



MEMORANDUM

Date: October 19, 2016

File:

**To: Mark Zacharias,
Assistant Deputy Minister
Environmental Protection Division**

Quesnel River Water Quality for samples collected August 4, 2014 to August 4, 2016 compared to Drinking Water and Aquatic Life Guidelines

Water samples are being collected from the Quesnel River at both the Likely Bridge and Gravelle Ferry Bridge sites. These sites are part of the Federal/Provincial (Fed/Prov) trend monitoring program with samples being collected monthly by local community samplers. Quesnel River at Gravelle Ferry Bridge was started on June 16, 2014 and Quesnel River at Likely Bridge started August 26, 2014. Note that there were more frequent samples in February and March to capture spring freshet conditions. The Ministry of Environment (MoE) has reported out on these results since the Mount Polley Mine Breach on August 4, 2014. All data has been made publically available on the MoE Mount Polley Breach website.

This memo is to summarize and provide any conclusions in the data from the past two years of sampling data collected. For this memo, water samples collected between August 4, 2014 and August 4, 2016 are reviewed to determine potential impacts to drinking water and to aquatic life. In addition, summary graphs have been included which illustrate data results from June 16, 2014 to present for the Gravelle Ferry site and results from August 26, 2014 to present for the Likely Bridge site. Please note that this is the last memo MoE will be publishing so that more resources can be put towards other areas of the Mount Polley monitoring project.

The parameters analysed include pH, conductivity, turbidity, total suspended solids, total dissolved solids, total organic carbon, hardness, alkalinity, nutrients, general ions, total and dissolved metals. Samples collected at the Fed/Prov sites are analyzed by ALS Environmental (previously by Maxxam Analytical), with metal and phosphorus samples shipped to a different lab (NLET) in Ontario, for analysis.

An overall assessment of the data from the Likely Bridge and Gravelle Ferry Bridge sites from August 2014 up to and including August 2016 results was conducted. Turbidity and copper levels have been the main parameter of concern at these sites with respect to drinking water and aquatic life and are illustrated in Figures 1 through 4 (below). The graphs capture the period when fall overturn (or lake mixing) occurred in Quesnel Lake in early November 2014 and began to flow out the Quesnel River. This coincides with the green cloudy water that was visible in Quesnel River though out that time period. In early spring 2015, there was a couple of turbidity peaks

which coincided with rain on snow events, and spring melt. Turbidity levels have decreased throughout the summer and are low, below guidelines, in the Quesnel River at the Likely Bridge site. Copper levels, which are likely bound to the particles in the water column, tend to follow this same pattern.

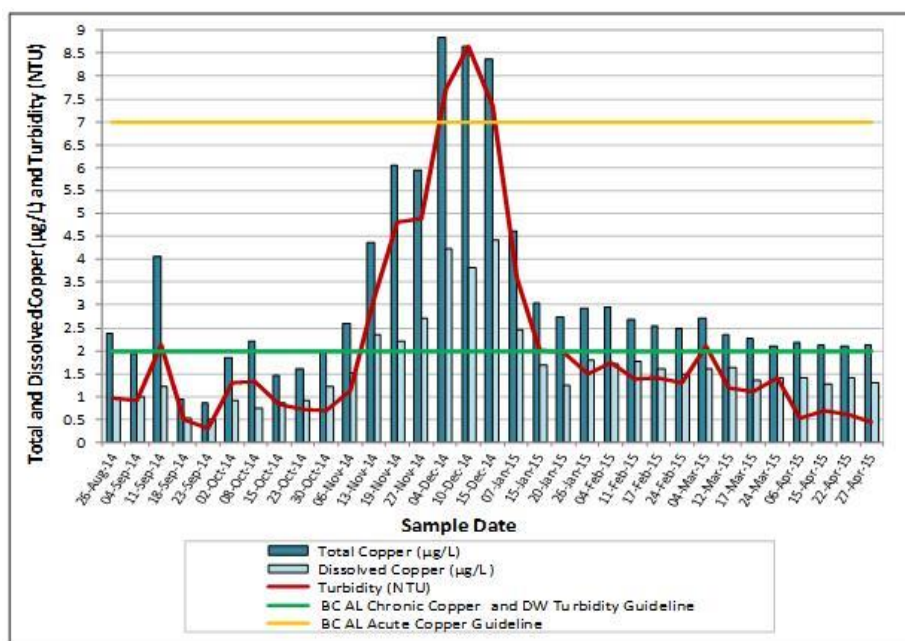


Figure 1. Quesnel River at Likely Bridge – turbidity (NTU) and copper (µg/L) (total and dissolved) results from August 26, 2014 to April 27, 2015.

