,735	$155,557
30-31	Waterline Replacement (WF)	$15,000	$338,735	$170,137
31-32	Waterline Replacement (WF)	$15,000	$354,735	$184,717
32-33	Waterline Replacement (WF)	$15,000	$370,735	$199,297
33-34	Waterline Replacement (WF)	$15,000	$386,735	$213,877

Section 1

Overview

1.1 AUTHORIZATION

The City of Nehalem retained Otak, Inc. to prepare this Water Master Plan. A particular focus of this update will be on the changes in water usage since the 1995 report

This document was prepared by Otak, Inc. and includes background discussion, review, and input received from the staff of the City of Nehalem. The writers of this report gratefully acknowledge this review and input.

The purpose of this report is to comply with the requirements of OAR 333-061-0060(5) for Water Master Plans. This OAR is included in Appendix A of this report.

1.2 NEED

Nehalem's 1995 Water Master Plan will expire on December 31, 2015. In addition to the regulatory requirement for a new master plan, the City also required an updated capital improvement plan.

1.3 PURPOSE

The purpose of this water master plan is to provide the City of Nehalem with a comprehensive water utility planning document through the year 2035, and to identify potential improvements or management options needed for compliance with current and anticipated future regulatory requirements.

1.4 STUDY AREA

The area under study is the entire area currently within the City of Nehalem Urban Growth Boundary. This area is generally located on the north side of the Nehalem Bay, and East of the Nehalem River. The Urban Growth Boundary (UGB) extends across the north fork of the Nehalem River at McDonald Road and includes dead-end roads that connect to McDonald Road. The UGB lies within the following sections: Township 3 North, Range 10 West, Sections 23, 26, 27, 28, 34, and the City of Manzanita, on the South by the Nehalem Bay and the City of Wheeler, on the North by forest lands, and on the East by the Nehalem River and rural residential areas outside of the UGB. The limits of the water system are shown on the attached maps.

This area encompasses approximately 1,587 acres: 313 acres within city limits, and an additional 1,274 acres within the Urban Growth Boundary (UGB). As of 2013, 727 of the current connections, approximately 155 connections (21 percent) were within the city limits of Nehalem.

1.5 PLAN IMPLEMENTATION

A proposed schedule for implementation of capital improvements is included in the executive summary of this report. The actual timing of the improvements will depend upon the amount of money or financing that the City has available, the actual population growth (according to both how much and where the growth occurs) and the actual water consumption as compared to the projected growth and consumption.

The Master Plan is an ever-changing document that should be used as a tool to make decisions based upon actual needs of the City and changing circumstances. The Master Plan should not be construed as a permanent document to be followed as an absolute authoritative tool. Rather, the Master Plan should be a general guide. The timing and priorities of the Master Plan will always be dependent upon the actual timing of improvements, changes in the regulatory environment, and the amount of growth experienced within the service area. In order to maintain this Water Master Plan as a useful document, it is recommended that the following be done:

1. **Update the Master Plan as necessary.**

   The recommended improvements are based on the development of the portions of the land within the existing service area, the zoning in the area and the associated fire flow requirements. In general, the fire flow requirements are much greater than the domestic flow requirements as demonstrated later in this report. Changes in any of the assumptions could change the recommendations contained in this report, particularly the timing and priorities. Should significant change in any of the base assumptions occur, the Master Plan should be updated accordingly.

2. **Track population, development, water demands, and minimum creek flows.**

   Water demands may vary from the projected values. The monitoring of actual flows at the creek and storage tanks, accurate record keeping, and precise billing records of water usage for individual customers will provide important data necessary for the timing of future improvements needs.

Section 2

2.1 HISTORICAL GROWTH TRENDS

2.1.1 Historical and Existing Connections

As of 2014, the City provided 737 connections including residential, agricultural, and commercial businesses. Based on the usage, for the remainder of this report, and all calculations, 737 will be considered the number of current connections.

In 2002, the total number of connections was 563. Since 2002, the number of connections has increased at a moderately steady rate, averaging at about 2.3 percent annual growth rate (compounded). Table 2.1 shows the growth rate for each of the years from 2002 to the present. The net increase in the number of connections over 12 years has been 32 percent.

Table 2.1 Historical System Growth in Number of Connections

Year	New Connections	Total Connections	Percent Increase
2002	17	563	3.11%
2003	14	577	2.49%
2004	12	589	2.08%
2005	23	612	3.90%
2006	24	636	3.92%
2007	39	675	6.13%
2008	22	697	3.26%
2009	12	709	1.72%
2010	4	713	0.56%
2011	8	721	1.12%
2012	5	726	0.69%
2013	1	727	0.14%
2014	10	737	1.38%

2.1.2 Historical Population Growth

As Table 2.2 shows, the population trend within the city limits of Nehalem had been decreasing overall since the 1980 census. Based on census data, the population within the city limits of Nehalem peaked in 1980, declined for two decades and then increased in 2010. The increase in the number of connections had been determined to be nearly entirely outside of the city limits. This relates to the increased development of Bayside Gardens, as predicted in the 1995 Water Master Plan. Yet over the last decades, some of the increases have been attributed to connections within the City.

Table 2.2 Regional Historical Population Trends

REGION	1960	1970	1980	1990	2000	2010	2014 *	Housing Units (2010)	People/ Occupied House Unit
Tillamook County	18,955	18,034	21,164	21,570	24,262	25,250	25,480	18,359	1.38
Manzanita	363	365	443	513	564	598	615	1,285	0.47
Rockaway Beach	771	665	906	970	1267	1,312	1325	1,875	0.70
Wheeler	244	262	319	335	391	414	405	289	1.43
Nehalem	233	241	258	232	203	271	280	155	1.75
* US Census Reference ** PSU Reference									

Table 2.3 shows certified population estimates from Portland State University. These population estimates show a 0.50% average annual growth in population.

2.2 FORECASTED WATER SYSTEM GROWTH TREND

Without well-defined recent population data for the UGB, projected growth of the water system for this Water Master Plans shall be based on historical growth, specifically, the number of water service connections.

The overall population within the city limits, based on census data, declined for many years. This does not represent the rate of development growth in the City or within the Nehalem service area. In actuality, the number of connections within the city limits has increased while the population declined. This is attributed to a reduced occupancy rate, with many homes having fewer people, and an increased proportion of second (vacation) homes in the area.

Table 2.3 Nehalem Recent Population Trends (City Limits)

	2010	2011	2012	2013	2014
Connections	713	721	726	727	737
Population	271 *	270 **	270 **	280 **	280 **
* US Census Reference ** PSU Reference					

The *City of Nehalem's – Revised Draft Housing Needs Analysis* (Cogan Owens Cogan August 03, 2007) forecasted a future growth rate of approximately 1% per year over the next 20 years. This growth rate is consistent with the population growth rate experienced in recent years. In addition, the analysis assumes similar occupancy rates within and outside the city limits and estimated a population of the Nehalem UGB of 860 in the year 2006.

Similar occupancy rates have been assumed throughout the Nehalem UGB and populations can be correlated with water service connections. Using this assumption, the Nehalem population was forecasted using total amount of water connections. In 2006, the City's UGB had 636 connections and an approximate population of 860, or 1.35 people per connection.

From 2009-2014 the City water system has averaged 6 new connections per year for the service area. This corresponds to the increase in the number of connections an average of 0.67 percent each year. For the purposes of planning for future water demands, it is assumed that the number of connections will continue to increase by 0.67% percent each year.

Table 2.4 summarizes historical and projected future population assuming a future growth rate of 1.35 people per future connection. The table accounts for population within the entire UGB.

Table 2.4 Historical and Future Population Data and Forecasts, Nehalem UGB

	Historical			Future	
	2006	**2010**	**2014**	**2025**	**2035**
Connections	636	713	737	792	846
Population	860	971	995	1,069	1,142

2.3 SOCIO-ECONOMIC ENVIRONMENT

2.3.1 Economic Conditions and Trends

A summary of 2010 Census data is provided below as documentation of current economic conditions in Nehalem.

Housing:

Housing Units (Total): 155

Occupied: 116 (74.8%)

Vacant: 39 (25.2%)

Owner Occupied: 84 (72.4%)

Renter Occupied: 32 (27.6%)

Average Household Size (persons per household): 2.34

Median Housing Value (2012): $235,909

Median Rent per Unit: $650

Median Age (years): 44.2

Median Household Income (2012): $47,283/year

Nehalem is primarily a residential and tourist oriented community. Approximately 87% of workers are in the Accommodation and Food Services group. The present situation is likely to continue into the future with a similar mix of residents and nonresidents, tourists, and businesses that cater to these peoples.

Section 3

3.1 INTRODUCTION

This section analyzes current water requirements for the City of Nehalem and the water system as a whole, including water production and water demand. The analysis was developed using water production records provided by the City.

3.1.1 Consumption Statistic Definitions and Abbreviations

Planning for future water demands will be based on the following set of consumption statistics drawn from current meter records. The following are several generally accepted water use definitions that are commonly used in evaluating water consumption statistics for any City or Water District.

Caution should be used when relying on these factors for predicting future consumption rates. These numbers are based on master meter readings, which account for all water used regardless of the method of consumption. These numbers include water losses, which will fluctuate with leaks and, as such, pipe age. Additionally, high usage customers, which are a small number of the customers, increase the average use per customer. Using this high number, for an average day or a high-use day, will significantly increase the predicted usage when projected into the future. The number of these customers and their usage is not expected to follow the patterns of residential development, which is expected to increase at a constant rate.

Annual Use, expressed in gallons, is taken directly from the master meter records. This figure includes all types of consumption, losses and water used in firefighting. Annual use is important in assessing the adequacy of the water sources.

Average Daily Demand (ADD), expressed in gallons per day, is also taken directly from the master meter records and includes water uses and all water losses. The average daily demand is one of several factors that will be used in determining future requirements for the City.

Maximum Monthly Demand (MMD), expressed in gallons, is the highest monthly master meter reading for a year. This figure is useful in determining the seasonal peaking factors and designing the system for peak flows.

Average Day of Maximum Month (AD-MM), expressed in gallons per day, will also be used for estimating peak flows.

Maximum Daily Demand (MDD), expressed in gallons per day, Total use for the day with the highest total use during the year.

Maximum Instantaneous Demand (MID), expressed in gallons per minute, is the theoretical maximum amount of water that will ever be used at one time and is used as a design parameter in assessing the ability of the distribution system to supply the needs of the community. The MID is estimated as 0.6 gallons per minute per connection plus estimated fire flow of 1,000 gpm. Since the only variable in this consumption statistic is the number of connections (EDUs), the MID will always be increasing since the number of connections is always increasing. The value of 0.6 gallons per minute per connections is a generally accepted value commonly used in estimating the maximum daily demand when actual instantaneous peak flow records are not available.

Equivalent Dwelling Units (EDU) are frequently used to compare statistics between districts including estimated size, leakage, and overall usage. With a mixture of uses within a water district, EDUs give a base value.

EDUs are calculated by determining how much water is used on average by the residential customers within the service area. Other consumers, such as industries or businesses, can be equated to a number of residential units. If the average residence (1 EDU) uses 300 gallons per day, then a business that uses 900 gallons per day is counted as 3 EDUs. An overall district EDU count can also be determined by looking at the total water used by the district. The district EDU total will be more than the sum of the individual services.

