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**RESPONSE TO REPORT NO.5 MEADOWBANK MINE DIKE REVIEW BOARD, DATED JANUARY 5, 2010
SUBJECT: REVIEW COMMENTS**

Dear Dr. Lamontagne,

On December 17 and 18, 2009, the fifth meeting was held between Meadowbank Dike Review Board (MDRB), Agnico-Eagle Mines Limited (AEM), and Golder Associates Ltd. (Golder). The meeting was held in the Golder Burnaby BC office. The objectives of the meeting were to present an update on the performance and evaluation of the East Dike, and the design and construction of the Bay-Goose Dike and TSF structures.

On January 5, 2010, the MDRB provided a letter with their comments from this meeting. The following provides Golder's response to the MDRB questions and comments raised in their letter.

1.0 EAST DIKE

1.1 East Dike Instrumentation

Comment: GAL and AEM presented recent data on the dike performance including measurements from the vibrating wire piezometers, thermistors & inclinometers. However, it was noted that the inclinometers provide only horizontal movement data and vertical control is currently missing. Settlement monuments have been installed on the dike crest but, for a variety of logistical or staffing reasons, even the baseline survey has yet to be completed. Measurement of settlements and heave (frost) is an important component of the monitoring programme and this situation should be rectified as soon as reasonably possible even if the work is somewhat laborious due to interrupted lines of sight.

Response: Golder/AEM agrees with the Board's comments. It is understood that AEM plans to initiate the settlement monitoring program in the spring as several of the monuments are currently covered by snow or are surrounded by high snow banks limiting access.



- Comment:** *Deformation monitoring could be enhanced by the installation of shallow settlement gauges which would detect any tendency for separation at the cut-off wall/frozen dike cap interface.*
- Response:** The need for enhanced deformation monitoring will be re-evaluated based on the results of the monitoring of vertical deformations at the settlement monuments this spring. A technical memorandum providing details of a potential shallow settlement gauge to be used, if necessary, to monitor for separation at the cut-off wall/frozen dike cap interface has been prepared and will be provided to the Board for review and discussion during the next MDRB meeting planned for April 30, 2010.
- Comment:** *The evolution of the temperature [at instrument TH 485], when compared to that of a string placed in the lake, indicates a strong correlation with little time lag, which provides evidence of a communication and potentially severe leak. The Board recommends additional thermistors in the vicinity of TH 485 to validate the findings, and to determine the possible extent of any high permeability zone. If this check confirms the interpretation of a leak then the following is needed:*
i) Estimate permeabilities and calculate flux/m of wall and compare with current leakage
ii) Evaluate determining the possibility and the extent of other local anomalies by monitoring with additional thermistor installations which could also be installed in the grout tubes to avoid damage to the cut-off by new drilling.
- Response:** Golder/AEM agrees with the MDRB interpretation. A total of ten additional thermistor cables are planned to be installed in the most likely zones of advective flow in the cutoff wall. The cables will be installed in existing grout casings as soon as the crest thaws down to casing level.

1.2 CPT Investigation

- Comment:** *One of the conclusions drawn by GAL from [the CPT investigation] was that a large proportion of the results could be classified in a region of low tip resistance and high friction ratio that was not consistent with the expected values for a well graded material such as the SB mix. The low tip resistance was interpreted as being indicative of low stresses, possibly the result of arching (silo effect) within the confines of the slurry trench.*
- The Board is sceptical with respect to the arching conclusion/silo effect but, if further analysis leads in this direction, suggests that Flat Dilatometer (DMT) tests be conducted to measure directly the lateral stresses within the SB slurry wall.*
- Response:** Arching (silo effect) was only presented as a possible explanation of the results observed in some locations. Further analysis of the CPT data has been completed and will be presented in a technical memorandum to the Board for review and discussion during the next MDRB meeting planned for April 30, 2010.

Comment: *The Board is...not convinced about conclusions [from the CPT investigation] with respect to uniformly variable point resistance and wishes to emphasize the possible hypothesis that high tip resistance (qt) zones are indicative of granular and relatively free draining materials related to foreign intrusions and recommends that the CPTs be interrogated from this perspective.*

Response: As indicated above, further analysis of the CPT data has been completed and will be presented in a technical memorandum to the Board for review and discussion during the next MDRB meeting planned for April 30, 2010. Based on the results of this analysis, it appears that some clear differences may exist between the zone where the sinkhole has developed and the immediately surrounding zones.

Comment: *The Board would like the unfiltered data with respect to the permeability assessments [from the CPT investigation] to be made available.*

Response: As indicated above, further analysis of the CPT data has been completed and is presented in a technical memorandum for review and discussion during the next MDRB meeting planned for April 30, 2010. Golder will provide the requested data should the Board still feel it necessary following review of this analysis.

Comment: *The Board agrees that additional CPTs may be warranted in relation to the leakage study mentioned above and in other areas along the dike where discrepancies between the bottom of the cut-off and the bedrock level were noted.*

Response: Golder/AEM agrees with the Board but believes that these works should be carried out following initiation of this summer's flow monitoring program so as to better target zones requiring additional testing, if any.

