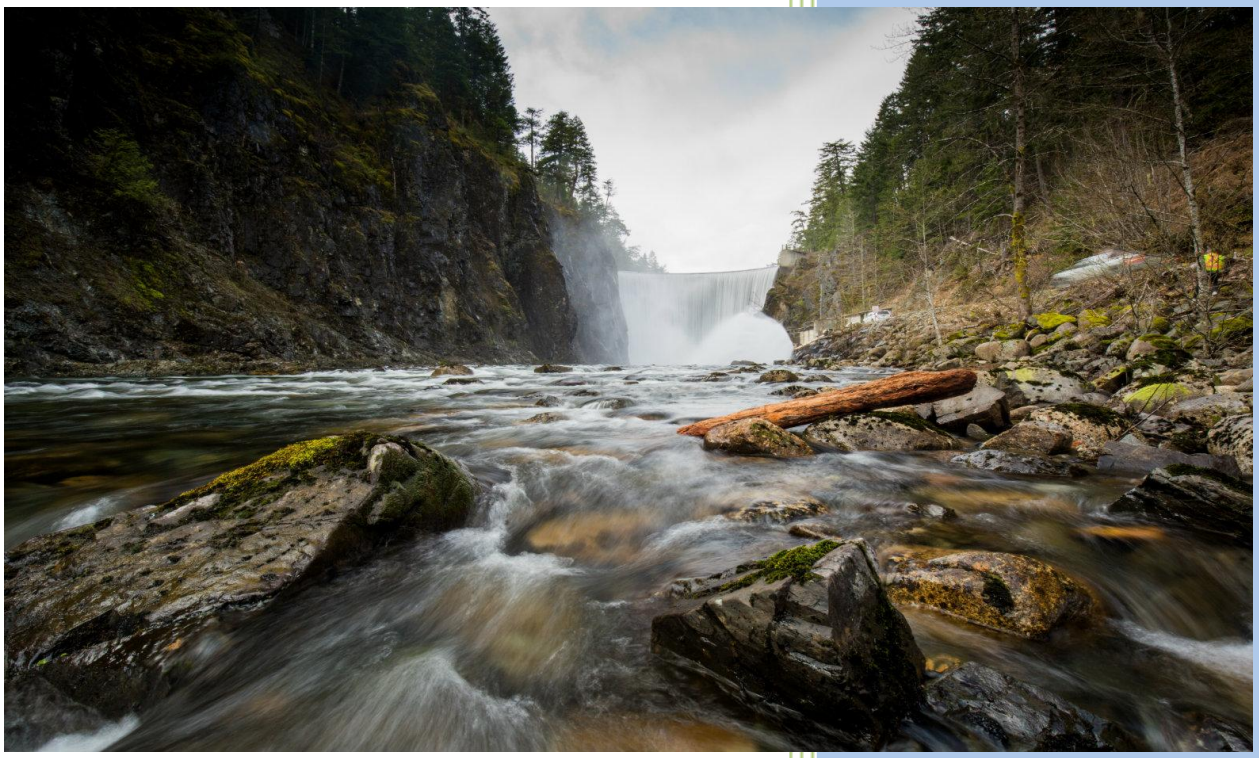
CITY OF NANAIMO
THE HARBOUR CITY
WATER RESOURCES

2015

Annual Water Quality Report



City of Nanaimo

May 3, 2016

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front cover photograph taken by; **Lance Sullivan, Concept Photography**
location; south fork of the Nanaimo River & South Fork dam

1. INTRODUCTION

The City of Nanaimo (City) continually strives to provide high quality drinking water to its citizens through responsible operation, monitoring, evaluation and management of its water system.

raw water sampling at a Jump Creek tributary

Under the British Columbia Drinking Water Protection Act all water purveyors are required to provide customers (the public) with an annual report on the quality of their drinking water. The City has compiled the following information to help you better understand your drinking water.

This report also describes where your water comes from, how it is distributed, and how we ensure it is safe to drink. This information will allow people, especially those with special health needs, to be better informed about their drinking water.

Drinking water is a complex issue and much of the information in the report is technical. We have tried to provide it in a format that is as understandable as possible. Throughout the report there are some terms which are *italicized*. An explanation of these terms can be found in the glossary at the back of this report. If you have any questions please contact the staff contacts listed in this report.

This annual report covers the period from January 1, 2015 to December 31, 2015.

The City operates its water system under Water Licences for Jump Creek dam (numbers 41112, 41113 and 100838) and for South Fork dam (numbers 41112, 41113 and 100838) issued by the British Columbia Ministry of Forests, Lands and Natural Resource Operations.

2. CITY OF NANAIMO - DRINKING WATER SYSTEM

The City's water system originates in a large protected watershed area at the headwaters of the south fork of the Nanaimo River. There are two dams in the watershed which capture precipitation and supply the *surface water* to the City of Nanaimo, Snuneymuxw First Nation and South West Extension Water District.

Jump Creek Reservoir

The South Fork Dam impounds approximately 2,000 ML (million litres) of water and Jump Creek Dam impounds approximately 16,600 ML.

