



Ministry of  
Environment

**Newcastle Creek Community Watershed  
Water Quality Objectives Attainment Report**

Environmental Quality Section  
Environmental Protection Division  
West Coast Region

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Approved by \_\_\_\_\_

Date Approved \_\_\_\_\_

## Executive Summary

Water quality objectives (WQOs) were approved for Newcastle Creek in 2009 (Epps and Phippen, 2009) based on data collected between 2001 and 2005. Newcastle Creek provides drinking water for the Village of Sayward. WQO attainment monitoring occurred during summer low flow and fall flush periods in 2009. Samples were also taken once in the fall of 2006 as part of the Ministry of Environment's (MOE's) benthic invertebrate sampling program. These data and changes that have occurred in the watershed between 2005 and 2012 are presented in this report. The recommended sampling frequency of five weekly samples in 30 days was not met during either the summer or fall sample periods. However, the data collected over 42 days and 36 days in the summer and fall, respectively, were considered to be representative of summer low flow and fall flush events in the area. Data showed water quality was generally excellent, and values were within objectives recommendations for all parameters except fecal coliform bacteria and *Escherichia coli* during the fall sampling period.

Recommendations to improve and maintain water quality in the watershed include:

- The Village of Sayward should continue to pursue funding to build a new reservoir and filtration facility, while continuing efforts to meet WQOs for all designated users of the watershed.
- implement five weekly samples in 30 days sampling for metals during the next attainment period, and
- consider creating a WQO for copper in Newcastle Creek.

## Introduction

As part of the Province of British Columbia MOE's mandate to manage water bodies, water quality objective reports have been created for a number of lakes, rivers and marine surface waters. These reports provide a list of objectives to protect water quality that are tailored to the specific water body for which they have been created, taking into account natural local water quality, water uses, water movement, and waste discharges. While the water quality objectives currently have no legal standing, they can direct resource managers aiming to protect the water body in question and are used as a standard against which to measure the water quality of that water body. Once objectives have been developed, periodic monitoring (every three to five years) is undertaken to determine whether they are being met (attainment monitoring).

Newcastle Creek is located on the north east coast of Vancouver Island and provides drinking water for the Village of Sayward, British Columbia (Figure 1). Objectives were approved for Newcastle Creek in 2009, based on data that were collected from 2001 to 2005. Some data collection occurred between 2005 and 2009, and attainment monitoring occurred from August to November 2009. This report summarizes these data.



**Figure 1.** Map of Newcastle Creek indicating sample site E229564.

## Changes in the Watershed since Objectives Development

Notable activities have occurred in the watershed since 2005 includes forestry activity that took place in the Newcastle Creek watershed in the fall of 2011. However, this occurred after representatives from the Village of Sayward, Western Forest Products, Ministry of Forest, Lands, and Natural Resource Operations, the Ministry of Environment, and the Vancouver Island Health Authority toured the site to discuss the then proposed logging activity (MOE files, 2011). The results of the site visit was an agreement that Western Forest Products would postpone harvesting a higher-risk slope area until the Village of Sayward could complete construction of a water reservoir and filtration system in the area (Wachs, pers comm. 2012). The logging that took place was therefore deemed a lower risk to water quality. The grant application for constructing a new reservoir and filtration facility was turned down in 2011, stalling construction (Wachs, pers comm. 2012). The Village of Sayward continues to look for funding in order to begin this project.

## Sampling and Analytical Methods

The Village of Sayward, on behalf of MOE, sampled one water quality site from August 5 to September 16, 2009 and from October 14 to November 18, 2009 following recommendations in the WQO report (Table 1). Grab samples were collected once in 2005 as part of the original WQO development dataset (but were not included in the 2009 WQO report) and once the fall of 2006 as part of MOE's benthic invertebrate sampling program following Canadian Aquatic Biomonitoring Network protocols. Only water quality results (not benthic invertebrate data) are included in this report. Samples were analyzed by Maxxam Analytics Ltd. with bacteriological analysis completed by Cantest Laboratories. The WQOs report recommended for each attainment monitoring sampling period that five weekly samples be collected over 30 days (5-in-30 sampling) to calculate 30-day averages and 90<sup>th</sup> percentiles. However, this regime was not met for the summer and fall 2009 sampling events, which were sampled five times over 42 and 36 days, respectively. Thus, the data can give insight into the conditions of the watershed, but are not directly comparable to the WQOs. All data are summarized in Appendix 1.

