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## **Project Memorandum**

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<b>To:</b>	<b>KGHM Ajax Mining Inc.</b>	<b>Doc. No.:</b>	<b>BGC-022</b>
<b>Attention:</b>	<b>Nettie Ore</b>	<b>cc:</b>	
<b>From:</b>	<b>Cassandra Koenig</b>	<b>Date:</b>	<b>December 13, 2016</b>
<b>Subject:</b>	<b>Ajax Project EA/EIS - Responses to Round 2 Information Requests from FLNRO</b>		
<b>Project No.:</b>	<b>1125011</b>		

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### **1.0 INTRODUCTION**

*An Application for an Environmental Assessment Certificate / Environmental Impact Statement for a Comprehensive Study* (the Application/EIS) was issued in January 2016 (KAM, 2016) for the Ajax Project (the Project). The Application/EIS is currently in the review phase, during which the Environmental Assessment Office (EAO) reviews all available information and seeks input from Aboriginal groups, all levels of government and the public to identify potential environmental impacts of the Project. The review phase includes technical review through an iterative comment-response process (i.e., Round 1 and Round 2), followed by the preparation of an Assessment Report by EAO (the Assessment Report). The Assessment Report documents the results of the review phase and is used by BC Provincial Ministers to aid their decision about whether to approve the Project (EAO, 2016).

Round 2 comments and commenter Information Requests (IRs) related to groundwater quantity were provided to KGHM Ajax Mining Inc. (KAM) by the following parties:

- the Stk'emlupsemc Te Secwepemc Nation (SSN);
- the Ministry of Forests, Lands & Natural Resource Operations (FLNRO);
- SLR Consulting (SLR) on behalf of the City of Kamloops (COK); and
- the COK.

This memorandum has been prepared by BGC Engineering Inc. on behalf of KAM, and provides responses to Round 2 comments received from FLNRO (the reviewer). The memorandum includes:

- A general response to supplementary memo 0831\_FLNR\_HG prepared by FLNRO dated September 28, 2016 (Section 2.1); and
- Individual responses to Round 2 comment ID Nos. FLNRO-005.1, FLNRO-006.1, FLNRO-009.1, FLNRO-013.1, FLNRO-031.1, FLNRO-052.1, FLNRO-053.1, FLNRO-060.1, FLNRO-062.1 and FLNRO-063.1 (Section 2.2).

## **2.0 INFORMATION REQUIREMENT RESPONSES**

### **2.1. Supplementary Memorandum 0831\_FLNR\_HG**

#### **2.1.1. Summary of Issues Raised and General Response**

The overarching issues raised within Supplementary memo 0831\_FLNR\_HG include:

1. A suggestion to revise and update the existing surface water and groundwater monitoring and management plan (SWGMMMP) at the current application review stage.
2. Request for a commitment to update and recalibrate the numerical groundwater flow model annually (by a qualified professional with competency in hydrogeology) during construction and operation phases.
3. Identification of the need for KAM to acquire authorization under the Water Sustainability Act (WSA) for the diversion and use of water from a stream or groundwater for the purpose of water use within the mine site.

The above-noted issues were raised as concerns by FLNRO and other reviewers as Round 1 comments during the review of the Application/EIS. KAM has previously responded to these issues through various supplementary memoranda and individual responses within the working group tracking table. Based on ongoing correspondence on these matters, it appears that the alignment of planned groundwater investigations with Project phasing and permitting needs may not be clear. Additional field studies that will address the reviewer's stated concerns will be completed according to timelines associated with Permitting (i.e., Mine Act (MA) and Environmental Management Act (EMA) and WSA), as well as Detailed Engineering, which would occur before the Project construction phase and/or any mining activity. In addition, it is understood that the SSN prefer KAM only undertake studies that are immediately necessary; this proposed timing is therefore beneficial to First Nations' interests, as it would minimize disturbance to culturally sensitive areas.

At this time, the level of study completed for the Project (i.e., for the Application/EIS and in response to IRs) fulfill the requirements of an EA, which is to identify and understand the significance of potential effects and mitigations. This is discussed in detail in Section 2.1.2 and Section 2.2. The proposed sequencing of groundwater quantity studies to be completed after a decision on the EA is made (and before any mining activity) is provided in Section 2.1.2.

The general response to the issues raised in 0831\_FLNR\_HG is as follows:

- The existing SWGMMP (i.e., Section 11.24 from the Application/EIS) is sufficient for the Ajax Application/EIS, and updates to the plan can be completed at future stages of the Project. Much of the information needed to guide monitoring plan updates will not be available until future phases of the Project (i.e., Detailed Engineering and/or Permitting) are complete. As well, the level of detail in the existing SWGMMP is commensurate with (and possibly in excess of) what is typically required of mining proponents to obtain an EA Certificate in BC (discussed further in Section 2.1.2).

- KAM is committed to re-calibrating and updating the numerical groundwater flow model as-needed as the Project moves forward. However, an annual commitment is onerous and of little value if monitoring results do not support a need to revise the conceptual hydrogeologic model. As per the BC MOE (2012) Guidelines, KAM will update the groundwater model if the mine plan (or, for example, a seepage mitigation design) has changed and/or new field data indicate that the existing conceptual hydrogeologic model may no longer be valid in specific areas of the project. In the absence of such data from monitoring or construction suggesting the need for more immediate review of the conceptual hydrogeologic model and/or numerical model, KAM considers a model review and update (if deemed necessary by the review) every 5 years, to be a more reasonable requirement for Ajax. Updates (if needed) would reflect actual conditions encountered during mining, and would be submitted with the 5-year mine plan, as is common practice in BC.
- Similar to the requested update to the SWGMMP, information needed to complete permit applications under the WSA will not be available until Detailed Engineering and/or Permitting for the Project is complete. This would include detailed plans for water diversion and dewatering, which are not typically determined at, nor needed, other than to a conservative conceptual level to evaluate project effects, for the EA stage of a project in BC.

Although an official update to the SWGMMP is not required for the EA, KAM has commenced its update to the SWGMMP for Permitting. Table A-1 (Appendix A) of this memo includes a preliminary schedule and revised locations for groundwater monitoring at the Project. Note that baseline monitoring at these locations is currently underway and will continue into the Permit Application phase. For Permit Applications, monitoring locations will be reviewed and an official update to the SWGMMP will be prepared.

A more detailed summary of the specific issues raised in 0831\_FLNR\_HG and KAM's responses are provided in Table 1.

#### 2.1.2. Level of study completed on the Ajax Project to date

As demonstrated in the numerous supplementary response memoranda prepared during the Application/EIS review, KAM is committed to completing additional studies to investigate common areas of concern raised by Aboriginal groups, regulatory bodies and the general public in relation to potential impacts on groundwater quantity. These include aspects of the issues raised in 0831\_FLNR\_HG and noted above.

However, the level of groundwater quantity investigations, modelling and detail of the monitoring plan developed for the Application/EIS is more than adequate for bracketing the range of potential mining effects to groundwater quantity due to the Project for an Environmental Assessment (EA) Certificate. Additionally, the area is culturally sensitive to the SSN, and it is understood that the SSN prefer that additional studies are only undertaken if they are immediately necessary.

The anomalous rigour of groundwater quantity studies and monitoring plans completed for the Ajax Project Application/EIS is demonstrated by reviewing the detail of study deemed acceptable for other mine projects in BC that have recently been awarded EA Certificates. Two examples of this include the Brucejack and KSM Projects (near Stewart BC).

The groundwater monitoring plan prepared for the Brucejack Project EA application (Pretium 2014) is limited to brief descriptions and timelines for work to be completed, and is significantly less detailed than what has already been prepared for the Ajax Application/EIS. The Brucejack Project monitoring plan for groundwater was captured under the Water Management Plan, and at the EA application level provided the general philosophy, methodology and practices that would be used to develop a monitoring plan for the Project. The EA Certificate that was issued for the Brucejack Project included specific conditions and schedules for updating their monitoring plans going forward, and development of specific groundwater monitoring points and rationale was reserved until the permit application stage.

