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May 15, 2014

File: L020-01-07

Angela Love
Regulatory Officer
Mackenzie Valley Land & Water Board
Box 2130
7th Floor, 4922 – 48th Street
Yellowknife NT X1A 2P6

Dear Ms. Love:

**Gahcho Kué Project Mackenzie Valley Land and Water Board Public Hearing
– Undertaking #5 - Effluent Quality Criteria Report – Version 2, Table D2**

Undertaking 5:

De Beers Canada Inc. to provide to the MVLWB further information related to predicted hardness concentrations in the water management pond over time. Please update Table D.2 of the EQC Report to include hardness. Due May 15, 2014.

Response:

The updated Table D2 from the Effluent Quality Criteria (EQC) Report – Version 2 (De Beers 2014) is provided.

As the hardness information has been requested by the Mackenzie Valley Land and Water Board (MVLWB), De Beers notes the additional conservatism provided for the projected nitrate and ammonia concentrations in the water management pond (WMP) as a result of chemical-residual loading of nitrogen species (e.g., nitrate and ammonium) from explosive usage at the mine site. As stated in Appendix 8.II (Water Quality Model Report) of the 2012 EIS Supplement (De Beers 2012):

The total life-of-mine explosives tonnages formed the basis for determining chemical loadings. The total mass of explosive was assumed to be released linearly over the mine life to develop estimates of nitrogen-species concentrations from blasting activities. Water reporting to active open pits is expected to mobilize the majority of explosives residues, and the mass of explosives released during each month was added to the WMP.

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The modelling assumed the life of mine to include the construction and dewatering period (i.e., Years -3 to -1), which is an overly conservative assumption, as lakebed dewatering will not be completed to the extent necessary to pre-strip and initiate Hearne and 5034 development until the end of Year -1/start of Year 1. Nitrogen residual loading to the WMP should not be initiated until this period. Therefore, the period that the explosive tonnages have to be linearly segregated would be reduced from 13 to 14 years to 11 to 12 years. While this may increase the annual nitrogen residual loading to the WMP during operations, more importantly, nitrate and ammonia levels in the WMP in Year 1 will be expected to be closer to early influx concentrations than presented in the table (i.e., approximately <0.1 mg N/L to 2 mg/L for ammonia and nitrate in Year 1 over the course of the year compared to approximately 3 mg N/L to 6 mg/L for ammonia and nitrate in Year 1 as presented in Table D2.

Additionally, the proposed EQC limits for nitrate were developed considering only the south basin of Lake N11 as the receiving environment, and not all of lake receiving environment. As outlined at the Water Licence Hearing (see also response to Undertaking 3), the south basin possesses a volume of approximately 10 million cubic metres (Mm³) and a water yield of approximately 8.8 Mm³, compared to all of Lake N11, which has an approximate volume of 18 Mm³, and a water yield of approximately 20 Mm³. Consideration of the whole lake as a receiving environment provides a substantially greater attenuation of the WMP discharge, with a maximum estimated effluent proportion in winter of Year 3 being approximately 20% as compared to 42% in the south basin of Lake N11.

Sincerely,



Veronica Chisholm

References:

De Beers (De Beers Canada Inc.). 2014. Effluent Quality Criteria Report – Version 2 for the Gahcho Kué Mine. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT. April 2014.

De Beers. 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT. April 2012.

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Table D2 Parameter Concentrations in the Operational Discharge from the Water Management Pond (Years 1 to 3)