**Table 1.** Water quality sampling program as recommended in the 2009 WQO report.

Site Name	EMS ID	Parameters measured	Description
Newcastle Creek at water intake	E229564	Turbidity, true colour, total suspended solids, total organic carbon, dissolved organic carbon, <i>E. coli</i> , fecal coliform, total and dissolved metals, nutrients, pH, hardness, specific conductivity, UV absorbance	At water intake upstream from the Newcastle Creek Dam

## Objectives Attainment

A list of the water quality objectives for Newcastle Creek along with a summary of the exceedances observed from the attainment monitoring are presented in Table 2. Although the 5-in-30 sampling period was prolonged, the data were deemed representative of summer low flow and fall flush events in the area, and were considered relative to objective recommendations. Of the parameters measured, only those that had the potential to exceed the Newcastle Creek water quality objectives (based on the prolonged sample period) will be discussed in this report, with the exception of one parameter which was compared to the BC water quality guidelines.

**Table 2.** WQOs and attainment information, “Y” indicates results were within objectives recommendations or met objectives while “N” indicates they were/did not. \*Note the 5-in-30 sampling regime was not adhered to during the two sampling events. Where the 5-in-30 requirement is in place, attainment data cannot be directly compared to WQOs but instead are considered relative to objective recommendations.

Parameter	Objective	Newcastle Creek Summer 2009	Newcastle Creek Fall 2009
Fecal Coliform Bacteria	≤ 10 CFU/100 ml (90 <sup>th</sup> percentile)	Y	N
<i>Escherichia coli</i>	≤ 10 CFU/100 ml (90 <sup>th</sup> percentile)	Y	N
Turbidity	2 NTU (average)	Y	Y
	5 NTU (maximum)	Y	Y
True Colour	≤ 27 TCU (average)	Y	Y
Total Suspended Solids	26 mg/L (maximum in a 24-hour period)	Y	Y
	6 mg/L (average)	Y	Y
Total Organic Carbon	≤ 6.5 mg/L (average)	Y	Y

\*all calculations for 90<sup>th</sup> percentiles and averages are based on prolonged 5-in-30 sampling events (42 days for summer and 36 days for fall)

Values were within objective recommendations for all parameters except fecal coliform and *E. coli* during the fall sampling period (Table 3). The one elevated fall value coincided with rainfall events that took place prior to and during one of the sample dates (Environment Canada, 2012). It appears that the fall sampling period only captured one rainfall event. The single 2005 and 2006 grab samples showed no exceedences of applicable WQOs. With little to no human activity in the watershed when attainment monitoring took place. These results likely represent natural conditions.

Total metals concentrations were measured twice during attainment monitoring in Newcastle Creek. The British Columbia Water Quality Guideline for maximum total copper for aquatic life (3.57µg/L, based on a maximum observed hardness of 16.7 mg/L) (Singleton, 1987) was exceeded in both samples (Table 3). The maximum total copper seen during WQO development was 4 µg/L, while the maximum total copper seen during attainment monitoring was 23.7µg/L.

**Table 3.** Attainment monitoring grab sample results showing parameters in exceedence of either WQO recommendations or BC Water Quality Guidelines for the Newcastle Creek sample site.

Sample Date	Fecal Coliform (CFU/100mL)	<i>E. Coli</i> (CFU/100mL)	Total Copper (µg/L)
<b>Summer</b>			
2009-08-05	2	2	23.7
2009-08-12	4	4	-
2009-08-19	1	1	-
2009-09-02	1	1	-
2009-09-16	7	7	-
5/42 90th Percentile	6	6	
<b>Fall</b>			
2009-10-14	-	-	6.9
2009-10-15	1	1	-
2009-10-21	68	68	-
2009-10-28	1	1	-
2009-11-04	3	3	-
2009-11-18	1	1	-
5/36 90th Percentile	42	42	

Highlighted values indicate exceedence. “-” indicates date where no data were collected.

\*Note the 5-in-30 sampling regime was not adhered to during the two sampling events. Where the 5-in-30 requirement is in place, attainment data cannot be directly compared to WQOs but instead are considered relative to objective recommendations.