Detailed usage data is necessary for determining the amount of residential usage and the number of residential connections. These factors are important in the determination of the calculated EDUs.

Flow and demand parameters are typically abbreviated and expressed as:

mgd: millions of gallons per day

gpd: gallons per day

gpcd: gallons per capita per day

gpm: gallons per minute

cfs: cubic feet per second

gal: gallons

MG: million gallons

cf: cubic feet

3.2 Historic Water Usage

The City of Nehalem's water service area includes three mobile home/trailer parks, the Nehalem Bay Wastewater Agency, two farms, and residential developments located to the Northeast and West of the City.

As of August 2014, the City of Nehalem had 737 connections within its service area. Table 3.1 shows the accounts broken down by type:

Table 3.1 Type of Use

Type of Use	Percentage of Overall Use
Residential (City)	17.1%
Residential (Outside City Limits)	68.0%
Commercial (City)	5.5%
Commercial (Outside City Limits)	9.4%

The average daily (system) demand for this service area for the years 2002 through 2004 was 179,538 gpd. Between 2011 and 2014, the average demand was 102,339 gpd. Table 3.2 shows the daily demands for the system since 2009.

Table 3.2 Water Demand Summary, 2009-2014

	2009	2010	2011	2012	2013	2014
Total (Year) (gpd)	39.8 MG	36.7 MG	37.6 MG	40.8 MG	38.8 MG	32.3 MG
Average Daily (gpd)	109,041	100,548	103,014	111,781	106,301	88,493
Peak Day (gpd)	221,000	221,000	188,000	240,000	199,000	196,000
3-Day Peak (Daily) (gpd)	200,667	189,333	178,000	201,333	178,000	160,667
14-Day Peak (Daily) (gpd)	181,214	162,286	158,643	181,714	161,214	144,571
Low (Daily) (gpd)	63,000	65,000	10,000	67,000	52,000	49,000
Total Connections	709	713	721	726	727	737
Average Use/Connection (gpd)	154	142	143	154	147	121

The annual water use has been relatively constant in the subject five year period (2009 to 2014), and is currently lower than the reported usage in 2004. As noted previously, the average annual water use on a per connection basis has gone down over the last 10 years. Improvements are probably due to fewer leaks (lost water) and less waste.

3.3 Current Consumption

Master meter records are the total readings from the master meters and include all system losses as well as all water consumption. The total water use, as measured by the master meter, for the summer

months is generally more than twice as much as the use for the rest of the year. This is to be expected due to the increased per capita use during summer months. Table 3.3 shows a summary of the total master meter records for total water use.

Table 3.3 Master Meter Readings, 2000-2013

Year	Total Use (gallons)	Number of Connections	Average Use (gal/conn/day)
2001	62,708,000	546	315
2002	68,329,000	563	333
2003	64,838,000	577	308
2004	63,966,000	589	298
2005	56,995,000	612	255
2006	57,544,000	636	248
2007	53,591,000	675	218
2008	44,055,000	697	173
2009	39,779,000	709	154
2010	36,746,000	713	141
2011	37,624,000	721	143
2012	40,816,000	726	154
2013	38,847,000	727	146
2014	32,342,000	737	120
2010 – 2014 Average			141

As a planning criterion, the average gallons per connection per day of the years 2010 through 2014 will be used as an estimate of average consumption (including system losses) per connection. This value is 141 gallons per connection per day. This average rate of consumption is about average when compared to other residential communities on the Oregon Coast. For comparison purposes only, the following cities have historical average annual per connection water uses:

- The City of Manzanita uses 133 gallons per connection per day (metered water use at individual meters, not including losses)
- The Barview/Watseco Water District has used 93 gallons per connection per day
- The City of Rockaway Beach has used 268 gallons per connection per day

3.3.1 Seasonal Raw Water Usage and Peaking

Seasonal peaking typically occurs in July and August with the largest (recent) water withdrawal in July 2014 (4.2 MG). Annual average withdrawal for the system in 2014 was 88,493 gpd. The peak month was 4,150,000 gal. (July 2014). For the month of July 2014, Nehalem utilized an average of 133,871 gpd

of source water with a peak day of 196,000 gpd. Table 3.4 shows measured and estimated peaking for the system's raw source water.

Table 3.4: Raw Water Withdrawals 2014

Parameter	gpd	gpm	cfs	Peaking Factor
Average Day	88,608	61.5	0.14	1.00
Peak Month	133,871	93.0	0.21	1.51
Peak Day	196,000	136.1	0.30	2.21
Peak Hour Demand	354,433*	246.1	0.55	4.00

** A peaking factor of 4 was used to calculate this demand*

3.3.2 Water Losses

Water losses are an inevitable fact for any City or water district. While they can never be fully eliminated, they can be reduced through care in construction and replacement of old, worn out pipes and isolated leak elimination. The difference between the master meter readings and the total of the service connection meter readings represents the total amount of water lost in the system. Since lost water represents lost money in terms of chemical treatment, it is important that these losses be minimized. If large losses occur or continue, this would require earlier development of additional sources.

The existing system demand is recorded at a master flow meter located at the system's chlorinator. Water consumption by system users is measured at individual water meters. Water losses are defined as the difference between the master meter readings, which indicate how much water left the reservoir, and the combined total of the customer service meters, which indicate how much water was used. These losses are due to periodic line flushing, catch basin cleaning, fire hydrant flow tests, water sales from hydrants of unrecorded amounts, and leaks within the distribution system. Including all of the miscellaneous sales and usage of water, the net system losses for 2009 – 2014 is estimated to be approximately -10.93 percent. This value was 14% in 1995 and 37% in 2004.

The negative value of the loss for 2009 – 2014 indicates that the volume of water used by customers exceeded the volume of water provided, and treated, that left the reservoir. Possibilities for the apparent exceedance include inaccurate master meter readings, inaccurate service meter readings, or a supplemental treated source. No information for an additional treated source was provided for this report.

A comparison of recent yearly service meter reading data does not indicate inaccuracies. Comparison of the master meter data for 2014 shows the entire year's readings have been an average of 84% less than the 2009 – 2013 readings. 2010 and 2013 data also indicate an exceedance.

A better representation of the losses for the year 2014 can be estimated by substitution of an average meter reading of 38,762,400 gallons, taken from 2009 – 2013. This estimation results in a percent loss of 0.33%. This positive amount indicates an estimated loss of treated water which could be reasonably attributed to miscellaneous unmetered use and system leakage.

Comparing historical loses to the estimation shows an improvement in controlling loss. This change in losses reflects the 2004 – 2009 effort made to replace older pipes in the system.

Table 3.5 shows the meter readings for the period 2004 through 2014 but does not include the estimated 2014 percent loss.

Table 3.5 Water Losses During the Period July 2004 - December 2014

Year	Master Meter (gallons)	Service Meters (gallons)	Total Loss (gallons)	Percent Loss	
2004	63,966,000	40,478,000	23,488,000	36.72%	Pipe Replacement Project
2005	56,995,000	43,804,000	13,191,000	23.14%	
2006	57,544,000	46,064,000	11,480,000	19.95%	
2007	53,591,000	44,169,000	8,422,000	15.72%	
2008	44,055,000	38,917,000	5,138,000	11.66%	
2009	39,779,000	39,134,000	645,000	1.62%	Updated Distribution System
2010	36,746,000	37,503,000	-757,000	-2.06%	
2011	37,624,000	37,057,000	567,000	1.51%	
2012	40,816,000	37,642,000	3,174,000	7.78%	
2013	38,847,000	38,977,000	-130,000	-0.33%	
2014	32,342,000	38,633,000	6,291,000	-19.45%	
	2009-2014 Total	228,946,000	9,790,000	-10.93%	
	2009-2014 Yearly Avg.	38,157,667	1,631,667	-1.82%	

3.3.3 Fire Protection Ratings

Fire Protection Ratings for individual communities are established by the Insurance Services Office (ISO). The following information is provided about the Fire Suppression Rating Schedule by ISO.

> The Fire Suppression Rating Schedule is the manual ISO uses in reviewing the fire-fighting capabilities of individual communities. The schedule measures the major elements of a community's fire-suppression system and develops a numerical grading called a Public Protection Classification (PPC™). Here's how it works:
>
> Fire alarms

Ten percent of the overall grading is based on how well the fire department receives fire alarms and dispatches its fire-fighting resources. The ISO field representatives evaluate the communications center, looking at the number of operators at the center, the telephone service, including the number of telephone lines coming into the center; and the listing of emergency numbers in the telephone book. ISO field representatives also look at the dispatch circuits and how the center notifies firefighters about the location of the emergency.

Engine companies

Fifty percent of the overall grading is based on the number of engine companies and the amount of water a community needs to fight a fire. ISO reviews the distribution of fire companies throughout the area and checks that the fire department tests its pumps regularly and inventories each engine company's nozzles, hoses, breathing apparatus and other equipment. ISO also reviews the fire-company records to determine:

- type and extent of training provided to fire-company personnel
- number of people who participate in training
- firefighter response to emergencies
- maintenance and testing of the fire department's equipment
- water supply

Forty percent of the grading is based on the community's water supply. This part of the survey focuses on whether the community has sufficient water supply for fire suppression beyond daily maximum consumption, ISO surveys all components of the water supply system, including pump storage and filtration. To determine the rate of flow the water mains provide, fire-flow tests at representative locations in the community are observed. Finally, ISO evaluates the distribution of fire hydrants.

Fire flow requirements for this Water Master Plan update are taken from the Insurance Services Office "Fire Suppression Rating Schedule." Section 604 FIRE FLOW AND DURATION reads that: "The fire flow duration shall be two hours for needed fire flows up to 2,500 gpm and three hours for needed fire flows of 3,500 gpm." Requirements for needed fire flows are shown in Section 304 of that schedule. Needed fire flows for single- and multiple-family residences vary from 1000 gpm where homes are spaced greater than 100 feet to as much as 1,500 gpm for homes spaced at 100 feet and closer. AWWA recommendations, for public water systems used for fire suppression is a minimum of 500 gpm with a residential pressure of 20 psi at any point in the system. The need to prioritize system improvements according to financial resources and realities may result in some areas, such as higher level pressure zones or isolated properties/areas, having more limited fire protection capabilities. Higher fire flows are needed for larger buildings and higher densities of construction characteristic of many core commercial

areas and schools. Actual fire flow needs in any given area may vary widely according to the actual construction present.

Otak recommends that the City adopt the value of 1000 gallons per minute for an average separation of single-family homes in the Nehalem area, and aspire to 1500 gpm where feasible. A value of 1,500 gpm is used in this master plan.

3.4 FUTURE WATER USAGE

3.4.1 Future Connection Projections

Due to the changing nature of the community, we expect most increases in the number of connections will come as a result of new residents building in the area rather than from population growth within the community. In general, fewer families with children are moving into the Nehalem community. The Neah-Kah-Nie School District has experienced an 11 percent decline in student population over the past decade. Considering the subdivisions currently under development, we expect new connections to include a combination of second homes, such as Nehalem Point, but also more full time residential homes located to the North and West of the city limits.

