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Pacific & Yukon Region
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VIA EMAIL
January 25/10 @ 3:46 pm

January 25, 2010

Carola Scheu
Manager, Water Board Secretariat
Suite 106 - 419 Range Road
Whitehorse, Yukon
Y1A 3V1

Dear Carola:

**RE: Type A Water Use License Application QZ08-084
Carmacks Copper Project**

The following attachment provides Environment Canada's intervention comments regarding Water License Application QZ08-084, the Carmacks Copper Project.

While Environment Canada does not request a public hearing, we would be pleased to attend a hearing if one is called. Please contact John Miller at (867) 393-6846 or Eric Soprovich at (867) 667-3410 if you have any questions regarding this intervention or otherwise seek clarification upon any matter.

Respectfully

John Miller, M.Sc., P.Geo.
Sr. Environmental Scientist – Hydrogeology
Environmental Protection Operations
Environment Canada – Yukon

Eric Soprovich, B.Sc. (geol.) MNRM
Head, Public & Natural Resources Sectors
Environmental Protection Operations
Environment Canada – Yukon

Cc'ed: Selkirk First Nation
Little Salmon-Carmacks First Nation
Government of Yukon: Water Resources
Department of Fisheries Oceans Canada
Carmacks Copper Ltd. – Jonathan Clegg

January 25, 2010

Environment Canada
Type A Water License Intervention

Mandate

By Prime Ministerial instruction, Environment Canada is responsible for administration of Section 36(3) of the Fisheries Act. This section of the Act prohibits the deposit of deleterious substances into waters frequented by fish, or deposit to any place where those deleterious substances may then report to fish-bearing waters. The overall objective of the department is to protect and conserve fish, ensure that water quality is not impaired, and that healthy fish habitat is maintained.

Discussion on the Proposed Effluent Quality Standards

The suggested licensed effluent quality standards provided by the proponent should be protective of the downstream environment at the receiving water monitoring station for William's Creek, represented by W12. The licensed effluent standards should be able to achieve the Site Specific Water Quality Objectives (SSWQO) or the CCME guidelines, where no SSWQO was calculated, at all times including closure and post-closure of the mine at W12. The final standards should provide protection based on the load of contaminants to the system.

Several scenarios of discharges of effluent from the project into the Williams Creek environment from the Heap Leach Facility (HLF) and the Waste Rock Storage Area (WRSA) were provided in the application. A water balance for the project was completed and calculations of discharges from the mine during operation, closure and post-closure under different climatic scenarios were developed. In addition, substantial work was carried out on determining site specific water quality objectives (SSWQO) for copper using a Water Effects Ratio (WER) procedure, and for aluminum and iron using a background water quality methodology. These SSWQO were not used to calculate the Effluent Quality Standards proposed for the project. A rationale why they did not use the SSWQO to determine the effluent quality standards was not provided or why they calculated SSWQO for certain parameters but did not include these within the list of parameters with the effluent quality standards. The proponent suggests using the Metal Mining Effluent Regulations (MMER) Schedule 4 Maximum Authorized Monthly Mean Concentration for their effluent quality standards. The MMER values for effluent discharge were proposed to ensure there are national baseline *minimum* standards that all metal mines in Canada can achieve, but with the recognition that for some cases there is a scientifically defensible need for more stringent measures to protect fish, fish habitat and fisheries on a site specific basis. It appears this is the case for the Carmacks Copper Project considering the important utilization of Williams Creek as fish habitat and small assimilative capacity within the Williams Creek system to accommodate for significant metal loads.

As shown in the attached Table 2 to this intervention, discharges from the HLF and the WRSA at the effluent quality standards proposed by the applicant will not meet the SSWQO or CCME guideline at the compliance point W12 for arsenic, copper, lead or zinc under any discharge scenario provided within the water balance (Table 1). The values in Table 2 were derived from using the calculations of loadings in the Appendix to this intervention. Essentially, the load of contaminants at the receiving water monitoring point W12 is determined by the effluent load and the load of William's Creek. Therefore, the proponent should develop effluent quality standards that will meet the SSWQO they developed for copper, aluminum and iron and for the CCME guidelines for all other relevant parameters at W12.

Recommendation: The list of parameters in the proposed Effluent Quality Standards should be expanded to include parameters where the proponent has calculated a SSWQO (i.e. copper, aluminum and iron) or where an applicable CCME guideline is established.

