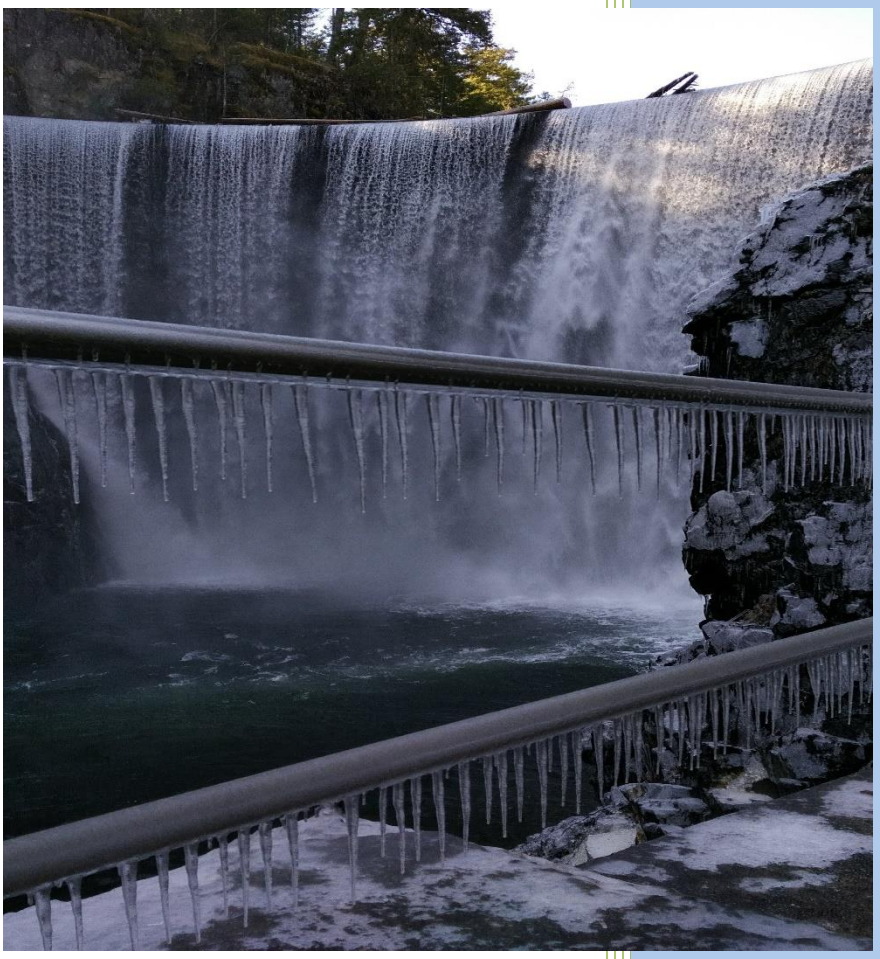
CITY OF NANAIMO
THE HARBOUR CITY
WATER RESOURCES

2019

Annual Water Quality Report



City of Nanaimo

May 28, 2020

TABLE OF CONTENTS

front cover photograph location: South Fork dam, January 2020

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, 2019 to December 31, 2019.

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, Natural Resource Operations and Rural Development.

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. The City can also provide an emergency waater supply to Lantzville and North Cedar Improvement District.

Jump Creek dam spillway and log boom

The Jump Creek reservoir catchment area is approximately 230 km^2. The land within the watershed is owned by Mosaic Forest Management, 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 Mosaic Forest Management. Jointly, many forestry and water resource best management policies and regulations have been put into place to protect the water quality.

