July 20, 2009

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Mr. Stéphane Robert
Environment Superintendent
Agnico-Eagle Mines Limited
Meadowbank Division
P.O. Box 540
Baker Lake, Nunavut
X0C 0A0

**RESPONSE TO REPORT NO. 3 MEADOWBANK MINE DIKE REVIEW BOARD, JUNE 12, 2009**
**SUBJECT: REVIEW COMMENTS**

Dear Mr. Robert,

On June 12, 2009, the third meeting was held between the Meadowbank Dike Review Board (MDRB), Agnico Eagle Mines (AEM), and Golder Associates Ltd. (Golder). The meeting was convened to discuss the status of the design for the Bay Goose Dike and Tailings Storage Facility. In addition, the as-built report for the East Dike construction was presented along with the results of the remedial grouting undertaken at the East Dike. On June 18, 2009, the MDRB provided a letter with their comments from this meeting. This letter provides Golder's response to MDRB questions and comments which is being submitted on behalf of AEM.

## 1.0 EAST DIKE

*Comment:* *Explanation of the mechanism which led to the leak in the East Dike;*

Response: The mechanism which led to the leak at the East Dike still remains a matter of debate and speculation at this stage. Upon review of the most likely causes, we are of the opinion that it was probably linked to the presence of a zone in which adequate closure may not have been achieved. It is believed that during dewatering, localized washout started to occur and accelerated as the gradient increased. The evolution of thermal regime appears to have been the best indicator of activity in this area and demonstrated the value of detailed instrumentation. This event also allowed a contingency leak management plan to be developed.

*Comment:* *Recommendation that a downstream seepage measurement system be implemented following dewatering;*

Response: A system to monitor seepage within the seepage collection ditches will be implemented by AEM.

*Comment:* *Recommendation that a 'contingency leak management plan' be incorporated in the OMS – Dike Manual (equipment, supplies, procedures, people) in recognition that further leaks could occur;*

Response: An East Dike OMS Manual has been prepared and is currently under the control of AEM. At the request of AEM, Golder can assist with incorporating the recent 'contingency leak management plan' developed as a result of the anomalous East Dike instrument readings into the overall OMS plan for the dike. The plan should include a list of required equipment, supplies, personnel and procedures.

*Comment:* *Evaluate the long-term needs for grouting equipment to be located at Meadowbank;*

Response: The required length of time for grouting equipment to be located at site will be assessed in consultation with AEM during development of OMS manuals for the remaining Meadowbank dikes.

*Comment:* *Assess AEM's capacity for long term seepage management for the East Dike and other structures that will be constructed;*

Response: AEM is planning to provide the future open pits with sufficient pumping capacity to allow safe dewatering during storm events and should large water inflows be experienced. Details of the pumping capacity is to be provided by AEM.

*Comment:* *Additional information could be incorporated into the final version of the East Dike As-Built Report, including: dynamic compaction grid pattern and number of drops;*

Response: Additional details concerning the dynamic compaction process will be included in the final version of the East Dike As-Built Report.

## 2.0 BAY GOOSE DIKE DESIGN

*Comment:* *Interpretation of the results indicates 5 m of lake bed sediments on axis B-B' in the north sector, which establishes a need for more detailed information before start-up (if practical) and a management plan (stability issues, mud wave issues, turbidity issues);*

Response: Unfortunately current site conditions (*i.e.,* limited ice thickness) do not permit gathering of additional information regarding the area identified as potentially having a thicker zone of lake bed sediments.

The presence of a thicker zone of lake bed sediments has been inferred from drilling pressures, which we were unable to confirm with sample collection methods available during the most recent investigation program.

Therefore the presence or potential presence of thicker, softer lake bed sediments along the Bay-Goose Dike alignment was discussed with AEM and the selected contractor during a construction kick-off meeting held on June 18, 2009 in Montreal. During dike construction in these areas, rockfill placement will initially proceed along the dike centerline, followed by placement of rockfill laterally to displace outward as much of the softer sediments as possible. The rate of rockfill placement will be monitored and adjusted, if necessary. Stability of the rockfill embankment will also be monitored and adjusted, if necessary during construction. Stability of the downstream toe of the rockfill embankment will be monitored following dewatering.

The stability of rockfill placement will be observed and placement methods modified in other areas, if necessary.

*Comment:* *In order to complete the design in the south sector, where a partial cut-off is an option being considered, additional characterisation is required. The adoption of a partial cut-off is a significant departure from the design concepts being adopted elsewhere in the dike designs. In order to justify this proposal it is essential that continuous coring, to the degree practical, be obtained over the interval from the base of the proposed cut-off to the bedrock. The identification of local conductive layers, such as gravel seams is important;*

Response: Golder, on behalf and at the request of AEM, is reviewing potential geotechnical investigation methods and equipment that could provide continuous samples which would in turn permit a better assessment and characterization of the lakebed soils. Preparation for the winter 2009 – 2010 program is underway to facilitate the potential mobilization of selected investigation equipment to site during the 2009 barge season. It is understood that the applicability of the partial cutoff wall concept is dependant on the characteristics of the material that may be left in place and upon the ability to demonstrate the continuity of the material and its low hydraulic properties.

*Comment:* *Rock hydraulic conductivity appears to be greater than at the East Dike and may make grouting more of a challenge;*

Response: Packer test results from the 2009 geotechnical investigation program will be further analyzed to assess the potential implications to grouting. Additional packer testing will be conducted as part of the winter 2009 – 2010 program. Adjustments to the grouting program will be made, as required.

