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Project Memorandum

To:	**KGHM Ajax Mining Inc.**	**Doc. No.:**	**BGC-013**
Attention:	**Nettie Ore**	**Project No.:**	**1125011**
From:	**Hamish Weatherly**	**Date:**	**April 28, 2016**
Subject:	**Ajax Project Environmental Assessment Certificate Application / Environmental Impact Statement for a Comprehensive Study - Responses to Information Requests from DFO, FLNRO and MOE**		

1.0 INTRODUCTION

The *Ajax Project Environmental Assessment Certificate Application / Environmental Impact Statement for a Comprehensive Study* was issued in September 2015 (KAM, 2015). Comments, *Mines Act* and *Environmental Management Act* (MA and EMA) Application Permit Conditions, and Permit Information Requirements (IRs) were provided to KAM on February 22, 2016 by the Department of Fisheries and Oceans Canada (DFO), British Columbia Ministry of Forests, Lands and Natural Resource Operations (FLNRO) and Ministry of Environment (MOE) following a review of the Application and supporting documents.

This memorandum documents responses for the following IRs:

- DFO-004
- FLNRO-185, FLNRO-186, FLNRO-187, FLNRO-188, FLNRO-196, FLNRO-203, FLNRO-211, FLNRO-219, FLNRO-221
- MOE-011

2.0 INFORMATION REQUIREMENT RESPONSES

2.1. Information Requirement Issue ID # DFO-004

What are the water balance implications of the loss of 50 m^3 /day of water from Jacko Lake to the pit with regards to the littoral habitats of the lake in particular during low precipitation years and maximum water extraction by downstream water licence holders? Is the current conservation licence held by the province of BC sufficient to maintain these habitats with the expected loss due to seepage?

Response:

Predicted lake levels in Jacko Lake under existing conditions and at the end of Operations are addressed in IR# MOE-012 (BGC 2016a). These predictions account for seepage from the lake to the Open Pit. Results are presented in Table DFO.004-1.

Table DFO.004-1. Predicted changes in Jacko Lake water levels.

Month	Existing (masl)	End of Operations (masl)	Difference (m)
January	891.48	891.38	-0.10
February	891.50	891.39	-0.11
March	891.59	891.48	-0.11
April	892.05	892.03	-0.02
May	892.17	892.17	0.00
June	892.10	892.10	0.00
July	891.70	891.67	-0.03
August	891.31	891.25	-0.05
September	891.39	891.33	-0.06
October	891.43	891.36	-0.07
November	891.45	891.37	-0.08
December	891.46	891.38	-0.09

In total the water balance model (WBM) predicts that flows to Jacko Lake will be reduced by about 75,000 m^3 on an annual basis. Currently, KAM and its consultants are working with regulators on a mitigation strategy that addresses potential impacts to existing water licenses and fish habitat on Peterson Creek.

2.2. Information Requirement Issue ID # FLNRO-185

(Memo received, filename: 0309_FLNRO_Surface Water Hydrology_FLNRO-185-188. pdf - please review for details of key issues): Provide cumulative effects of water loss from mine footprint, operation and post-closure stages for Peterson Creek downstream of mine operating area (P02.3) - including effects of climate change and evaporation from the proposed Peterson Creek Downstream Pond - expressed in m^3/s for Q5, Q10, Q20 and Q50 monthly flows; and, the 7Q5 over the irrigation season;

Response:

Predicted monthly flows for Peterson Creek downstream of mine operations at PC02.3 and PC02 are presented in Tables FLNRO.185-1 and FLNRO.185-2 for existing conditions, the end of operations, and post-closure (Year 100) conditions, expressed in 5, 10, 20 and 50-year return periods. As described in IR# FLNRO-186, the water balance model (WBM) developed for the Project is set up on a monthly time-step and cannot provide predictions on a weekly time increment (e.g., 7Q5 estimates). As a result, low flow estimates are provided in the tables below as 5-year dry (1.25-year return period) and 10-year dry (1.11-year return period) monthly values (30Q5 and 30Q10). Results shown are based on an updated water balance model (WBM), which was initiated following a number of IR comments. Details of the updated WBM are provided in BGC, 2016c.

Additionally, monthly flow estimates (30Q5, 30Q10) at the nearby *Cherry Creek below Pendleton Creek* (08LF086) Water Survey of Canada (WSC) station were compared to low flow (7Q5 and 7Q10) estimates for the same time periods to determine a relative relationship between flow metrics for potential application to Peterson Creek, as shown in Table FLNRO.185-3.

Based on this comparison, 30Q5 and 30Q10 flow estimates were determined to be approximately 230% and 360% higher than the 7Q5 and 7Q10 estimated values at the Cherry Creek station for the months of November to February, respectively. 30Q5 and 30Q10 flow estimates at PC02.3 and PC02 could be scaled down by a similar factor to arrive at 7Q5 and 7Q10 estimates.

Please refer to IR# MOE-009 (BGC 2016b) for discussion on the incorporation of evaporation and climate change scenarios in the development of the WBM for the Project.

Table FLNRO.185-1. Predicted monthly flows (m^3/s) in Peterson Creek (Lower) at PC02 for existing conditions, end of operations, and closure (Year 100).