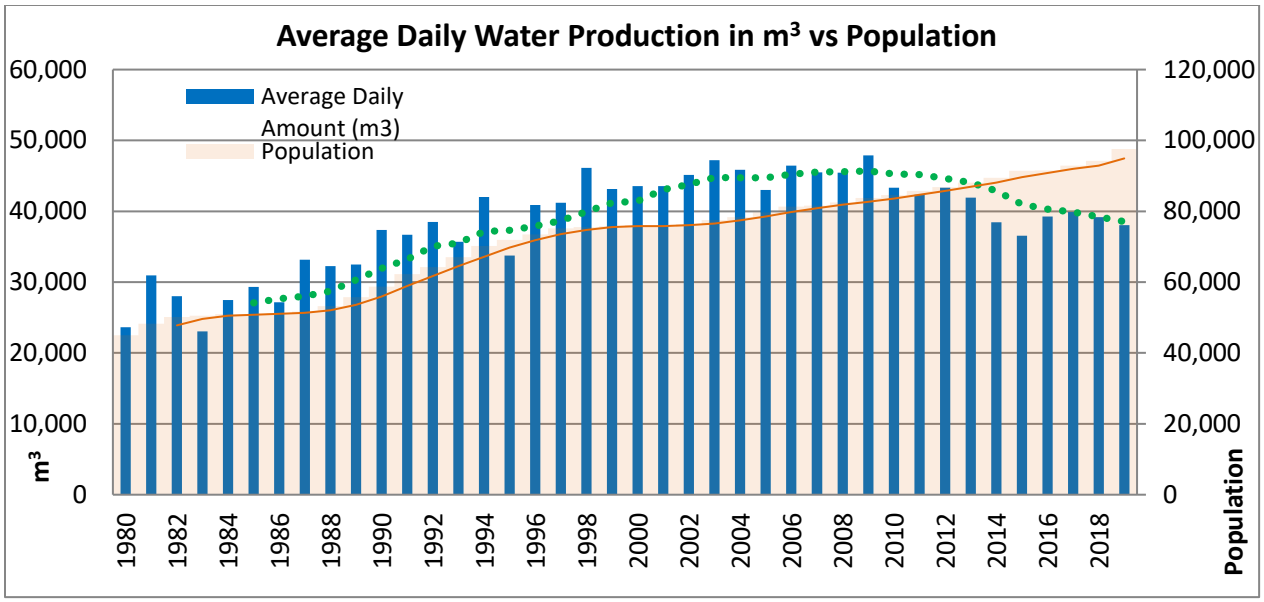
Watershed access is restricted to valid permit holders who have passed a water quality screening program.

At the head of the watershed, Jump Creek Dam impounds approximately 16,600 ML (million litres) of water. This water flows 9km downstream towards the South Fork Dam which impounds approximately 2,000 ML of water. Behind this dam is the City's water intake and the raw untreated water is then piped, via two parallel pipelines that start out as 750 mm (30") and 1200 mm (48") diameter, to the South Fork Water Treatment Plant (SFWTP) for a distance of 12.3km for treatment. The treatment plant has the ability to supply peak day flows of 116 ML per day.

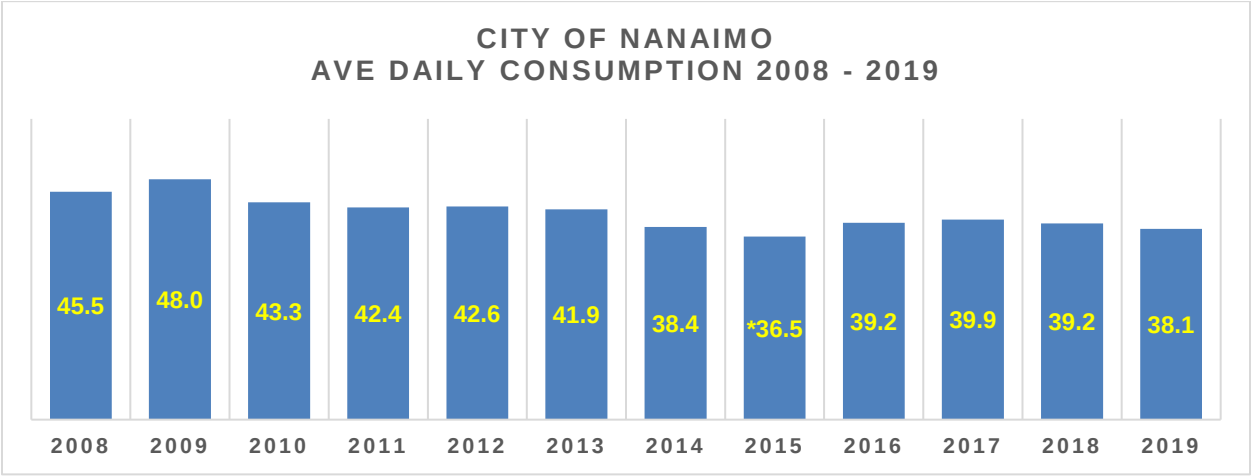
South Fork Water Treatment Plant

(left to right) strainers, primary feeder channel and primary membranes

The SFWTP potable water is then distributed through approximately 30 kilometres of secondary supply pipelines 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 65 million litres per day during peak summer flows in 2019. Peak hour flows can exceed the daily average flows by two times and are supplied from the tanks. Average daily flow to the City in 2019 was 38.06 ML/day, and this annual average daily flow fell slightly compared to the previous year.