Growth will most likely be dependent upon the amount of undeveloped land that is available for development based on topography, geologic hazards, and the preferences of owners and developers. The concept of "Ultimate Buildout" has long been used as a planning guide in the area and in the 1995 Water Master Plan. It is difficult to accurately determine what the ultimate buildout will be because there are many factors involved such as roads, topography, and owners' preference. Most realistic estimations put the ultimate buildout at around 2,000 total water service connections. It is highly unlikely that this figure will be reached in the design period.

The growth rate for Tillamook County for 1990-2000 was 12 percent, and 2000-2010 was 4.3 percent with an average of 0.4 percent per year (not compounded). The growth rate in Nehalem for 1990-2000 was -12.5 percent, and 2000-2010 was 33.5 percent with an average of 3.3 percent per year (not compounded). From 2009-2014 the City water system has averaged 6 new connections per year for the service area. This corresponds to the increase in the number of connections an average of 0.67 percent each year. For the purposes of planning for future water demands, it is assumed that the number of connections will continue to increase by 0.67% percent each year.

This projected rate of growth will result in a design system demand in the year 2035 of 846 connections. This rate of growth predicts a 2025 system demand of 792 connections. This is a reduction from the previous predictions of 1,246 connections in 2025 that was made in the previous report. However, this update takes into account the development that has actually occurred in the last 5 years.

3.4.2 Future Consumption Projections

The total consumption for the service area is expected to grow with the increased population through the 20-year planning horizon for this Water Master Plan. A progressive rate structure that emphasizes conservation and an overall conservation plan will help to lessen the total increase in consumption. However, in planning for the future, it would be prudent not to rely too heavily on these factors when determining the amount of water that will be needed. For estimating the total demand for the 2035 design year, an average consumption of 141 gallons per connection per day will be used, (see Table 3.3).

An average of 141 gallons per day per connection has been calculated as the average of the five-year period of 2010 through 2014. However, this number is skewed by commercial and agriculture customers since those customers are not expected to increase as the same rate as the residential customers.

All of the water use statistics will be based on the following assumptions:

- design population in 2035 of 846 connections
- average annual daily use of 141 gallons per day per connection
- Maximum Instantaneous Demand (MID) of 0.6 gallons per minute per connection plus a fire flow of 1,500 gallons per minute.

Annual Use = 846 connections x 141 gal/day/conn x 365 days = 43,539,390 gallons

ADD, Average Daily Demand = Annual Use / 365 = 119,286 gallons per day

MMD, Maximum Monthly Demand = 846 conn x 141 gal/day/conn x 31 days = 3,697,866 gallons

Again, note that the Maximum Monthly Demand, which is based on the Average Day for the Maximum Month, should not be considered a certain representation of future conditions. The AD-MM includes the use for all customers and the number of high usage customers is expected to not increase at the same rate as residential customers.

AD-MM, Average Day-Maximum Month = MMD / 31 days = 191,286 gallons per day

MDD, Maximum Daily Demand = MMD x 5 percent = 184,893 gallons per day.

MID, Maximum Instantaneous Demand = 846 connections x 0.6 gpm/connection + 1,500 gpm = 2,008 gpm

Table 3.6 Comparison of Water Use Statistics

	2004	2014	Design Year - 2035
Annual Use (gal.)	63,966,000	32,342,000	43,539,390
ADD (gal./day)	174,770	88,608	119,286
MMD (gal.)	8,760,000	4,150,000	3,697,866
AD-MM (gal./day)	292,000	133,871	191,286
MDD (gal./day)	438,000	207,500	184,893
MID (gpm)	-	-	2,008
Total Connections	589	737	846

Section 4

4.1 WATER RIGHTS

The available sources for Municipal Water Use by the City of Nehalem are from the following surface water sources:

West Fork of Coal Creek	1.5 cfs	Bob's Creek	2.0 cfs
Unnamed Tributary that flows into the North Fork of the Nehalem River	1.0 cfs	Coal Creek	1.5 cfs

As such, the total water available for municipal use is 6.0 cfs (13.3 Mgd). Other water is available for use in irrigation, livestock, dairy barn, domestic use, and non-consumer power use.

The neighboring City of Manzanita currently has a raw water intake on Anderson Creek which may be a future supply source for Nehalem. The use of Anderson Creek will require an inter-agency agreement.

4.2 SURFACE WATER RESOURCES

The flows carried in Bobs Creek, Coal Creek and its tributaries, and Anderson Creek are derived from a 7,450-acre watershed on the west flank of the Onion Peak I Neah-kah-nie Mountain ranges.

4.2.1 Bob's Creek

The City of Nehalem currently utilizes only Bob's Creek for its water supply. The watershed covers approximately 367 acres of actively managed forest land, owned almost entirely by the City. The City of Nehalem currently maintains a forestry program within its 960-acre parcel. The only entrance into the watershed is gated and locked since it is on private forest land.

There are no requirements for minimum instream flow for fish habitat in Bob's Creek; however, the lower two-thirds of the watershed contribute to flows which support autumn chum runs. The estimated low flow in Bob's Creek is 0.34 cfs (220,000 gpd).

4.2.2 Coal Creek and Its Tributaries

The Coal Creek watershed covers approximately 5,257 acres. The City of Nehalem does not own any of the watersheds. The State of Oregon (Tillamook State Forest) and Longview Fibre own the upstream portions of the watershed. It is an actively managed forest.

The estimated low flow for the entire basin is 5 cfs (3.25 Mgd). The City of Nehalem has water rights to appropriate 3 cfs (2.6 Mgd); however, this is subject to established instream flows agreed upon by the

City of Nehalem and the Oregon State Department of Fish and Wildlife. Approximately 2.29 cfs (1.48 Mgd) is available to the City of Nehalem during the low flow periods.

4.2.3 Anderson Creek

The West Fork Anderson Creek watershed is located primarily on lands owned by the City of Nehalem. The Anderson Creek watershed is located on Longview Fiber lands. This watershed covers approximately 1,263 acres. The low flow water balance in Anderson Creek is estimated at 0.36 cfs (233,000 gpd).

4.3 RECOMMENDATIONS

Bob's Creek is currently the only source of water that the City draws from. Research of the low flow conditions for Bob's Creek has been completed many times in the past for previous Water Master Plans for the City. It has been determined that a low flow summertime supply could reasonably be estimated 220,000 gallons per day.

With the low flow of Bob's Creek is 220,000 gallons per day plus 16,000 gallons per day from the Manzanita raw water connection, the city has a minimum flow of 236,000 gallons per day. This is above the projected maximum daily demand of 184,893 gpd in the year 2035. Regardless, a shortage can be accommodated by drawing water from the City's 1.5 MG reservoir.

The City does not propose to expand or initiate any new diversion of water. No water beyond the existing supply is necessary to meet the projected future demands.

It is recommended that the City continue to work with the City of Manzanita to make use of possible excess raw water from Anderson Creek in addition to finalizing an agreement to provide finished water at the existing intertie.

Section 5

5.1 SYSTEM OVERVIEW

The water supply for the City of Nehalem flows from Bob's Creek through 8,000 feet of transmission line to the reservoir/treatment site.

With the construction of the new reservoir, the water stored at the reservoir site is now potable. The hypochlorinator that was 1,500 feet downstream of the reservoir site (towards the City) has been relocated to the reservoir site. The City's master meter is located at the chlorinator, measuring the potable water entering the reservoir.

From the reservoir site, the potable water flows through a pressure reducing valve and into the distribution system.

Distribution pipelines are shown in drawings 1 through 5 in Appendix B.

5.2 DIVERSION STRUCTURE

The diversion structure at Bob's Creek has not been modified in the last 10 years. Periodic cleaning to remove settled material continues to be done as needed. No other work has been completed at the diversion structure. From the collection point to the reservoir site, the pipe has been repaired numerous times and has become a combination of steel pipe, PVC pipe and asbestos-cement pipe. Since 1996, portions of the pipe have been damaged by landslides and have been replaced with butt-fused HDPE. The new pipe has been located on the surface of the ground and suspended above the ground in places.

5.3 EXISTING RESERVOIR

5.3.1 Description

The reservoir site is located on a small ridge above the City of Nehalem, at an approximate elevation of 220 feet. Since the 1995 report was completed, a new 1.5-million gallon reservoir has been constructed at the site. The new reservoir is constructed of glass-fused-to-steel and is covered. The high water level in the new reservoir is 252 feet. The construction of a new 1.25-million gallon reservoir was recommended in the previous report.

The old reservoirs that previously served the City have been adapted and are now being used as clarifiers in the treatment of raw water. The water being stored in the new reservoir is now potable water. This is a significant improvement, allowing for maintenance or other work to be completed on the treatment system while still providing potable water to the customers. When storing only raw

water in the old reservoirs, this isolation of the treatment system was not possible while maintaining service.

The reservoir now complies with OAR 333-61-050 (7) which requires that the potable water supply be covered with a roof.

The new reservoir satisfies the current and projected storage needs for the City. The City will have adequate storage for a combination of two days of projected peak demand for the year 2034 and for fighting a fire. The reservoir will maintain an adequate supply of water for a dry period of over two days, if no water can be drawn from the creek. With the typical low flow available from Bob's Creek, the reservoir will maintain the projected 2035 peak demand for a period of almost 3 ½ days. The reservoir level will continue to drop since the projected peak demand is larger than the low source flow.

Under current conditions, the reservoir holds more than 9 days worth of storage at the maximum daily flow assuming continued inflow from Bob's Creek at the predicted low flow rate.

The pipeline from the reservoir site down to the pressure reducing valve has also been replaced with 12-inch diameter PVC pipe. Below the pressure reducing valve, the pipeline remains composed of 6-inch diameter PVC pipe.

5.3.2 Recommendations

A primary concern of extended storage time is stagnation of the water; for current average summer day usage, the reservoir can hold almost 7 days worth of water. Water in storage tanks has a tendency to form undesirable stagnant or dead zones where little mixing of water occurs. The introduction of stagnant tank water into a distribution system can lead to numerous water quality problems including taste and odor complaints, loss of chlorine residual, high levels of DBPs, and introduction of microbial contamination. A tank that is well mixed achieves uniform water quality and age and is much easier to manage. We recommend the City provide either active or passive mixing to their tank.

5.4 DISTRIBUTION

The existing distribution system includes approximately 12 miles of pipe extending from the reservoir site to all customers.

Since 1995, new development that has extended the system included Dean's Point, Uppertown and areas within the Bayside Garden's area. Projects completed within the existing system have improved capacity, removed old pipes, and rerouted pipes away from areas of frequent ground movement.

5.4.1 Improvements since 1995

Improvements to the distribution system since 1995 have generally consisted of improving the looping in the system and replacing old piping. Expanding the system to the Bayside Gardens area has significantly improved service to the western portions of the UGB.

5.4.2 Future Connections

Each future connection will typically be able to be served by the reservoir while maintaining the preferred pressure range of 40 to 80 psi. Small areas have been required to install a booster pump or pressure reducing valve to adjust the most extreme pressures resulting from the reservoir elevation. For an example of expected future connections, a subdivision that is planned to the East of Bob's Creek is at an elevation of 135 feet; this results in a service pressure of approximately 50 psi. The peak at the south end of Dean's Point is at a similar elevation. Future infilling, increasing development density in Nehalem and existing subdivisions will be connected to established pipelines with pre-determined pressures.