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10-year Dry												
Existing	0.0015	0.0015	0.0018	0.0030	0.0065	0.0020	0.0818	0.0817	0.0015	0.0015	0.0015	0.0015
Operations	0.0012	0.0013	0.0014	0.0018	0.0029	0.0014	0.0815	0.0815	0.0012	0.0013	0.0013	0.0012
Difference	-0.0002	-0.0003	-0.0004	-0.0013	-0.0036	-0.0006	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
%	-16%	-19%	-22%	-42%	-55%	-29%	0%	0%	-15%	-15%	-15%	-15%
Closure	0.0011	0.0011	0.0015	0.0060	0.0063	0.0026	0.0815	0.0814	0.0011	0.0012	0.0011	0.0011
Difference	-0.0003	-0.0004	-0.0003	0.0030	-0.0002	0.0005	-0.0003	-0.0004	-0.0003	-0.0003	-0.0003	-0.0003
%	-23%	-26%	-16%	98%	-4%	27%	0%	0%	-22%	-22%	-23%	-23%
5-year Dry												
Existing	0.0018	0.0018	0.0021	0.0106	0.0373	0.0086	0.0820	0.0820	0.0017	0.0017	0.0017	0.0017
Operations	0.0014	0.0014	0.0016	0.0050	0.0240	0.0037	0.0817	0.0816	0.0014	0.0014	0.0014	0.0014
Difference	-0.0004	-0.0004	-0.0005	-0.0056	-0.0134	-0.0048	-0.0003	-0.0003	-0.0003	-0.0004	-0.0004	-0.0003
%	-22%	-22%	-24%	-53%	-36%	-56%	0%	0%	-20%	-21%	-21%	-20%
Closure	0.0013	0.0013	0.0018	0.0126	0.0326	0.0075	0.0818	0.0815	0.0013	0.0014	0.0013	0.0013
Difference	-0.0004	-0.0004	-0.0003	0.0020	-0.0048	-0.0011	-0.0002	-0.0005	-0.0004	-0.0004	-0.0004	-0.0004
%	-25%	-25%	-15%	19%	-13%	-13%	0%	-1%	-22%	-22%	-23%	-24%
Q5												
Existing	0.0027	0.0032	0.0374	0.2550	0.3882	0.1975	0.0874	0.0831	0.0029	0.0044	0.0030	0.0025
Operations	0.0018	0.0019	0.0226	0.2307	0.3609	0.1829	0.0850	0.0823	0.0020	0.0028	0.0020	0.0018
Difference	-0.0009	-0.0013	-0.0148	-0.0242	-0.0273	-0.0146	-0.0025	-0.0008	-0.0009	-0.0016	-0.0010	-0.0007
%	-34%	-39%	-40%	-10%	-7%	-7%	-3%	-1%	-31%	-37%	-34%	-28%
Closure	0.0018	0.0021	0.0314	0.2430	0.3793	0.1941	0.0879	0.0826	0.0025	0.0034	0.0023	0.0018
Difference	-0.0009	-0.0011	-0.0060	-0.0119	-0.0089	-0.0034	0.0004	-0.0006	-0.0003	-0.0010	-0.0007	-0.0007
%	-33%	-35%	-16%	-5%	-2%	-2%	1%	-1%	-12%	-23%	-22%	-27%

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Q10												
Existing	0.0043	0.0051	0.1256	0.3564	0.7546	0.3103	0.0938	0.0853	0.0066	0.0121	0.0069	0.0059
Operations	0.0021	0.0027	0.0882	0.3171	0.6525	0.2907	0.0887	0.0834	0.0043	0.0071	0.0040	0.0021
Difference	-0.0023	-0.0024	-0.0374	-0.0393	-0.1021	-0.0196	-0.0051	-0.0018	-0.0023	-0.0051	-0.0029	-0.0038
%	-52%	-46%	-30%	-11%	-14%	-6%	-5%	-2%	-35%	-42%	-42%	-64%
Closure	0.0022	0.0029	0.1043	0.3485	0.7074	0.3047	0.0927	0.0847	0.0053	0.0093	0.0045	0.0026
Difference	-0.0021	-0.0022	-0.0213	-0.0079	-0.0472	-0.0056	-0.0011	-0.0006	-0.0013	-0.0028	-0.0024	-0.0033
%	-49%	-43%	-17%	-2%	-6%	-2%	-1%	-1%	-20%	-23%	-34%	-56%
Q20												
Existing	0.0053	0.0060	0.2166	0.4686	0.8440	0.3843	0.1336	0.0877	0.0088	0.0384	0.0083	0.0069
Operations	0.0031	0.0034	0.1592	0.3949	0.7760	0.3586	0.1192	0.0852	0.0057	0.0184	0.0051	0.0038
Difference	-0.0022	-0.0026	-0.0574	-0.0737	-0.0680	-0.0257	-0.0144	-0.0025	-0.0031	-0.0200	-0.0032	-0.0031
%	-42%	-43%	-27%	-16%	-8%	-7%	-11%	-3%	-36%	-52%	-39%	-45%
Closure	0.0030	0.0035	0.1828	0.4520	0.8248	0.3748	0.1275	0.0874	0.0073	0.0191	0.0053	0.0039
Difference	-0.0022	-0.0025	-0.0338	-0.0166	-0.0192	-0.0094	-0.0061	-0.0003	-0.0015	-0.0193	-0.0030	-0.0029
%	-43%	-42%	-16%	-4%	-2%	-2%	-5%	0%	-17%	-50%	-36%	-43%
Q50												
Existing	0.0060	0.0159	0.3499	0.7693	1.1267	0.5270	0.3226	0.2063	0.0537	0.2050	0.0295	0.0092
Operations	0.0036	0.0099	0.2483	0.6937	1.0161	0.4875	0.2820	0.1856	0.0471	0.1759	0.0182	0.0051
Difference	-0.0024	-0.0060	-0.1016	-0.0756	-0.1106	-0.0395	-0.0406	-0.0207	-0.0066	-0.0291	-0.0114	-0.0041
%	-40%	-38%	-29%	-10%	-10%	-8%	-13%	-10%	-12%	-14%	-39%	-45%
Closure	0.0036	0.0137	0.3042	0.7653	1.0986	0.5186	0.3126	0.1935	0.0494	0.1866	0.0244	0.0052
Difference	-0.0023	-0.0022	-0.0458	-0.0040	-0.0281	-0.0084	-0.0100	-0.0127	-0.0042	-0.0184	-0.0051	-0.0040
%	-39%	-14%	-13%	-1%	-2%	-2%	-3%	-6%	-8%	-9%	-17%	-43%