The KSM Project EA Application considered 3 proposed open pits, a block cave mine development, and an out-of-catchment tailings impoundment area among other infrastructure (Seabridge 2013). The assessments completed for groundwater quantity and quality as part of the KSM EA Application were also considerably less detailed than what has been completed for Ajax, despite being a much larger project. Hydraulic testing for KSM was limited to constant head injection (i.e. packer tests) and “point scale” single well response tests (“slug” and “bail” tests). No larger scale estimates of aquifer properties were obtained by pumping tests on this project. The Monitoring plan for KSM was considerably less detailed than what was prepared for Ajax, and consisted of only 8 monitoring locations over construction, operations, closure and post closure (Seabridge 2013).

### 2.1.3. Proposed Schedule for Additional Study

As outlined in EAO (2016), and, as demonstrated by the above examples, precedent exists for mining proponents in BC to complete technical studies identified from concerns raised during an EA review at future stages of a project (i.e., prior to construction), and according to a schedule set out by EAO.

It is therefore proposed that, as with other projects that have been granted EA Certificates in BC, KAM could complete additional groundwater quantity investigations, modelling and monitoring plan updates suggested in this memorandum (and in other responses provided to previous IRs received) as part of studies to support post EA Certificate activities (i.e., as summarized in Step 8 in EAO (2016)).

The Project phases and permitting that are to follow the EA review include:

1. Mine Act (MA) and Environmental Management Act (EMA) Permit Application
2. Detailed Engineering
3. Pre-construction
4. Construction/Operations

Specific timelines for the above Project milestones have not been finalized and are subject to change while KAM works on ongoing optimizations of the Project and on concerns raised in the review of the Application/EIS. However, KAM expects that studies to be carried out as part of MA/EMA Permitting (i.e., Milestone no. 1) will be completed after the EA is complete, and studies to support Detailed Engineering (i.e., Milestone no. 2) will be completed following the MA/EMA Permit Application. As some Detailed Engineering information is typically required for the permit application process, KAM intends to complete relevant supporting studies specific to MA/EMA Permitting prior to those specific to Detailed Engineering.

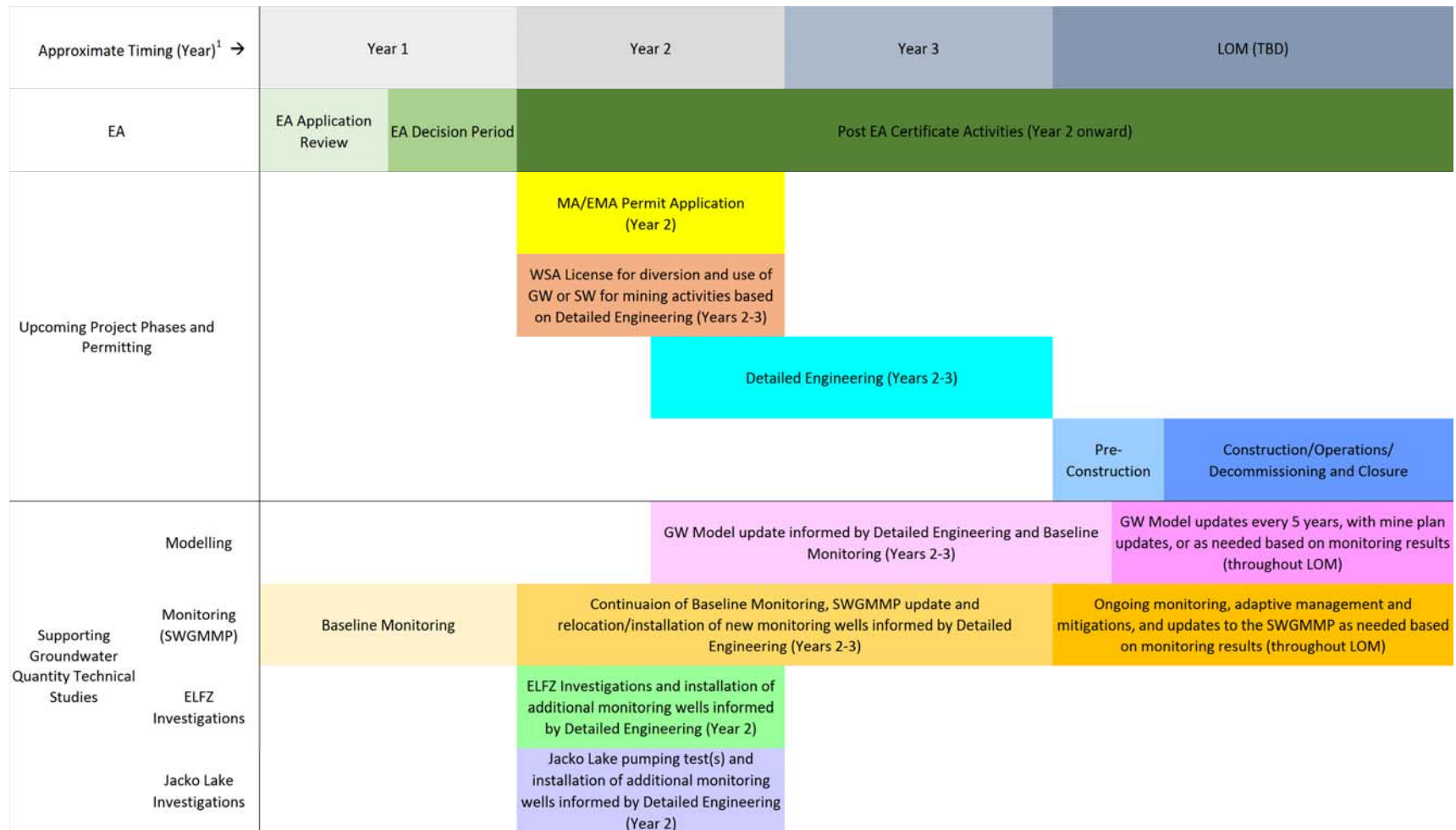
Note that baseline monitoring for the Project (not mentioned above) is currently underway at the locations in Table A-1 (Appendix A), which includes a preliminary update to the groundwater monitoring schedule. Monitoring at these locations will continue into the Permit Application phase, at which time KAM anticipates fully updating and implementing the existing SWGMMP.

With regards to additional field studies suggested by FLNRO, a clear timeline over which the activities should take place has not been proposed. Much of the suggested work was requested to be completed during the Application/EIS review stage; however, FLNRO also requests that some work be completed prior to relevant construction and operation activities and/or baseline monitoring. Nevertheless, KAM is of the position that the work proposed in Supplementary memo 0831\_FLNR\_HG is not required until at least the Project Construction/Operations phase. Further detail on this rationale is provided in Table 1.

A proposed preliminary schedule integrating the concerns raised by FLNRO is provided in Figure 1.