Rationale: The list of parameters included in the *MMER* or the proposed Effluent Quality Standards is very limited. The proponent has spent considerable time looking at the background water quality to determine which parameters potentially exceed CCME or SSWQO but have not included these parameters in the list of effluent standards. Several parameters of concern should be included to ensure that the water quality at W12 is not degraded. The list of CCME parameters with guidelines for the protection of aquatic life is provided in Table 2.

Recommendation: Within Schedule A Part II, continuous flow monitoring at W12 should be instituted.

Rationale: W12 is considered the receiving water representative for the project and therefore, flow should be continuously monitored to aid in long-term protection goals.

Recommendation: The proponent should provide a report on the proposed groundwater monitoring well installation and monitoring program prior to the commencement of mining. The groundwater well installation and monitoring program should be overseen by a qualified professional hydrogeologist experienced in this work.

Rationale: The potential for groundwater to be impacted by site activities has not been adequately addressed in the scope of the project. There has been sparse information collected to date on groundwater at the site. The proponent has discussed future work to address this information gap but the details are not provided. Groundwater monitoring wells should be installed immediately downstream of the Waste Rock Storage Area, the Heap Leach Facility and the open pit to assess the potential long-term affects on groundwater quality and quantity. As Williams Creek's baseflow is sustained by groundwater discharge for much of the year, impairment of the groundwater quality at the site from site operations will eventually lead to impacts on the water quality and therefore, the receiving environment of William's Creek.

Recommendation: The groundwater modelling scenario of the leaking Heap Leach Facility should be updated to include the influence of the finger drains. This should be completed for the first annual report.

Rationale: A groundwater modelling exercise was carried out for the project, specifically the pit area and the heap leach pad, to determine pit inflows and outflows and to determine potential pathways and travel times for any leakage from the HLF. The modelling scenario calculated a travel which would suggest that any potential leakage from the HLF would take up to 7 years. The model did not include any inference to the finger drains proposed for installation beneath the liner. The finger drains are specifically designed to convey groundwater away from the HLF as a highly conductive layer. These finger drains could potentially facilitate a shorter duration for any leakage from the HLF to reach Williams Creek.

Recommendation: The closure water balance should include potential flows from the waste rock storage area and groundwater outflow from the pit to Williams Creek. This should be included within the first annual report.

Rationale: The closure water balance scenario did not include any discharges from the Waste Rock Storage Area (WRSA). The long-term implications of discharge from the WRSA were not considered in the closure scenarios. The geochemical testing of the waste rock has not determined that metal leaching is not a potential issue; therefore any discharges from the WRSA must be accounted for in any closure scenario.

Recommendation: The groundwater modelling program should include any seepage from the Waste Rock Storage Area (WRSA). This should be included in the first annual report.

Rationale: The groundwater modelling project did not include any information regarding potential impacts on groundwater from seepage from the WRSA. The geochemical analysis on the WRSA has not conclusively shown that metal leaching will not be a potential long-term issue. As such, there exists the potential for loadings from the WRSA to impact groundwater which in turn discharges to Williams Creek. These potential loadings have not been accounted for.

Recommendation: Effluent quality standards should be applied to groundwater quality. The effluent quality standards should be applied to groundwater monitoring well compliance points downgradient of the Heap Leach Facility, the Waste Rock Storage Area and the Open Pit.

Rationale: During much of the year, the baseflow of Williams Creek is sustained by groundwater discharge. Any impairment of groundwater quality by site operations, will eventually lead to impacts on the water quality of William's Creek. As such, effluent quality standards should be applied to any groundwater monitoring wells that are considered compliance points. As the groundwater monitoring network is not known at this time, compliance points cannot be suggested.

Recommendation: The water balance scenarios should be updated to include relevant site specific data. This should be completed by the first annual report.

Rationale: Specifically the storm event that occurred in August 2008 was not adequately addressed in the application. In the event that such as storm could occur during freshet, the existing water retaining and diverting structures might not be adequate to convey or hold back any non-compliant waters. We have seen within the same area what these storm events can lead to if not properly accounted for prior to mine start-up and development.