Table FLNRO.185-2. Predicted monthly flows (m^3/s) in Peterson Creek (Lower) at PC02.3 for existing conditions, end of operations and closure (Year 100).

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10-year Dry												
Existing	0.0007	0.0007	0.0009	0.0016	0.0042	0.0010	0.0810	0.0810	0.0007	0.0007	0.0007	0.0007
Operations	0.0004	0.0004	0.0004	0.0005	0.0012	0.0005	0.0806	0.0806	0.0004	0.0004	0.0004	0.0004
Difference	-0.0003	-0.0004	-0.0004	-0.0011	-0.0031	-0.0006	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003
%	-48%	-50%	-52%	-67%	-73%	-55%	0%	0%	-48%	-48%	-49%	-48%
Closure	0.0004	0.0004	0.0004	0.0044	0.0052	0.0017	0.0806	0.0806	0.0004	0.0004	0.0003	0.0003
Difference	-0.0004	-0.0004	-0.0004	0.0028	0.0009	0.0007	-0.0004	-0.0004	-0.0003	-0.0004	-0.0004	-0.0004
%	-51%	-52%	-49%	181%	22%	67%	0%	-1%	-50%	-51%	-51%	-50%
5-year Dry												
Existing	0.0008	0.0008	0.0010	0.0074	0.0346	0.0075	0.0811	0.0811	0.0008	0.0008	0.0008	0.0008
Operations	0.0004	0.0004	0.0005	0.0021	0.0225	0.0017	0.0807	0.0807	0.0004	0.0004	0.0004	0.0004
Difference	-0.0004	-0.0004	-0.0006	-0.0053	-0.0121	-0.0058	-0.0004	-0.0004	-0.0004	-0.0004	-0.0004	-0.0004
%	-52%	-52%	-55%	-72%	-35%	-77%	-1%	-1%	-51%	-51%	-52%	-51%
Closure	0.0004	0.0004	0.0005	0.0092	0.0296	0.0044	0.0807	0.0806	0.0004	0.0004	0.0004	0.0004
Difference	-0.0005	-0.0005	-0.0005	0.0018	-0.0050	-0.0031	-0.0004	-0.0005	-0.0004	-0.0004	-0.0004	-0.0004
%	-54%	-54%	-52%	25%	-14%	-41%	-1%	-1%	-52%	-53%	-53%	-53%
Q5												
Existing	0.0013	0.0015	0.0259	0.2403	0.3728	0.1885	0.0849	0.0816	0.0014	0.0025	0.0014	0.0012
Operations	0.0005	0.0005	0.0111	0.2002	0.3460	0.1739	0.0823	0.0809	0.0006	0.0011	0.0006	0.0005
Difference	-0.0008	-0.0010	-0.0148	-0.0401	-0.0268	-0.0145	-0.0026	-0.0008	-0.0008	-0.0014	-0.0009	-0.0007
%	-61%	-64%	-57%	-17%	-7%	-8%	-3%	-1%	-57%	-58%	-61%	-57%
Closure	0.0005	0.0005	0.0200	0.2316	0.3651	0.1826	0.0847	0.0811	0.0010	0.0018	0.0009	0.0005
Difference	-0.0008	-0.0010	-0.0058	-0.0087	-0.0077	-0.0058	-0.0002	-0.0005	-0.0004	-0.0007	-0.0006	-0.0007
%	-62%	-64%	-23%	-4%	-2%	-3%	0%	-1%	-30%	-30%	-39%	-59%