5.4.3 Recommendations

The City should continue to make an effort to create pipe loops wherever possible. Looping provides redundancy in the system and allows water to be distributed more efficiently. It will also provide much more reliable flows and enable the City's maintenance personnel to make repairs to sections of pipe with a minimal interruption to service.

The City should adopt minimum standards for water pipes of 6-inch diameter PVC for all main lines. 4-inch diameter PVC can be used on dead end streets less than 300 feet long and without fire hydrants; however, it is recommended that the City not allow any new dead end lines to be constructed.

5.5 WATER QUALITY

5.5.1 Water Quality Testing

It should be noted that the City continues the regular testing required by the State Health Division.

5.5.2 Surface Treatment

When the new water reservoir was constructed, the treatment system was improved. All treatment is now completed prior to storage. The current treatment method includes two separate clarifiers, a media filter system, a cartridge filter, and the injection of hypochlorite.

The standard treatment of raw water coming from Bob's Creek includes:

1. Raw water runs through the clarifier to reduce turbidity
2. The water then runs through media filters and cartridge filters
3. Hypochlorite is injected into water (chlorine)

4. Treated water flows into storage reservoir, ready for distribution

5.5.3 Lead and Copper Testing

The City has continued testing for lead and copper contamination in the water supply. All tests have passed with contaminants below the required minimums.

5.5.4 Future Testing

The testing requirements for public water systems are constantly changing as more information is learned about potential hazards in drinking water supplies. All testing requirements are generally established by the federal government (US EPA) and implemented by the Oregon Health Authority Drinking Water Services. In the future, it is likely that the federal government will develop additional requirements for testing. There are several requirements that have not yet been determined but may be expected in the next decade. It is unknown at this point in time what chemicals will be added to the required testing list and what the effects of such chemicals, if found to be present, would have on the City of Nehalem.

5.5.5 Recommendations

The new reservoir has minimized the effect of shortages, but could increase stagnant water introduced to the system. The introduction of stagnant tank water into a distribution system can lead to numerous water quality problems including taste and odor complaints, loss of chlorine residual, high levels of disinfection byproducts, and introduction of microbial contamination. A tank that is well mixed achieves uniform water quality and age and is much easier to manage. We recommend the City provide either active or passive mixing to their tank.

5.6 FIRE HYDRANTS

In 1992, the typical separation between hydrants was well over 1,000 feet. Since that time, several new hydrants have been installed and the current map indicates that hydrants are typically at an interval of under 500 feet. This generally meets the International Fire Code hydrant spacing requirements.

5.6.1 Description

In order to provide adequate fire protection, the City must provide sufficient storage capacity, an efficient distribution system, and proper spacing of fire hydrants. The current International Fire Code (with Oregon amendments) recommends that every building in the City should be within 250 feet of at least one hydrant. Therefore, the hydrants should be no more than 500 feet apart. Ideally, there should be a hydrant within 250 to 300 feet of all homes, or two or more hydrants within 600 feet. This is a significant increase in the density of hydrants from previous reports and codes that recommended a fire

hydrant every 1,000 feet. For structures that require more than 1,750 gallons per minute, the spacing between hydrants should be reduced based on the requirements of the 2004 Oregon Fire Code, Table C105.1.

TABLE C105.1
NUMBER AND DISTRIBUTION OF FIRE HYDRANTS

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS[a, b, c] (feet)	MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT[d]
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500-7,000	7	250	150
7,500 or more	8 or more[e]	200	120

For SI: 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

a. Reduce by 100 feet for dead-end streets or roads.

b. Where streets are provided with median dividers which can be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis up to a fire-flow requirement of 7,000 gallons per minute and 400 feet for higher fire-flow requirements.

c. Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.

d. Reduce by 50 feet for dead-end streets or roads.

e. One hydrant for each 1,000 gallons per minute or fraction thereof.

Section 6

6.1 PROPOSED PROJECTS

The 1995 Water Master Plan included a detailed list of pipe inventory and recommendations for each segment of pipe (Table 6.4.2-1). Pipes on the list which have not been replaced and should still be considered necessary for replacement are listed in Appendix C.

6.1.1 Distribution

Pipe Replacement

Various old sections of pipe should be replaced with new PVC or HDPE pipe. We recommend using PVC where service connections are made to maintain a service saddle standard. Where no connections are to be made for segments of more than a few hundred feet, we recommend using HDPE pipe to allow for minor ground movements without damaging the pipe.

This is not an urgent requirement, but replacements should be made regularly to remove old pipe from the system and increase pipe sizes to a minimum of 6-inch diameter.

Pipe Looping

On streets where PVC lines have been installed as dead-end lines, we recommend the extension of the pipe to eliminate any dead-ends. Looping provides redundancy in the system and allows water to be distributed more efficiently. It will also provide much more reliable flows and enable the City's maintenance personnel to make repairs to sections of pipe with a minimal interruption to service.

6.1.2 Transmission

Improvement

We recommend that a pipeline be installed to transmit water from the collection point to the reservoir that is less likely to be damaged by future landslide movement. An alternate route should be determined in order to circumvent the areas of movement or a method of construction should be utilized that will allow the pipe to continue to function despite local ground movement.

The most apparent solution is to route the pipe along the roadways from the collection point to the reservoir, at least in part. This solution will require several thousand feet of new pipeline installation.

Construction using a flexible type of pipe, such as HDPE would help prevent damage from small ground movements. To further limit damage to the pipe during ground movement, we recommend elevating the pipe above the ground in areas that are known to experience ground movement.

Maintaining a reliable pipeline between the source of water and the treatment location is vital. We recommend further investigation into this matter be conducted to determine the best route for construction.

6.2 CAPITAL IMPROVEMENTS

No improvements are critically urgent to the City system. The serviced areas are provided with adequate storage and water pressure for the current conditions. Fire flows, however, are generally less than recommended due to undersized water mains throughout the system.

We recommend that investigation begin into using excess raw water from the City of Manzanitas system. This would include raw water from Anderson Creek.

6.3 ROUTINE PIPE REPLACEMENT

The City should adopt a policy of systematically replacing all of the older pipes with new PVC water pipes over the next 5 years. All main lines should be replaced with minimum 6-inch diameter PVC pipe. On dead end sections less than 300 feet long, the pipe size can be reduced to 4-inch unless there is a fire hydrant on the line. In addition to the routine replacement, the City should install minimum 6-inch diameter PVC pipe wherever the existing pipe has broken and needs repair. When new pipes are installed, fire hydrants should also be installed so that there is a maximum distance of 500 feet between any two fire hydrants.

Section 7

7.1 WATER FUND BUDGET

Since fiscal year 2010-2011, the City has gained $61,224 and has spent $32,288 in Capital Outlay. This calculates to approximately $31,000 in net revenue per fiscal year. Table 7.1 includes a summary of recent Water Operating Fund budgets. In addition, the City has received an average $14,580 per year in system development charge (SDC) revenue.

Table 7.1: Recent Water Operating Fund Budgets

Description	Actual FY 10-11	Actual FY 11-12	Actual FY 12-13	Actual FY 13-14
Revenue:				
Beginning Fund Balance	$216,210	$194,160	$198,303	$196,622
Water Rate Revenue	$472,794	$475,940	$484,753	$483,658
Other	$3,322	$4,956	$2,303	$4,256
Revenue Total:	$692,326	$675,056	$685,359	$684,536
Expenses:				
Personal Services	$256,024	$232,681	$257,734	$235,512
Materials and Services	$123,712	$70,619	$78,648	$94,486
Capital Outlay	$21,277	$0	$32,288	$0
Debt Service	$125,931	$125,932	$125,932	$125,932
Expenses Total:	$526,944	$429,232	$494,602	$457,930
Revenue Minus Expenses:	**$165,382**	**$245,824**	**$190,757**	**$226,606**

Table 7.2: Recent System Development Charges

Description	Actual FY 10-11	Actual FY 11-12	Actual FY 12-13	Actual FY 13-14
Beginning Fund Balance	$98,096	$114,727	$141,089	$151,596
SDC's	$16,175	$25,880	$9,793	$6,470
Other	$456	$482	$715	$1,080
Revenue Total:	$114,727	$141,089	$151,597	$159,146

7.2 WATER SYSTEM REVENUE

7.2.1 Water Rate Methodology.

A customer's Base Water Rate and Base Monthly Gallons is calculated on an equivalent residential unit (ERU) basis, using one or more of the following Customer Classes, as applicable to each individual

customer (i.e. single-family residential, single-family residential plus an apartment, light-commercial, light-commercial plus apartment, etc.):

Table 7.3 Base Monthly Gallons Per Customer Class

Customer Classes	ERU	Base Monthly Gallons
Usage Over Base Allotment & Wholesale Rate	0.25	1,000
Single-Family Residential, Condo (each unit)	1.00	4,000
Apartments	0.50	2,000
Manufactured Home Park (each space)	0.75	3,000
Motel, Hotel and Bed & Breakfast		
With Kitchen (i.e., sink, refrigerator, cooking)	0.50	2,000
Without Kitchen	0.25	1,000
Light-Commercial (Office, retail, etc.)	0.50	2,000
Commercial (Medical, Landscaping, Grocery, etc.)	1.00	4,000
Restaurant/Food Service or Tavern/Bar	2.00	8,000
Restaurant with Tavern/Bar	3.00	12,000
Sewer Treatment Plant (per Lagoon)	3.00	12,000
Light-industrial/Manufacturing - each 9 employees	2.00	8,000
Recreational Vehicle Parks		
Office/Manager's Site	1.00	4,000
Each Space	0.25	1,000
Churches or Lodges	1.00	4,000
Public Restroom (each)	0.50	2,000
Maintenance Building w/ restroom		
Associated - each 9 employees	1.00	4,000
Laundromats, Each Machine	0.75	3,000

Table 7.3 Base Monthly Gallons Per Customer Class (Cont.)

Customer Classes	ERU	Base Monthly Gallons
Schools, Colleges & Recreation Centers		
Kindergarten/Preschool/Elementary-each 40 students	1.00	4,000
Jr./Sr. High Schools - each 20 students	1.00	4,000
Colleges · each 20 full-time equivalent students	1.00	4,000
Recreation Center - each 40 FT equivalent students	1.00	4,000
*Swimming Pool, Public	20.00	80,000
Car Wash, per two washing stations (round up)	1.00	4,000
Kitchen, food service	2.00	8,000
*Farms	5.00	20,000
*Denotes Wholesale Customer		

A customer's Base Monthly Gallons, Monthly Water Rate, and other Fees, Charges and/or Monetary Penalties are provided below:

Table 7.4 Customer's Base Monthly Rates

Customer Classes, Each	ERU	City Rate	Rural Rate	Gallons
Single-Family Residential, Condo. (ea. Space)	1	$ 36.60	$ 44.60	4,000
Apartments	0.5	$ 18.30	$ 22.30	2,000
Mobile Home Park (each space)	0.75	$ 27.45	$ 33.45	3,000
Motel, Hotel and Bed & Breakfast				
With Kitchen (sink, refrigerator, cooking)	0.5	$ 18.30	$ 22.30	2,000
Without Kitchen	0.25	$ 9.15	$ 11.15	1,000
Light-Commercial (Office, retail, etc.)	0.5	$ 18.30	$ 22.30	2,000
Commercial (Med., Grocery, Auto, Land, etc.)	1	$ 36.60	$ 44.60	4,000
Restaurant/Food Service or Tavern/Bar	2	$ 73.20	$ 89.20	8,000
Restaurant with Tavern/Bar	3	$ 109.80	$ 133.80	12,000
Sewer Treatment Plant (each Lagoon)	3	$ 109.80	$ 133.80	12,000
Light-industrial/Manufact. - each 9 emp.	2	$ 73.20	$ 89.20	8,000
Churches or Lodges	1	$ 36.60	$ 44.60	4,000

Table 7.4 Customer's Base Monthly Rates (Cont.)