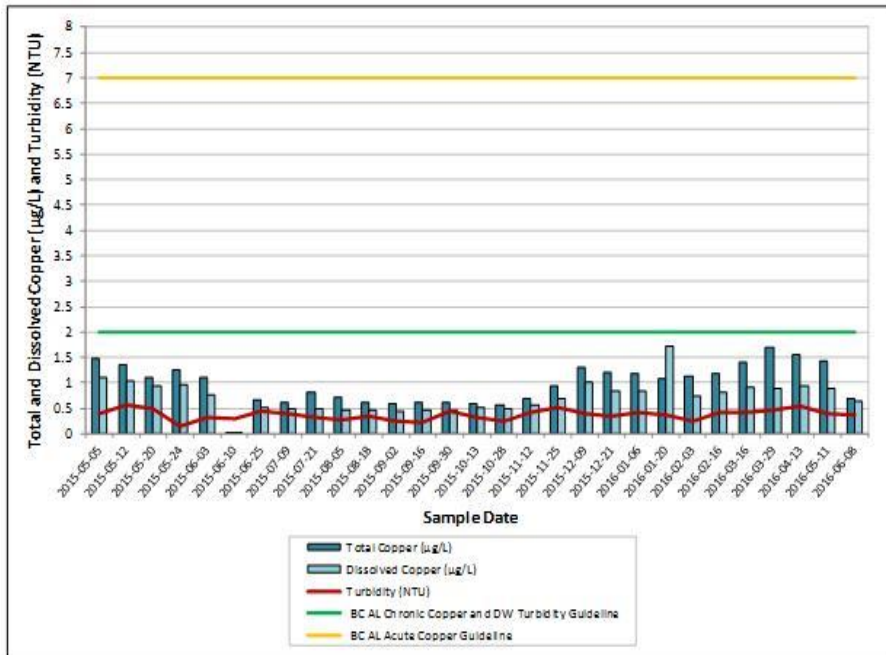


Figure 2. Quesnel River at Likely Bridge – turbidity (NTU) and copper ($\mu\text{g/L}$) (total and dissolved) results from May 5, 2015 to June 8, 2016.