**Table 1: Summary and proposed schedule to address issues Raised in 0831\_FLNR\_HG**

Category	Description	FLNRO Requested Schedule	Required Schedule (from Technical Basis/Rationale)	Proposed Schedule	Technical Basis/Rationale driving schedule	Reference / Example Mining Project in BC	Notes
GW Model Update	Commitment to update and recalibrate the GW model by a QP with competency in hydrogeology	Annually, during construction and operation phases	Construction/Operations with updates through life of mine (based on changes to the mine plan and as needed based on updated monitoring results)	Permit Application with required updates through life of mine (every 5 years based on changes to the mine plan and more frequently if needed based on annual monitoring results reviewed by a 3 <sup>rd</sup> party Qualified Professional)	Model updates will be made if the mine plan (or, for example, a seepage mitigation design) has changed and/or new field data indicate that the existing conceptual hydrogeologic model may no longer be valid. A model review and update (if deemed necessary by the review) every 5 years is a reasonable requirement for Ajax. Updates (if needed) would reflect actual conditions encountered during mining, and would be submitted with the 5-year mine plan, as is common practice in BC.	Brucejack Project (Pretium, 2014)	
SWGMMMP Update	Additional monitoring stations for monitoring Jacko Lake Seepage to replace wells that will be destroyed	Unclear as stated by reviewer (1- Application Review Stage; 2-Prior to relevant construction and operation activities; 3-baseline monitoring)	Detailed Engineering and/or Permitting	Permit Application	Detailed Engineering will dictate optimal design of the open pit. Final monitoring wells and VWP locations for Jacko Lake-Pit interactions should be installed after infrastructure design details are finalized in order to minimize unnecessary environmental disturbance and number of instruments to be decommissioned. This level of design is typically available at the Permit Application phase. Detailed monitoring system design in this area of the Project for groundwater will be supplemented by instrumentation installed in the pit walls to measure pore pressures for geotechnical and mining safety purposes. Integration, refinement and optimization of these monitoring systems to avoid overlap and unnecessary expense or redundancy must necessarily await Detailed Engineering designs and for regulatory review (i.e., MEM) of proposed monitoring plans based on these designs at the permit application stage.	Brucejack Project (Pretium, 2014); KSM Project (Seabridge, 2013)	FLNRO's request for targeting specific bedrock units is not warranted from a technical standpoint. Seepage monitoring in bedrock will be governed by fracture flow and not rock type. See response to FLNRO-031.1
SWGMMMP Update	Revise commitment in existing SWGMMMP to monitor Jacko Lake Seepage Wells through decommissioning and closure	Application review stage	N/A	Permit Application	See technical rationale driving schedule for other SWGMMMP updates, which require information from Detailed Engineering phase of the Project.	N/A	Commitment to be included in the updated SWGMMMP. These wells are currently being monitored as a part of the baseline program. See Table A-1 for preliminary update to groundwater monitoring schedule.
SWGMMMP Update	Include ELFZ in overall groundwater monitoring program as well as individual hydraulic feature. Install additional wells to collect baseline data.	Application review stage	Detailed Engineering and/or Permitting	Permit Application	Detailed Engineering design of the site water management is not complete and is needed in order to locate wells strategically so they are not destroyed by the optimized locations of the mine infrastructure. This level of design is typically available at the Permit Application phase. It is prudent to await optimal design in order to minimize unnecessary environmental disturbance and number of instruments to be decommissioned.  In fact, installation of additional groundwater monitoring points for any of the proposed water management ponds would be more appropriate upon completion of detailed investigation and construction of these facilities. This allows the locations of any additional monitoring points to be informed by the improved understanding of the local scale geology and hydrogeology thus gained	Brucejack Project (Pretium, 2014); KSM Project (Seabridge, 2013)	The existing SWGMMMP has 12 locations installed to specifically monitor the ELFZ. See response to FLNRO-006.1. These locations are currently being monitored as part of the baseline program. See Table A-1 for preliminary update to groundwater monitoring schedule.
SWGMMMP Update	Provide supporting data for groundwater license applications under the WSA, as applicable	Application review stage	Detailed Engineering and/or Permitting	Permit Application	Final plans for water diversion will be determined as a part of the permitting process. Permitting under the WSA cannot be completed before plans are finalized. Supporting groundwater data for the WSA application is currently being compiled from existing wells on site. Data from specific wells to support the WSA application will be identified and submitted as part of the Permit Application.	Brucejack Project (Pretium, 2014); KSM Project (Seabridge, 2013)	
WSA Act and Groundwater	Obtain WSA License for diversion and use of GW or SW use for mining activities	Permit Application	Detailed Engineering and/or Permitting	Permit Application, prior to Construction	Final plans for water diversion will be determined as a part of Detailed Engineering and/or MA/EMA Permitting. Permitting under the WSA cannot be completed before plans are finalized.	N/A	KAM will consider open pit lakes as a groundwater source as opposed to a surface water source.



Notes:

1. Groundwater studies to be completed concurrent with permitting activities will commence when the Proponent elects to proceed to permitting (i.e., the beginning of Year 2 coincides with the timing of the decision to begin permitting, not necessarily with the end of Year 1).

**Figure 1: Summary of EA timeline, upcoming Project phases and proposed timeline to complete additional groundwater quantity studies**

#### 2.1.4. Summary

- Sufficient work has been completed on the Ajax Project in regards to predicting the range of potential impacts to groundwater quantity in the Application/EIS. The conceptual hydrogeologic model developed for the site is robust and predicated upon significant baseline data collection efforts and monitoring. Best estimates of potential effects have been predicted using a numerical groundwater flow model that has been rigorously calibrated to the robust baseline dataset. Areas of potential uncertainty in the modelling work have been identified, quantified using targeted sensitivity studies and assessed in the Application/EIS. Through the IR process, additional effects assessment work has been completed in some of these areas and KAM has committed to completing specific hydrogeologic studies that will further reduce the uncertainty bracket associated with these areas (e.g., Jacko Lake and the Open Pit, the ELFZ).
- The Ajax Project has been subjected to a high level of scrutiny, which has driven even more thorough groundwater quantity studies during the Application/EIS review.
- The level of groundwater quantity studies completed to date for the Ajax Project (i.e., for the Application/EIS itself and subsequent Round 1 review) is commensurate with, and in some cases beyond what has been deemed acceptable for other mine projects in BC recently awarded EA Certificates.
- Many of the Reviewer's requests require input from the Detailed Engineering phase of the Project which is scheduled to begin in tandem with Permitting.
- KAM would like to request that additional work suggested in this memorandum (and in other responses provided to previous IRs received) be deferred to later stages (i.e., after the EA is complete) as has been done with similar projects.
- KAM has proposed a preliminary schedule in which to complete additional groundwater quantity studies, alongside forecasted future Project phases. Further, this schedule balances the need to minimize uncertainty in predictions of project effects (thus minimizing the risk of environmental harm as a result of project construction and operation) with the needs to respect SSN wishes and to minimize disturbance of the project area during the study phase.
- KAM wishes to work collaboratively with FLNRO and EAO to revise the schedule proposed in this document.

#### 2.2. Individual Responses to Round 2 Comments received from FLNRO

The various Round 2 comments received from FLNRO are copied below, and are followed by KAM's responses. Round 1 comments and responses are not reproduced herein but may be reviewed in the referenced Round 1 supplementary memoranda as well as the EA review comment tracking sheet for the Project.

### 2.2.1. Response to FLNRO-005.1

*FLNRO.005.1: Within BGC-002, the proponent has supplied a conceptual model of groundwater flow in and around the ELFZ and Jacko Lake. The proponent demonstrates intent to conduct physical monitoring to verify the conceptual model and numerical model predictions (S 2.2.4). The intent to develop specific monitoring and mitigation triggers is less certain. The monitoring program to consider groundwater transport pathways along the ELFZ and between the TSF, WMRSF and SMRSF and Jacko Lake should be sufficiently robust, in conjunction with the current and future modelling predictions, that the proponent is able to commit to developing specific monitoring triggers (quality and elevation) at the permitting stage, to guide mitigation. See also memo 0831\_FLNR\_HG.*

#### Response:

The Proponent agrees with the reviewer that the plan for groundwater monitoring along the ELFZ and between the TSF, WMRSF and SMRSF and Jacko Lake will need to be sufficiently robust so that specific monitoring triggers (quality and hydraulic heads) can be defined to guide mitigations at the MA/EMA Permit Application stage of the Project. However, the Proponent advocates that the existing SWGMMP that was submitted as part of the Ajax Application/EIS is adequate for the purposes of the Environmental Assessment. In addition, KAM has completed a preliminary update to the groundwater monitoring schedule, and has been actively collecting data at the locations summarized in Table A-1 (Appendix A) since 2014.