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Q10												
Existing	0.0034	0.0040	0.0998	0.3439	0.7139	0.2981	0.0893	0.0830	0.0042	0.0080	0.0053	0.0047
Operations	0.0006	0.0012	0.0731	0.3049	0.5996	0.2783	0.0842	0.0814	0.0018	0.0030	0.0023	0.0006
Difference	-0.0028	-0.0028	-0.0266	-0.0390	-0.1144	-0.0198	-0.0052	-0.0016	-0.0024	-0.0050	-0.0031	-0.0041
%	-83%	-70%	-27%	-11%	-16%	-7%	-6%	-2%	-57%	-62%	-58%	-88%
Closure	0.0006	0.0017	0.0899	0.3220	0.6545	0.2924	0.0898	0.0825	0.0027	0.0053	0.0031	0.0007
Difference	-0.0029	-0.0023	-0.0099	-0.0219	-0.0594	-0.0057	0.0005	-0.0005	-0.0015	-0.0028	-0.0023	-0.0040
%	-84%	-57%	-10%	-6%	-8%	-2%	1%	-1%	-35%	-35%	-43%	-86%
Q20												
Existing	0.0042	0.0047	0.1902	0.4219	0.8159	0.3664	0.1235	0.0848	0.0057	0.0356	0.0062	0.0054
Operations	0.0018	0.0022	0.1328	0.3639	0.7112	0.3451	0.1153	0.0822	0.0025	0.0165	0.0029	0.0025
Difference	-0.0023	-0.0026	-0.0575	-0.0581	-0.1047	-0.0213	-0.0082	-0.0026	-0.0032	-0.0192	-0.0033	-0.0029
%	-56%	-54%	-30%	-14%	-13%	-6%	-7%	-3%	-57%	-54%	-54%	-54%
Closure	0.0019	0.0023	0.1563	0.4052	0.7958	0.3573	0.1179	0.0853	0.0041	0.0171	0.0035	0.0026
Difference	-0.0023	-0.0024	-0.0339	-0.0167	-0.0201	-0.0091	-0.0056	0.0005	-0.0016	-0.0186	-0.0027	-0.0029
%	-55%	-52%	-18%	-4%	-2%	-2%	-5%	1%	-27%	-52%	-44%	-53%
Q50												
Existing	0.0047	0.0107	0.2956	0.7225	1.0590	0.5026	0.2949	0.1939	0.0497	0.1911	0.0202	0.0073
Operations	0.0023	0.0046	0.1961	0.6468	0.9482	0.4624	0.2541	0.1718	0.0431	0.1620	0.0087	0.0034
Difference	-0.0024	-0.0061	-0.0995	-0.0757	-0.1108	-0.0402	-0.0408	-0.0221	-0.0065	-0.0291	-0.0116	-0.0038
%	-52%	-57%	-34%	-10%	-10%	-8%	-14%	-11%	-13%	-15%	-57%	-53%
Closure	0.0024	0.0084	0.2497	0.7183	1.0306	0.4941	0.2848	0.1837	0.0454	0.1727	0.0150	0.0035
Difference	-0.0024	-0.0022	-0.0459	-0.0042	-0.0284	-0.0086	-0.0101	-0.0102	-0.0043	-0.0185	-0.0052	-0.0038
%	-50%	-21%	-16%	-1%	-3%	-2%	-3%	-5%	-9%	-10%	-26%	-51%

Table FLNRO.185-3. Low flow frequency for Cherry Creek below Pendleton Creek.

Month	7Q10 (m^3/s)	30Q10 (m^3/s)	7Q5 (m^3/s)	30Q5 (m^3/s)
November	0.016	0.044	0.019	0.037
December	0.012	0.054	0.014	0.039
January	0.012	0.041	0.014	0.029
February	0.010	0.036	0.012	0.028

2.3. Information Requirement Issue ID # FLNRO-186

(Memo received, filename: 0309_FLNRO_Surface Water Hydrology_FLNRO-185-188. pdf - please review for details of key issues): Provide standardized estimates of the change in timing of available flows, having as a minimum weekly time increment resolution, for the construction, operational, and post-closure stages of the mine. Include future considerations of climate change and groundwater losses/gains from the mine;

Response:

The water balance model (WBM) developed for the Project is set up on a monthly time step. The model is sufficiently discretized in time to support seasonal water management requirements for the site and potential effects on streamflows, including baseflows. As such, it includes groundwater losses/grains from the mine. However, the model is not suitable for short-term predictions on a weekly time increment.

Please refer to IR# FLNRO-185 for predicted flow metrics, including the 5-year dry and 10-year dry values for inflows to Peterson Creek at PC02.3 for existing, operational and post-closure conditions.

Additional quantitative consideration for climate change will be determined at the MA and EMA permitting stage of the project in coordination with regulators.

2.4. Information Requirement Issue ID # FLNRO-187

(Memo received, filename: 0309_FLNRO_Surface Water Hydrology_FLNRO-185-188. pdf - please review for details of key issues): Provide estimates of stream flow increases/decreases relating to impacts of mine footprint on groundwater contributions to stream flow, as in FLNRO-185 above

Response:

The site-wide water balance model (WBM) developed for the Project accounts for both surface flows and groundwater flows. Groundwater flows considered in the WBM include recharge on undisturbed ground, infiltration into the mine rock storage facilities, and seepage flows from the TSF. Therefore, groundwater contributions to streamflow are captured in the tables provided in IR# FLNRO-185. As streamflow during periods of low flow (i.e., late summer

through winter) is assumed to be almost entirely groundwater-fed, the impacts of the mine footprint on groundwater contributions to streamflow are captured in IR# FLNRO-185.

2.5. Information Requirement Issue ID # FLNRO-188

(Memo received, filename: 0309_FLNRO_Surface Water Hydrology_FLNRO-185-188. pdf - please review for details of key issues): Provide hydrologic effects of the mine, standardized as in FLNRO-185 above, on inflows to Jacko Lake (JACINF) and lake storage, using m^3/s and m^3 respectively, for operation, and post-closure stages. Relate these quantities to spatial and temporal effects on existing water licensing, incorporating the anticipated effects of climate change.