In the summer months (from 1st June to 30th September inclusive between 2008 and 2019) the City enforced Stage 1 water restrictions. These restrictions allowed residents to irrigate their lawns every second day. However due to warm dry summer weather and virtually no snowpack during the winter months spanning 2014/2015 on 15th June, 2015 the water restrictions in the City were raised to the more stringent level Stage 2 which led to enhanced conservation measures resulting the lowest recorded annual average daily flow.



**stricter water restrictions occurred in the summer of 2015*

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 633 kilometres of supply and distribution watermains serving a population of approximately 97,619.

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

3. REGULATORY REQUIREMENTS

The Province through Island Health (formerly 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 monitors the drinking water source and distribution system to ensure compliance with the *Drinking Water Protection Regulation* and report all results to VIHA.

As a condition of its Operating Permit, the City is required to meet the following standards:

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 South Fork Water Treatment Plant met and exceeded these requirements during 2019.

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; at the source, at the South Fork Water Treatment Plant and throughout the water supply 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 potable water* quality sampling and testing program has been set up in conjunction with VIHA. 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 table 4 of this report.

The City also extensively monitors the raw (untreated) water at the source. Results of this program are found in table 2 and table 3 of this report.

Collected water samples are uniquely identified and sent to Provincially approved laboratories for testing. Test results are uploaded by the lab into WaterTrax (a water quality data management system) which provides the City with comprehensive access to all the test results and incorporates a notification alert system to supply the City with information if a sample failure is detected and exceeds the stipulated standards.

At the South Fork Water Treatment Plant multiple tests are carried out by certified water treatment operators on a daily basis (as per the Canadian Drinking Water Regulations) of the treated potable water and a summary of these results can be found on pages 8 – 10 of this report.

In addition, at each sample location in the water supply and distribution system 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 Island Health 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 graphs summarize results of the City's water quality testing and monitoring program for 2019. Results in the tables that are preceded with '< ' means results are below detectable limits.

Treated Water Microbiological

The following Table 1 illustrates that 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)

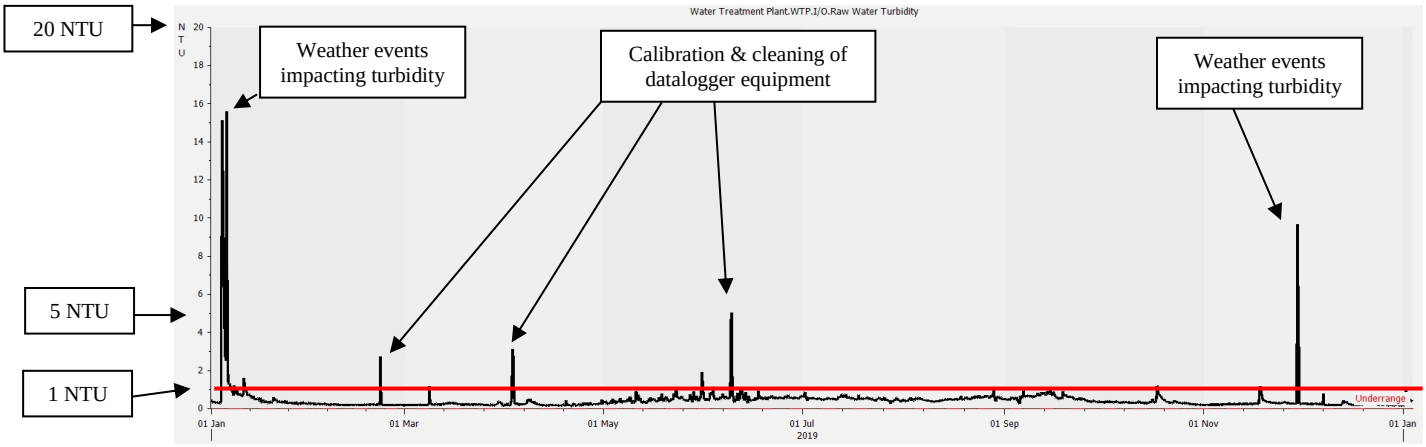
Microbiological Parameter	Number of Samples	Number of Detectable Results	Number of Adverse Results	Sampling Date	Results	
					Minimum	Maximum
Total Coliforms (counts / 100ml)	1006	0	0	January to December	< 1	< 1
E. Coli * (counts / 100ml)	1006	2	0	January to December	< 1	25