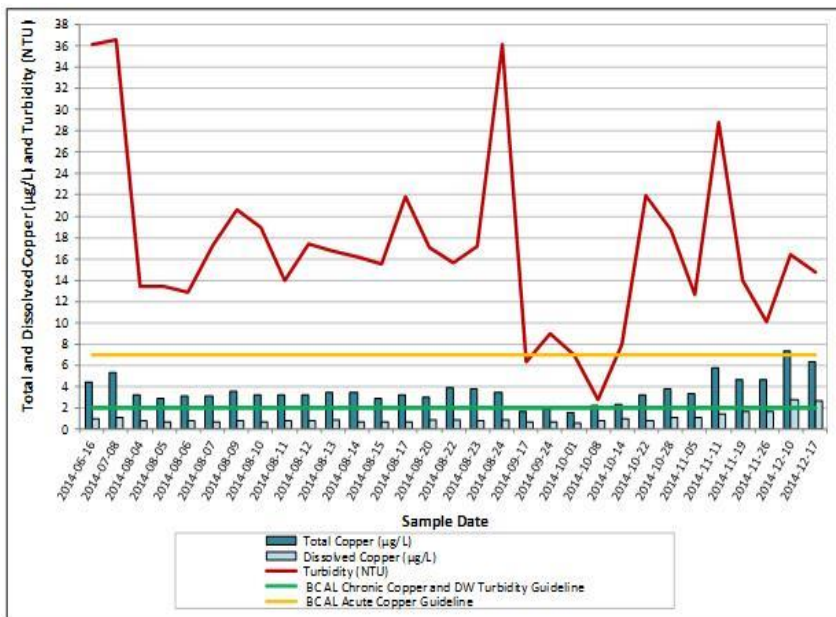


Figure 3. Quesnel River at Gravelle Ferry Bridge – turbidity (NTU) and copper ($\mu\text{g/L}$) (total and dissolved) results from June 16, 2014 to December 17, 2015.

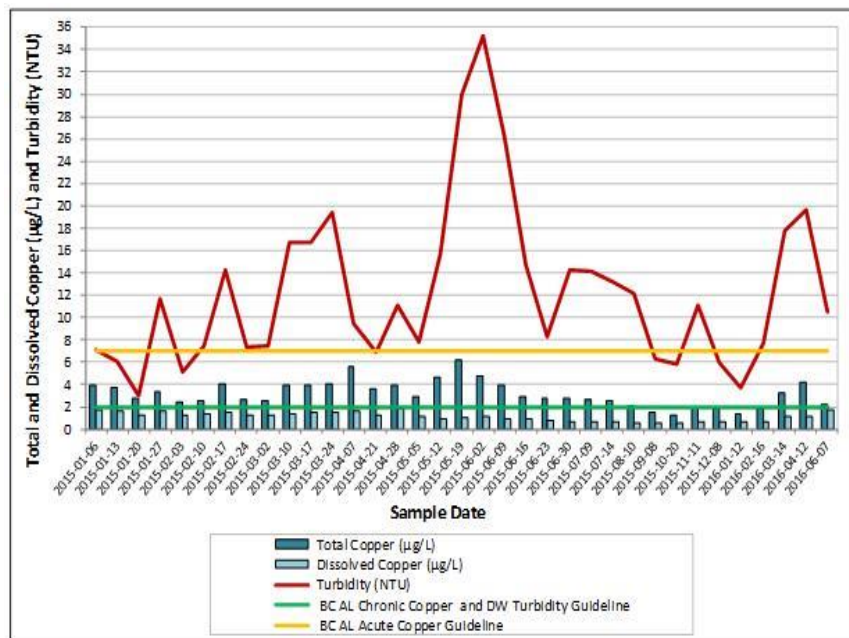


Figure 4. Quesnel River at Gravelle Ferry Bridge – turbidity (NTU) and copper (µg/L) (total and dissolved) results from January 6, 2015 to June 7, 2016.

A summary of all drinking water and aquatic life exceedances up to August 2016 can be seen in Table 1 and 2 (below), respectively. There have not been any drinking water or aquatic life exceedances at the Likely Bridge site, for any parameters since spring 2015, with the exception of one total aluminum value which exceeded the drinking water guideline and one total copper value which exceeded the aquatic life guideline in March 2016. There were more exceedances for both drinking water and aquatic life observed at the Gravelle Ferry site, however it is important to note that while background conditions for some parameters are naturally elevated in the area, the Gravelle Ferry Bridge site also receives inputs from several smaller tributaries and one large river (Cariboo River); thus the observed water quality is influenced by factors other than Quesnel Lake. In addition, prior to the breach, water samples collected from this location also exceeded BC MOE Guidelines for the purposes of drinking water for turbidity, total chromium, total copper, total iron and dissolved aluminum. However, there are no drinking water intakes located in the vicinity of the Quesnel River at the Gravelle Ferry Bridge location.

Health Canada indicates there is no weight of evidence for adverse health effects of aluminum at levels above the guideline. In addition, the iron drinking water guideline is based on staining and taste, not direct health effects. While chemical parameters may not be of concern, residents should still follow Health Canada protocols for treating raw drinking water.