The provision for adaptive management is included in the existing SWGMMP, allowing sampling locations and frequency to be altered, if necessary, to suit conditions encountered at any stage of mining. Appropriate mitigations will be developed based on actual conditions encountered. It is noted that the existing SWGMMP is currently under revision, and an update will be submitted at the MA/EMA Permit Application stage of the Project. This approach is common practice in BC (e.g., Seabridge (2013), Pretium (2014) and was discussed previously in Section 2.1.2).

However, in response to the reviewer's specific concerns, KAM has already committed to completing additional investigations of the ELFZ trace between Jacko Lake and the TSF at future stages of the Project (i.e., during or in support of MA/EMA Permit Application and post-permitting as part of Project construction (e.g., to support TSF seepage collection pond design, optimization and construction)). This work will include:

- Relocation of some monitoring points that would need to be decommissioned due to slight changes in mine infrastructure footprints (e.g., BGC-14-012D/S and BGC14-003D/I/S around the WMRSF/TSF and BGC14-016 and BGC14-014D/S around the SMRSF). The appropriate time for installation of any relocated or new monitoring points would be post permit application with sufficient time to establish a reasonable baseline data set (i.e., 1 year prior to decommissioning of the existing points).
- Additional groundwater monitoring locations for the areas between Jacko Lake and the proposed WMRSF, and southeast of the SMRSF and ELFZ trace. The need, timing, location and rationale for any such monitoring points would necessarily be informed by the additional hydrogeological investigations already committed to for some of these areas.

- Hydraulic conductivity testing, as described in Supplementary Memorandum 0706\_KAM\_BGC-17.pdf.

It is proposed that this work would be a condition on the EA Certificate and would be completed in time to inform monitoring and management planning at the Project permitting stage (Table 1, Figure 1).

#### 2.2.2. Response to FLNRO-006.1

FLNRO-006.1: See FLNR-0831-HG

Response:

The expressed concern within this comment is with regards to whether the ELFZ has been adequately characterized as a preferential conduit for groundwater (see also FLNRO-006 and documented response within 0706\_KAM\_ELFZ\_Model\_BGC-002). The concern as stated within FLNR-0831-HG is as follows:

*FLNR-0831-HG (Page 2): The revised GWQMMP needs to consider the ELFZ in the general case and specifically per the proponent response BGC-002. From that, it is understood the existing monitoring program will be augmented to "specifically consider the potential groundwater transport pathways along the ELFZ and between proposed mine infrastructure (TSF, WMRSF and SMRSF) and Jacko Lake".*

*Currently the ELFZ footwall is mentioned as partial rationale for two nested groundwater monitoring locations (four monitoring wells). The ELFZ needs to be included as part of the overall groundwater monitoring program, as well as an individual hydraulic feature.*

The Proponent agrees with the reviewer that (based on the data and studies available to date) the prudent course at this time is assume that the ELFZ is a potentially conductive hydraulic feature and to include for monitoring of this feature as part of the overall groundwater monitoring program. The ELFZ has been included as such in the existing SWGMMP (Table A-1, Appendix A), with twelve (12) monitoring locations specifically for monitoring groundwater within the feature. These locations are located:

- Between the WMRSF and Jacko Lake at BGC14-001D and BGC14-002D/S, for monitoring water levels and quality in the footwall (BGC04-001) and hanging wall (BGC14-002D/S) of the ELFZ.
- Between the WMRSF and Jacko Lake at DH-BGC15-01 and DH-BGC15-02 for monitoring water levels using a total of six vibrating wire piezometers (VWPs).
  - Three installed VWPs at DH-BGC15-01 will monitor pressures within both the potential fault zone and footwall rockmass per structural Interpretation 1 in Appendix 6.2-B of the Application/EIS (i.e., a Northeast dipping ELFZ) or pressures in the potential fault zone per drilling section Interpretations 2 and 3 (Southwest dipping ELFZ and near-vertical, wider ELFZ).

- Three installed VWP's at DH-BGC15-02 will monitor pressures in the hanging wall rockmass, as faulting was not encountered at this location.
- Southeast of the SMRSF at BGC14-013 and BGC14-015D/S for water levels and quality in the footwall (BGC14-013) and hanging wall (BGC14-015D/S) of the ELFZ.

Monitoring is planned to be conducted at these 12 locations throughout all phases of the Project.

As discussed in the Proponent's response to FLNRO-005.1, the SWGMMP will be updated as part of the MA/EMA permitting process. It is also noted that KAM has committed to conducting additional hydrogeologic investigations, including a pumping test in the ELFZ between the TSF and Jacko Lake. Additional wells and instrumentation would be installed as part of any such investigation. An update to the monitoring strategy must consider the results of these findings and be adapted accordingly; therefore, updates to the monitoring strategy prior to the completion of these studies would not only result in unnecessary expense, it is contrary to the preference of the SSN that additional field work be conducted only as immediately necessary (i.e., due to the cultural sensitivity of the area). As stated previously, it is proposed that additional field work would be a condition on the EA Certificate and would be completed in time to inform monitoring and management planning at the MA/EMA Permit Application stage (Table 1, Figure 1).

#### 2.2.3. Response to FLNRO-009.1

*FLNRO-009.1: The proponent has clarified that a hydraulic connection exists between Peterson Creek and the Peterson Creek Aquifer, and that the pumping test shows a 'damped' connection. It is understood that ongoing monitoring of existing and future stations will allow for verification of modelled recharge and discharge zones, and also for adaptive management decisions to be made. See also FLNR-016.*

#### Response:

Thank you for the comment. The reviewer is correct in stating that monitoring of existing and future stations will allow for verification of modelled recharge and discharge zones, and also for adaptive management decisions to be made. No action is required to address comment FLNRO-009.1. The reviewer is directed to the working group tracking table for a response regarding FLNRO-016 and subsequent follow-up.

#### 2.2.4. Response to FLNRO-013.1

*FLNRO-013.1: It is understood that PW-01 was constructed primarily as a prototype dewatering well. Note that diversion of water to prevent it from entering a mine site, under the WSA, is an activity requiring authorization. See FLNR\_0831\_HG. No further comments.*

#### Response:

It is noted that diversion of water to prevent it from entering a mine site is an activity requiring authorization under the WSA, as indicated in the commenter's memo. We note that the WSA

came into force during the review stage of the Application/EIS. However, final plans for managing the diversion and use of water resources will be determined as part of Detailed Engineering and/or Permitting for the Project (Table 1, Figure 1).

All regulatory permits and authorizations deemed necessary to complete water diversion and dewatering activities (including activities described under the WSA) will be obtained at the permitting phase of the Project and prior to Construction (see Figure 1). No further action is required for the EA.

#### 2.2.5. Response to FLNRO-031.1

*FLNRO-031.1: KAX-14-121 is one of four monitoring locations proposed to monitor seepage from Jacko Lake to the open pit. As such, and given the new model results showing a potential of double or more the seepage rate, it is important to understand which unit it is completed in, or provide some rationale for assigning it to one unit or the other. If it is not understood then predictions about seepage may be difficult to monitor. It may be necessary to decommission this location and recomplete. See also FLNR-0831-HG.*

Response:

The screen at KAX-14-121 is completed within bedrock and across a hybrid lithology of the Sugarloaf Diorite (SLD) containing Picrite, and Nicola Volcanics (NV). The well is not completed in a single unit, but instead across contacts that contain fractures and a potential shear zone. As discussed within the Application/EIS, groundwater flow (and therefore seepage) through bedrock will be controlled by fractured and/or faulted zones, which are expected to have locally enhanced hydraulic conductivity with respect to the adjacent competent rock mass. While distinct rock units were included in the groundwater conceptual and numerical hydrogeologic models, they are not conceptualized as isolated and distinct aquifers. That is that groundwater flowing in the NV may, relatively speaking, easily flow along fractures into a fault zone or adjacent SLD or Picrite unit along its flow path and back into the NV unit. As such, installation of the well screen across different rock types is not considered to represent a well screen that is cross-connecting distinct aquifers.