## Summary and Recommendations

Water quality in Newcastle Creek during attainment monitoring was excellent. The fall bacteriological numbers that exceeded WQOs are likely natural and indicate the need for water purveyors to treat the water prior to consumption in order to remove bacteriological contamination. Given that the Village of Sayward’s grant application for a new reservoir and filtration facility was turned down in 2011, it is recommended that they continue to pursue funding to build a reservoir and filtration facility that can meet the villages’ drinking water quality needs. It is important, even with such a facility, that efforts be made to continue to meet WQOs for all designated users of the watershed. It is advised that the five weekly samples in 30 days sampling regime set out in the WQOs report be adhered to during the next attainment monitoring in order to provide direct comparisons to the WQOs. Furthermore it is recommended that the start of the fall sampling be determined by analyzing the long-range weather forecast and choosing the first period where significant and persistent rain is predicted for that year. Also, it is recommended that water temperature data be collected, and that total and dissolved metals samples be collected on a 5-in-30 schedule in both summer and fall during

the next attainment sampling. If copper levels are continually higher than the BC Water Quality Guideline, the development of a WQO for copper should be considered in the future.

## References

British Columbia Ministry of Environment. 2011. Note to file. Newcastle Creek Watershed file. B.C. Ministry of Environment. Nanaimo, B.C.

Epps, D. and Phippen, B. 2009. Water quality assessment and objectives for the Newcastle Creek Community Watershed: technical report. British Columbia Ministry of Environment. Victoria, B.C. Available online at:  
[http://www.env.gov.bc.ca/wat/wq/wq\\_objectives.html](http://www.env.gov.bc.ca/wat/wq/wq_objectives.html)

Environment Canada. 2012. National Climate and Data Information Archive.  
[http://www.climate.weatheroffice.gc.ca/Welcome\\_e.html](http://www.climate.weatheroffice.gc.ca/Welcome_e.html). Accessed on October 19, 2012.

Singleton, H.J. 1987. Water quality criteria for copper: technical appendix. British Columbia Ministry of Environment. Victoria. B.C.

Wachs, L. 2012. Personal communication. Public works foreman. Village of Sayward, Public Works. Sayward, B.C.

## Appendix

**Table 4.** Summary statistics for grab samples taken at the Newcastle Creek sample site from February 2005 to November 2009. Shaded cells indicate values below minimum detection limits.

Location Name					
E229564 NEWCASTLE CREEK AT WATER INTAKE					
Parameter	Min	Max	Average	Standard Deviation	Number of Samples
Ag-D (mg/L)	0.000005	0.000005	0.000005	0	2
Ag-T (mg/L)	0.000005	0.00002	8.75E-06	7.5E-06	4
Al-D (mg/L)	0.0293	0.0404	0.03485	0.007849	2
Al-T (mg/L)	0.0281	0.0428	0.03505	0.006151	4
As-D (mg/L)	0.00006	0.00007	0.000065	7.07E-06	2
As-T (mg/L)	0.00006	0.0001	8.25E-05	1.71E-05	4
B--D (mg/L)	0.05	0.05	0.05	0	2
B--T (mg/L)	0.05	0.05	0.05	8.5E-18	3
Ba-D (mg/L)	0.00117	0.00147	0.00132	0.000212	2
Ba-T (mg/L)	0.0012	0.00155	0.001373	0.000161	4
Be-D (mg/L)	0.00001	0.00001	0.00001	0	2
Be-T (mg/L)	0.00001	0.00002	1.25E-05	0.000005	4
Bi-D (mg/L)	0.000005	0.000005	0.000005	0	2
Bi-T (mg/L)	0.000005	0.00002	8.75E-06	7.5E-06	4
Ca-D (mg/L)	4.41	5.01	4.71	0.424264	2
Ca-T (mg/L)	4.43	4.98	4.705	0.388909	2
Cd-D (mg/L)	0.000005	0.000008	6.5E-06	2.12E-06	2
Cd-T (mg/L)	0.000005	0.00001	6.25E-06	2.5E-06	4
Co-D (mg/L)	0.000055	0.000066	6.05E-05	7.78E-06	2
Co-T (mg/L)	0.000005	0.00008	4.03E-05	3.64E-05	4
Cr-D (mg/L)	0.0001	0.0001	0.0001	0	2
Cr-T (mg/L)	0.0001	0.0002	0.000125	0.00005	4
Cu-D (mg/L)	0.0069	0.00892	0.00791	0.001428	2
Li-D (mg/L)	0.0005	0.0005	0.0005	0	2
Li-T (mg/L)	0.00012	0.0005	0.000405	0.00019	4
Mg-D (mg/L)	0.89	1	0.945	0.077782	2
Mg-T (mg/L)	0.87	1.05	0.98	0.096437	3
Mn-D (mg/L)	0.00294	0.00444	0.00369	0.001061	2
Mn-T (mg/L)	0.00039	0.00432	0.002196	0.001899	4
Mo-D (mg/L)	0.00011	0.00014	0.000125	2.12E-05	2
Mo-T (mg/L)	0.00009	0.00016	0.000125	3.11E-05	4