Parameter	Units	Maximum Concentration Year 1	Year 1											
			January	February	March	April	May	June	July	August	September	October	November	December
Conventional														
Total Dissolved Solids	mg/L	107	41	46	52	59	65	71	78	83	89	94	100	107
Hardness	mg/L ¹	72	27	31	35	39	44	48	53	56	60	64	68	72
Major Ions														
Chloride	mg/L	41.1	10.5	13.3	16.3	19.6	22.8	25.9	27.3	29.4	31.9	34.8	37.9	41.1
Fluoride	mg/L	0.088	0.057	0.059	0.061	0.063	0.066	0.068	0.075	0.078	0.081	0.084	0.086	0.088
Potassium	mg/L	2.7	1.3	1.4	1.5	1.6	1.7	1.7	2.0	2.2	2.4	2.5	2.6	2.7
Sulphate	mg/L	15	5.9	6.4	6.9	7.4	8.0	8.6	12	12	13	14	14	15
Nutrients														
Ammonia	mg N/L	7.1	5.1	5.4	5.7	5.9	6.2	6.4	6.2	6.2	6.3	6.6	6.8	7.1
Nitrate	mg N/L	7.0	5.1	5.4	5.6	5.9	6.1	6.3	6.1	6.2	6.3	6.5	6.8	7.0
Nitrite	mg N/L	0.00036	0.00023	0.00024	0.00024	0.00024	0.00023	0.00023	0.00028	0.00032	0.00036	0.00036	0.00036	0.00036
Total phosphorus	mg/L	0.023	0.0109	0.0114	0.0119	0.0126	0.0134	0.0141	0.0158	0.018	0.02	0.021	0.022	0.023
Total Metals														
Aluminum	mg/L	0.069	0.049	0.05	0.05	0.05	0.05	0.052	0.061	0.065	0.067	0.068	0.069	0.069
Antimony	mg/L	0.0018	0.00039	0.00043	0.0005	0.00057	0.00065	0.00074	0.001	0.0012	0.0014	0.0016	0.0017	0.0018
Arsenic	mg/L	0.0012	0.00074	0.00076	0.00079	0.00083	0.00086	0.0009	0.00096	0.001	0.001	0.0011	0.0011	0.0012
Barium	mg/L	0.026	0.013	0.014	0.015	0.016	0.017	0.018	0.02	0.021	0.023	0.024	0.025	0.026
Beryllium	mg/L	0.00010	0.000066	0.000066	0.000066	0.000066	0.000066	0.000068	0.000088	0.000095	0.000098	0.000099	0.00010	0.00010
Boron	mg/L	0.07	0.038	0.04	0.042	0.045	0.048	0.051	0.056	0.059	0.062	0.065	0.067	0.07
Cadmium	mg/L	0.000031	0.000026	0.000026	0.000026	0.000026	0.000026	0.000027	0.00003	0.00003	0.000031	0.000031	0.000031	0.000031
Chromium	mg/L	0.0014	0.00075	0.00077	0.00081	0.00084	0.00088	0.00093	0.001	0.0011	0.0012	0.0013	0.0013	0.0014
Cobalt	mg/L	0.0009	0.00051	0.00051	0.00051	0.00051	0.00052	0.00053	0.00081	0.00086	0.00088	0.00089	0.0009	0.0009
Copper	mg/L	0.0021	0.0016	0.0016	0.0016	0.0016	0.0017	0.0017	0.0019	0.0019	0.002	0.002	0.0021	0.0021
Iron	mg/L	0.21	0.15	0.16	0.16	0.16	0.17	0.17	0.19	0.19	0.2	0.2	0.21	0.21
Lead	mg/L	0.00026	0.00015	0.00015	0.00016	0.00016	0.00016	0.00017	0.00022	0.00024	0.00025	0.00026	0.00026	0.00026
Manganese	mg/L	0.037	0.023	0.023	0.024	0.025	0.025	0.026	0.034	0.035	0.035	0.036	0.036	0.037
Mercury	mg/L	0.000014	0.000011	0.000011	0.000011	0.000011	0.000011	0.000012	0.000012	0.000012	0.000013	0.000013	0.000014	0.000014
Molybdenum	mg/L	0.0031	0.0019	0.0019	0.002	0.002	0.0021	0.0021	0.0028	0.0029	0.0029	0.003	0.003	0.0031
Nickel	mg/L	0.0036	0.0025	0.0025	0.0025	0.0025	0.0026	0.0026	0.0033	0.0034	0.0035	0.0035	0.0036	0.0036
Selenium	mg/L	0.00027	0.00022	0.00022	0.00023	0.00023	0.00023	0.00023	0.00026	0.00026	0.00027	0.00027	0.00027	0.00027
Silver	mg/L	0.000098	0.000084	0.000084	0.000085	0.000085	0.000086	0.000087	0.00009	0.000092	0.000094	0.000096	0.000097	0.000098
Strontium	mg/L	0.045	0.021	0.021	0.022	0.023	0.024	0.025	0.034	0.037	0.041	0.043	0.044	0.045
Thallium	mg/L	0.00011	0.000064	0.000069	0.000074	0.000079	0.000085	0.00009	0.000092	0.000094	0.0001	0.0001	0.00011	0.00011
Uranium	mg/L	0.0013	0.00056	0.00058	0.00061	0.00064	0.00066	0.00069	0.0011	0.0012	0.0012	0.0012	0.0012	0.0013
Vanadium	mg/L	0.0022	0.00071	0.00075	0.00082	0.00089	0.00097	0.0011	0.0013	0.0016	0.0018	0.002	0.0021	0.0022
Zinc	mg/L	0.0073	0.0046	0.0047	0.0048	0.0049	0.005	0.0052	0.0063	0.0066	0.0069	0.007	0.0072	0.0073

¹ mg/L as calcium carbonate; mg/L = milligrams per litre; N = nitrogen.