*For E. Coli exceedances, 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 in the water system. The following graph 1 illustrates *turbidity* of the *raw water* supply entering the South Fork Water Treatment Plant (SFWTP). Potable treated water turbidity is also measured at SFWTP before reaching any customers and this is shown below in graph 2.

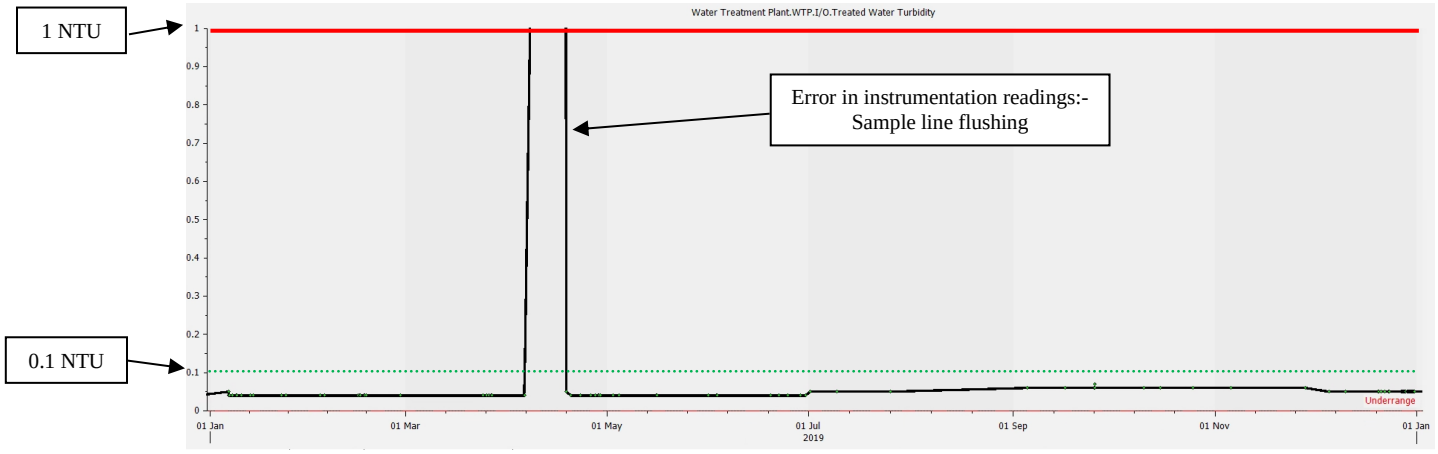
Graph 1 – raw water turbidity entering the South Fork Water Treatment Plant (SFWTP)



As a condition of its Operating Permit, the City is required to meet the following standard:

- A turbidity level less than or equal to 0.1 NTU in at least 99% of **<u>treated water</u>** measurements per operational filter period per month.

Graph 2 – potable water turbidity at the SFWTP



Operating Permit standard 0.1 NTU for <u>treated</u> potable water

Operating Permit maximum acceptable concentration 1 NTU for <u>treated</u> potable water

Water Chemical Properties

The following tables 2 and table 3 illustrates the chemical and physical properties of the City's water. Samples were taken at the source.