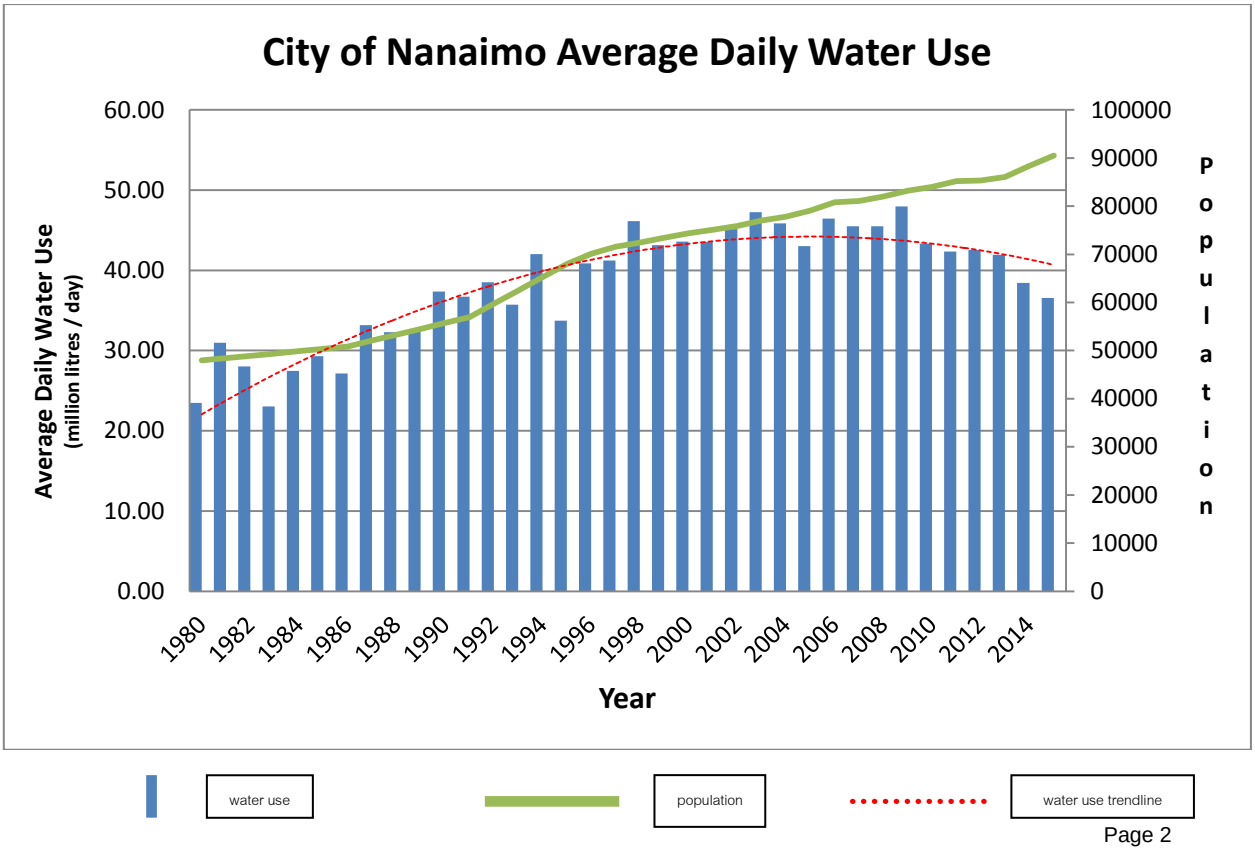
The reservoir catchment area is approximately 230 km^2. The land within the watershed is owned primarily by Island Timberlands Limited Partnership and TimberWest Forest Corporation, and the lakes created by the two dams are held under water licenses by the City.

The watershed is co-managed by the City and Island Timberlands. Management policies and regulations have been put into place to protect the water quality.

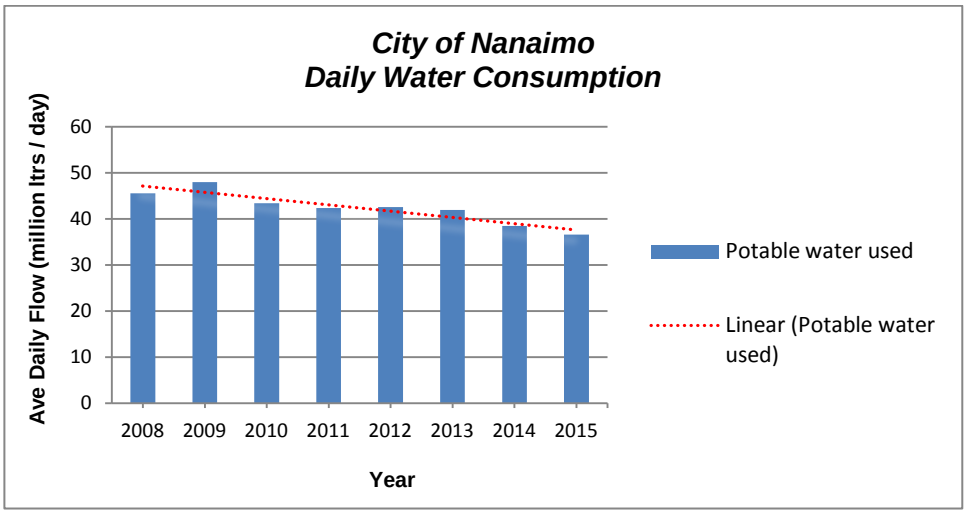
Watershed access is restricted to valid permit holders who have passed a water quality screening program.