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Table D2 Parameter Concentrations in the Operational Discharge from the Water Management Pond (Years 1 to 3) (continued)

Parameter	Units	Maximum Concentration Year 2	Year 2											
			January	February	March	April	May	June	July	August	September	October	November	December
Conventional														
Total Dissolved Solids	mg/L	206	113	123	134	146	157	167	167	169	176	185	195	206
Hardness	mg/L ¹	135	77	84	90	98	105	112	111	112	115	121	128	135
Major Ions														
Chloride	mg/L	97	45	51	56	63	70	76	74	75	79	85	90	97
Fluoride	mg/L	0.13	0.091	0.094	0.097	0.1	0.1	0.11	0.11	0.11	0.12	0.12	0.12	0.13
Potassium	mg/L	3.8	2.8	2.9	3.0	3.1	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8
Sulphate	mg/L	24	15	16	17	18	18	19	21	22	22	23	24	24
Nutrients														
Ammonia	mg N/L	8.6	7.4	7.6	7.9	8.2	8.4	8.6	8.0	7.8	7.8	8.0	8.3	8.5
Nitrate	mg N/L	8.5	7.3	7.6	7.8	8.1	8.4	8.5	7.9	7.7	7.7	7.9	8.2	8.4
Nitrite	mg N/L	0.00047	0.00036	0.00035	0.00035	0.00035	0.00035	0.00034	0.00038	0.00042	0.00047	0.00046	0.00046	0.00046
Total phosphorus	mg/L	0.031	0.024	0.024	0.025	0.025	0.026	0.026	0.026	0.027	0.029	0.03	0.03	0.031
Total Metals														
Aluminum	mg/L	0.085	0.069	0.069	0.069	0.069	0.069	0.07	0.077	0.081	0.083	0.085	0.085	0.085
Antimony	mg/L	0.0027	0.0019	0.0019	0.002	0.002	0.0021	0.0021	0.0022	0.0023	0.0024	0.0025	0.0026	0.0027
Arsenic	mg/L	0.0016	0.0012	0.0012	0.0013	0.0013	0.0014	0.0014	0.0014	0.0015	0.0015	0.0015	0.0016	0.0016
Barium	mg/L	0.036	0.027	0.028	0.029	0.03	0.031	0.032	0.032	0.032	0.034	0.035	0.035	0.036
Beryllium	mg/L	0.00013	0.00010	0.00010	0.000099	0.000099	0.000099	0.000101	0.00012	0.00013	0.00013	0.00013	0.00013	0.00013
Boron	mg/L	0.1	0.072	0.076	0.079	0.082	0.085	0.088	0.09	0.09	0.093	0.095	0.1	0.1
Cadmium	mg/L	0.00035	0.00031	0.00031	0.00031	0.00031	0.00031	0.00031	0.00033	0.00034	0.00035	0.00035	0.00035	0.00035
Chromium	mg/L	0.0019	0.0014	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0017	0.0017	0.0018	0.0019	0.0019
Cobalt	mg/L	0.0013	0.0009	0.0009	0.00091	0.00091	0.00091	0.00092	0.0012	0.0012	0.0013	0.0013	0.0013	0.0013
Copper	mg/L	0.0025	0.0021	0.0021	0.0021	0.0021	0.0022	0.0022	0.0023	0.0024	0.0024	0.0024	0.0025	0.0025
Iron	mg/L	0.31	0.22	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.28	0.29	0.3	0.31
Lead	mg/L	0.00037	0.00026	0.00027	0.00027	0.00027	0.00028	0.00029	0.00032	0.00034	0.00035	0.00036	0.00037	0.00037
Manganese	mg/L	0.052	0.037	0.038	0.039	0.04	0.041	0.042	0.049	0.049	0.05	0.051	0.052	0.052
Mercury	mg/L	0.000016	0.000014	0.000014	0.000014	0.000014	0.000014	0.000015	0.000015	0.000015	0.000015	0.000015	0.000016	0.000016
Molybdenum	mg/L	0.0041	0.0031	0.0032	0.0032	0.0033	0.0033	0.0034	0.0039	0.0039	0.004	0.004	0.0041	0.0041
Nickel	mg/L	0.0046	0.0036	0.0036	0.0036	0.0036	0.0036	0.0037	0.0043	0.0044	0.0045	0.0045	0.0045	0.0046
Selenium	mg/L	0.00031	0.00027	0.00027	0.00027	0.00028	0.00028	0.00028	0.0003	0.0003	0.00031	0.00031	0.00031	0.00031
Silver	mg/L	0.00011	0.000098	0.000099	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00011	0.00011	0.00011
Strontium	mg/L	0.063	0.046	0.047	0.048	0.048	0.049	0.05	0.055	0.057	0.06	0.061	0.062	0.063
Thallium	mg/L	0.00015	0.00012	0.00012	0.00013	0.00013	0.00014	0.00014	0.00014	0.00013	0.00013	0.00014	0.00014	0.00015
Uranium	mg/L	0.0019	0.0013	0.0013	0.0013	0.0014	0.0014	0.0014	0.0018	0.0018	0.0019	0.0019	0.0019	0.0019
Vanadium	mg/L	0.0032	0.0022	0.0023	0.0024	0.0024	0.0025	0.0025	0.0026	0.0028	0.003	0.0031	0.0032	0.0032
Zinc	mg/L	0.011	0.0074	0.0077	0.0079	0.0082	0.0085	0.0088	0.0097	0.01	0.01	0.011	0.011	0.011

¹ mg/L as calcium carbonate; mg/L = milligrams per litre; N = nitrogen.