Customer Classes, Each	ERU	City Rate	Rural Rate	Gallons
Recreational Vehicle Parks				
Office/Manager's Site	1	$ 36.60	$ 44.60	4,000
Each Space	0.25	$ 9.15	$ 11.15	1,000
Maintenance Building w/ restroom				
Associated - each 9 employees	1	$ 36.60	$ 44.60	4,000
Washing Machine, Commercial	0.75	$ 27.45	$ 33.45	3,000
Schools, Colleges & Recreation Centers				
Kindergarten/Preschool/Elementary-each 40 students	1	$ 36.60	$ 44.60	4,000
Jr./Sr. High Schools - each 20 students	1	$ 36.60	$ 44.60	4,000
Colleges - each 20 full-time equivalent students	1	$ 36.60	$ 44.60	4,000
*Recreation Center - each 40 FT equivalent students	1	$ 16.80	$ 16.80	4,000
*Swimming Pool, Public	20	$ 336.00	$ 336.00	80,000
Car Wash, per two washing stations (round up)	1	$ 36.60	$ 44.60	4,000
Nursing Home/Hospital, per two beds	1	$ 36.60	$ 44.60	4,000
Kitchen, food service	2	$ 73.20	$ 89.20	8,000
*Farms	20	$ 336.00	$ 336.00	80,000
Overage Charge & Wholesale Rate		$ 4.20	$ 4.20	1,000
Bulk Rate, Per 1,000 gallons		$ 9.15	$ 11.15	1,000
*Denotes Wholesale ERU equivalent @ $4. 20 per 1, 000 gallons				

7.2.2 Current Rate Revenue

Current annual revenue is approximately $484,000. Total annual receipts are likely to increase at a rate comparable to overall system growth. There are no large commercial or industrial customers that would adversely affect total receipts if the business closed. Rate revenue in excess of the budget is carried over to the next year as part of the beginning fund balance.

7.2.3 Equivalent Dwelling Units (EDUs)

In general, funding agencies have recommended or required that water rates reflect or incorporate consideration of dwelling units for residential customers and equivalent dwelling units (EDUs) for non-residential customers. Definitions for an EDU can vary, but in general refer to that amount of metered water used by one residential unit - a single family house, manufactured home, or a single unit of a multifamily building (duplex, apartment, etc.). For non-residential customers, the total water used divided by the average usage per residential dwelling unit yields the number of "equivalent dwelling units" associated with the non-residential customers. Adding the residential and non-residential customer components yields the total number of EDUs associated with the water system. Consultants

and funding agencies use the EDU total to determine what the average monthly bill will be by dividing the annual revenue required by the total number of EDUs and 12 months per year.

7.2.4 Property Taxes

Currently, water system revenue includes no property tax component.

7.2.5 "Other" Revenue

"Other" revenue noted in Table 7.1 includes: meter installations, interest, and miscellaneous. Miscellaneous is a category with nominal sums, typically $0-$100. These sources typically contribute a relatively small portion of overall revenue.

7.3 WATER SYSTEM EXPENSES

7.3.1 Debt Service

Nehalem recently constructed major improvements to the water system, including a new water main throughout the City. A loan of $3,290,410 is the City's share of the total project cost of approximately $6 million dollars. (Remainder of total cost was provided by Federal grants from the Rural Utilities Service, a branch of the USDA.)

The water revenue bonds carry an annual 1% interest rate, a 30-year term, and an annual payment of $125,932 through FY 2038.

7.4 CURRENT RATES - ANALYSIS AND RECOMMENDATIONS

A simple formula for budget viability is: *Revenue - Expenses* ≥ 0. In reviewing recent budgets, it is apparent that rate revenues have basically kept pace with expenditures. There is no current basis for increasing water rates at this time. Future rate increases may be needed if the utility budget costs (due to inflation) exceed revenues associated with an expanded customer base (system growth). Capital improvement projects, depending on overall cost and funding sources, may require rate increases to meet debt service requirements.

7.5 CAPITAL IMPROVEMENTS PLAN

7.5.1 Capital Improvement Summary

Capital improvements are discussed in this section. A detailed listing of projects and costs are included in Table E.3 of the Executive Summary. The projects include a reservoir stabilization project, two inter-tie water connection projects, a water main replacement project, and miscellaneous distribution pipeline maintenance and replacement projects.

7.5.2 Capital Improvement Implementation

Seven specific improvement projects have been identified for construction over the next eight years. A description of these improvements are as follows:

1. Reservoir Slope Failure: As specified by the geotechnical report in Appendix C, micro-piles need to be placed at the slope failure in order to under pin the existing concrete reservoir structure.

2. ¾-inch Anderson Creek Raw Water Tie-In: As specified in the 1983 Manzanita/Nehalem water agreement in Appendix D, the ¾-inch water service connection from the City of Manzanita's Anderson Creek transmission main needs to be connected to the City of Nehalem transmission main to allow for the continuous 11.1 gallon per minute raw water connection. The agreement specifies the connection as follows:

   > *"The first connection shall be a ¾-inch PVC pipe connection tapped into the Manzanita main with a ½-inch tap with an increaser to ¾-inch size, and tapped into the Nehalem main with a ¾-inch tap. There shall be one ¾-inch gate valve in this line, set in a valve box, and meter idler. It is the intent there shall also be a meter box with meter connections and a meter idler installed in the line."*

3. Uppertown Water Main Replacement: The 8-inch HDPE distribution main installed along North Fork Road connects to an existing 6-inch PVC main that was constructed as a bypass around the active land slide along North Fork Road, south of Division Street. The 6-inch PVC bypass connects into two 4-inch PVC water lines and then reconnects to the 8-inch HDPE water main. These two sections of undersized pipes need to be replaced with minimum 8-inch water main in order to remove a bottle-neck in the system which results in pressure and flow loss further downstream in the system.

4. Four-inch Anderson Creek Raw Water Tie-In: As specified in the 1983 Manzanita/Nehalem water agreement in Appendix D, a 4-inch connection from the City of Manzanita's Anderson Creek transmission main needs to be connected to the City of Nehalem transmission main to allow for the continuous use of surplus raw water. The agreement specifies the connection as follows:

   > *"The second connection shall be a 4-inch PVC pipe connection cut into both mains with reducing tees and dresser couplings, and having a pressure reducing valve and AWWA gate valve with valve boxes installed in it. The pressure reducing valve shall be set to just prevent backspill of water from Manzanita's main over the Bob's Creek spillway. Manzanita shall have the right to inspect these valves from time to time; however, maintenance and replacement of them will be the responsibility of Nehalem."*

5. City of Manzanita Treated Water Inter-Tie: The City of Nehalem currently has a treated water Inter-Tie with the City of Manzanita, located along US Highway 101, near the edge of the Urban Growth Boundary. This Inter-Tie needs to be reconstructed with new PVC water main, gate valves and a by-directional flow meter to allow for water service in either direction. All valves and meters are to be installed within an approved valve vault for access and maintenance.

6. Reservoir Roofs: It is recommended that the existing covered settling ponds have a new roof system constructed over these basins to prevent debris from settling on the existing covers.

7. Reservoir Mixer: As discussed in Section 5.3.2, it is recommended that active or passive mixing be introduced to the water reservoir.

This list of Capital Improvements should be addressed on an as needed basis with the intent of relying on the regional system as a backup supply. Implementation of well related improvements will depend on their actual system growth that occurs and the ability of the regional reservoir to meet peak diurnal demands. Replacement of old AC or undersized lines will depend on budget availability, construction opportunities, and perceived need. From a general planning standpoint, the City should anticipate addressing all of these issues and improvements within the next 20 years.

7.5.3 Financing

For the budget year ending June 30, 2015, the City's Water Construction Fund had net assets of $267,735. During the same budget year, the City's SDC Fund had net assets of $161,858. It is quite likely that the Construction Fund will have sufficient monies to construct the suggested Capital Improvements without incurring debt or requiring a rate increase.

7.5.4 Water Rate Impacts

Implementation of the Capital Improvement Plan are not anticipated to result in water rate increases based on utilizing existing and anticipated cash reserves.

7.6 SYSTEMS DEVELOPMENT CHARGES (SDCs)

System Development Charges (SDCs) can be charged to all users of transportation, water, sewer, storm drainage, and parks and recreation facilities. The fee is usually charged as each piece of property is developed in the future and goes into a capital construction fund to pay for improvements required by growth in the community. The Oregon System Development Charges Act, House Bill 3224, became effective in 1991. Legislation requires that capital improvement plans be developed, and that methodology used to compute SDCs be documented and reviewed by the community before SDCs can be charged.

The Oregon System Development Charges Act permits two types of charges: 1) a reimbursable fee, and 2) an improvement charge. A reimbursable fee is a charge for unused capacity in existing capital improvements. An improvement charge is a fee associated with capital improvements to be constructed. Improvement fees are generally more popular than reimbursement fees, due to the complexity of computing reimbursable fees for infrastructure constructed sometime in the past.

SDCs charged before construction will be considered improvement fees. After construction the charges will be considered reimbursement fees. The cost estimate should be modified to reflect actual cost of construction and recomputed SDCs. To insure that new development is not charged twice through system development charges and user fees, the revenue generated from reimbursement fees is typically used to pay back existing loans for improvements. Legislation requires that the methodology for establishing fees be available for public inspection.

The City adopted a Capital Improvements Plan and SDC Methodology in December 1995. The report provides for periodic updates to account for inflation according to the ENR Construction Cost Index. SDCs were last updated and adopted by Resolution No. 2009-01 on May 11, 2009. The current water system SDC is $3,235.

7.6.1 SDC Recommendations

It has been 6 years since SCDs were last evaluated for the system. SDCs should be updated to reflect new construction and recommended improvements associated with this Master Plan.

APPENDIX A

333-061-0060 Plan Submission and Review Requirements

(1) Plan Submission:

(a) Construction and installation plans shall be submitted to and approved by the Authority before construction begins on new systems or major additions or modifications, as determined by the Authority, are made to existing systems. Plans shall be drawn to scale;

(b) Preliminary plans, pilot studies, master plans and construction plans shall be prepared by a Professional Engineer registered in Oregon, and submitted to the Authority unless exempted by the Authority (See OAR 333-061-0060(4));

(c) Plans shall set forth the following:

(A) Sufficient detail, including specifications, to completely and clearly illustrate what is to be constructed and how those facilities will meet the construction standards set forth in these regulations. Elevation or section views shall be provided where required for clarity;

(B) Supporting information attesting to the quality of the proposed source of water;

(C) Vicinity map of the proposed project relative to the existing system or established landmarks of the area;

(D) Name of the owner of the water system facilities during construction and the name of the owner and operator of the facilities after completion of the project;

(E) Procedures for cleaning and disinfecting those facilities which will be in contact with the potable water.