Table 2 - Water Chemical Properties

Parameter	Parts per million measured (actual results)			Number of Tests	Guidelines for Canadian Drinking Water Quality	
	Max. (mg/L)	Min. (mg/L)	Ave. (mg/L)		MAC (mg/L)	AO or [OG] (mg/L)
Aluminum	0.075	0.02	0.021	4	<=0.10*	
Ammonia	< 0.01	< 0.01	< 0.01	1		
Antimony	0.00017	< 0.0001	0.00017	2	<=0.006	
Arsenic	< 0.0005	0.00018	0.00018	2	<=0.010	
Barium	0.14	0.005	0.073	2	<=1.0	
Boron	0.01	0.037	0.024	2	<=5.0	
Cadmium	< 0.00005	0.00004	0.00004	2	<=0.005	
Chloride	2.82	2.82	2.82	1		<=250
Chromium	< 0.0003	0.00018	0.00018	2	<=0.05	
Copper	0.0032	< 0.001	0.0032	2		<=1.0
Cyanide	< 0.002	< 0.002	< 0.002	1	<=0.2	
Fluoride	0.03	0.03	0.03	1	<=1.5	
Iron	**0.13 #**	0.02	6.51	2	**# exceedance**	<=0.3
Lead	< 0.00005	0.00004	0.00004	2	<=0.005	
Manganese	**24 +**	< 0.005	24	2	**+ exceedance**	<=0.02
Mercury	0.00003	< 0.00001	0.00003	2	<=0.001	
Nitrate (as N)	0.06	0.03	0.04	3	<=10	
Nitrite (as N)	< 0.01	< 0.01	< 0.01	3	<=1	
Selenium	< 0.001	0.0009	0.0009	2	<=0.05	
Sodium	8.7	4	6.4	2		<=200
Sulphate	0.9	0.9	0.9	1		<=500
Uranium	0.00005	< 0.00005	0.00005	2	<=0.02	
Zinc	0.0050	< 0.002	0.0050	2		<=5

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).

Water Physical Properties

Colour occurs in water 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). The South Fork Water Treatment Plant process greatly reduces colour in the potable water supplied.

Table 3 - Water Physical Properties

Parameter	Actual Results			Number of Tests	Guidelines for Canadian Drinking Water Quality	
	Max.	Min.	Ave.		MAC	AO or [OG]
Alkalinity	>100 mg/L	8.5 mg/L	32.1 mg/L	5		
Colour	27 TCU **$**	0 TCU	5 TCU	526	**$ exceedance**	<=15 TCU
Conductivity	94.2 uS/cm	14.4 uS/cm	48.2 uS/cm	1343		
pH	8.97	6.38	7.58	1345		
Total Dissolved Solids	10 mg/L	10 mg/L	10 mg/L	1		<=500 mg/L

UV Transmittance	98.6 %	69.5 %	92.8 %	1342		
Total Organic Carbon	1.4 mg/L	1.3 mg/L	1.4 mg/L	2		

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 4 –Water Disinfection By-Products

Parameter	Parts per million measured (actual results)			Number of Tests	Guidelines for Canadian Drinking Water Quality	
	Max. (mg/L)	Min. (mg/L)	Ave. (mg/L)		MAC	AO or [OG]
Total Trihalomethanes	0.058	0.035	0.047	12	<=0.1	
Bromodichloromethane	0.006	0.002	0.004	12	<=0.016	
Bromoform	< 0.001	< 0.001	n/a	12		
Chloroform	0.056	0.031	0.044	12		
Dibromochloromethane	< 0.001	< 0.001	n/a	12		

Hardness

Hardness tests are not a mandatory requirement of the Canadian Drinking Water Guidelines. In the winter and fall months of 2019, three hardness tests were carried out on the City's raw water and the highest water hardness was measured at 77mg/L. The lowest water hardness was measured at 9mg/L and the average hardness was measured at 32mg/L.

Water in Nanaimo is classified as very soft (typically less than 20 mg/L), 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 6 – * 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 2019, the City received 13 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. All of the 13 concerns received by the City in 2019 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;