Response:

Predicted inflows into Jacko Lake are presented in Table FLNRO.188-1 for existing conditions, operations and post-closure conditions expressed as 5, 10, 20 and 50-year return periods. As described in IR# FLNRO-186, the water balance model (WBM) developed for the Project is set up on a monthly time-step and cannot provide predictions on a weekly time increment (e.g., 7Q5 estimates). As a result, low flow estimates are provided in the tables below as 5-year dry (1.25-year return period) and 10-year dry (1.1-year return period) values. Please note that these values do account for evaporative losses from the lake surface and seepage into the open pit during operations and closure.

Please refer to IR# MOE-009 (BGC 2016b) for discussion on the incorporation of evaporation and climate change scenarios in the development of the WBM for the Project. It is further noted that KAM and its consultants are currently working with regulators on a mitigation strategy that addresses potential impacts to existing water licenses on Peterson Creek.

Table FLNRO.188-1. Predicted monthly flows (m^3/s) at Jacko Lake for existing conditions, end of operations, and closure (Year 100).

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10-year Dry												
Existing	0.0022	0.0022	0.0030	0.0474	0.0241	-0.0041	-0.0193	-0.0169	-0.0088	-0.0004	0.0023	0.0022
Operations	0.0005	0.0005	0.0013	0.0421	0.0220	-0.0054	-0.0201	-0.0179	-0.0101	-0.0020	0.0005	0.0005
Difference	-0.0018	-0.0018	-0.0018	-0.0053	-0.0021	0.0013	0.0008	0.0009	-0.0013	0.0016	-0.0018	-0.0018
%	-79%	-79%	-59%	-11%	-9%	32%	4%	5%	15%	425%	-78%	-79%
Closure	0.0011	0.0011	0.0019	0.0426	0.0222	-0.0052	-0.0198	-0.0175	-0.0098	-0.0015	0.0011	0.0011
Difference	-0.0012	-0.0012	-0.0012	-0.0048	-0.0019	0.0011	0.0006	0.0006	-0.0010	0.0011	-0.0012	-0.0012
%	-52%	-52%	-39%	-10%	-8%	27%	3%	3%	12%	296%	-51%	-52%
5-year Dry												
Existing	0.0026	0.0026	0.0035	0.0736	0.0480	0.0066	-0.0164	-0.0145	-0.0063	0.0033	0.0026	0.0026
Operations	0.0008	0.0008	0.0017	0.0684	0.0427	0.0053	-0.0174	-0.0155	-0.0076	0.0016	0.0009	0.0008
Difference	-0.0018	-0.0018	-0.0018	-0.0052	-0.0053	-0.0014	0.0009	0.0010	0.0014	-0.0017	-0.0017	-0.0018
%	-68%	-68%	-52%	-7%	-11%	-21%	6%	7%	22%	-52%	-66%	-68%
Closure	0.0015	0.0014	0.0023	0.0693	0.0431	0.0054	-0.0173	-0.0154	-0.0074	0.0021	0.0015	0.0014
Difference	-0.0012	-0.0012	-0.0012	-0.0043	-0.0049	-0.0012	0.0009	0.0009	0.0011	-0.0012	-0.0011	-0.0012
%	-44%	-44%	-34%	-6%	-10%	-18%	5%	6%	17%	-37%	-43%	-44%
Q5												
Existing	0.0037	0.0038	0.0678	0.2475	0.3436	0.1691	0.0363	0.0160	0.0291	0.0382	0.0044	0.0037
Operations	0.0019	0.0020	0.0624	0.2365	0.3377	0.1657	0.0366	0.0141	0.0269	0.0359	0.0026	0.0019
Difference	-0.0018	-0.0018	-0.0053	-0.0110	-0.0059	-0.0034	0.0003	-0.0019	-0.0023	-0.0023	-0.0018	-0.0018
%	-49%	-47%	-8%	-4%	-2%	-2%	1%	-12%	-8%	-6%	-42%	-48%
Closure	0.0025	0.0026	0.0635	0.2366	0.3387	0.1663	0.0369	0.0145	0.0274	0.0366	0.0032	0.0025
Difference	-0.0012	-0.0012	-0.0042	-0.0109	-0.0049	-0.0028	0.0006	-0.0015	-0.0017	-0.0017	-0.0012	-0.0012
%	-32%	-31%	-6%	-4%	-1%	-2%	2%	-9%	-6%	-4%	-27%	-32%