The water is transported to Water Process Centre (where the water is treated) via two parallel pipelines that start out as 750 mm and 1200 mm diameter from South Fork Dam and travel approximately 20 kilometres to the city boundary. These mains have the ability to supply peak day flows of 240 ML per day.

The water is then distributed through approximately 30 kilometres of secondary supply systems to 9 balancing tanks located throughout the City. These tanks collectively contain approximately 59 ML of *treated storage* and act to maintain system pressures during peak hour flows. The City used up to 68.1 million litres per day during peak summer flows in 2015. Peak hour flows can exceed the daily average flows by two and a-half-times and are supplied from the tanks. Average daily flow to the City in 2015 was 36.55 ML/day, and this annual average daily flow continues the recent year's downward trend in water consumption.



A drier than average summer prompted the City to raise its water restrictions from level 1 to level 2 from June, 15 to September 30, 2015. The restriction to allow residents to irrigate their lawns to only twice a week is a major contributory factor to the 2015 reduction in the annual water consumption in the City.



From January 1, 2015 until December 3, 2015 the City's potable water was disinfected using chlorine at facilities located at Water Process Centre in the village of Extension. From December 4 until the end of the year the City's potable water was treated at the new South Fork Water Treatment Plant. Water is no longer treated at Water Process Centre and this facility is scheduled for decommissioning in 2016.

chlorine tanks at Water Process Centre

chlorine disinfection at Water Process Centre

Approximately 75% of the water reaches the customer by gravity. The City also operates several pump stations that are used to supply water to higher elevations in the City or boost pressures during peak flows. The pump stations and tanks also act to give the system a safety factor for fighting fires and redundancy for possible system failures.

The distribution of water from the tanks to the consumers is provided by the City of Nanaimo and South West Extension Water District through approximately 630 kilometres of distribution watermains serving a population of approximately 90,524 (2015 data from *BC Stats*).

The water system facilities are monitored on a 24-hour basis. Abnormal conditions are reported to the Public Works Department electronically and immediate action is taken to correct the condition.

3. REGULATORY REQUIREMENTS

The Provincial Ministry of Health through Vancouver Island Health Authority (VIHA) is the regulatory agency for water suppliers. The Drinking Water Protection Act is the legislation governing safe drinking water in the province. This legislation requires that the water supplier monitor the drinking water source and distribution system to ensure compliance with the *Drinking Water Protection Regulation* and report all results to VIHA.

In April 2006 Vancouver Island Health Authority gave notice of a new policy titled Drinking Water Treatment for Surface Water Supplies. This policy characterizes the level of treatment for *surface water* expected by the Vancouver Island Health Authority and provides for adequate removal or inactivation of pathogenic organisms that may be present in raw water.

This policy states:

1. All water supply systems in the Island Health jurisdiction that use *surface water* will ensure a minimum level of treatment and disinfection so the following criteria are met:
    - *i.* 4-log reduction (99.99%) removal/ inactivation of viruses and bacteria
    - *ii.* 3-log reduction (99.9%) removal/ inactivation of giardia lamblia cysts and cryptosporidium oocysts
    - iii. 2 log reduction (99%) removal/ inactivation of viruses
    - *iv.* 1 NTU turbidity (maximum) in finished water

2. The ultrafiltration primary membranes shall operate to achieve a turbidity level of less than or equal to 0.1 NTU in at least 99% of the measurements per operational filter period.

3. The ultrafiltration secondary membranes and ultra violet disinfection system shall operate to achieve a turbidity level of less than or equal to 0.1 NTU in at least 99% of the measurements per operational filter period.

4. The chlorine disinfection system shall ensure the 4-log reduction (99.99%) inactivation of viruses.

5. The finished potable water produced shall meet or be lower than the concentration limits listed in the Canadian Dinking Water Regulations. There shall be no detectable Escherichia coli bacteria per 100 mL and no detectable total coliform bacteria per 100 mL.

The new South Fork Water Treatment Plant met these requirements during the first month of December 2015 when water treatment production commenced for the City.

The City's action in response to this new policy is explained in Section 7 of this report.

Water Quality Standards for Potable Water

Parameter	Standard
Fecal Coliform Bacteria	No detectable fecal coliform bacteria per 100 ml
Escherichia Coli	No detectable Escherichia Coli per 100 ml
Total Coliform Bacteria	At least 90% of samples have no detectable total coliform bacteria per 100 ml and no sample has more than 10 total coliform bacteria per 100 ml

source: Drinking Water Protection Regulation (amended B.C. Reg. 87/2011)

The City of Nanaimo water operations staff currently take water samples at fixed locations throughout the water distribution network at the following sampling frequencies.