While total metals concentrations may exceed aquatic life guidelines, the much lower concentrations of the dissolved form of most of these metals (except for aluminum), indicates that the high levels are associated with particulates and may not be as bioavailable as dissolved metals, thus decreasing the risk to aquatic life in Quesnel Lake and River. Total copper levels are also declining and remaining below the chronic life guideline at the Likely Bridge site. More importantly the dissolved form of copper, or the portion that is more bioavailable, is lower and staying relatively constant.



The Quesnel River at Likely Bridge and Gravelle Ferry Fed/Prov sites will be sampled monthly going forward. MoE will continue to watch the water quality closely and determine any potential impacts to drinking water and aquatic life. Normally the Fed/Prov data, once verified, can be found on the Environment Canada website: [<http://aquatic.pyr.ec.gc.ca/webDataOnlineNational/>].

Sincerely,

Deborah Epps, MSc., R.P.Bio.
Section Head, Provincial Water Quality
Ministry of Environment



Table 1. Drinking Water Exceedances from August 4, 2014 to August 4, 2016 for Quesnel River at Likely Bridge and Quesnel River at Gravelle Ferry Bridge.

Location	Quesnel River at Likely Bridge	Quesnel River at Gravelle Ferry Bridge
Parameter	Date	Date
Turbidity	November 13, 19, 27, 2014	August 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 20, 22, 23, 24, 2014
	December 4, 10, 15, 2014	September 17, 24, 2014
	January 7, 2015	October 1, 14, 22, 28, 2014
		November 5, 11, 19, 26, 2014
		December 10, 17, 2014
		January 6, 13, 27, 2015
		February 3, 10, 17, 24, 2015
		March 2, 10, 17, 24, 2015
		April 7, 14, 21, 28, 2015
		May 5, 12, 19, 2015
		June 2, 9, 16, 23, 30, 2015
		July 9, 14, 2015
		August 10, 2015
		September 8, 2015
		October 20, 2015
		November 11, 2015
		December 8, 2015
		February 16, 2016
		March 14, 2016
		April 12, 2016
		May 17, 2016
		June 7, 2016
		July 6, 2016
Total Aluminum	September 11, 2014	August 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 20, 22, 23, 24, 2014
	October 8, 2014	September 17, 24, 2014
	November 13, 19, 27, 2014	October 1, 8, 14, 22, 28, 2014
	December 4, 10, 15, 2014	November 5, 11, 19, 26, 2014
	January 7, 15, 20, 26, 2015	December 10, 17, 2014
	March 24, 2015	January 6, 13, 20, 27, 2015
	March 2, 2016	February 3, 10, 17, 24, 2015
		March 2, 10, 17, 24, 2015
		April 7, 14, 21, 28, 2015
		May 5, 12, 19, 2015
		June 2, 9, 16, 23, 30, 2015
		July 9, 14, 2015
		August 10, 2015
		September 8, 2015
		October 20, 2015
		November 11, 2015
		December 8, 2015
		January 12, 2016
		February 16, 2016
		March 14, 2016
		April 12, 2016
		May 17, 2016
		June 7, 2016
	July 6, 2016	
Total Iron	January 20, 2015	August 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 20, 22, 23, 24, 2014
	March 24, 2015	September 17, 24, 2014



		October 1, 8, 14, 22, 28, 2014
		November 5, 11, 26, 2014
		December 10, 17, 2014
		January 6, 13, 20, 27, 2015
		February 3, 10, 17, 24, 2015
		March 2, 10, 17, 24, 2015
		April 7, 14, 21, 28, 2015
		May 5, 12, 19, 2015
		June 2, 9, 16, 23, 30, 2015
		July 9, 14, 2015
		August 10, 2015
		September 8, 2015
		October 20, 2015
		November 11, 2015
		December 8, 2015
		February 16, 2016
		March 14, 2016
		April 12, 2016
		May 17, 2016
		June 7, 2016
		July 6, 2016
Total Manganese	No exceedances	November 11, 2014
		April 7, 2015
		May 12, 19, 2015
		June 2, 2015
		April 12, 2016
		May 17, 2016
Dissolved Aluminum	No exceedances	April 28, 2015

Table 2. Aquatic Life exceedances from August 4, 2014 to August 4, 2016 for Quesnel River at Likely Bridge and Quesnel River at Gravelle Ferry Bridge.