(d) Prior to drilling a well, a site plan shall be submitted which shows the site location, topography, drainage, surface water sources, specifications for well drilling, location of the well relative to sanitary hazards, dimensions of the area reserved to be kept free of potential sources of contamination, evidence of ownership or control of the reserve area and the anticipated depth of the aquifer from which the water is to be derived. The Authority will review well reports from the area and in consultation with the local watermaster and the well constructor as appropriate will recommend the depth of placement of the casing seal. After the well is drilled, the following documents shall be submitted to the Authority for review and approval: Well driller's report, report of the pump test which indicates that the well has been pumped for a sufficient length of time to establish the reliable yield of the well on a sustained basis, including data on the static water level, the pumping rate(s), the changes in drawdown over the duration of the test, the rate of recovery after the pump was turned off, reports on physical, chemical and microbiological quality of the well water, performance data on the well pump, a plan of the structure for protecting above-ground controls and

appurtenances, and a plan showing how the well will be connected to the water system. (See OAR 333-061-0050(2)).

(e) Any community, non-transient non-community, or transient non-community water system that treats surface water or groundwater under the influence of surface water and that desires to make a significant change to its disinfection treatment process as defined by paragraphs (1)(e)(A) through (1)(e)(D) of this rule, is required to develop a disinfection profile and calculate a disinfection benchmark according to OAR 333-061-0036(4)(g). The water system must consult with and provide any additional information requested by the Authority prior to making such a change. The water system must develop a disinfection profile for *Giardia lamblia* and viruses, calculate a disinfection benchmark, describe the proposed change in the disinfection process, and analyze the effect(s) of the proposed change on current levels of disinfection according to the USEPA Disinfection Profiling and Benchmarking Guidance Manual and/or the USEPA LT1-ESWTR Disinfection Profiling and Benchmarking Technical Guidance Manual and submit the information to the Authority for review and approval. Significant changes to the disinfection treatment process include:

(A) Changes to the point of application:

(B) Changes to the disinfectants used in the treatment process;

(C) Changes to the disinfection process;

(D) Any other modification identified by the Authority.

(f) A water system that uses either chloramines, chlorine dioxide, or ozone for primary disinfection, and that is required to prepare a disinfection profile for *Giardia lamblia* as prescribed by subsection (1)(e) of this rule, must also prepare a disinfection profile for viruses and calculate the logs of inactivation for viruses using the methods specified in OAR 333-061-0036(4)(g).

(2) Plan review:

(a) Upon receipt of plans, the Authority shall review the plans and either approve them or advise that correction or clarification is required. When the correction or clarification is received, and the item(s) in question are resolved, the Authority shall then approve the plans;

(b) Upon completion of a project, a professional engineer registered in Oregon shall submit to the Authority a statement certifying that the project has been constructed in compliance with the approved plans and specifications. When substantial deviations from the approved plans are made, as-built plans showing compliance with these rules shall be submitted to the Authority;

(c) Plans shall not be required for emergency repair of existing facilities. In lieu of plans, written notice shall be submitted to the Authority immediately after the emergency work is completed stating the nature of the emergency, the

extent of the work and whether or not any threats to the water quality exists or existed during the emergency.

(3) Plan review fees: Plans submitted to the Authority shall be accompanied by a fee as indicated in Table 47. Those plans not accompanied by a fee will not be reviewed.

Table 47		
Nature of Plan	Community Water System	Non-Community Water System
Water source	$600	$150
Water Treatment	$600	$150
Water Treatment (full)	$600	$150
Disinfection only	$150	$45
Corrosion Control only	$150	$45
Distribution & Storage	$600	$150
Distribution only	$600	$150
Storage only	$600	$150
Combination two or more	$750	$150
Master Plan	$750	$150
Corrosion Control study	$750	$150
As-built plans & certification statement	No fee if original plans reviewed	

(4) Plan review exemptions:

(a) Water suppliers may be exempted from submitting plans of main extensions, providing they:

(A) Have provided the Authority with a current master plan; and

(B) Certify that the work will be carried out in conformance with the construction standards of these rules; and

(C) Submit to the Authority an annual summary of the projects completed; and

(D) Certify that they have staff qualified to effectively supervise the projects.

(b) Those water suppliers certifying that they have staff qualified to effectively plan, design and supervise their projects, may request the Authority for further exemption from this rule. Such requests must be accompanied by a listing of staff proposed to accomplish the work and a current master plan. To maintain the exemption, the foregoing must be annually updated;

(c) At the discretion of the Authority, Community, Transient and Non-Transient Non-Community and State Regulated water systems may be exempted from submitting engineered plans. They shall, however, submit adequate plans

indicating that the project meets the minimum construction standards of these rules.

(5) Master plans:

(a) Community water systems with 300 or more service connections shall maintain a current master plan. Master plans shall be prepared by a professional engineer registered in Oregon and submitted to the Authority for review and approval.

(b) Each master plan shall evaluate the needs of the water system for at least a twenty year period and shall include but is not limited to the following elements:

(A) A summary of the overall plan that includes the water quality and service goals, identified present and future water system deficiencies, the engineer's recommended alternative for achieving the goals and correcting the deficiencies, and the recommended implementation schedule and financing program for constructing improvements.

(B) A description of the existing water system which includes the service area, source(s) of supply, status of water rights, current status of drinking water quality and compliance with regulatory standards, maps or schematics of the water system showing size and location of facilities, estimates of water use, and operation and maintenance requirements.

(C) A description of water quality and level of service goals for the water system, considering, as appropriate, existing and future regulatory requirements, nonregulatory water quality needs of water users, flow and pressure requirements, and capacity needs related to water use and fire flow needs.

(D) An estimate of the projected growth of the water system during the master plan period and the impacts on the service area boundaries, water supply source(s) and availability, and customer water use.

(E) An engineering evaluation of the ability of the existing water system facilities to meet the water quality and level of service goals, identification of any existing water system deficiencies, and deficiencies likely to develop within the master plan period. The evaluation shall include the water supply source, water treatment, storage, distribution facilities, and operation and maintenance requirements. The evaluation shall also include a description of the water rights with a determination of additional water availability, and the impacts of present and probable future drinking water quality regulations.

(F) Identification of alternative engineering solutions, environmental impacts, and associated capital and operation and maintenance costs, to correct water system deficiencies and achieve system expansion to

meet anticipated growth, including identification of available options for cooperative or coordinated water system improvements with other local water suppliers.

(G) A description of alternatives to finance water system improvements including local financing (such as user rates and system development charges) and financing assistance programs.

(H) A recommended water system improvement program including the recommended engineering alternative and associated costs, maps or schematics showing size and location of proposed facilities, the recommended financing alternative, and a recommended schedule for water system design and construction.

(I) If required as a condition of a water use permit issued by the Water Resources Department, the Master Plan shall address the requirements of OAR 690-086-0120 (Water Management and Conservation Plans).

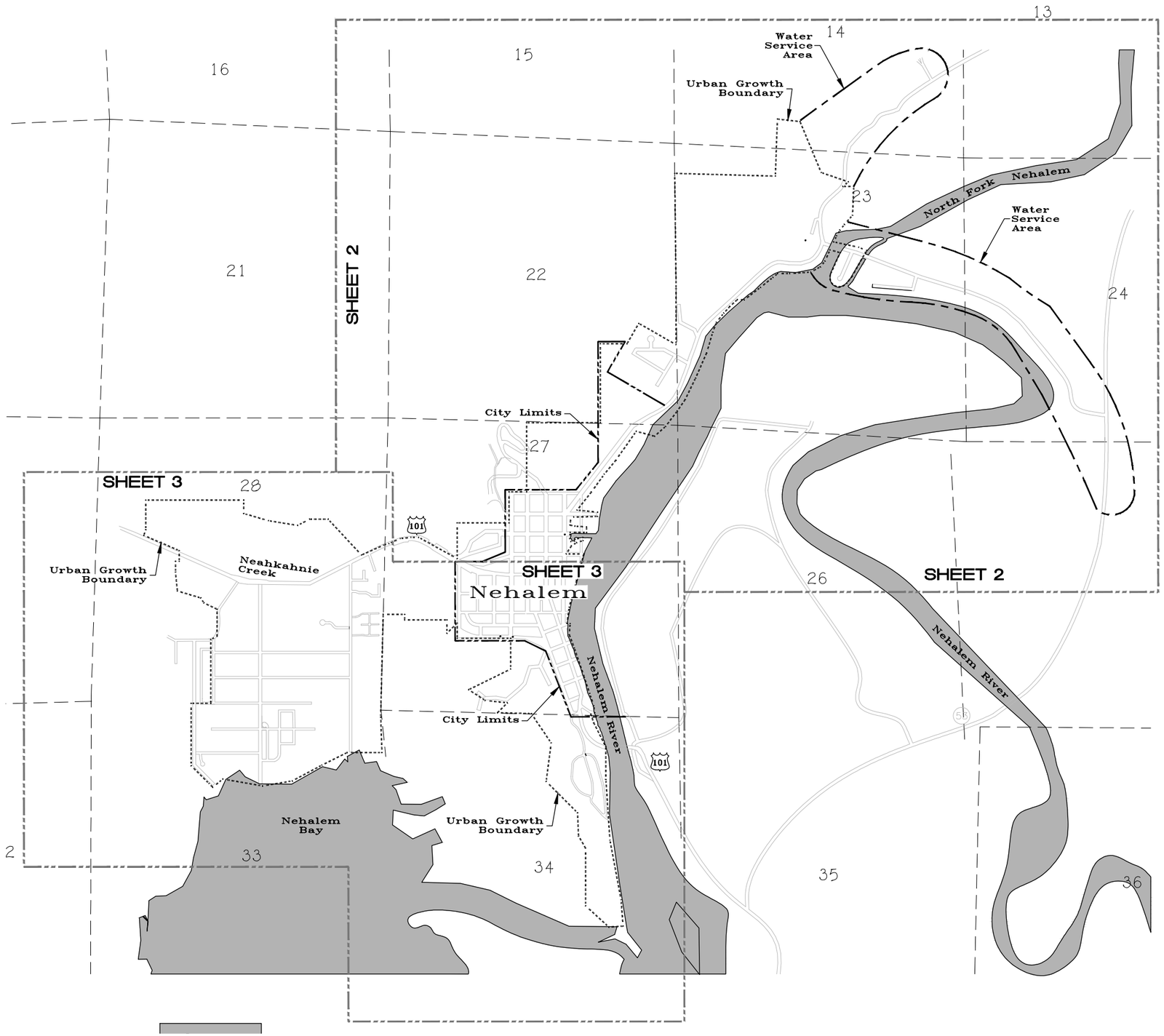
(c) The implementation of any portion of a water system master plan must be consistent with OAR 333-061 (Public Drinking Water Systems, Oregon Health Authority), OAR 660-011 (Public Facilities Planning, Department of Land Conservation and Development) and OAR 690-086 (Water Management and Conservation Plans, Water Resources Department).