Water Sample Frequency	Number of Samples Taken
Weekly	14
Bi-Weekly	7
Monthly	11

The City also compares its water to Health Canada's *Guidelines for Canadian Drinking Water Quality.*

4. WATER QUALITY MONITORING

Water sampling and testing is carried out regularly in the source and distribution piping system to ensure the drinking water remains safe and meets legislated drinking water requirements.

The *Guidelines for Canadian Drinking Water Quality* are based on current, published scientific research related to health effects, aesthetic effects, and operational considerations. Health-based guidelines are established on the basis of comprehensive review of the known health effects associated with each contaminant, on exposure levels and on the availability of treatment and analytical techniques. Operational considerations are factored in when the presence of a substance may interfere with or impair a treatment process or technology (e.g. turbidity interfering with chlorination) or adversely affect drinking water infrastructure (e.g. corrosion in pipes).

The Guidelines are specific to contaminants that meet all of the following criteria:

1. Exposure to the contaminant could lead to adverse health effects;
2. The contaminant is frequently detected or could be expected to be found in a large number of drinking water supplies throughout Canada; and
3. The contaminant is detected, or could be expected to be detected, at a level that is of possible health significance.

In general the highest priority guidelines are those dealing with microbiological contaminants such as *bacteria*, *protozoa* and *viruses*. Any measures taken to reduce

concentrations of chemical contaminants should not compromise the effectiveness of *disinfection.*

The City's *finished water* quality sampling and testing program has been set up in conjunction with the Vancouver Island Health Authority. The program samples water quality at reservoirs, tanks, low, medium and high flow watermains, dead end watermains and various pressure zones. Results of this sampling program are found in Table 1 and 3 of this report.

The City also extensively monitors the raw (untreated) water at the source. Results of this program are found in Table 2.

Collected water samples are uniquely identified and sent to Provincially approved laboratories for testing. Test results are uploaded by the lab into a data management system which provides the City with comprehensive access to all data and alert information.

In addition, at each sample location a pocket chlorimeter is used by staff to determine the *free chlorine* residual which is an indicator of the effectiveness of disinfection in the distribution system. When indicators of adverse samples are found, corrective action is taken and the Vancouver Island Health Authority is notified when necessary.

5. WATER QUALITY RESULTS

According to the Guidelines for Canadian Drinking Water Quality parameters are either health-based and listed as *Maximum Acceptable Concentrations (MAC),* based on aesthetic considerations and listed as *Aesthetic Objectives (AO)* or established based on operational considerations and listed as *Operational Guidance Values (OG).*

The following tables and graph summarize results of the City's water quality testing and monitoring program for 2015. Results in the tables that are preceded with " < " means results are below detectable limits.

Treated Water Microbiological

The following Table 1 illustrates the City's disinfection system met the bacteriological standards for potable water as set out in Schedule A of the Drinking Water Protection Regulation.

Table 1 – Treated Water Microbiological (Bacteria)

Parameter	Number of Samples	Number of Exceedences	Drinking Water Protection Regulation
E-Coli	998	0	0 per 100 ml
Total Coliform	998	3*	0 per 100 ml

*For total coliform exceedences, the area was flushed and re-sampled. In all cases, the re-test result was zero.