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Q10												
Existing	0.0041	0.0045	0.1116	0.3451	0.6391	0.2713	0.0690	0.0454	0.0516	0.0744	0.0115	0.0042
Operations	0.0023	0.0027	0.1072	0.3302	0.6255	0.2669	0.0668	0.0429	0.0488	0.0715	0.0094	0.0024
Difference	-0.0018	-0.0018	-0.0043	-0.0149	-0.0136	-0.0044	-0.0022	-0.0025	-0.0028	-0.0029	-0.0021	-0.0018
%	-44%	-40%	-4%	-4%	-2%	-2%	-3%	-5%	-5%	-4%	-18%	-44%
Closure	0.0029	0.0033	0.1080	0.3347	0.6268	0.2681	0.0672	0.0435	0.0495	0.0722	0.0101	0.0030
Difference	-0.0012	-0.0012	-0.0035	-0.0104	-0.0123	-0.0032	-0.0018	-0.0020	-0.0022	-0.0022	-0.0014	-0.0012
%	-29%	-26%	-3%	-3%	-2%	-1%	-3%	-4%	-4%	-3%	-13%	-29%
Q20												
Existing	0.0044	0.0063	0.2021	0.3666	0.6846	0.3366	0.1122	0.0669	0.0710	0.0938	0.0196	0.0044
Operations	0.0026	0.0044	0.1946	0.3547	0.6606	0.3324	0.1093	0.0637	0.0682	0.0901	0.0169	0.0026
Difference	-0.0018	-0.0020	-0.0075	-0.0119	-0.0240	-0.0042	-0.0029	-0.0031	-0.0028	-0.0037	-0.0027	-0.0018
%	-42%	-31%	-4%	-3%	-4%	-1%	-3%	-5%	-4%	-4%	-14%	-41%
Closure	0.0032	0.0049	0.1959	0.3583	0.6674	0.3336	0.1101	0.0644	0.0688	0.0909	0.0177	0.0032
Difference	-0.0012	-0.0014	-0.0062	-0.0083	-0.0172	-0.0029	-0.0021	-0.0025	-0.0021	-0.0029	-0.0020	-0.0012
%	-27%	-23%	-3%	-2%	-3%	-1%	-2%	-4%	-3%	-3%	-10%	-27%
Q50												
Existing	0.0047	0.0176	0.2499	0.6146	0.9028	0.4448	0.2322	0.1682	0.0974	0.2557	0.0638	0.0055
Operations	0.0029	0.0151	0.2421	0.6008	0.8816	0.4357	0.2274	0.1630	0.0941	0.2494	0.0585	0.0037
Difference	-0.0018	-0.0025	-0.0079	-0.0139	-0.0212	-0.0091	-0.0048	-0.0052	-0.0033	-0.0062	-0.0053	-0.0018
%	-39%	-14%	-3%	-2%	-2%	-2%	-2%	-3%	-3%	-2%	-8%	-33%
Closure	0.0035	0.0160	0.2432	0.6064	0.8899	0.4385	0.2303	0.1640	0.0949	0.2505	0.0595	0.0043
Difference	-0.0012	-0.0015	-0.0068	-0.0082	-0.0129	-0.0063	-0.0019	-0.0043	-0.0025	-0.0052	-0.0043	-0.0012
%	-26%	-9%	-3%	-1%	-1%	-1%	-1%	-3%	-3%	-2%	-7%	-22%

2.6. Information Requirement Issue ID # FLNRO-196

KGHM must provide information on how low flows will be impacted at the inflow of Jacko Lake including ability of the watershed to provide full storage quantities in Jacko Lake to downstream licensees.

Response:

Please refer to IR# FLNRO-188. Currently, KAM and its consultants are working with regulators on a mitigation strategy that addresses potential impacts to existing water licenses on Peterson Creek.

2.7. Information Requirement Issue ID # FLNRO-203

Clarification is required on how the PCDP is intended to be established and used. Where will the initial water to fill PCDP come from? How will water levels in PCDP be maintained, and to what level? Will there be water stored at all times or will the PCDP be drained? If the intention is to store water in the balancing reservoir year round, a portion of the existing storage licences would need to be transferred to this new reservoir. If not, during winter months the gates would be open and water would be flowing through. This also has implications to the storage/release schedule that will need to be developed.

Response:

The initial water to fill the Peterson Creek Diversion Pond (PCDP) will come from the water intake on Kamloops Lake. The intake on Kamloops Lake will provide a maximum capacity of 1,500 m^3/h to the Project. At this pumping rate the pond, which has a proposed capacity of 68,000 m^3, could be filled within 48 hours although a slower fill rate would likely be employed. If Peterson Creek (Lower) was flowing during the period of filling, downstream flows would need to be maintained.

The intention is to store water year round in the PCDP. Thus, when flows are being released from Jacko Lake via the Peterson Creek Diversion System (PCDS), either because Jacko Lake water levels exceed an elevation of 892 masl or water is being released in the summer to meet downstream water license requirements, there would be no need for active management of the system. That is, water pumped out of Jacko Lake would gravity discharge through the PCDP spillway, which would be maintained at full pool. This system would minimize the operational requirements of the province-appointed water bailiff.

Low flow releases to meet downstream water licenses would cease toward the end of the summer (typically late August). At this time, water levels in the PCDP may fall slightly below the spillway invert elevation due to minimal inflow from the catchment area located between Jacko Lake and the PCDP and minor seepage losses. Norwest (S. Ennis, pers. comm.) has estimated seepage losses from the footprint of the PCDP at approximately 0.3 m^3/h, which is about 2,600 m^3 on an annual basis (please also refer to IR# FLNRO-198). Whether water levels fall below the spillway invert during this period will be dependent on how much of the upstream baseflow bypasses the pond versus discharging to the surface.

2.8. Information Requirement Issue ID # FLNRO-211

It is expected that seepage losses from Jacko Lake into the Open Pit will occur throughout the life of the project. KGHM must advise how this loss of storage water will affect existing water license holders.

Response:

Please refer to IR# DFO-004 for the quantification of seepage losses. Seepage losses will affect existing water license holders in that there is a loss of storage water, which would be replenished each spring but not report as runoff to downstream users. Currently, KAM and its consultants are working with regulators on a mitigation strategy that addresses potential impacts to existing water licenses and fish habitat on Peterson Creek.