The utility of a monitoring well network that is installed solely to monitor a specific bedrock unit is low if the objective of the well is to monitor for potential seepage quantities; this is because, at the local scale, seepage monitoring wells must be located in known zones of enhanced hydraulic conductivity where groundwater will flow. At the Ajax site, discrete zones of locally enhanced hydraulic conductivity are known to occur in faulted zones and at contacts between the different lithologic units, particularly at contacts between the SLD/Picrite/NV units encountered near the mineralized area. Therefore, monitoring wells completed in such zones should be considered a necessary aspect of the groundwater monitoring well network design for the Ajax Project.

In summary, the completion lithology is understood at KAX-14-121 and recompletion for seepage monitoring at this specific location is not reasonable.

#### 2.2.6. Response to FLNRO-052.1

*FLNRO-052.1: Drawing 6 does not identify hydrostratigraphy but i assume this unit is the occurrences of grey-shaded "C" on Drawing 07 that is surrounded by 'undivided glacial deposits'. This unit is widespread, covers the entire project area and is present within all areas proposed to contain mine infrastructure. Please provide more rationale as to why this unit is not considered significant. If it is not significant perhaps it can be incorporated into another hydrostratigraphic unit. See also FLNR-0831\_HG.*

Response:

The unit that the reviewer is referring to within this comment is “colluvium” (see FLNRO-052 and Proponent’s response to FLNRO-052), which has been interpreted at the Project scale based on local terrain mapping. The reviewer is correct in stating that the grey-shaded "C" on Drawing 07 (Appendix 6.6-A of the Application/EIS) that is surrounded by 'undivided glacial deposits' is colluvium.

This unit was considered to be insignificant because:

- Colluvium is not present in the regional mapping data. Where mapped at the Project scale, the deposits are generally discontinuous and therefore are not expected to transmit significant volumes of groundwater;
- Colluvium was only intercepted in a single borehole drilled on site (i.e., BGC14-014S) out of all holes drilled within locally mapped deposits shown on Drawing 07.

However, as the reviewer has noted, the local terrain mapping suggests that colluvium covers “the entire project area and is present within all areas proposed to contain mine infrastructure”. Due to the pervasiveness of this unit suggested by the local mapping, and a high hydraulic conductivity estimated from a slug test at BGC14-014S (i.e.,  $9 \times 10^{-4}$  m/s), colluvium was incorporated into the numerical groundwater flow model in order to simulate a conservative case (i.e., the potential for higher groundwater velocities in the overburden).

The Proponent agrees that this unit could be incorporated into another hydrostratigraphic unit in future modelling. However, it should be noted that the current representation of this unit in the numerical groundwater flow model is a conservative case, and incorporating it into another hydrostratigraphic unit would not change results or predictions in the Project Effects Assessment. As such, no action is considered necessary.

#### 2.2.7. Response to FLNRO-053.1

*FLNRO-053.1: See FLNR-005.*

Response:

Please see the response above for FLNRO-005.1.

#### 2.2.8. Response to FLNRO-060.1

*FLNRO-060.1: This limitation, and associated uncertainty with the model's ability to identify/predict adverse effects at scales less than 100m, can be addressed by increasing the density of the groundwater monitoring network. See FLNR-0831-HG.*

Response:

We agree with the reviewer that groundwater model predictions at lateral scales less than 100 m and in areas where adverse effects could occur can be supplemented with monitoring. However, a general increase in network density to monitor groundwater at scales less than 100 m is exhaustive, would not address uncertainties in the predictive modelling or inform adaptive management of potential impacts to downstream receptors beyond what has already been considered in the Application/EIS.

There are no vulnerable receptors that have been identified within 100 m and downgradient of the mine facilities, which have not been targeted for monitoring as part of SWGMMP (Table A-1, Appendix A). The SWGMMP has been specifically designed to monitor groundwater around the planned project infrastructure, between the mine site and potential downgradient and downstream receptors.

As discussed in the Proponent's response to FLNRO-005.1 above, the SWGMMP will be updated at future stages of the Project (Table 1, Figure 1). Additional locations to monitor downstream receptors, if any, will be strategically located as a part of this update.

In summary, we agree that increasing the density of the groundwater monitoring network would act to improve project understanding and reduce uncertainty. However, the time, expense and increase in project understanding to be gained by increasing the density of the monitoring network at this time is not at all commensurate with the minor reduction in uncertainty in predictions that would be gained.

#### 2.2.9. Response to FLNRO-062.1

*FLNRO-062.1: See memo 0831\_FLNR\_HG.*

Response:

The reviewer's comment is regarding monitoring points within hydrostratigraphic units that were used in calibration of the numerical groundwater flow model. There is no specific request within 0831\_FLNR\_HG regarding further clarification of the hydrostratigraphic distribution of the 418 groundwater elevations used for steady state groundwater model calibration. This information was provided in supplementary response memo 0415\_KAM\_Model\_Calibration\_BGC-004 in response to comment FLNRO-062. No action required.

#### 2.2.10. Response to FLNRO-063.1

*FLNRO-063.1: See memo 0831\_FLNR\_HG.*

Response:

The reviewer's comment is regarding monitoring points within hydrostratigraphic units that were used in calibration of the numerical groundwater flow model. There is no specific request within 0831\_FLNR\_HG regarding further clarification of the hydrostratigraphic distribution of the 45 groundwater elevations used for transient groundwater model calibration. This information was provided in supplementary response memo 0415\_KAM\_Model\_Calibration\_BGC-004 in response to comment FLNRO-063. No action required.

### 3.0 CLOSURE

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Yours sincerely,

**BGC ENGINEERING INC.**  
per:



Cassandra Koenig, M.Sc., P.Geo.  
Hydrogeologist

Reviewed by:

Trevor W. Crozier, M.Eng., P.Eng.  
Principal Hydrogeological Engineer

Attachments: Table A-1

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**APPENDIX A**  
**TABLE A-1**