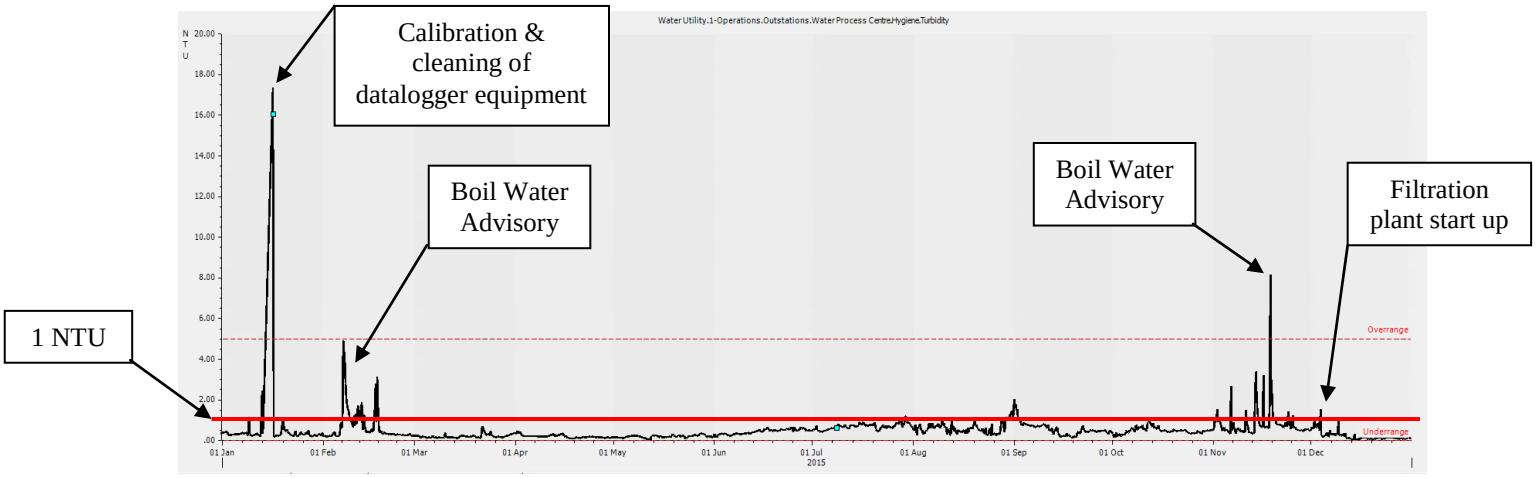
Turbidity

The City's water *turbidity* is continuously measured at several points in the water system. The following graph 1 illustrates *turbidity* measured at a midway point of the *raw water* supply piping system before reaching any customers.

The Guidelines for Canadian Drinking Water Quality suggests a maximum acceptable concentration (MAC) of 1 nephelometric turbidity unit (NTU) and an aesthetic objective (AO) of ≤5 NTU.

It should be noted however that the maximum acceptable concentration of 1 NTU is dependent upon the method of treatment of the raw water.

Graph 1 – Turbidity



**Please note the Boil Water Advisories were as a result of a change in the regulatory regime. The City's Operating Permit was changed to require notification when turbidity is >1 for any length of time

Canadian Drinking Water Guideline 1 NTU

Raw Water Chemical Properties

The following Table 2 illustrates the chemical properties of the City's raw water. Samples were taken at the source.

Table 2 - Raw Water Chemical Properties

Parameter	Parts per million measured (actual results)		Number of Tests	Guidelines for Canadian Drinking Water Quality	
	Max. (mg/L)	Ave. (mg/L)		MAC (mg/L)	AO or [OG] (mg/L)
Aluminum	0.139	0.048	10	<=0.1*	
Arsenic	0.00030	0.00020	10	<=0.01	
Barium	0.00900	0.00596	10	<=1.0	
Boron	0.0070	0.0054	10	<=5.0	
Cadmium	< 0.00001	< 0.00001	10	<=0.005	
Chloride	15.20	4.05	10		<=250
Chromium	< 0.0005	0.00045	10	<=0.05	
Copper	0.0016	0.0005	10		<=1.0
Fluoride	0.03	0.016	10	<=1.5	
Iron	0.276	0.091	10		<=0.3
Lead	< 0.0001	< 0.0001	10	<=0.010	

Parameter	Parts per million measured (actual results)		Number of Tests	Guidelines for Canadian Drinking Water Quality	
	Max. (mg/L)	Ave. (mg/L)		MAC (mg/L)	AO or [OG] (mg/L)
Manganese	0.0138	0.0070	10		<=0.05
Mercury	< 0.00001	0.00001	10	<=0.001	
Nitrate (as NO3)	0.08	0.022	10	<=10	
Nitrite (as N)	0.110	0.044	10	<=1	
Selenium	< 0.0006	0.0004	11	<=0.01	
Sodium	2.800	1.702	10		<=200
Zinc	0.0030	0.0012	10		<=5

* The maximum acceptable concentration (MAC) for aluminum does not apply to naturally occurring aluminum. There is no consistent convincing evidence that aluminum in drinking water causes adverse health effects on humans. (source: Guidelines for Canadian Drinking Water Quality, October 2014)

Please note the above table represents a partial listing of all the parameters the City tests for. Other parameters tested are typically not detected, or are detected orders of magnitude below the Maximum Acceptable Concentration (MAC).

Treated Water Disinfection By-Products

Trihalomethanes (THM's) are formed as a by-product predominantly when chlorine is used to disinfect water for drinking. They represent one group of chemicals generally referred to as disinfection by-products. They result from the reaction of chlorine and/or bromine with organic matter present in the water being treated. The level of THM's in treated water will depend on numerous factors including: total organic carbon, temperature, pH, bromide ion concentration, and chlorination dose.

Table 3 – Treated Water Disinfection By-Products

Parameter	Parts per million measured	Number of Tests	Guidelines for Canadian Drinking Water Quality	
	Ave. (mg/L)		MAC (mg/L)	AO or [OG] (mg/L)
Total Trihalomethanes	0.0505		0.1	
Bromodichloromethane	0.000167	48	<=0.016	
Bromoform	< 0.001	48		
Chloroform	0.0483	48		
Dibromochloromethane	< 0.001	48		

Raw Water Physical Properties

The aesthetic measure of colour occasionally exceeds the aesthetic objectives. This is due to increased level of dissolved organics from changes in temperature or increased runoff from storms. The colour levels in this water system are generally lower than other surface supplies and average below the aesthetic objective of 15 TCU (total colour units). In future the water treatment plant will greatly reduce colour.