Stat. Auth.: ORS 448.131
Stats. Implemented: ORS 431.110, 431.150, 448.131, 448.150, 448.273 & 448.279

APPENDIX B

CITY of NEHALEM
WATERLINE MAPPING

SCALE: 1"=2000' 2015



GRAPHIC SCALE

2000 0 1000 2000 4000

SCALE: 1"=2000'

HLB otak

- SURVEYING
- CIVIL ENGINEERING
- PLANNING
- WATER RIGHTS
- WETLAND CONSULTING

CLATSOP COUNTY
4253-A HWY 101 N.
GEARHART, OR 97138
(503) 738-3425
FAX: (503) 738-7455
WWW.OTAK.COM

CITY of NEHALEM
WATERLINE MAPPING

SCALE: 1"=1000' 2015

Bob's Creek Intake

Raw Water Intake With Manzanita

Transmission Line Route Markham (1961)

Water Service Area

Urban Growth Boundary

City Limits

Treatment Plant and Reservoir

Urban Growth Boundary

Bob's Creek

Anderson Creek

Coal Creek

North Fork Nehalem

Nehalem River

JARRY ROAD

NORTH FORK ROAD

BRIDGE

ISLAND DR.

McDONALD ROAD

LIAR'S LAIR

McDONALD ROAD

PRIVATE ROAD

DIVISION ST.

J.T. WAY

SUNRISE DR.

ANGLER'S ACRES

NORTH FORK ROAD

TOHL RANCH ROAD

D ST

C ST

B ST

A ST

10TH ST

9TH ST

8TH ST

7TH ST

6TH ST

B ST.

HAYES DRIVE

101

14

15

22

23

24

26

27

SEE SHEET 3

- 4" PVC
- 4" A/C
- 4" STEEL
- 4" HDPE
- 6" PVC
- 6" A/C
- 6" STEEL
- 6" HDPE
- 8" PVC
- 8" HDPE
- 10" PVC
- 10" HDPE
- 12" PVC

GRAPHIC SCALE

1000 0 500 1000 2000

SCALE: 1"=1000'

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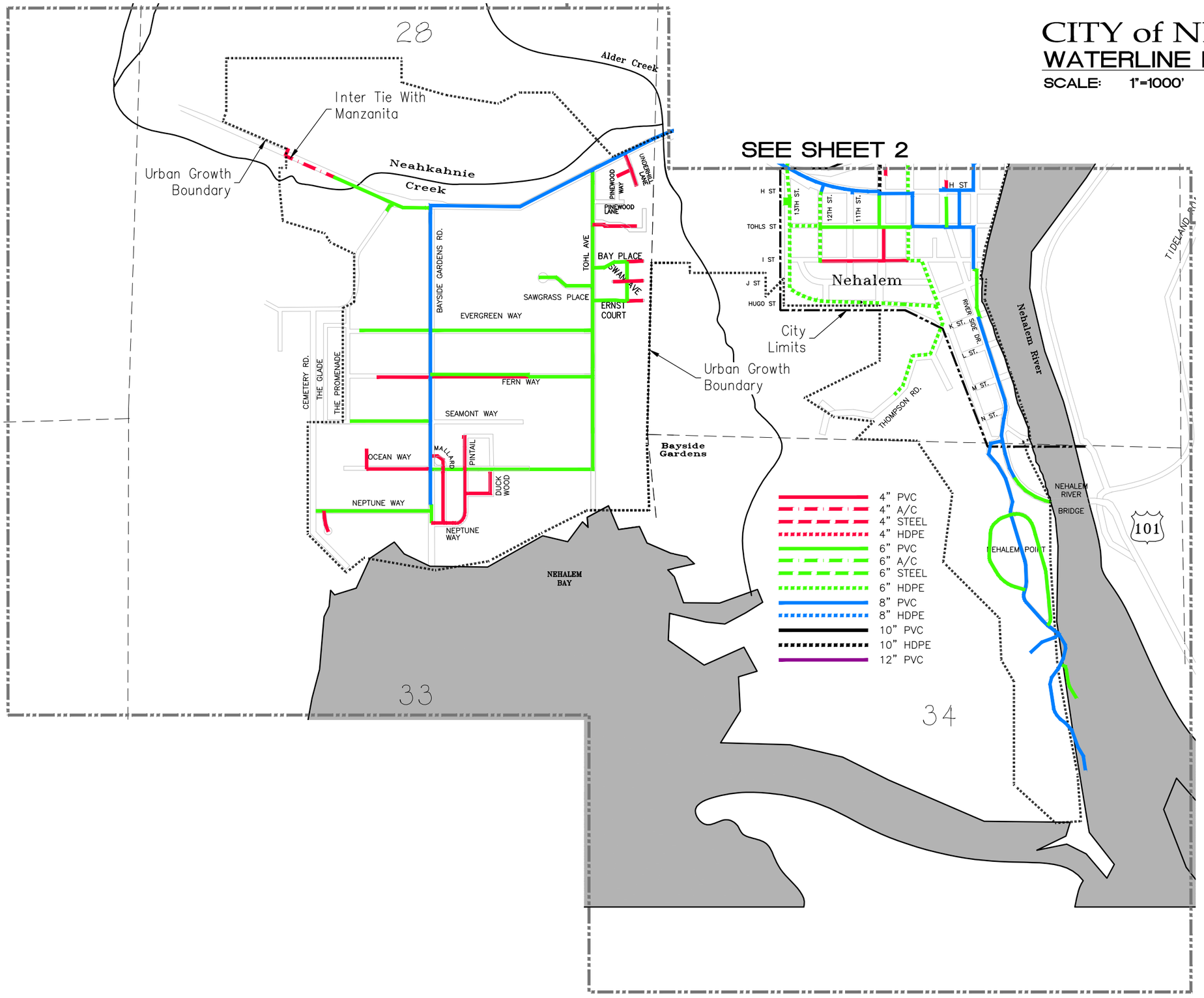
CITY of NEHALEM
WATERLINE MAPPING

SCALE: 1"=1000' 2015



GRAPHIC SCALE
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SCALE: 1"=1000'

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APPENDIX C

January 9, 2015 *nehalem-14-1-consult*

City of Nehalem
Dale Shafer
manager@ci.nehalem.or.us

REPORT OF GEOTECHNICAL ENGINEERING SERVICES
Nehalem Water Facility Outfall - Nehalem, OR

We are pleased to present this agreement for geotechnical services. The former and new pipe outflow at the facility is elevated immediately above an active slide zone that is regressing and has caused the pipes concrete support structure to rotate over many years. The concrete structure is in need of underpinning as a short term measure to delay more costly repairs. The purpose of our services was to provide initial geotechnical recommendations for temporary underpinning for use by a structural engineer and contractor. It should be understood this is not for slide stabilization, just temporary support of the structure to delay further damage. Slide stabilization would require extensive investigations, design, and high construction costs. The recommendations herein will need to be adjusted in the field for proper embedment based on soil conditions actually encountered during pile/pier installation at greater depths. Our scope of work included the following:

Design

- Complete a site reconnaissance of the existing slope conditions.
- Complete up to 2 drive probes to depths of up to 8 feet near outfall culvert structure.
- Provide geotechnical parameters for helical pier or grouted micropile design, including vertical and lateral capacity and embedment.
- Summarize our observations and recommendations in a letter report.

Subsequent to design, we will also provide the following when called:

Construction Observation

- Complete one site visit to observe one pier/pile installation.
- Provide a site visit report summarizing our observations.
- Review contractor provided installation logs

SITE CONDITONS

Surface Conditions

The site is located roughly 1300 feet northeast of the intersection of D and 8th Streets at the City's water facility. The site is on a steep ridge line (as shown in the attached aerial photo), with lined lagoons to the north and a very steep slope inclined at roughly 1H:1V to heights of over 30 feet above slopes of roughly 1.5H:1V for slopes greater than 60 feet to the south. A large storage tank is located roughly 200 feet to the east southeast of the outfall. This slope has been over-steepened as the headscarp to an actively regressing landslide that has progressed over many years. The water outfall/blowoff was formerly at this location with discharge directly onto the slope, and likely created or exacerbated the slide. According to the City, outfall directly onto the slope has not occurred here for over 10 years, and the pipe has been moved back against the slope, and lies within an open topped, braced box culvert structure. The previous report for the tank in 2000 also referenced this slide as existing. Photos from the time of our exploration in November, 2014, are attached. The open end of

1112 7th Street, Oregon City, OR 97045 *ph 503.657.3487 fax 503.722.9946*

the culvert structure has rotated downward toward the slide over many years, with displacement and lifting of the back end of several inches. No significant cracking was noted in the culvert structure. No slide features were noted at the crest at the top of the structure, and the City stated no impact to the holding structures have been experienced.

Subsurface Conditions

We explored subsurface conditions at the outer edges near the downslope opening of the concrete structure at two locations with drive probes. We also reviewed deep borings for the nearby tank provided by the city. Based on this information, subsurface conditions consisted of very soft to soft silt with some clay to depths of roughly 2.5 feet, underlain by medium stiff conditions to depths of 6 feet, where driving conditions increased to stiff conditions to the 8 foot depth explored. Based on the nearby boring, stiffness increased with depth to SPT blowcounts of 25 and greater below depths of 10 to 15 feet where soil transitioned to soft rock to the 55 foot depth explored.

Conclusions and Recommendations

The slide below the culvert is active and progressing upslope. The culvert and outflow pipe will continue to be in jeopardy of damaging movements from this slide. However, to aid in prolonging the life of the pipe and outfall, underpinning could be completed for the culvert. The measures herein will not prevent eventual damage and need for more in depth measures, but may delay them. For this purpose and risk exposure level, we recommend temporary underpinning of the downslope portion of the concrete culvert. This can be done with underpinning piles extending vertically below the edges of the culvert, as well as battered back into the hillside to provide some lateral resistance. As the soils become stiff and significant embedment is needed, we recommend grouted micro-piles for this purpose as helical piers may not penetrate adequately.

Grouted Micropiles

The contractor must evaluate the culvert for proper structural connections with the micro-piles, which will dictate if additional culvert strengthening is needed. We anticipate that piles will be installed through the base in cored holes near the inside wall faces, but relocation may be needed based on culvert strength and accessibility as determined by the contractor. The upper portion of the micro-piles will likely need to be cased to prevent grout loss from blowouts on the nearby steep slope face. Because of the slope height and the need to derive support from stiffer soils further from the slide face, we recommend a minimum embedment of 25 feet for both vertical and batter piles, with one of each pile likely needed at each side of the culvert for a total of 4 piles. Piles should be located near the outfall, but no closer than 4 feet from the end, or as close as the structural engineer determines the culvert can cantilever. Batter piles should be inclined at 45 degrees. This embedment will control design more than the needed capacity, and actual embedment must be determined by our observation of installation.

We recommend Ischebeck Titan grouted micro-piles with a minimum steel diameter of 30 mm (30/11) and bit diameter of 100mm. The site soils are cohesive when stiff, and cutting/drag type bits are recommended. Grout is recommended as the drilling fluid to reduce water infiltration in the head-scarp and reduce potential blowouts. Structural connections should accommodate pile loads of up to 15 kips each.