**Table A-1. Preliminary Groundwater Monitoring Locations for Ajax Project MA/EMA Permitting**

Nearest Facility <sup>4</sup>	Site ID	Datalogger Type	Quality Sampling <sup>1,2</sup>				Quantity Monitoring <sup>2</sup> (Water Levels)					Coordinates <sup>3</sup>			Completion Zone <sup>4</sup>			Screened and Monitored Stratigraphy	Survives Construction?	Rationale Based on Proximity to Facility <sup>5,6</sup>
			Construction	Operations	Decommissioning and Closure	Post Closure	Pre-Construction	Construction	Operations	Decommissioning and Closure	Post Closure	Easting	Northing	Elevation (masl)	From (mbgs)	To (mbgs)	Depth to VWP (mah)			
Open Pit	AJGW02-D	Solinst Levelogger					B					683,581	5,609,337	900	16.2	19.8	-	Nicola Volcanics	N (Pit)	Hydraulic gradients in Open-Pit location (pre-construction)
Open Pit	AJGW02-S	Solinst Levelogger					B					683,581	5,609,337	900	1.8	8.2	-	Glacial Till	N (Pit)	Hydraulic gradients in Open-Pit location (pre-construction)
Open Pit	AJGW03-D	Solinst Levelogger					B					684,045	5,609,277	897	22.3	25.9	-	Fluvial / Glaciofluvial	N (Pit)	Hydraulic gradients in Open-Pit location (pre-construction)
Open Pit	BGC10-MWA-075	VWP with RST Datalogger					B					683,365	5,609,556	905	-	-	25.0	Glacial Till	N (Pit)	Hydraulic gradients in Open-Pit location (pre-construction)
Open Pit	BGC10-MWA-125	VWP with RST Datalogger					B					683,365	5,609,556	905	-	-	125.0	Sugarloaf Diorite	N (Pit)	Hydraulic gradients in Open-Pit location (pre-construction)
Open Pit	BGC10-MWA-175	VWP with RST Datalogger					B					683,365	5,609,556	905	-	-	175.0	Sugarloaf Diorite	N (Pit)	Hydraulic gradients in Open-Pit location (pre-construction)
Open Pit	BGC10-MWB-075	VWP with RST Datalogger					B					683,326	5,609,533	905	-	-	75.0	Glacial Till	N (Pit)	Hydraulic gradients in Open-Pit location (pre-construction)
Open Pit	BGC10-MWB-125	VWP with RST Datalogger					B					683,326	5,609,533	905	-	-	125.0	Sugarloaf Diorite	N (Pit)	Hydraulic gradients in Open-Pit location (pre-construction)
Open Pit	BGC10-MWB-175	VWP with RST Datalogger					B					683,326	5,609,533	905	-	-	175.0	Sugarloaf Diorite	N (Pit)	Hydraulic gradients in Open-Pit location (pre-construction)
EMRSF	BGC13-021	N/A					B	Q	Q	Q	B	687,756	5,609,524	874	9.2	12.2	-	Fluvial / Glaciofluvial	Y	Hydraulic gradients near EMRSF
EMRSF	BGC13-022	N/A					B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	687,168	5,609,516	878	13.7	16.8	-	Glacial Till	N	Hydraulic gradients near EMRSF
WMRSF	BGC14-001D	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	682,286	5,608,796	936	18.0	24.1	-	Nicola Volcanics	Y	Down-gradient of TSF and WMRSF; ELFZ foot wall; vertical hydraulic gradient with BGC14-001S
WMRSF	BGC14-001S	Solinst Levelogger					B	Q	Q	Q	B	682,286	5,608,796	934	4.0	5.5	-	Glacial Till	Y	Down-gradient of TSF and WMRSF; ELFZ foot wall; vertical hydraulic gradient with BGC14-001D
WMRSF	BGC14-002D	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	682,756	5,608,900	925	16.8	22.9	-	Nicola Volcanics	Y	Down-gradient of TSF and WMRSF; ELFZ foot wall; vertical hydraulic gradient with BGC14-002S
WMRSF	BGC14-002S	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	682,756	5,608,900	925	9.1	15.2	-	Glacial Till	Y	Down-gradient of TSF and WMRSF; ELFZ foot wall; vertical hydraulic gradient with BGC14-002D
TSF	BGC14-003D	Solinst Levelogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	683,544	5,608,858	897	28.4	31.4	-	Nicola Volcanics	N (WMRSF)	Down-gradient of TSF and WMRSF; vertical hydraulic gradient with BGC14-003I/S
TSF	BGC14-003I	Solinst Levelogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	683,544	5,608,858	897	16.8	19.8	-	Fluvial / Glaciofluvial	N (WMRSF)	Down-gradient of TSF and WMRSF; seepage and runoff; vertical hydraulic gradient with BGC14-003D/S
TSF	BGC14-003S	Solinst Levelogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	683,544	5,608,858	897	9.8	11.3	-	Glacial Till	N (WMRSF)	Down-gradient of TSF and WMRSF; seepage and runoff; vertical hydraulic gradient with BGC14-003D/I

**Table A-1. Preliminary Groundwater Monitoring Locations for Ajax Project MA/EMA Permitting**

Nearest Facility <sup>4</sup>	Site ID	Datalogger Type	Quality Sampling <sup>1,2</sup>				Quantity Monitoring <sup>2</sup> (Water Levels)					Coordinates <sup>3</sup>			Completion Zone <sup>4</sup>			Screened and Monitored Stratigraphy	Survives Construction?	Rationale Based on Proximity to Facility <sup>5,6</sup>
			Construction	Operations	Decommissioning and Closure	Post Closure	Pre-Construction	Construction	Operations	Decommissioning and Closure	Post Closure	Easting	Northing	Elevation (masl)	From (mbgs)	To (mbgs)	Depth to VWP (mah)			
EMRSF	BGC14-004	Solinst Levelogger					B	Q	Q	Q	B	687,746	5,609,526	871	72.2	78.3	-	Iron Mask Hybrid	Y	Vertical hydraulic gradient with BGC13-021 (near EMRSF)
EMRSF	BGC14-005	Solinst Levelogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	687,161	5,609,519	878	47.2	50.5	-	Iron Mask Hybrid	N (Mine Infrastructure)	Vertical hydraulic gradient and groundwater quality between Peterson Creek Aquifer (BGC13-022) and underlying Sugarloaf Hill Bedrock Aquifer
EMRSF	BGC14-006D	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	687,288	5,610,779	940	20.4	26.5	-	Iron Mask Hybrid	Y	EMRSF interactions with Aberdeen; vertical hydraulic gradient with BGC14-006S
EMRSF	BGC14-006S	Solinst Levelogger					B	Q	Q	Q	B	687,288	5,610,779	940	11.0	14.0	-	Glacial Till	Y	EMRSF seepage and runoff and interactions with Aberdeen; vertical hydraulic gradient with BGC14-006D
SMRSF	BGC14-007D	Solinst Levelogger					B	Q	Q	Q	B	685,324	5,608,722	924	26.5	29.6	-	Nicola Volcanics	Y	Down-gradient of SMRSF; Peterson Creek aquifer; vertical gradient with BGC14-007S
SMRSF	BGC14-007S	Solinst Levelogger					B	Q	Q	Q	B	685,324	5,608,722	924	14.3	17.4	-	Glacial Till	Y	Down-gradient of SMRSF; Peterson Creek aquifer; vertical gradient with BGC14-007SD
SMRSF	BGC14-008D	Solinst Levelogger					B	Q	Q	Q	B	686,107	5,608,923	878	26.5	29.6	-	Iron Mask Hybrid	Y	Down-gradient of SMRSF; Peterson Creek aquifer; vertical gradient with BGC14-008S
SMRSF	BGC14-008S	Solinst Levelogger					B	Q	Q	Q	B	686,107	5,608,923	878	4.6	6.1	-	Fluvial / Glaciofluvial	Y	Down-gradient of SMRSF; Peterson Creek aquifer; vertical gradient with BGC14-008S
SMRSF	BGC14-009	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	686,799	5,608,547	919	47.9	54.0	-	Iron Mask Hybrid	Y	Down-gradient of SMRSF; hydraulic gradients in Iron Mask Hybrid Unit
TSF	BGC14-010	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	681,730	5,607,414	979	46.0	58.2	-	Nicola Volcanics	Y	Down-gradient of TSF and WMRSF
TSF	BGC14-011D	Solinst Levelogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	682,796	5,605,945	1029	23.5	29.6	-	Nicola Volcanics	N (TSF)	Southwest end of TSF; Potential groundwater divide location; vertical hydraulic gradient with BGC14-011D
TSF	BGC14-011S	Solinst Levelogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	682,796	5,605,945	1029	15.2	18.3	-	Nicola Volcanics	N (TSF)	Southwest end of TSF; Potential groundwater divide location; vertical hydraulic gradient with BGC14-011S
WMRSF	BGC14-012D	Solinst Levelogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	681,950	5,608,373	924	20.4	26.2	-	Nicola Volcanics	N (WMRSF)	Down-gradient of TSF and WMRSF; vertical hydraulic gradient with BGC14-012S
WMRSF	BGC14-012S	Solinst Levelogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	681,950	5,608,373	924	2.7	3.4	-	Colluvium	N (WMRSF)	Down-gradient of TSF and WMRSF; seepage and runoff; vertical hydraulic gradient with BGC14-012S