Table 4 – Raw Water Physical Properties

Parameter	Parts per million measured (actual results)			Number of Tests	Guidelines for Canadian Drinking Water Quality	
	Min. (mg/L)	Max. (mg/L)	Ave. (mg/L)		MAC (mg/L)	AO or [OG] (mg/L)
Colour	0	53	9.2	80	1 exceedance	< = 15
pH	6.64	8.07	7.05	74		>=6.5 & <= 8.5
Total Dissolved Solids	< 5	138	35.5	10		< = 500
* Hardness	8	15	11.4	5	n/a	n/a

Hardness

Nanaimo water's hardness is typically less than 20.

Water in Nanaimo is classified as very soft, that is the water hardly contains any natural dissolved salts of calcium and magnesium. Rain water and snow melt may pick up these minerals as it seeps through soil and rock into our reservoirs. Chalk and limestone rock contain the greatest amounts of these minerals but these rocks are not common on Vancouver Island. An indicator of having hard water in your home means it will take more soap to form a lather and a slight scum will appear while washing. Also hard water can often form a limescale on the inside of kettles and water fittings. However, whether your water is classified soft or hard it is perfectly safe to drink regardless.

Table 5 – * Hard /Soft Water Classification

Classification	Hardness (mg/L)	Hardness (grains/gal)
Soft	0 - 60	0 - 3.5
Moderately Hard	61 – 120	3.5 – 7.0
Hard	121 – 180	7.0 – 10.5
Very Hard	>181	>10.5

source: United States Geological Survey

Please note on the water hardness scale: 17.1 milligrams/litre = 1 grain/gallon

6. WATER QUALITY CONCERNS

Occasionally the City of Nanaimo receives concerns from the public regarding the quality of their drinking water. During the course of 2015, the City received 40 such enquiries and the most common issue of concern related to water colour and taste. Every individual enquiry was investigated by the City's water supply and distribution operations staff and the appropriate action was taken to resolve the appropriate water quality issue. The majority of concerns were resolved following additional flushing of the distribution main lines. In some instances it was necessary to adjust air valves and replace broken water appurtenances. The majority of the 40 concerns received by the City in 2015 were rectified

within 24 hours of the City being notified. Despite these water quality concerns being noted, at no time is the general health of the public put at risk.

Typical examples of water quality concerns (most notably dirty water) arise as a result of the following;

- water mains flushing
- fire fighting
- water main breaks
- local construction in the area (i.e. water main tie-ins by developers)
- a build up of algae in reservoirs in the summer months during warm weather
- reservoir turnover in early autumn when season rain commences

7. WATER TREATMENT PLANT

The City of Nanaimo developed a 50 year vision for long term water supply. Key directions resulting from the Water Supply Strategic Plan (2007) include providing a safe, sustainable and affordable water supply, adopting a multi-barrier approach, and recognizing that water is a shared resource.

The Vancouver Island Health Authority (now Island Health) notified the City in June 2008 that it was implementing its Surface Water Treatment Policy, the purpose of which was to ensure "surface water suppliers provide potable water, which is safe to drink and free of pathogens." The Policy requires that suppliers using surface water supply sources provide both filtration and disinfection to attain a given standard of finished water quality. Safe drinking water is a cornerstone for public health, social and economic well-being, and is a fundamental human need.

The City's previous water treatment process consisted of chlorine gas injection which was formerly considered adequate to treat the raw water most of the time. However, regular chlorination is not sufficient to remove certain pathogens (e.g. giardia lamblia cysts, cryptosporidium oocysts). In addition, standalone chlorine treatment is insufficient treatment during turbidity events, where turbidity can rise above 1 NTU several days per year.

Although the City of Nanaimo is blessed with a very good surface water supply, a number of factors have brought the need for a water treatment plant into sharper focus:

- The City completed its Water Supply Strategic Plan (January 2007) and adopted a multi-barrier approach to water quality. A multi-barrier approach is "an integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from source to tap in order reduce risks to public health."
- The water supply is subject to turbidity events especially during early wet season severe precipitation events; a condition that is expected to worsen with climate change.

- During the course of 2015 there were two boil water advisories due to turbidity from extreme winter precipitation events (prolonged heavy rainfall) and these occurred between 6 and 10 February 2015 and on 17 November 2015.
- The previous form of treatment was coarse and fine screening followed by chlorine injection. While this was sufficient for removing bacteriological agents when turbidity is low, this 'barrier' is considered insufficient for removing viruses or protozoa.
- Vancouver Island Health Authority notified the City that it was implementing a Surface Water Treatment Policy, which the existing water supply at that time did not meet.
- As the City grows, there will be a diversity of businesses and light industry that will rely on a secure, consistent supply of quality water.