*Comment:* *For both of the dike, a cement-soil-bentontie slurry cut-off wall is proposed for all sections where the bedrock surface is more than 8 m below the lake level (i.e., below elevation 125 m). .... Clarify procedures to achieve a clean CSB/SB interface, following discussions between AEM and the contractor;*

Response: Preliminary discussions were held between AEM, Golder, and the contractor on June 18, 2009 regarding the construction procedures to be used for this part of the work. It was clarified that the maximum time permitted between placement of the CSB and SB is 1 day and that the time between placement of the two materials should be minimized in order to limit the formation of a cold contact. It is understood that the CSB will be placed using a large diameter tremmied pipe to the base of the excavation. The contractor plans to use excavators and a crane supplied by AEM for this operation. The contractor is to provide a detailed work plan that will provide additional information.

*Comment:* *Clarify the planned methods of execution and in-situ validation of effective densification to full depth of the core backfill material;*

Response: The compaction contractor plans to use the same equipment and general methods for compaction of the core backfill for the Bay-Goose Dike as were employed for construction of the East Dike. It is understood that the contractor plans to modify the grid pattern for compaction, number of drops, and number of passes, in order to achieve sufficient compaction to depth in the deeper portions of the Bay-Goose Dike. The contractor is confident that the material can be adequately compacted to the depths anticipated in the northern sector of the dike based on experience elsewhere. As part of the quality assurance program, for the deeper portion of the dike, Golder is proposing to perform large penetration tests (LPTs) prior to and following compaction. The testing is proposed to occur along the centerline of the cutoff wall. The results will be used to infer the relative change in density as a result of compaction. Testing is proposed to occur below a specified depth (*e.g.,* 3 m) at a regular interval of about 1.5 m to the depth of the backfill.

*Comment:* *In view of the greater depths, and in light of the possibility of leaks developing despite diligent foundation treatment work, the Board recommends consideration of a downstream filter blanket beneath rockfill in deep sections as an additional line of defence against piping;*

Response: At this time, Golder is of the opinion that a downstream filter blanket beneath the rockfill in the deeper portions of the Bay-Goose dike is not required and the added cost for this item is not justified. The interface between the rockfill and the lakebed soils is expected to be gradual and varied, due to the mixture of the materials, and variability in the properties of the lakebed soils. Seepage gradients along the interface are not anticipated to be sufficiently high enough to result in a large degree of piping.

*Comment:* *Review of the alignment detail on the north side of Goose Island that currently incorporates an abutment location which would necessitate dealing with frozen ground;*

Response: Based on the results of the 2009 geotechnical investigation program it is anticipated that frozen ground is present on the abutments and in shallow water (up to a water depth of 1.5 m). Construction of the entire dike on unfrozen ground is not feasible, therefore a contingency grouting program will be in place that will permit grouting of additional areas (*i.e.,* abutments or shallow areas) if thawing occurs and results in an increase in seepage. The head of water acting across the cutoff wall in these areas is low and therefore it is expected that mitigative grouting can be successfully performed, if required. In order to avoid the presence of frozen ground near Goose Island, the cutoff wall would need to be moved into deeper water and this would necessitate a larger volume of fill materials (rockfill, coarse filter, core backfill). Golder and AEM recognize the potential risks of constructing the cutoff on frozen ground and are prepared to manage these risks.

*Comment:* *Comments from Mr. Tony Rattue regarding the specifications;*

Response: The comments on the specifications provided by Mr. Rattue are appreciated and are currently under review.

## 3.0 TSF STORMWATER DIKE AND SADDLE DAM NO. 1

*Comment:* *Confirmation of removal of ice-rich soils in the abutment areas of the Stormwater Dike was requested;*

Response: The ice-rich soils within the footprint of the Stormwater Dike, determined to be only in the areas of the abutments, will be removed prior to fill placement. The construction drawings and specifications are being revised to incorporate this item.

*Comment:* *The geomembrane material selection was questioned with regards to the potential for settlement due to the thawing of ice-rich foundation soils;*

Response: The geomembrane material for both the Stormwater Dike and Saddle Dam 1 were re-evaluated in light of the discussion with the Board. A technical memorandum discussing the geomembranes of the structures has been prepared and will be discussed with the Board during the next meeting. The document also discusses the foundation preparation activities for the structures.

## 4.0 OTHER ISSUES

*Comment:* *It is understood that AEM will act as contractor for the construction of the Saddle Dam 1, in addition to carrying out the embankment placement for the Bay-Goose dike in 2009. The designer of record will be GAL and AEM needs to be held to the same specifications and QC/QA protocols as is normal for a third party contractor. It will be in the interest of both parties to clearly define applicable roles and responsibilities;*

Response: AEM and Golder thank the Board for their insight on this matter, and recognize the importance of achieving the design requirements for these structures and of demonstrating appropriate and thorough QC/QA.

## 5.0 CLOSURE

We hope the above information provides the required clarification. If additional information is required, please do not hesitate to contact us.

Yours very truly,

**GOLDER ASSOCIATES LTD.**

ORIGINAL SIGNED

Fiona Esford, M.Sc., P.Eng. (BC, Yukon)
Geotechnical Engineer

ORIGINAL SIGNED

Michel Julien, Ph.D., P.Eng. (QC)
Principal, Project Director

ORIGINAL SIGNED

Paul M. Bedell, M.E.Sc., P.Eng. (NT/NU)
Associate, Senior Geotechnical Engineer

ORIGINAL SIGNED

Dan Walker, Ph.D., P.Eng. (NT/NU)
Associate, Project Manager

KD/FCE/MJ/PMB/DRW/lw/rs/lw

CC: Eric Lamontagne and Gaston Blanchette (AEM)

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