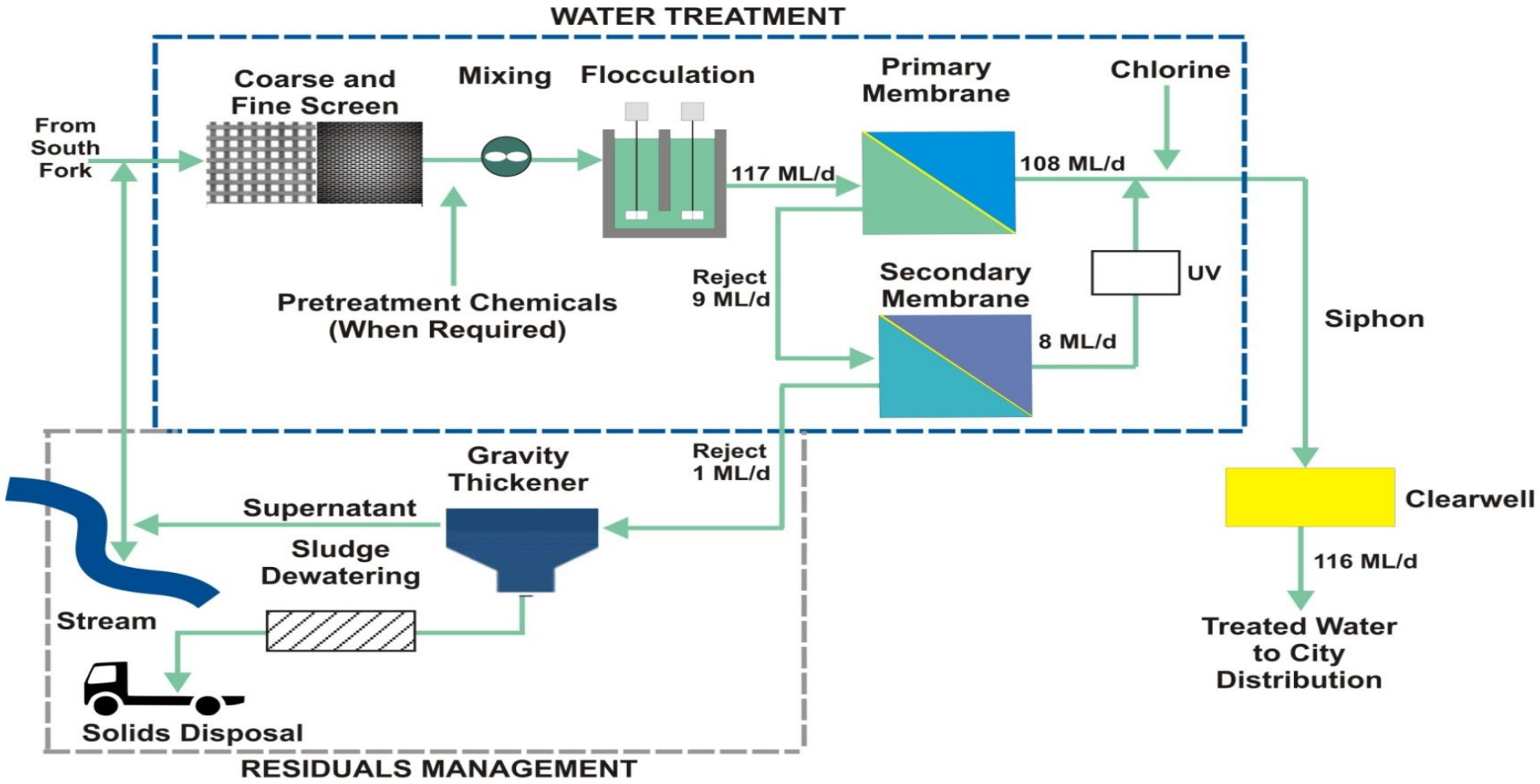
- water mains flushing
- fire fighting
- water main breaks
- local construction in the area (i.e. watermain tie-ins by developers)
- a build up of algae in reservoirs in the summer months during warm weather
- reservoir turnover in early autumn when season rain commences

7. WATER TREATMENT PLANT

Design of the 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.

South Fork Water Treatment 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 injection.

South Fork Water Treatment Plant Process



South Fork Water Treatment Plant Process in Pictures

Raw water collected and stored in South Fork Dam

Raw water flows (by gravity) to South Fork Water Treatment Plant

Raw water passes through coarse & fine screens

Raw water passes chemical injection points and mixing pumps

Raw water flocculation (mixing) tanks

Raw water being filtered in primary membranes

Raw (reject primary) water being filtered in secondary membranes

Secondary membranes raw water uv treatment

Primary and secondary membrane filtered water being treated at the chlorine injection point

Reject raw water centrifuge

Dewatered sludge (dirt removed from water by centrifuge) ready for disposal

Treated potable water clearwell (storage tank)