Design of the proposed South Fork Water Treatment Plant was complete in 2012 and the construction of the treatment plant pipelines was complete by April 2013. The construction of the treatment plant building commenced in May 2013, and the plant was operational and producing sparkling clear drinking water in December 2015. The new plant treats raw water using the following process: coarse screening, fine screening, flocculation and chemical mixing (if required), ultra membrane filtration, ultra violet irradiation (secondary membranes only) and chlorine.

new Water Treatment Plant

building, wetlands & clearwell tank – January 28, 2016

In January 2012, the City received notification of Federal funding under the *Canada Gas Tax Fund* towards the building of a new Energy Recovery Facility and an enclosed concrete water storage tank. The new 14 million litre drinking water storage tank replaced the old open reservoir and improved treated water quality. Construction on this new tank commenced in March 2013 and was completed May 2015. This new facility provides storage for treated drinking water for just over 30% of the City residents covering an area from downtown to Neck Point in north Nanaimo. The new tank received clean potable water from the new South Fork Water Treatment Plant in December 2015. The City also provides potable water to Snuneymuxw Reserves Nos. 1, 2, 4 and to the village of Extension southwest of Nanaimo.

The new Energy Recovery Facility and drinking water storage tank - April 1, 2015

Inside the new Energy Recovery Facility - April 1, 2015

8. WATER CONSUMPTION STATISTICS

The following summarizes City water consumption data for 2015.

Total volume delivered: 13,340 million litres (ML)
Population served: 90,524

Average consumption (all uses *): 404 litres/person/day
(Canadian average 510 litres/person/day)
Average residential only consumption: 208 litres/person/day
(Canadian average 274 litres/ person/day)

Average daily amount: 36.55 million litres
Peak day system demand: 68.103 million litres, July 2, 2015 or 752 litres/person/day
(All uses * includes residential, commercial and institutional water demands.)

In 2012 the City completed its first Water Audit and this provided a thorough examination of the water utility data, records and practices regarding the volume of water needed from the treatment source to the customer. The City also updated its Water Conservation Strategy in 2014 which details initiatives being undertaken to reduce water consumption and promote water efficient practices. Both the Water Audit and the Water Conservation Strategy reports are available on the City's website. In addition the City participates in

Team WaterSmart (teamwatersmart.ca) education programs in partnership with the Regional District of Nanaimo to promote water conservation and more efficient water use.

9. MAINTENANCE AND FLUSHING PROGRAM

Regular inspections, maintenance and water quality testing is performed by certified operators to ensure optimal operation of the City's water system.

The City performs systematic flushing of the entire water supply and distribution piping system in the spring of each year. Flushing is a process of sending a rapid flow of water through the water piping to clean them. This helps to maintain water quality by removing sediments and stagnant stale water.

Flushing activities may cause a temporary discoloration of your water. While the discoloration is unpleasant, it is not harmful. If this happens wait thirty to sixty minutes, then turn on your cold water and let it run for ten to fifteen minutes. If your water does not clear up after this process, please contact the Public Works Department at 250-758-5222.

10. EMERGENCY RESPONSE PLAN

The City has prepared a Water System Emergency Response Plan so an adequate supply of clean potable water can be delivered to its citizens even in the event of an emergency or disaster. Disruptions in water quality and delivery may also result from emergencies such as natural disasters or accidents. The City's goal is to minimize all adverse impacts resulting from disruptions in the water system which can only be achieved through sound emergency planning and thorough communication coordination. This also supports the City's goal of providing a safe and sustainable supply of water.

A copy of the City's Water System Emergency Response Plan is posted on the City's website or is available for viewing by contacting Water Resources staff at either (250) 756-5302 or (250) 756-5349.

11. STAFF CONTACTS

The following persons are responsible for the management, operation and system maintenance of the supply and distribution system:

Title	Name	Telephone
Manager, Water Resources	Bill Sims	(250) 758-5222
General Foreman - Waterworks	Ritchie Fulla	(250) 756-5324

If you have any water quality questions please contact either of these staff members.

12. AVAILABILITY OF THE REPORT

This report may be found on the City's website at www.nanaimo.ca / Departments / Engineering/Public Works / Water Supply / Water Quality and Treatment / 2015 Water Quality Report.

If anyone has any questions regarding this report, please contact Bill Sims, Manager, Water Resources, 250-758-5222. Mailing address: 2020 Labieux Road, Nanaimo, B.C. V9T 6J9.

13. GLOSSARY

Alkalinity – the capacity of water to neutralize an acid or the measure of how much acid can be added to a liquid without causing a significant change in pH. Alkalinity is not the same as pH because water does not have to be strongly basic (high pH) to have high alkalinity.

Aesthetic Objective (AO) – conforming to accepted notions of good taste.

Bacteria – many different types of bacterial organisms are found in drinking water. Most municipal treated water is essentially bacteria free due to the addition of chlorine. Some forms of cyst type bacteria have a degree of immunity to chlorine due to the cocoon-like shell around the organism, such as Giardia Lamblia, and Cryptosporidium.

Canadian Drinking Water Quality Guidelines – standards established by health Canada that recommend the maximum acceptable concentrations (MAC) for physical, microbiological, chemical and radiological substances in drinking water.

Chemical Parameter – properties of water relating to the molecular composition, such as mineral or metal concentrations.

Chlorine – widely used in the disinfection of water available as a gas, a liquid in sodium hypochlorite, or as a solid in calcium hypochlorite.

Chlorine Demand – the amount of chlorine required to react with all dissolved and particulate materials and inorganic ammonia in the water to purify drinking water.