Appendix to Intervention

Effluent Discharge Criterion Calculations used in Table 2 of this Intervention

Upstream load + effluent load = maximum load at receiving water monitoring point

$$C_{us}Q_{us} + C_{eff}Q_{eff} = C_{cp}(Q_{us}+Q_{eff}) \qquad (1)$$

C_{us} - concentration of parameter in receiving water
Q_{us} – flow of William's Creek (assume that the flow is equal to the measured flows at W12)
C_{eff} – Effluent concentration
Q_{eff} – Effluent discharge flow
C_{cp} – concentration of parameter of concern at the receiving water monitoring station represented by W12

To determine what the concentration of the parameter of concern at W12 would be based on the proposed Effluent Quality Standards, Equation 1 can be rearranged to get;

$$C_{cp} = \frac{C_{eff}Q_{eff}}{(Q_{us}+Q_{eff}) - C_{us}Q_{us}} \qquad (2)$$

Which can be transformed further for calculating the effluent concentration;

$$C_{eff} = \frac{C_{cp}(Q_{us}+Q_{eff}) - C_{us}Q_{us}}{Q_{eff}} \qquad (3)$$

Table 1 : Discharge Scenarios from the Carmack's Copper Water Balance

W12 Flow *	Discharge Scenarios - Section 1.7.4 Updated Water Balance							
	Average Conditions 14 day melt		Average Conditions 30 day melt		1:100 year Wet		1:20 year dry	
	total	summer	total	summer	total	summer	total	summer
0.09	0.013	0.026	0.013	0.024	0.015	0.029	0.011	0.022

* - Geometric mean of measured flows at W12 from 2005 -2008 Section 1.18.5
All flows are in m^3/second

Table 2: Calculation of W12 concentrations based on Effluent Quality Standards

Parameter	W12 Baseline Average Concentration[1]	SSWQO	CCME	Proposed Discharge Criteria	Discharge Scenarios for Summer Flows: Scenario 1	Scenario 2	Scenario 3	Scenario 4
					Predicted W12 Concentration at Proposed Effluent Quality Standard			
Ammonia (N)	0.025		2	5	1.14	1.07	1.24	1.13
Nitrate (N)	0.047		13					
Nitrite (N)	0.016		0.06					
TSS	4		15	15	6	6	7	4
pH (-)	7.82		6.5 - 9	6.5 - 9.0				
hardness (H as $CaCO_3$)	184							
aluminum (Al)	0.12	0.63	0.1*					
arsenic (As)	0.00040		0.005	0.5	**0.11**	**0.11**	**0.12**	**0.11**
cadmium (Cd)	0.000026		0.000017					
chromium (Cr)	0.00066		0.001					
copper (Cu)	0.0027	0.004[2], 0.015[3], 0.0246[4], 0.042[5]	0.004**	0.3	**0.07**	**0.07**	**0.08**	**0.07**
iron (Fe)	0.20	1	0.3					
lead (Pb)	0.000340		0.007**	0.2	**0.05**	**0.04**	**0.05**	**0.04**
mercury (Hg)	0.000010		0.000026					
molybdenum (Mo)	0.0014		0.073					
nickel (Ni)	0.0011		0.15**	0.5	0.11	0.11	0.12	0.11
selenium (Se)	0.00023		0.001					
silver (Ag)	0.000070		0.0001					
zinc (Zn)	0.0054		0.03	0.5	**0.12**	**0.11**	**0.13**	**0.11**

Notes:
All values are in mg/L unless otherwise stated
1 - calculated as the average from 2005 - 2008 in Section 1.18.5
2 - Based on information provided in Table 4.4 in Section 1.12
3 - based on Section 1.12
4 - from section 1.14.1
5 - from section 1.14.2 SSWQO for Cu 0.021mg/L when H <120 mg/L; 0.032 mg/L when H = 120-180; 0.042 mg/L when H>180
* - based on a pH>6.5
** - based on an average hardness of 184 mg/L
CCME - Canadian Council of Ministers of the Environment
Discharge Scenarios from Section 1.17 - Water Balance
SSWQO - Site Specific Water Quality Objective
0.11 - value exceeds SSWQO

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Table 3: Water Quality at W12