Location Name		E229564 NEWCASTLE CREEK AT WATER INTAKE			
Parameter	Min	Max	Average	Standard Deviation	Number of Samples
N.Kjel:T (mg/L)	0.02	0.02	0.02		1
NO2+NO3 (mg/L)	0.06	0.06	0.06		1
Ni-D (mg/L)	0.00009	0.00009	0.00009	0	2
Ni-T (mg/L)	0.00005	0.00044	0.000163	0.000187	4
P--T (mg/L)	0.002	0.006	0.0036	0.001817	5
Pb-D (mg/L)	0.000087	0.000116	0.000102	2.05E-05	2
Pb-T (mg/L)	0.00002	0.00125	0.00064	0.000676	4
Sb-D (mg/L)	0.00002	0.00002	0.00002	0	2
Sb-T (mg/L)	0.000007	0.00005	2.43E-05	1.82E-05	4
Se-D (mg/L)	0.00004	0.00004	0.00004	0	2
Se-T (mg/L)	0.00004	0.0003	0.000105	0.00013	4
Sn-D (mg/L)	0.00001	0.00001	0.00001	0	2
Sn-T (mg/L)	0.00001	0.00063	0.000165	0.00031	4
Sr-D (mg/L)	0.00832	0.00984	0.00908	0.001075	2
U--D (mg/L)	0.000002	0.000002	0.000002	0	2
V--D (mg/L)	0.0004	0.0005	0.00045	7.07E-05	2
V--T (mg/L)	0.0004	0.00053	0.000483	5.68E-05	4
Zn-D (mg/L)	0.0002	0.0002	0.0002	0	2
Zn-T (mg/L)	0.0001	0.0008	0.00045	0.000289	4
Ammonia Dissolved (mg/L)	0.005	0.005	0.005	0	2
Carbon Dissolved Organic (mg/L)	0.8	5.7	2.39	1.587066	10
Carbon Total Organic (mg/L)	0.6	5.9	2.075	1.526806	12
Color True (Col.unit)	5	30	15.41667	8.382431	12
E Coli (CFU/100mL)	1	68	8.9	20.85639	10
Fecal coliforms (CFU/100mL)	1	68	8.9	20.85639	10
Hardness Total (D) (mg/L)	14.7	16.6	15.65	1.343503	2
Nitrate (NO3) Dissolved (mg/L)	0.03	0.085	0.0526	0.022941	5
Nitrate + Nitrite Diss. (mg/L)	0.026	0.089	0.053	0.025348	5
Nitrogen (Kjel.) Tot Diss (mg/L)	0.02	0.02	0.02		1
Nitrogen - Nitrite Diss. (mg/L)	0.002	0.004	0.0024	0.000894	5
Nitrogen Organic-Total (mg/L)	0.02	0.02	0.02	0	2
Nitrogen Total (mg/L)	0.07	0.08	0.075	0.007071	2
Nitrogen Total Dissolved (mg/L)	0.072	0.072	0.072		1
Ortho-Phosphate Dissolved (mg/L)	0.001	0.001	0.001	0	2
pH (pH units)	7.1	8	7.46	0.328634	5

Location Name					
E229564 NEWCASTLE CREEK AT WATER INTAKE					
Parameter	Min	Max	Average	Standard Deviation	Number of Samples
Phosphorus Tot. Dissolved (mg/L)	0.002	0.002	0.002		1
Residue Total (mg/L)	31	31	31		1
Residue Filterable 1.0u (mg/L)	30	30	30		1
Residue Non-filterable (mg/L)	1	2	1.090909	0.301511	11
Specific Conductance (uS/cm)	25	42	35.66667	9.291573	3
Turbidity (NTU)	0.1	1.3	0.438462	0.370896	13