8. ENERGY RECOVERY FACILITY & RESERVOIR #1

In January 2012, the City received notification of Federal funding under the *Canada Gas Tax Fund* towards the building of an Energy Recovery Facility (ERF) and an enclosed concrete water storage tank. The 14 million litre drinking water storage tank replaced the old open reservoir and improved treated water quality. Construction on this tank commenced in March 2013 and was completed May 2015. This 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 Energy Recovery Facility and the new Reservoir #1 drinking water storage tank (in the background)

As the new Reservoir #1 storage tank fills up with potable water (by gravity from the SFWTP) to replenish water consumed by residents on a daily basis, turbines located in the ERF generate power that in turn is sold back to BC Hydro on a monthly basis. In 2019 the City generated 756 megawatt hours of electricity, that is the equivalent of supplying power to approximately 60 homes for one year.

Turbines inside the Energy Recovery Facility

9. WATER CONSUMPTION STATISTICS

The following summarizes City water consumption data for 2019.

Total volume delivered: 13,893 million litres (ML)
Population served: 97,619 (BC government statistics 2019)
Average consumption (all uses *): 390 litres/person/day
(Canadian average 427 litres/person/day in 2017)
Average residential only consumption: 215 litres/person/day
(Canadian average 220 litres/ person/day in 2017 for properties that utilize water metres)
Average daily amount: 38.06 million litres
Summer peak day demand: 65.178 million litres on July 1, 2019 or 668 litres/person/day
(All uses * includes residential, commercial, industrial and institutional water demands.)
The City's inaugural water audit was undertaken in 2012, and a second follow up water audit was carried out in 2017. In the period between the two audits, numerous significant changes

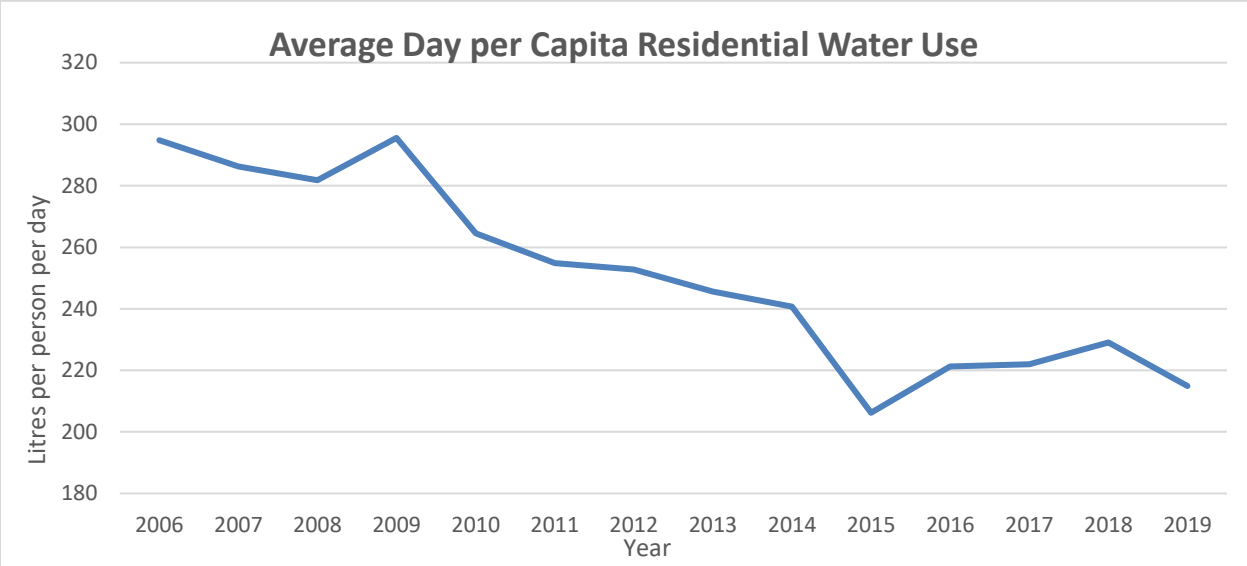
were undertaken to the City's water treatment, water supply and distribution systems. These water system upgrades together with conscientious water conservation by residents and businesses over the five year period have resulted in positive changes in almost every aspect of the water audit. (see table 7 - conservation progress below).