**Table A-1. Preliminary Groundwater Monitoring Locations for Ajax Project MA/EMA Permitting**

Nearest Facility <sup>4</sup>	Site ID	Datalogger Type	Quality Sampling <sup>1,2</sup>				Quantity Monitoring <sup>2</sup> (Water Levels)					Coordinates <sup>3</sup>			Completion Zone <sup>4</sup>			Screened and Monitored Stratigraphy	Survives Construction?	Rationale Based on Proximity to Facility <sup>5,6</sup>
			Construction	Operations	Decommissioning and Closure	Post Closure	Pre-Construction	Construction	Operations	Decommissioning and Closure	Post Closure	Easting	Northing	Elevation (masl)	From (mbgs)	To (mbgs)	Depth to VWP (mah)			
SMRSF	BGC14-013	Solinst Levellogger	●	●	●	●	B	Q	Q	Q	B	686,466	5,606,777	987	27.4	30.5	-	Nicola Volcanics	Y	Down-gradient of SMRSF; hydraulic gradients with BGC14-015D; water levels and quality in the ELFZ foot wall
Plant	BGC14-014D	Solinst Levellogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	686,672	5,607,810	986	23.5	29.6	-	Nicola Volcanics	N (Plant)	Down-gradient of SMRSF; vertical hydraulic gradient with BGC14-014S
Plant	BGC14-014S	Solinst Levellogger					B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	686,672	5,607,810	986	12.8	18.9	-	Glacial Till	N (Plant)	Down-gradient of SMRSF; seepage and runoff; vertical hydraulic gradient with BGC14-014S
SMRSF	BGC14-015D	Solinst Levellogger	●	●	●	●	B	Q	Q	Q	B	686,773	5,606,920	977	23.5	29.6	-	Nicola Volcanics	Y	Down-gradient of SMRSF; vertical hydraulic gradient with BGC14-015S; water levels and quality in the ELFZ hanging wall
SMRSF	BGC14-015S	Solinst Levellogger	●	●	●	●	B	Q	Q	Q	B	686,773	5,606,920	977	8.2	11.3	-	Glacial Till	Y	Down-gradient of SMRSF; seepage and runoff; vertical hydraulic gradient with BGC14-015D; water levels and quality in the ELFZ hanging wall
TSF	BGC14-016	Solinst Levellogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	685,348	5,607,041	1039	23.5	29.6	-	Nicola Volcanics	N (SMRSF)	Down-gradient of TSF and up-gradient of SMRSF
TSF	BGC14-017D	Solinst Levellogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	685,540	5,605,928	1040	23.5	29.6	-	Nicola Volcanics	N (TSF)	Southeast end of TSF; vertical hydraulic gradient with BGC14-017S
TSF	BGC14-017S	Solinst Levellogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	685,540	5,605,928	1040	3.0	4.6	-	Glacial Till	N (TSF)	Southeast end of TSF; vertical hydraulic gradient with BGC14-017D
Inks Lake	BH10-11	N/A					B	Q	Q	Q	B	680,877	5,610,537	851.9	17.4	20.4	-	Glacial Till	Y	Near Inks Lake
Inks Lake	BH10-12	N/A					B	Q	Q	Q	B	680,849	5,610,893	863.1	9.9	13.0	-	Glacial Till	Y	Near Inks Lake
Admin	DH-BGC11-PS-19	N/A					B	Q	Q	Q	B	683,158	5,610,849	917.4	1.3	4.3	-	Glacial Till	Y	Hydraulic gradients during dewatering
Admin	DH-BGC11-PS-22	N/A					B	Q	Q	Q	B	683,394	5,610,792	934.3	10.7	16.8	-	Iron Mask Hybrid	Y	Hydraulic gradients during dewatering
Admin	DH-BGC11-PS-25	N/A					B	Q	Q	Q	B	683,091	5,610,906	920.2	4.1	10.2	-	Iron Mask Hybrid	Y	Hydraulic gradients during dewatering
Open Pit	DH-BGC11-WC-17	N/A					B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	684,321	5,610,507	978.0	15.9	18.3	-	Glacial Till / Wasterock	N	Hydraulic gradients during dewatering
WMRSF	DH-BGC15-01-1	VWP with RST Datalogger					B	Q	Q	Q	B	682,638	5,608,871	938.1	-	-	71	Volcaniclastic	Y	Pressures within both the potential fault and footwall rockmass of the ELFZ per structural Interpretation 1 in Appendix 6.2-B of the Application/EIS (i.e., a Northeast dipping ELFZ) or pressures in the potential fault zone per drilling section Interpretations 2 and 3 (Southwest dipping ELFZ and near-vertical, wider ELFZ)

**Table A-1. Preliminary Groundwater Monitoring Locations for Ajax Project MA/EMA Permitting**

Nearest Facility <sup>4</sup>	Site ID	Datalogger Type	Quality Sampling <sup>1,2</sup>				Quantity Monitoring <sup>2</sup> (Water Levels)					Coordinates <sup>3</sup>			Completion Zone <sup>4</sup>			Screened and Monitored Stratigraphy	Survives Construction?	Rationale Based on Proximity to Facility <sup>5,6</sup>
			Construction	Operations	Decommissioning and Closure	Post Closure	Pre-Construction	Construction	Operations	Decommissioning and Closure	Post Closure	Easting	Northing	Elevation (masl)	From (mbgs)	To (mbgs)	Depth to VWP (mah)			
WMRSF	DH-BGC15-01-2	VWP with RST Datalogger					B	Q	Q	Q	B	682,638	5,608,871	938.1	-	-	151	Fault Zone	Y	Pressures within both the potential fault and footwall rockmass of the ELFZ per structural Interpretation 1 in Appendix 6.2-B of the Application/EIS (i.e., a Northeast dipping ELFZ) or pressures in the potential fault zone per drilling section Interpretations 2 and 3 (Southwest dipping ELFZ and near-vertical, wider ELFZ)
WMRSF	DH-BGC15-01-3	VWP with RST Datalogger					B	Q	Q	Q	B	682,638	5,608,871	938.1	-	-	191	Fault Zone	Y	Pressures within both the potential fault and footwall rockmass of the ELFZ per structural Interpretation 1 in Appendix 6.2-B of the Application/EIS (i.e., a Northeast dipping ELFZ) or pressures in the potential fault zone per drilling section Interpretations 2 and 3 (Southwest dipping ELFZ and near-vertical, wider ELFZ)
WMRSF	DH-BGC15-02-1	VWP with RST Datalogger					B	Q	Q	Q	B	682,712	5,608,971	947.7	-	-	66	Fault Zone	Y	Pressures in the ELFZ hanging wall rockmass, as faulting was not encountered at this location
WMRSF	DH-BGC15-02-2	VWP with RST Datalogger					B	Q	Q	Q	B	682,712	5,608,971	947.7	-	-	111	Volcaniclastic	Y	Pressures in the ELFZ hanging wall rockmass, as faulting was not encountered at this location
WMRSF	DH-BGC15-02-3	VWP with RST Datalogger					B	Q	Q	Q	B	682,712	5,608,971	947.7	-	-	167	Fault Zone	Y	Pressures in the ELFZ hanging wall rockmass, as faulting was not encountered at this location
Open Pit	KAX-13-007-D	VWP with RST Datalogger					B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	683,187	5,609,782	949.4	-	-	249.0	Iron Mask Hybrid	N (Pit)	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients (pre-construction)
Open Pit	KAX-13-007-S	VWP with RST Datalogger					B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	683,187	5,609,782	949.4	-	-	100.0	Nicola Volcanics	N (Pit)	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients (pre-construction)
Open Pit	KAX-14-107D	N/A					B	Q	Q	Q	B	683,224	5,609,202	896.2	56.7	75.0	-	Picrite	Y	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients
Open Pit	KAX-14-107S	N/A	●	●			B	Q	Q	Q	B	683,224	5,609,202	896.2	29.9	38.0	-	Lacustrine	Y	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients
Open Pit	KAX-14-108D	N/A					B	Q				683,140	5,609,428	901.4	92.8	110.8	-	Picrite (Fractured zone)	N (Pit)	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients (pre-construction)
Open Pit	KAX-14-108S	N/A	●	●			B	Q	Q			683,140	5,609,428	901.4	32.3	35.4	-	Glacial Till	N (Pit)	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients (pre-construction)
Open Pit	KAX-14-114D	N/A					B	Q	Q	Q	B	683,210	5,609,277	895.5	104.4	122.7	-	Picrite (Fractured zone)	Y	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients
Open Pit	KAX-14-114S	N/A	●	●			B	Q	Q	Q	B	683,210	5,609,277	895.5	22.0	31.1	-	Fluvial / Glaciofluvial	Y	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients