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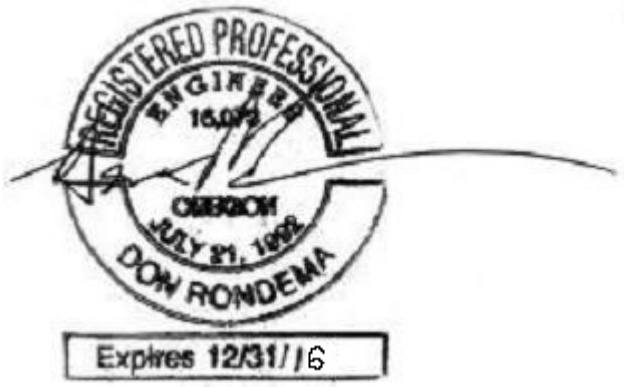
Limitations and Observation during Construction

We have prepared the above information for use by the City of Nehalem and members of their design and construction teams for this project only. The information herein can be used for bidding or estimating purposes, but should not be construed as a warranty of subsurface conditions. We have made observations only at the aforementioned locations, and only at the stated depths. These observations do not reflect soil types, strata thicknesses, water levels or seepage that may exist between observations or at other areas of the site. We must be consulted to review final design and specifications in order to see that our recommendations are suitably followed. If any changes are made to the anticipated locations, loads, configurations, or construction timing, our recommendations may not be applicable, and we must be consulted. The preceding recommendations must be considered preliminary, as actual soil conditions may vary. In order for our recommendations to be final, we must be retained to review final plans, to observe actual subsurface conditions encountered, and to observe underpinning installation. Our observations will allow us to adapt to actual conditions and to update our recommendations if needed.

We appreciate the opportunity to work with you on this project and look forward to our continued involvement. Please call if you have any questions.

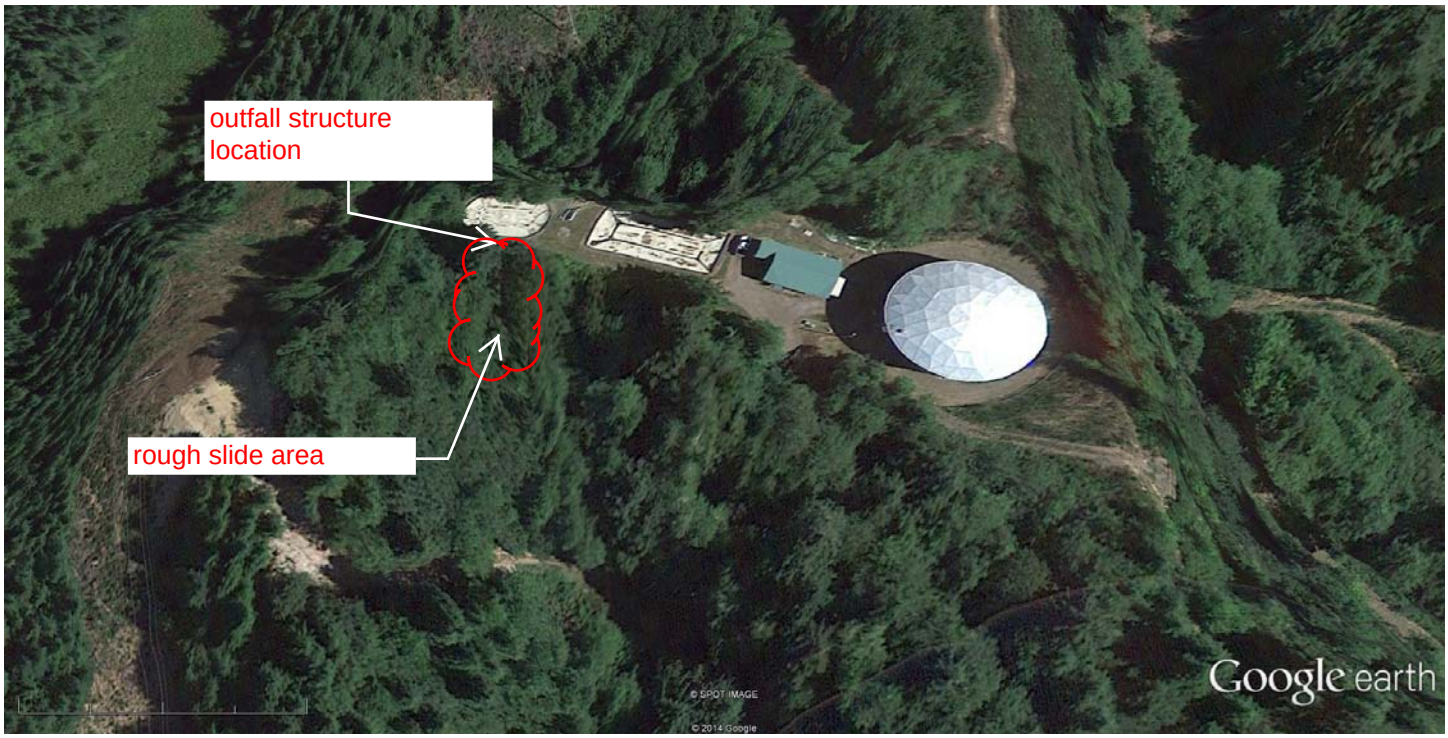
Sincerely,

Don Rondema, MS, PE, GE
Principal



Attachments – Site Aerial Photo, Photos (2)

1112 7th Street, Oregon City, OR 97045 *ph 503.657.3487 fax 503.722.9946*



Google earth

feet 400

meters 100

APPENDIX D

11/10/1983

EASEMENT AND AGREEMENT

THIS AGREEMENT is entered into between the CITY OF NEHALEM, a municipal corporation, herein "Nehalem" and the CITY OF MANZANITA, a municipal corporation, herein "Manzanita".

In consideration of the payment by Manzanita to Nehalem of ONE THOUSAND ONE HUNDRED FIFTY (1,150) DOLLARS, receipt of which is hereby acknowledged, and the mutual covenants and conditions herein agreed, the parties agree as follows:

1. Nehalem grants to Manzanita a permanent, exclusive easement to construct, operate, maintain, repair and rebuild a water pipeline, access road, dam, water impoundment and spoil area on property owned by Nehalem in Tillamook County, Oregon, more particularly described in Exhibit A attached hereto and incorporated by reference herein.

2. The easement hereby granted shall constitute a covenant running with the land for the benefit of grantee, its successors and assigns.

3. At its sole expense, Manzanita will install two connections from Manzanita's supply line to the Nehalem water supply line at Bob's Creek, including pipe, fittings, pressure reducing valve, shutoff valves, valve boxes and covers. The first connection shall be a 3/4 inch p.v.c. pipe connection tapped into the Manzanita main with a 1/2" tap with an increaser to 3/4" size, and tapped into the Nehalem main with a 3/4 inch tap. There shall be one 3/4 inch gate valve in this line, set in a valve box, and meter idler. It is the intent there shall also be a meter box with meter connections and a meter idler installed in the line.

The second connection shall be a four inch p.v.c. pipe connection cut into both mains with reducing tees and dresser couplings, and having a pressure reducing valve and AWWA gate valve with valve boxes installed in it. The pressure reducing valve shall be set to just prevent backspill of water from Manzanita's main over the Bob's Creek spillway. Manzanita shall have the right to inspect these valves from time to time; however, maintenance and replacement of them will be the responsibility of Nehalem.

4. Nehalem will have the right to take surplus water through the 4 inch connection at any time it wishes, except during periods when the City of Manzanita determines that a shortage exists, and there is only enough water in the main to meet Manzanita's needs. In such event, Manzanita shall notify Nehalem in writing of the beginning and end of the cutoff period, and shall give a minimum of three days' notice in advance of any proposed shutoff or start up date. In the event of a bona fide emergency, the required notice may be waived, but Manzanita will make every effort to notify Nehalem by radio or telephone as soon as the emergency is discovered. In addition the City of Nehalem shall at all times be entitled to a continuous release of 11.1 gallons per minute through the special direct 3/4 inch interconnection for that purpose.

5. Water supplied to Nehalem, through the provisions of the preceding paragraph, will be supplied without charge so long as the water remains untreated. In the event of installation of filtration or treatment facilities by Manzanita at a point above the connection to Nehalem's line, Nehalem will be charged the actual treatment cost per gallon for water supplied.

6. Nehalem shall in future years after completion of project construction have the right to harvest timber from the area above reservoir waterline and within the easement boundaries, so long as it does so selectively and in such a manner as to assure neither short term or long term degradation of reservoir water quality.

7. Manzanita agrees to indemnify and hold harmless Nehalem from any and all liabilities arising from Manzanita's construction or its use of the facilities within the granted easements.

8. Manzanita shall have the right to do such clearing and grading within the easement as it deems necessary for the construction and generation of a dam to impound not more than 30 acre feet of water. Manzanita shall also have the right to build and operate any and all structures, roads or pipelines it finds necessary, in its sole judgement, to install within the easement area.

9. Manzanita shall have the right to place spoil from the reservoir and dam excavation in the spoil area. Upon completion of initial construction and any subsequent construction, Manzanita shall shape and seed the spoil area in accordance with accepted forestry practices in order to prevent erosion.

10. Manzanita shall have the right to dispose of any timber or firewood from initial clearing operations and to retain for its own use any proceeds it may realize from such disposal. Any subsequent cutting or logging within the easement boundaries found necessary for access or to assure the quality and quantity of its water supply may be performed by the City of Manzanita after notifying the City of Nehalem of the proposed action, but any proceeds acruing to the disposal of such logs or wood shall go to the City of Nehalem. It is agreed between the parties that the dollar consideration paid by Manzanita includes the full appraised value as established by the firm of Mason, Bruce and Girard, Inc., retained by Nehalem for that purpose, of the timber on the approximately 3-acre clearing and grading area above the impoundment line plus the estimated 2-acre actual impoundment area.

11. Manzanita shall maintain a securely locked gate on the access road to the dam and shall provide Nehalem with a key. No unauthorized person shall be given access to keys, nor allowed to trespass upon this road or any other part of the granted easement.

IN WITNESS WHEREOF the parties sign and execute this agreement on the dates shown below:

CITY OF MANZANITA

By: Irving L. Carr
Mayor

By: Howard Wilson
Recorder

DATE: 11-10-83

CITY OF NEHALEM

By: Wm Lee Dillard
Mayor

By: C. Merlin Brown
Recorder

DATE: 11-16-83

STATE OF OREGON)
)ss.
County of Tillamook)

The foregoing instrument was acknowledged before me this 10th day of November, 1983, by _____ of the City of Manzanita, a municipal corporation of the State of Oregon, on behalf of the City.

JULIE L. JOSLYN
NOTARY PUBLIC-OREGON
My Commission Expires _____

Julie L. Joslyn
Notary Public for Oregon
My Commission Expires: June 1987

STATE OF OREGON)
)ss.
County of Tillamook)

The foregoing instrument was acknowledged before me this 16th day of November, 1983, by _____ of the City of Nehalem, a municipal corporation of the State of Oregon, on behalf of the City.

Roseanna M. Cardwell
Notary Public for Oregon
My Commission Expires: 9/23/84