The City also updated its Water Conservation Strategy in 2014 which details initiatives being undertaken to reduce water consumption and promote water efficient practices. This Water Conservation Strategy identifies a 10% reduction in per capita water use per decade is desired. 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. In 2016 the Regional District and the City partnered together and unified their water restriction stages and dates of implementation to promote region wide water conservation awareness. However the 'stage' of watering restrictions in the RDN and the City may differ at any given time as the available drinking water storage capacity of each municipality's watersheds and water sources are different.

Table 7 – Conservation Progress

Statistic	Water Audit		
	2012	2017	Change
Annual Production	15,575,392 m^3	13,775,700 m^3	-10.8%
Population (census data)	84,741	91,506	+7.9%
Revenue (billed from water generated)	72.0%	78.3%	+6.3%
Electricity Generated & Sold to BC Hydro	0 MWh	880 MWh	+100%
Infrastructure Leakage Index	1.54	1.13	-30%
Real Losses (leakage)	9.83%	8.27%	-15.8%
Apparent Losses (unauthorized consumption, meter inaccuracies & data handling errors)	438 ML	302 ML	-27.3%
Bulk Water Sales	84 ML	123 ML	+46.4%

Statistic	Water Audit		
	2012	2017	Change
Length of Watermains	615 km	636 km	+3.4%
Number of Water Meters	24,276	26,119	+7.6%
Residential Use (single family)	4,830 ML	4,258 ML	-11.8%
Residential Use (multi family)	3,050 ML	3,176 ML	+4.1%
Indoor Use	198 L/person/day	182 L/person/day	-8.0%
Average Day per Capita Residential Use	251 L/person/day	222 L/person/day	-13%



10. MAINTENANCE AND FLUSHING PROGRAM

Regular inspections, maintenance and water quality testing is performed weekly by certified water operators (as per the Canadian Drinking Water Regulations) 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 pipes to clean them. This helps to maintain water quality by removing sediments and stagnant stale water from low points in the pipe network and at watermain dead ends. Flushing takes place in spring when the watershed lakes are full from winter rains and there typically is some snowpack on the surrounding mountains.

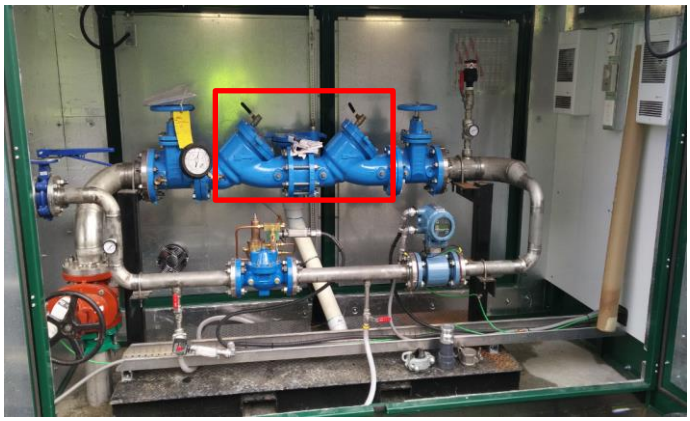
Flushing activities may cause a temporary discoloration of your water in your home. While the discoloration is unpleasant, it is not harmful. If this happens wait thirty to sixty minutes, then turn on your cold water taps and let them run for ten to fifteen minutes. If your water does not clear up after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

11. CROSS CONNECTION CONTROL PROGRAM

In 2019, the City saw the implementation of the first full year of the Cross Connection Control Program to further protect the quality of the City's potable water supply system. Now a dedicated Cross Connection Control Bylaw #7239 that ensures appropriate engineering measures are in place on private water system owners to protect the City's potable water supply so that it cannot be contaminated with non-potable water due to a backflow situation. Appropriate backflow prevention devices should be installed and these devices must be documented and tested annually by a qualified individual. Residents,

businesses and facility owners are responsible for the installation, maintenance and renewal of any backflow prevention devices.

Last year there were 178 cross connection control program inspections undertaken by City staff to ensure that the City's water supply is safe from cross contamination.



Water filling station piping with double check backflow preventer

12. EMERGENCY RESPONSE PLAN

The City has prepared and annually updates its 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.

13. 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	Mike Squire	(250) 758-5222
General Foreman - Waterworks	Ritchie Fulla	(250) 758-5222

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

14. 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 / 2019 Water Quality Report.

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

15. 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 Island Health (formerly 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.