1.3 Dike Investigations, Geophysical and Drilling

Comment: *The Board wishes to recognize the diligent manner in which this investigation work has been carried out. Certain questions remain, namely whether the current self-sealing plug with existing grouting constitutes an acceptable status (plus contingency plan); or is additional grouting at chosen targets justified?*

Maintaining a grout plant on site, as AEM has committed to, is a good idea. The Board is of the view that bolstering the grouting is appropriate and justified. The investigation demonstrates that further grouting of the rock in this vicinity may be beneficial but the program needs to be well planned and executed with care. The grouting would be performed from the upstream side of the SB trench. Based on the detailed analysis of the earlier grouting records, and on possible additional CPT tests, an extension to the remedial grouting may be considered for other areas.

Response: Based on the results of the monitoring program completed to date following the May 2009 inflow event, Golder/AEM is of the opinion that monitoring should be extended before a final decision is taken on the actual need for further East Dike remedial grouting. The monitoring in the coming summer months will be particularly critical in evaluating whether the process that resulted in the May 2009 inflow event has indeed stabilized.

The need for additional grouting will be based on the piezometric response of vibrating wire piezometers that will be installed on the downstream side of the wall in each zone identified as having a potential issue or concern with respect to seepage. If a need for further grouting is identified, it would be relatively straightforward to mobilize teams and equipment given the other grouting activities currently planned on site in the coming 12 months. Nevertheless, in anticipation of the development of additional zones of concern, contingency grouting measures including low mobility grout mix designs, and potential silicate (*i.e.*, flash set) grouting techniques will continue to be planned for.

2.0 BAY-GOOSE DIKE CONSTRUCTION REVIEW

Comment: *The 0-19 mm core backfill has a D_{15} size of 0.7 mm or less when sampled above the water line. Samples recovered from below the water line (possibly washed) have a D_{15} of up to 2.5 mm. Therefore, the importance of minimizing segregation during the placement of the core material, such that it can be relied upon as a filter, is amply demonstrated.*

Response: Golder/AEM agrees with the MDRB interpretation. The placement method for the core backfill to minimize loss of fines is important and will continue to be monitored as part of the Quality Assurance program. It is noted that samples of placed core backfill were obtained using the excavator sitting at the face of the trench reaching down and digging into the face and then raising the sample to the surface. This method additionally disturbs and promotes washing; therefore results may not be entirely representative of the in place material. Samples of core backfill material obtained during the LPT program had higher fines content and did not appear to have been washed.

Comment: *[T]he results [of the LPT] indicated that the dynamic compaction was efficient down to a depth of 6-8 m. The Board does not expect significantly deeper densification with this method and the vibro-densification technique may be required for areas of deeper fill.*

Response: The Contractor will be using vibro-densification in the deepest portions of the Bay-Goose Dike southern portion. .

- Comment:** *One modification to the planned construction method was the abandonment of tremie pipe placing for the Cement-Soil-Bentonite (CSB) in order to facilitate construction. Instead, continuous inclined placement was permitted. The Board has concerns related to placement of stiff CSB over ductile/settling SB and the potential development of a gap/crack at the interface and recommends that the project team evaluates alternative remediation schemes (now and in the future if this method is adopted for the 2010 work). The low slump value for the material placed is also noted. This may have led to irregular surface profiles for the CSB material in the trench.*
- Response:** Golder/AEM shares these concerns with the Board. Remediation and/or monitoring options are currently being evaluated to assess this condition.
- It should be noted that the low slump (50, 100 and 150 mm) was measured in the first three batches of the CSB (during the first shift). The slump was then adjusted, and for the remainder of the work, slump values were between 180 to 190 mm and met the specification.
- Comment:** *There is some concern over the use of Odex drilling with air in the CSB and the risk of cracking. The Board does not consider that a successful drilling test under controlled conditions with inspection by a televiewer will be a guarantee of problem free production work. Any blockage of the annular space may lead to a rapid build-up of pressures when using compressed air.*
- Response:** Alternative drilling methods to permit grouting through the CSB material with a single line of grout holes are being evaluated, along with a monitoring program to assess the impact of the drilling on the integrity of the CSB wall. The current approach for drilling in the wall will involve tricone drilling with water flush. As an additional precaution, the holes will be backfilled with grout under a small applied pressure to help seal off any large cracks that may have been created within the CSB.
- Comment:** *There is a need to evaluate the grouting methodology particularly with respect to:*
• *the hole washing strategy to ensure adequate removal of erodable joint infilling materials;*
• *phased contact grouting with sequential perforation to create, insofar as possible, a reticulate grout filament structure.*
The Board looks forward to a review and discussion of this issue at the next meeting or conference call
- Response:** Golder/AEM agrees with the Board's comments. Mandatory water/air flushing will be carried out in all holes in 2010. If necessary, special washing will also be completed until reasonably clean return water is achieved. Special washing would focus on the top 3 to 5 m of the grout hole, depending on conditions encountered during grout hole drilling.