Parameter	05-Oct	06-Mar	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Apr-07	May-07	Jun-07	Jul-07	Aug-07
hardness	130	360	130	179	184	205	217	178	71		203	206
Ammonia (N)	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025		0.025	0.025
Nitrate (N)	0.02						0.06	0.05	0.05		0.05	0.2
Nitrite (N)	0.0025						0.0025	0.025	0.025		0.025	0.025
TSS			5	1	1	1	3	1	19		3	1
pH	8.25	6.57	8.08	8.49	7.78	7.73	8.4	7.75	6.65		7.9	7.3
aluminum	0.156	0.01	0.389	0.038	0.07	0.02	0.047	0.08	0.634		0.238	0.033
antimony	0.0001	0.0001	0.0003	0.0001	0.0002	0.0002	0.0001	0.0001	0.0002		0.0001	0.0001
arsenic	0.0005	0.0005	0.0008	0.0004	0.0002	0.0002	0.0003	0.0004	0.0005		0.0008	0.0003
cadmium	0.000005	0.00001	0.00012	0.000005	0.00001	0.00001	0.000005	0.00005	0.00002		0.00001	0.00001
chromium	0.0007	0.00025	0.0019	0.00025	0.0005	0.0005	0.00025	0.00025	0.0005		0.0005	0.00025
copper	0.002	0.004	0.01	0.002	0.002	0.001	0.002	0.004	0.004		0.002	0.002
iron	0.4	0.05	0.3	0.1	0.1	0.1	0.05	0.1	0.7		0.2	0.05
lead	0.0001	0.0002	0.0022	0.00005	0.0001	0.0001	0.0001	0.0004	0.0003		0.0002	0.0001
mercury									0.00005		0.00001	0.00001
molybdenum	0.001	0.002	0.002	0.0005	0.001	0.001	0.002	0.0005	0.001		0.003	0.003
nickel	0.0011	0.00025	0.0007	0.001	0.0005	0.0005	0.0007	0.0012	0.002		0.00025	0.0007
selenium	0.0001	0.0006	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001	0.0002		0.0001	0.0003
silver	0.00005	0.00005	0.00005	0.00005	0.0001	0.0001	0.00005	0.00005	0.0001		0.00005	0.00005
zinc	0.001	0.003	0.002	0.003	0.001	0.005	0.002	0.013	0.01		0.009	0.005

(shaded) one half of MDL when conc<MDL

All data reporduced from Section 1.18.5

all values are in mg/L

Sep-07	Oct-08	08-Mar	08-Apr	08-May	08-Jun	08-Jul	08-Aug	08-Sep	08-Oct	08-Nov	Average	median	geo mean
169		277	386	59	131	171		97	120	203	184	179	166
0.025		0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
0.01		0.07	0.04	0.01	0.02	0.01	0.01	0.01	0.1		0.047	0.04	0.030
0.01		0.01	0.01	0.02	0.04	0.03	0.005	0.005	0.005		0.016	0.01	0.011
1		2	1	1	1	14	1	12	1	6	4	1	2
8.6		8.9		7.89	7.58	8.09	7.4	7.87	7.95	7.28	7.82	7.88	7.80
0.045		0.064	0.01	0.26	0.05	0.18	0.019	0.15	0.085	0.013	0.123381	0.064	0.065264
0.0001		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.000124	0.0001	0.000116
0.0002		0.0003	0.0005	0.0001	0.0002	0.0006	0.0006	0.0004	0.0004	0.0003	0.000405	0.0004	0.00036
0.00005		0.00003	0.000035	0.000035	0.000035	0.00004	0.000005	0.00005	0.000005	0.000005	2.6E-05	0.00001	1.62E-05
0.0008		0.00025	0.0008	0.0013	0.0012	0.001	0.0007	0.0008	0.0006	0.0005	0.000657	0.0005	0.000549
0.003		0.002	0.0005	0.003	0.002	0.003	0.001	0.003	0.002	0.003	0.002738	0.002	0.002301
0.05		0.05	0.03	0.58	0.15	0.42	0.08	0.46	0.16	0.04	0.198571	0.1	0.126336
0.0003		0.0003	0.0016	0.0003	0.00005	0.0002	0.00005	0.0002	0.0002	0.0001	0.00034	0.0002	0.000186
0.00001		0.000005	0.000005	0.00001	0.000005	0.000005	0.000005	0.00001	0.000005	0.000005	1.04E-05	0.000005	7.79E-06
0.002		0.002	0.00095	0.00037	0.00138	0.00114	0.0014	0.00077	0.002	0.00134	0.001445	0.00134	0.001254
0.0014		0.00025	0.0005	0.006	0.0005	0.002	0.0005	0.0005	0.0011	0.0005	0.001055	0.0007	0.000745
0.0001		0.0005	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0001	0.0003	0.000233	0.0002	0.000197
0.00005		0.00001	0.0005	0.00005	0.000025	0.000005	0.000005	0.000005	0.00012	0.0000005	7E-05	0.00005	3.33E-05
0.008		0.007	0.002	0.007	0.009	0.008	0.003	0.003	0.008	0.005	0.005429	0.005	0.004313