Location	Quesnel River at Likely Bridge	Quesnel River at Gravelle Ferry Bridge
Parameter	Date	Date
Turbidity	December 4, 10, 15, 2014	August 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 20, 22, 23, 2014
		September 24, 2014
		October 22, 28, 2014
		November 5, 11, 19, 26, 2014
		December 10, 17, 2014
		January 27, 2015
		February 17, 2015
		March 10, 17, 24, 2015
		April 7, 28, 2015
		May 12, 19, 2015
		June 2, 9, 16, 23, 30, 2015
		July 9, 14, 2015
		August 10, 2015
		November 11, 2015
		March 14, 2016
		April 12, 2016
		May 17, 2016
	June 7, 2016	
	July 6, 2016	
Total Suspended Solids	September 18, 2014	August 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 20, 22, 23, 24, 2014
		September 24, 2014



		October 8, 14, 22, 28, 2014
		November 5, 11, 19, 26, 2014
		December 10, 17, 2014
		January 6, 27, 2015
		February 3, 17, 24, 2015
		March 2, 10, 17, 24, 2015
		April 7, 14, 21, 28, 2015
		May 5, 12, 19, 2015
		June 2, 9, 16, 23, 30, 2015
		July 9, 14, 2015
		August 10, 2015
		September 8, 2015
		October 20, 2015
		November 11, 2015
		December 8, 2015
		February 16, 2016
		March 14, 2016
		April 12, 2016
		May 17, 2016
		June 7, 2016
		July 6, 2016
Total Chromium	No exceedances	August 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 20, 22, 23, 24, 2014
		September 24, 2014
		October 8, 14, 22, 28, 2014
		November 5, 11, 2014
		December 10, 17, 2014
		January 27, 2015
		February 17, 2015
		March 10, 17, 24, 2015
		April 7, 14, 21, 28, 2015
		May 5, 12, 19, 2015
		June 2, 9, 16, 23, 30, 2015
		July 9, 14, 2015
		August 10, 2015
		November 11, 2015
		March 14, 2016
		April 12, 2016
		May 17, 2016
		June 7, 2016
Total Copper	August 26, 2014	August 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 20, 22, 23, 24, 2014
	September 11, 2014	October 8, 14, 22, 28, 2014
	October 8, 2014	November 5, 11, 19, 26, 2014
	November 6, 13, 19, 27, 2014	December 10, 17, 2014
	December 4, 10, 15, 2014	January 6, 13, 20, 27, 2015
	January 7, 15, 20, 26, 2015	February 3, 10, 17, 24, 2015
	February 4, 11, 17, 24, 2015	March 2, 10, 17, 24, 2015
	March 4, 12, 17, 24, 2015	April 7, 14, 21, 28, 2015
	April 6, 15, 22, 27, 2015	May 5, 12, 19, 2015
	March 2, 2016	June 2, 9, 16, 23, 30, 2015
		July 9, 14, 2015
		August 10, 2015
		March 14, 2016
		April 12, 2016
		May 17, 2016
		June 7, 2016
Total Iron	March 24, 2015	August 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 20, 22, 23, 24, 2014
		October 22, 28, 2014



		November 5, 11, 2014
		December 17, 2014
		February 17, 2015
		March 10, 17, 24, 2015
		April 7, 21, 28, 2015
		May 12, 19, 2015
		June 2, 9, 30, 2015
		July 9, 2015
		March 14, 2016
		April 12, 2016
		May 17, 2016
Dissolved Aluminum	November 13, 19, 27, 2014	August 4, 7, 9, 10, 13, 22, 2014
	December 4, 10, 15, 2014	October 28, 2014
	January 7, 2015	November 5, 11, 19, 26, 2014
	March 24, 2015	December 10, 17, 2014
		January 6, 27, 2015
		February 17, 2015
		March 10, 17, 24, 2015
		April 7, 28, 2015
		May 19, 2015
		June 2, 9, 16, 2015
		March 14, 2016