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**Table A-1. Preliminary Groundwater Monitoring Locations for Ajax Project MA/EMA Permitting**

Nearest Facility <sup>4</sup>	Site ID	Datalogger Type	Quality Sampling <sup>1,2</sup>				Quantity Monitoring <sup>2</sup> (Water Levels)					Coordinates <sup>3</sup>			Completion Zone <sup>4</sup>			Screened and Monitored Stratigraphy	Survives Construction?	Rationale Based on Proximity to Facility <sup>5,6</sup>
			Construction	Operations	Decommissioning and Closure	Post Closure	Pre-Construction	Construction	Operations	Decommissioning and Closure	Post Closure	Easting	Northing	Elevation (masl)	From (mbgs)	To (mbgs)	Depth to VWP (mah)			
Open Pit	KAX-14-128D	N/A	●	●			B	Q	Q			683,325	5,609,497	904.3	71.7	90.0	-	Nicola Volcanics	N (Pit)	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients (pre-construction)
Open Pit	KAX-14-128S	N/A					B	Q				683,325	5,609,497	904.3	10.9	17.0	-	Fluvial / Glaciofluvial	N (Pit)	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients (pre-construction)
Open Pit	KAX-14-130A	VWP with RST Datalogger					B	Q	Q	Q	B	683,214	5,609,272	895.5	-	-	175.3	Nicola Volcanics	Y	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients
Open Pit	KAX-14-130B	VWP with RST Datalogger					B	Q	Q	Q	B	683,214	5,609,272	895.5	-	-	222.3	Picrite	Y	Jacko Lake-Open Pit Hydrogeological Connectivity and hydraulic gradients
Background	MW11-01D	Solinst Levelogger					B	Q	Q	Q	B	679,814	5,612,279	927.5	50.5	53.5	-	Iron Mask Hybrid	Y	Background groundwater levels
Background	MW11-01S	Solinst Levelogger					B	Q	Q	Q	B	679,814	5,612,279	927.5	19.4	22.4	-	Glacial Till	Y	Background groundwater levels
Inks Lake	MW11-02	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	680,578	5,610,272	854.8	38.7	41.7	-	Nicola Volcanics	Y	Near Inks Lake
Jacko Lake	MW11-04D	Solinst Levelogger					B	Q	Q	Q	B	682,620	5,610,360	899.3	31.6	34.6	-	Iron Mask Hybrid	Y	Near Jacko Lake
Jacko Lake	MW11-04S	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	682,620	5,610,360	899.3	17.6	20.6	-	Iron Mask Hybrid	Y	Near Jacko Lake
EMRSF	MW11-05D	Solinst Levelogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	686,804	5,610,502	961.1	25.6	28.6	-	Iron Mask Hybrid	N (EMRSF)	Vertical hydraulic gradient with MW11-05S
EMRSF	MW11-05S	Solinst Levelogger	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	● <sup>7</sup>	B	Q <sup>7</sup>	Q <sup>7</sup>	Q <sup>7</sup>	B <sup>7</sup>	686,804	5,610,502	961.1	12.7	14.2	-	Iron Mask Hybrid	N (EMRSF)	EMRSF seepage and runoff; vertical hydraulic gradient with MW11-05D
Background	MW11-06D	Solinst Levelogger					B	Q	Q	Q	B	683,485	5,612,052	943.0	42.3	45.3	-	Iron Mask Hybrid	Y	Vicinity of old MRSF option
Background	MW11-06S	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	683,485	5,612,052	943.0	8.3	9.8	-	Fluvial / Glaciofluvial	Y	Background groundwater levels and groundwater quality
Background	MW11-07D	Solinst Levelogger					B	Q	Q	Q	B	681,620	5,612,830	941.2	47.9	50.9	-	Iron Mask Hybrid	Y	Background groundwater levels
Background	MW11-07S	Solinst Levelogger					B	Q	Q	Q	B	681,620	5,612,830	941.2	5.8	7.3	-	Iron Mask Hybrid	Y	Background groundwater levels

**Table A-1. Preliminary Groundwater Monitoring Locations for Ajax Project MA/EMA Permitting**

Nearest Facility <sup>4</sup>	Site ID	Datalogger Type	Quality Sampling <sup>1,2</sup>				Quantity Monitoring <sup>2</sup> (Water Levels)					Coordinates <sup>3</sup>			Completion Zone <sup>4</sup>			Screened and Monitored Stratigraphy	Survives Construction?	Rationale Based on Proximity to Facility <sup>5,6</sup>
			Construction	Operations	Decommissioning and Closure	Post Closure	Pre-Construction	Construction	Operations	Decommissioning and Closure	Post Closure	Easting	Northing	Elevation (masl)	From (mbgs)	To (mbgs)	Depth to VWP (mah)			
Background	MW11-08D	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	681,471	5,608,940	896.7	31.3	32.8	-	Nicola Volcanics	Y	Up-gradient of proposed project - reference location.
Background	MW11-08S	Solinst Levelogger					B	Q	Q	Q	B	681,471	5,608,940	896.7	14.3	17.3	-	Glacial Till	Y	Up-gradient of proposed project - reference location.
Background	MW11-09D	Solinst Levelogger					B	Q	Q	Q	B	679,938	5,608,898	909.6	28.4	29.9	-	Nicola Volcanics	Y	Background groundwater levels
Background	MW11-09S	N/A					B	Q	Q	Q	B	679,938	5,608,898	909.6	11.5	14.5	-	Nicola Volcanics	Y	Background groundwater levels
EMRSF	MW11-10D	Solinst Levelogger	●	●	●	●	B	Q	Q	Q	B	687,492	5,609,465	887.0	76.2	79.2	-	Fluvial / Glaciofluvial	Y	Adjacent to EMRSF; Vertical hydraulic gradient with MW11-10S
EMRSF	MW11-10S	Solinst Levelogger					B	Q	Q	Q	B	687,492	5,609,465	887.0	20.2	23.2	-	Glacial Till	Y	EMRSF seepage and runoff; vertical hydraulic gradient with MW11-10D
Open Pit	MW12-01	N/A	●									684,638	5,609,892		36.0	38.5	-	Waste rock backfill	N	Geochemistry of groundwater in historic waste rock
Open Pit	MW12-02	N/A	●									684,637	5,609,894		15.1	16.8	-	Waste rock backfill	N	Geochemistry of groundwater in historic waste rock
Open Pit	MW12-04	N/A	●									684,327	5,609,146		32.0	35.5	-	Glacial Till	N	Geochemistry of groundwater in historic waste rock

Notes:

1. Parameters to be monitored include: In Situ (water level, temperature, dissolved oxygen, conductivity, specific conductance, redox potential and turbidity); Physical (hardness, pH, specific conductivity (SpC), total dissolved solids (TDS), total suspended solids (TSS), and turbidity); Dissolved Anions (alkalinity (bicarbonate, carbonate, and hydroxide), bromide, chloride, fluoride, and sulphate); Nutrients (ammonium nitrogen, nitrate, nitrite, dissolved orthophosphate, and total and dissolved phosphate); Dissolved Metals, and; Organics (TOC).
2. B = Biannually, Q = Quarterly
3. GPS coordinates are in UTM WGS84 zone 10 U. Ground surface elevations estimated from LIDAR.
4. Completion zone is top and bottom of well screens, or distance along hole to VWP.
5. Rationale based on proximity to proposed facility: up-gradient monitoring locations to assess interactions with project facilities; down-gradient monitoring locations to assess potential seepage pathways.
6. Edith lake fault zone – ELFZ; tailings storage facility - TSF, west mine rock storage facility - WMRSF, south mine rock storage facility - SMRSF, east mine rock storage facility – EMRSF, Plant Site = Plant, Administration Buildings = Admin.
7. New monitoring well to be installed nearby if facility footprint is on top of the existing well.