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Table D2 Parameter Concentrations in the Operational Discharge from the Water Management Pond (Years 1 to 3) (continued)

Parameter	Units	Maximum Concentration Year 3	Year 3							
			January	February	March	April	May	June	July	August
Conventional										
Total Dissolved Solids	mg/L	321	218	238	256	277	297	312	302	300
Hardness	mg/L ¹	205	142	154	166	179	191	200	193	192
Major Ions										
Chloride	mg/L	157	103	115	125	137	149	157	150	149
Fluoride	mg/L	0.15	0.13	0.13	0.14	0.14	0.15	0.15	0.15	0.15
Potassium	mg/L	4.3	3.9	3.9	4.0	4.1	4.2	4.2	4.3	4.3
Sulphate	mg/L	33	25	26	27	29	30	31	33	33
Nutrients										
Ammonia	mg N/L	10.0	8.8	9.1	9.3	9.6	9.8	10.0	9.1	8.8
Nitrate	mg N/L	9.9	8.7	9.0	9.2	9.5	9.7	9.9	9.0	8.7
Nitrite	mg N/L	0.00047	0.00045	0.00045	0.00045	0.00044	0.00044	0.00043	0.00045	0.00047
Total phosphorus	mg/L	0.033	0.032	0.032	0.032	0.033	0.033	0.033	0.032	0.033
Total Metals										
Aluminum	mg/L	0.099	0.084	0.084	0.084	0.084	0.083	0.085	0.094	0.099
Antimony	mg/L	0.003	0.0027	0.0028	0.0028	0.0028	0.0029	0.0029	0.0029	0.003
Arsenic	mg/L	0.0021	0.0017	0.0018	0.0018	0.0019	0.002	0.0021	0.0021	0.0021
Barium	mg/L	0.042	0.037	0.039	0.04	0.041	0.042	0.042	0.042	0.042
Beryllium	mg/L	0.00016	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00015	0.00016
Boron	mg/L	0.13	0.1	0.11	0.11	0.12	0.12	0.13	0.13	0.13
Cadmium	mg/L	0.000038	0.000034	0.000034	0.000034	0.000034	0.000034	0.000034	0.000038	0.000038
Chromium	mg/L	0.0021	0.0019	0.002	0.002	0.0021	0.0021	0.0021	0.0021	0.0021
Cobalt	mg/L	0.0017	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0016	0.0017
Copper	mg/L	0.0027	0.0025	0.0025	0.0025	0.0025	0.0025	0.0026	0.0027	0.0027
Iron	mg/L	0.39	0.32	0.34	0.35	0.36	0.38	0.39	0.39	0.39
Lead	mg/L	0.00046	0.00037	0.00037	0.00038	0.00038	0.00038	0.00039	0.00044	0.00046
Manganese	mg/L	0.067	0.053	0.054	0.055	0.057	0.058	0.059	0.067	0.066
Mercury	mg/L	0.000016	0.000016	0.000016	0.000016	0.000016	0.000016	0.000016	0.000016	0.000016
Molybdenum	mg/L	0.051	0.0042	0.0042	0.0043	0.0043	0.0044	0.0044	0.0051	0.0051
Nickel	mg/L	0.0056	0.0046	0.0046	0.0046	0.0046	0.0046	0.0047	0.0055	0.0056
Selenium	mg/L	0.00034	0.00031	0.00031	0.00031	0.00031	0.00031	0.00031	0.00034	0.00034
Silver	mg/L	0.0001	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011
Strontium	mg/L	0.073	0.064	0.064	0.064	0.064	0.064	0.064	0.071	0.073
Thallium	mg/L	0.00018	0.00015	0.00016	0.00016	0.00017	0.00017	0.00018	0.00017	0.00016
Uranium	mg/L	0.0026	0.0019	0.002	0.002	0.0021	0.0021	0.0021	0.0026	0.0025
Vanadium	mg/L	0.0037	0.0033	0.0033	0.0033	0.0034	0.0034	0.0034	0.0035	0.0037
Zinc	mg/L	0.014	0.011	0.012	0.012	0.013	0.013	0.013	0.014	0.014

¹ mg/L as calcium carbonate; mg/L = milligrams per litre; N = nitrogen. Note: Operational discharges to Lake N11 or Area 8 are only expected to occur until August of Year 3.