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Project Memorandum

To:	**KGHM Ajax Mining Inc.**	**Doc. No.:**	**BGC-018**
Attention:	**Nettie Ore, Nicola Banton**	**cc:**	
From:	**Cassandra Koenig, Craig Thompson**	**Date:**	**July 12, 2016**
Subject:	**Ajax Project EA/EIS - Responses to Information Requests ECCC-013, -014 and -015**		
Project No.:	**1125011-11-01**		

1.0 INTRODUCTION

The Environmental Assessment Certificate Application/Environmental Impact Statement (the Application/EIS) for the Ajax Project (the Project) was issued in January 2016 (KAM 2016). Following a review of the Application/EIS, comments and information requirements (IRs) were provided to KGHM Ajax Mining Inc. (KAM) from Environment and Climate Change Canada (ECCC).

This memorandum has been prepared to address IRs ECCC-013, 014 and -015.

2.0 INFORMATION REQUIREMENT RESPONSES

2.1. Information Requirement Issue ID # ECCC-013

"The EIS states, regarding 'Mine Rock Storage Facilities Case', [p. 6.3-71], "MRSF groundwater recharge values evaluated for sensitivity analysis were two times higher than base case values and the sensitivity case was run to assess the effects of mine rock closure cover performance on water quality predictions."

Sensitivity scenario selects 2x base case seepage rate; how does this relate to variability, i.e., 95% confidence interval around base case number? Explain the statistical context of a seepage rate 2x the base case rate."

<u>Response</u>

Infiltration and groundwater recharge at the mine rock storage facilities (MRSFs) was estimated using HYDRUS for a variety of cover scenarios (Appendix A of Appendix 6.4-C; Application/EIS) and material properties (BGC, 2016). Simulation results indicated that MRSF infiltration generally varied by a factor of 2 to 3 for a given scenario (i.e., uncovered mine rock versus covered mine rock); therefore, the same range was used for the sensitivity analysis. However, the geochemical source loading for the MRSFs used in the water quality assessments referenced in the reviewer's question was based on the average infiltration and was not adjusted for the sensitivity case infiltration rates (Section 3.5 of Appendix 6.3-C; Application/EIS). This results in additional conservatism in the water quality predictions for this sensitivity analysis as loading rates typically decrease with higher infiltration.

2.2. Information Requirement Issue ID # ECCC-014

"The EIS states, regarding 'Groundwater Assumptions Cases', [p. 6.3-71]; "Increasing and decreasing the hydraulic conductivity by a factor of 5 should result in an increase/decrease in groundwater flows, and should be reflected in the sensitivity of water quality predictions to changes in hydraulic conductivity." and "Increasing the TSF conductance by a factor of 10 increases the TSF seepage estimates; this sensitivity assessment was undertaken to assess the sensitivity of the predicted water concentrations to increased TSF seepage."

Sensitivity scenarios select 5x and 10x changes in hydraulic conductivity, and 10x change in TSF conductivity; how does this relate to variability, i.e., 95% confidence interval around base case number? Explain the statistical context of hydraulic conductivities 5x and 10x the base case values."

<u>Response</u>

Geometric mean hydraulic conductivity for Project area hydrostratigraphic units were provided in the Application/EIS (Figure 11 of Appendix 6.6-A; Figure 20 of Appendix 6.6-D). Confidence limits calculated at the 95% level (assuming a log normal distribution) for each hydrostratigraphic unit (Table 1) are generally within a factor of 5.

The tailings hydraulic conductivity (i.e., used to calculate the boundary conductance for the tailings storage facility or TSF) was assigned based on available estimates for the tailings. Meaningful statistical calculation of tailings hydraulic conductivity confidence limits cannot be performed at this time due to the limited dataset available. However, the representation of the TSF within the groundwater model incorporated several layers of conservatism (i.e., specified water level within the footprint of both the pond and tailings beach, assumed conventional tailings with larger TSF footprint rather than thickened tailings with a reduced TSF footprint, no seepage control measures, no decline in water level following closure), therefore simulations with the boundary conductance further increased were not performed.

Table 1. Statistical summary of hydraulic conductivity dataset.

Hydrostratigraphic Unit	Data Count	Hydraulic Conductivity (m/s)			
		Mean [c]	Mean + 95% C.I. [d]	Scale Factor [e]	Model [f]
Fluvial and Glaciofluvial Sands and Gravels	10	1.3E-05	4.7E-05	3.5	1.4E-05
Glacial Till, Diamicton and Undivided Glacial Material	33	1.0E-07	2.9E-07	2.9	1.7E-07
(Glacio)Lacustrine and Undivided Recent Lake Sediments [a]	1	1.0E-07	-	-	5.8E-07
Mine Rock and Anthropogenic Material	19	1.3E-05	8.2E-05	6.1	5.0E-07
Colluvium [a b]	1	9.3E-04	-	-	-
Undivided Surficial Deposits	21	4.0E-08	1.4E-07	3.4	5.8E-07
Nicola Group Volcanics and Sediments	65	1.9E-08	3.6E-08	1.9	1.0E-09 to 3.5E-09
Picrite	40	3.9E-08	8.0E-08	2.0	1.0E-09
Iron Mask Hybrid	54	5.4E-08	1.1E-07	2.0	1.0E-09
Sugarloaf Diorite	33	2.0E-08	3.2E-08	1.6	2.6E-08
Kamloops Group	28	1.3E-07	5.0E-07	3.8	1.0E-09
Undivided Bedrock	27	5.2E-08	1.3E-07	2.4	4.6E-10 to 5.8E-08

Notes

[a] *Sample n = 1 therefore 95% confidence interval not calculated.*

[b] *Hydrostratigraphic unit not explicitly defined within model.*

[c] *Geometric mean.*

[d] *95% C.I. = 95% confidence interval.*

[e] *Scale Factor = (Mean + 95% C.I.)/Mean.*

[f] *Calibrated model horizontal hydraulic conductivity*

[g] *Hydraulic conductivity data for each hydrostratigraphic unit were assumed to be log normally distributed.*

2.3. Information Requirement Issue ID # ECCC-015

"The EIS states, regarding 'Groundwater Assumptions Cases', [p. 6.3-71], "Another Base Case model groundwater assumption is that 20% of the macro flow in the MRSFs reports to the groundwater table and bypasses the downstream water management pond. The sensitivity assessment around this assumption included an increase of 20% in the macro flow bypassing the WMP in order to assess the sensitivity of the water quality predictions to this condition."

Sensitivity scenario incorporating 20% base flow bypassing WMP is unclear. Is 20% bypass part of base case and sensitivitiy scenario an additional 20%? Explain the sensitivity case more exactly; is the sensitivity scenario using 40% of macro flow or 24% of macro flow. "

Response

The base case water balance model (WBM) assumes that 10% of the water that infiltrates into the mine rock storage facilities (MRSFs) will pass through the facility along preferential flow paths (macro flow). Of this macro flow, 20% is assumed to infiltrate into the underlying soils (further details can be found in Section 6.2 of Appendix 6.4-C; Application/EIS). For the sensitivity case referred to in the comment, the proportion of water infiltrating into the MRSFs and contributing to macro flow was assumed to remain at 10%. However, in this case the proportion of macro flow infiltrating into the underlying soils was assumed to increase to 40% (Table 8-1 of Appendix 6.4-C; Application/EIS) (i.e. 20% of 10% for base case and 40% of 10% for sensitivity).

3.0 CLOSURE

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Yours sincerely,

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