2.9. Information Requirement Issue ID # FLNRO-219

Historical dataset – based on data which doesn't incorporate the closest available data. In fact, the closest available data are not even mentioned. Closest survey stations are at Lac le Jeune (lower- inactive, 50 years of data; upper- active).

Response:

Thank you for your comment. Appendix 6.4C discussed snow survey stations in the vicinity of the Project and it incorrectly stated that the nearest active manual snow course survey station is the Highland Valley station (ID No. 1C09A), located 40 km southwest of the study area. As noted in this IR the Lac Le Jeune (Upper and Lower) snow course stations are located closer to the study area. Additional information about these stations are provided in the following paragraphs.

The Lac Le Jeune (Upper) station (ID No. 1C25) is the closest active manual snow course survey station to the study area; it is located approximately 17 km southwest at an elevation of 1471 masl. This station has been in operation since 1972 and has 44 years of available historical snow course data. Normal snow water equivalent (SWE) depths are provided in Table FLNRO-219.1 for all survey periods. Based on these normals, the snowpack typically peaks between March 1st and April 1st and the snow is mostly melted by mid-May.

The Lac Le Jeune (Lower) manual snow course survey station was discontinued in 2007 but provided a historical snow survey record from 1956 to 2007 (51 years of data). This station is located just north of, and 100 m lower in elevation than the Lac Le Jeune (Upper) station. It is located approximately 16 km southwest of the study area at an elevation of 1370 masl. The snowpack at this station is generally shallower but follows the same temporal trend as the Lac Le Jeune (Upper) station in that the snow depths peak between March 1st and April 1st and the snowpack melts almost completely by the middle of May.

Table FLNRO-219.1. SWE Normals at Lac Le Jeune (Upper and Lower) snow course survey stations.

Snow Survey Period	Station SWE (mm)	
	Lac Le Jeune (Upper), 1C25	Lac Le Jeune (Lower), 1C07
January 1	69	53
February 1	98	74
March 1	120	89
April 1	127	86
May 1	30	11
May 15	22	5

2.10. Information Requirement Issue ID # FLNRO-221

The synthetic dataset for JACINF was produced using monthly derived relations between the long-term streamflow data from 08LF027 and the short-term streamflow data at JACINF. The resulting synthetic dataset provides monthly data. All Water Stewardship allocation decisions are made using 7Q5, 7Q10, etc low flow. These data are required so we can determine any impacts on existing licensees.

Response:

Please refer to IR# FLNRO-188.

2.11. Information Requirement Issue ID # MOE-011

Section 4.1 discusses the climate trends in the temperature and precipitation records collected at the Kamloops Airport (1951-2011). The report indicates that statistically significant trends (at the 10% confidence level) are apparent in the climate records resulting in an increase of 0.3 °C per decade in mean annual temperature, 10.9 mm increase in annual rainfall per decade and 7.3 mm decrease in annual snowfall per decade.

MOE requests that a representative climate change scenario be simulated for the water balance and water quality models to demonstrate the effects of potential climate change on the water quantity and water quality predictions for the project. MOE suggests that the input assumptions for the climate change scenario model reflect the statistically significant climate trends as discussed in Section 4.1 (summarized above).

Response:

As part of the site-wide water balance model (WBM), climate normals (1981 to 2010) from the Kamloops Airport climate station were compared to ClimateBC projections in air temperatures and precipitation for the region for the year 2085. Changes in temperature and precipitation will affect rates and timing of snowmelt and potential evaporation as discussed in IR# MOE-009 (BGC 2016b). The WBM has been refined since issuance of BGC, 2016b. Updated results are provided below.

As described in BGC (2015), changes in temperature and precipitation at the mine site were predicted for 2085 and compared to 1981-2000 climate normal using the ClimateBC model. For 2085 conditions, results from sixteen GCMs were averaged for the greenhouse gas emission scenario RCP 4.5 to predict future climate conditions at the mine site. Emission scenario RCP 4.5 assumes that anthropogenic greenhouse gas emissions pear around 2040 and then decline.

Figure MOE.011-1 shows the predicted increase in maximum, minimum and average temperatures in 2085 compared to the climate normals (1981-2010). July is expected to have the highest temperature increase for the 2085 predictions, with an increase of 3°C to 4.0°C, while January is predicted to have the lowest increase in maximum temperature of 1.0°C. Temperature predictions for 2085 suggest seasonal mean maximum temperatures could increase by an average of 1.8°C during the Winter, 3.1°C during the Spring, 3.8°C during the Summer and 2.4°C during the Autumn months compared to the seasonal mean maximum temperatures for the climate normal (1981-2010).