Chlorine Dosing – the quantity of chlorine added to the water expressed in milligrams per litre (mg/L), equivalent to parts per million.

Coliform Bacteria – a group of organisms primarily found in human and animal intestines and wastes, and thus widely used as an indicator organisms to show the presence of such wastes in water and the possible presence of pathogenic bacteria.

Contact Time – the time from when the chlorine is added to the water, to when the water reaches the first customers.

Contaminant – a substance that infects and degrades the quality and safety of water.

Corrosion – the deterioration of a material, specifically metals in water, caused by reactions and affected by complex interactions between pH, hardness, alkalinity and temperature of the water.

Cryptosporidium – an intestinal parasite that is found in water. If it is not properly destroyed through water treatment can cause nausea, diarrhea and abdominal pain in humans.

CT Values – the product of contact time and free chlorine concentration. It is used to calculate the percent removal of viruses and bacteria.

Disinfection by-products (DBP) – are created when the chlorine added to water reacts with naturally occurring matter in the water.

Disinfection – a process used to eliminate any harmful substance or micro-organism in water.

Domestic Use – water used by residents, in a household.

Drinking Water Protection Regulation (DWPR) – defines regulatory standards under the Provincial Water Act that must be met to ensure water is safe to drink and fit for domestic purposes.

Escherichia coli (E. Coli) – are bacteria present in the intestine and feces of warm-blooded animals. E. Coli are a member species of the fecal coliform group of indicator bacteria. Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal Coliform – a sub group of total coliform bacteria that are distinguished in laboratory tests at elevated temperatures. It is used as an indicator organism for potential waterborne disease risk.

Filtration – the process of passing water through a porous substance to remove solids in suspension, such as organics. Effectiveness is measured as a reduction of turbidity.

Finished Water – water that has passed through all the processes in a water treatment plant and is ready to be delivered to consumers.

Free Chlorine – the quantity of chlorine remaining which has not been consumed in reactions with microorganisms or organic matter. Also referred to as residual chlorine.

Giardia Lamblia – a common protozoan found in water derived from animal droppings. It can cause contagious waterbourne disease characterized by acute diarrhea. Its cyst forming nature is resistant to disinfectants such as chlorine.

Hardness – a characteristic of natural water due to the presence of dissolved calcium and magnesium.

Inactivation – to destroy or ensure the loss of the ability to cause disease.

Log Removal – indicates how effective disinfection is in eliminating protozoa. For example, 4 log removal guarantees 99.99% disinfection of pathogenic organism, 3 log removal guarantees 99.9%, and 2 log removal guarantees 99% removal.

Maximum Acceptable Concentration (MAC) – defines the upper most limit of a parameter before it can become a health concern.

NTU (Nephelometric Turbidity Units) – the standard unit of measurement for turbidity in water. It detects the amount of light that is scattered by fine suspended particles in water.

Organic – derived from plant or animal matter, as opposed to inorganic matter which is derived from rocks and minerals. Organic matter is characterized by it carbon-hydrogen structure.

Pathogen – an agent that causes disease; a living organism or virus.

pH – the expression of the acidity of a solution by the negative logarithm of the hydrogen ion concentration; pH of 1 is very acidic; pH of 14 is very basic (alkaline); pH of 7 is neutral. The neutral point of 7 indicates the presence of equal concentrations of free hydrogen and free hydroxide ions.

Physical Parameters – these are often observable properties such as colour, taste and odour.

Potable Water – water which is considered safe and fit for human consumption, culinary and domestic purposes and meets the requirements of the health authority having jurisdiction which is the Vancouver Island Health Authority in this region.

Protozoa – any of a large group of mostly microscopic, one cell animals living chiefly in water, mainly referring to Cryptosporidium or Giardia Lamblia.

Raw Water – untreated water from wells, surface sources (i.e. lakes and rivers) or any water before it reaches a water treatment device or process.

Reservoir – a receptacle used for storing water within the water system.

Residual Chlorine – the quantity of chlorine remaining which has not been consumed in reactions with microorganisms or organic matter. Also referred to as free chlorine.

Runoff - precipitation that does not infiltrate into soil.

Surface Water – water collecting on the ground or in a stream, river, lake sea or ocean, as opposed to groundwater, which is contained in underground aquifers.

Trihalomethanes (THMs) – a single carbon compound formed in drinking water as a result of the reaction between chlorine and organic matter.

Total Chlorine – the total amount of chlorine in a solution, which includes the chlorine demand as well as the residual chlorine.

Total Coliform – an indicator group of organisms mostly of intestinal origin used to appraise the microbiological risks to drinking water.

Turbidity – the measurement of how cloudy or murky water is. Its measurement relates to the optical property of water that causes light to be scattered and absorbed in a cloudy sample rather than transmitted in a straight line. Measured in NTU (Nephelometric Turbidity Units).

Virus – the smallest form of life known to be capable of producing disease or infection, usually considered to be of large molecular size. They multiple by assembly of component fragments in living cells, rather than by cell division as do most bacteria.