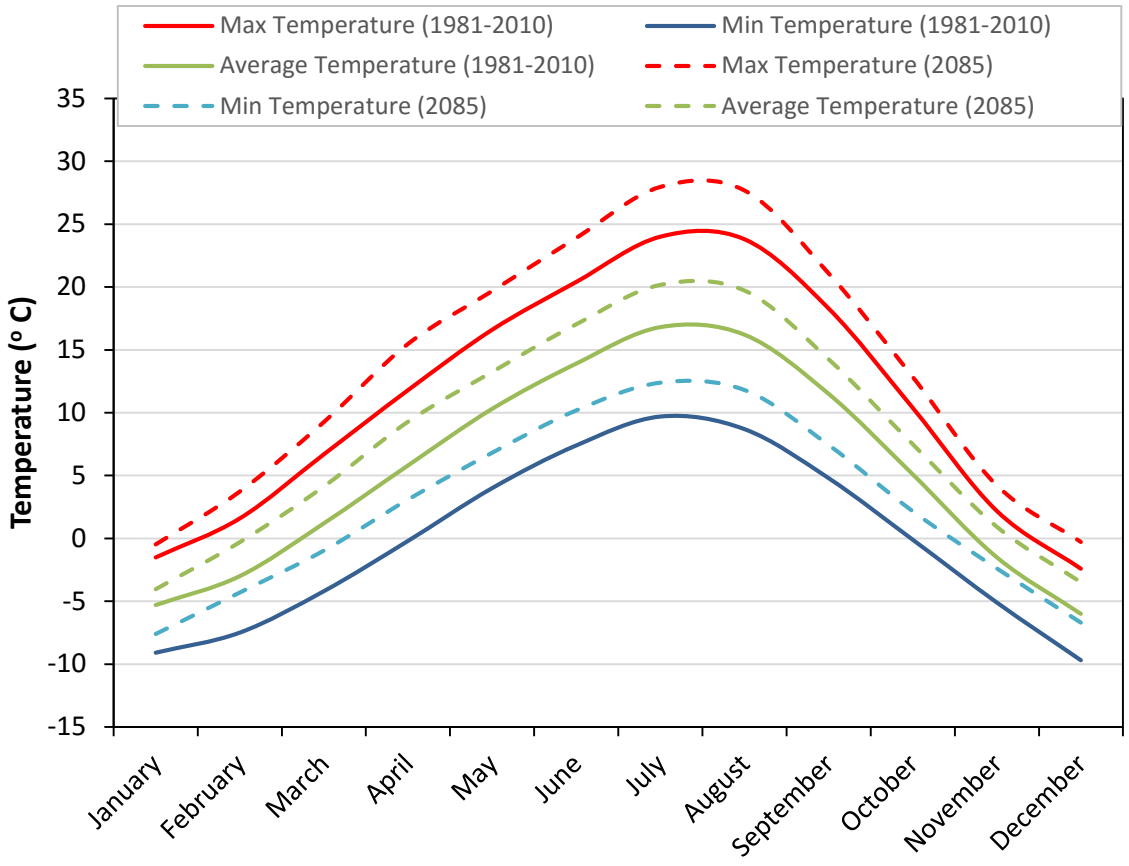

Figure MOE.011-1. ClimateBC results showing estimated seasonal normal temperatures (1981-2010) and predicted monthly temperatures in 2085.

Predicted monthly changes in precipitation between the climate normal and 2085 are shown in Table MOE.011-1. June and July predictions show the most significant decrease in

precipitation, 10.6 mm in July, while the most significant increase in predicted precipitation, 13.4 mm, is expected in December.

Table MOE.011-1. Predicted monthly changes in precipitation between climate normals (1981-2010) and 2085.

Month	Monthly Change in Precipitation between Normal (1981-2010) and 2085 (mm)
January	6.1
February	4.3
March	-1.6
April	2.6
May	-1.4
June	-8.1
July	-10.6
August	-4.6
September	-4.3
October	-0.8
November	1.4
December	13.4
Total	**-3.6**

To quantitatively evaluate potential changes in runoff volumes and patterns, the predicted changes in temperature and precipitation were input to the calibrated site-wide WBM for existing conditions (i.e., the updated WBM as described in BGC, 2016c). Two scenarios were evaluated: the first scenario considered only predicted increases in temperature, while the second scenario considered both increases in temperature and changes in precipitation (i.e., Table MOE.011-1). Results of the climate change analysis are shown in Table MOE.011-2 for Jacko Lake outflows and modelling node PC02.

Table MOE.011-2. Predicted average monthly flows under existing conditions and climate change.

Month	Jacko Lake Outflow (m^3/h)			PC02 (m^3/h)		
	existing	Δ temp	Δ temp + precip	existing	Δ temp	Δ temp + precip
January	0	0	0	7.5	7.7	7.9
Febraury	0	0	0	9.1	37.4	45.8
March	0	147	181	63.1	304.9	394.2
April	454	764	1,106	604	957	1,414
May	807	364	598	953	417	674
June	349	154	159	411	190	198
July	289	289	289	312	304	301
August	289	289	289	300	298	298
September	0	0	0	10.4	8.7	8.2
October	0	0	0	14.5	12.4	11.2
November	0	0	0	10.4	19.8	19.0
December	0	0	0	7.9	8.5	9.1
Average	**184**	**168**	**219**	**227**	**214**	**282**

With the projected increase in temperature, annual PET (including sublimation) is predicted to increase from 601 mm under existing conditions to 687 mm by 2085. Considering an increase in temperature only, annual runoff is predicted to decrease by approximately -9% at Jacko Lake and -5% at PC02. There is also a pronounced earlier onset in snowmelt with increased flows in March and April and decreased flows in May and June.

If both changes in temperature and precipitation are considered, runoff is predicted to increase by approximately 19% at Jacko Lake and 25% at PC02. This predicted increase in runoff can be attributed to increased winter precipitation with an additional 24 mm of precipitation forecast for the months of December to February (Table MOE.011-1). Because runoff in Peterson Creek is dominated by snowmelt, the increase in precipitation more than compensates for additional evapotranspiration losses.

Additional quantitative consideration for climate change will be determined at the MA and EMA permitting stage of the project in coordination with regulators.

3.0 CLOSURE

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