Comment: *At the last meeting, there was some limited discussion on the issue of freeze thaw within the SB cut-off. A preliminary testing program has been put together but more details need defining before implementation. This subject also will be treated at a future occasion. However, the Board suggests that samples be taken from the East Dike to show the current incidence of ice lenses vs the measured temperature gradient. Current rates of frost heave should be assessed by direct measurement and related to current temperature gradients.*

Response: Thermal modeling of the cutoff wall has been conducted to identify potential locations of the wall that may be subjected to freeze-thaw cycles. The results of thermal modeling are presented in a technical memorandum for review and discussion during the next MDRB meeting planned for April 30, 2010. The results indicate that for medium to deeper portions of the wall (greater than 4 m below lake level) the cutoff wall between Elevation 130 m and 132 m (5 to 7 m below the dike surface) may be exposed to repetitive cycles of freezing and thawing.

A laboratory testing procedure to expose a sample of CSB and SB material to freeze thaw cycles and in turn to test the hydraulic conductivity of the material at various stages has been proposed as described in a previous email to the MDRB. It is recognized that the testing method proposed does not supply a source of water to the sample during the freezing process, however the proposed approach is viewed as an appropriate laboratory scale to obtain a better understanding of the materials behavior under freeze thaw cycles.

A sample of frozen SB cutoff wall material was obtained from the East Dike, near Sta. 30+200 during the 2010 winter geotechnical investigation program recently completed at Meadowbank. The sample was obtained using the sonic rig and has been stored in such a manner to maintain the sample in a frozen condition. The sample was shipped to the Golder Burnaby offices for visual examination and assessment of the potential presence, magnitude and distribution of ice lenses. The results of this analysis will be presented to the Board during the next MDRB meeting planned for April 30, 2010.

3.0 BAY-GOOSE PLANS

Comment: *The 2009 site investigation program added to the knowledge of the BGD foundations in both sectors and additional work is planned from the ice during the 2010 winter period. There is a high expectation for good results from the sonic drilling for various site applications. The Board concurs with this approach to obtaining samples of the lakebed sediments and underlying till. Complete samples, even if disturbed, are essential for the evaluation of the various cut-off options in the South sector.*

Response: The sonic drilling program for the southern portion of the Bay-Goose Dike has recently been completed and an interim summary report of the complete 2010 geotechnical investigation will be provided to the Board for review prior to the next MDRB meeting planned for April 30, 2010. Recovery of samples is considered to have been good and is providing valuable information into the nature and condition of

the foundation soils. This information is being reviewed and assessed as part of the design process. Implications of the foundation conditions on potential cutoff wall designs for the dike are being evaluated and discussed with AEM.

Comment: *The design of the cut-off for the South sector must be carried out in parallel with investigations, as an iterative process, to ensure that any necessary adjustments to the investigation program are made in a timely manner. Preliminary results from the exercise are expected in April and a discussion with the Board in a teleconference is proposed.*

Response: Golder/AEM agrees with the Board's comment.

4.0 DIKE SEEPAGE MANAGEMENT PLAN

Comment: *The Board is content with the formulation of the plan, but notes a need for a push in the design of the seepage collection system, pump station location, protection against freezing and the avoidance of ice accumulation. The planning will be reviewed again as it evolves along with increasing geotechnical quantifications. Note that the TH 485 leakage scenario may indicate the value of more proactive measures in the plan.*

Response: Golder/AEM agrees with the Board's comment. The current plan is to collect the seepage water and pump it back to the lake providing water quality is sufficient to do so. AEM is in the process of developing this plan in collaboration with Golder but are waiting for ice break up before finalizing the design details.

5.0 TAILINGS STORAGE FACILITY 2009 CONSTRUCTION REVIEW

5.1 Stormwater Dike

Comment: *It is noted that underlying gravel/sand channels were discovered in some of the excavations and construction completion details, instrumentation installations, and monitoring during operation should take these into account.*

Response: Golder/AEM agrees with the Board's comment. Monitoring of the performance of the structures of the TSF is a planned activity and will be included in the OMS Manual.

Comment: *The SWD was constructed by AEM to plans prepared by GAL. The Board seeks clarification with respect to the final construction report roles and responsibilities. The Engineer of Record will need to sign off on the As-Built report.*

Response: The final construction report will be prepared and signed by AEM and Golder. The report will outline the party/parties responsible for each section of the report.

5.2 Saddle Dams

Comment: *The dike cross-section for Saddle Dam No. 1 (SD1), which was constructed in 2009, includes details such as a filter beneath the upstream shell to guard against piping and thus ensure longer life functionality. However, the Board notes that the [Saddle Dam 1] cut-off trench was backfilled with till so as to raise the location of the geomembrane liner key which now has a minimum seepage path length of only 2 to 3 m. Consequently, the Board recommends that an extra till berm be added above the liner to make a more robust tie-in to the foundation.*

Response: The as-built conditions will be compared to the design and recommendations will be provided to AEM as required. The current plan is to expose the bentonite-enriched crushed stone and cover it with additional till.

Comment: *The topography of the site is such that a small drainage basin exists between the main site access road and [SD1]. Moreover, the stripped foundation elevation lies below the level of a lake situated on the opposite side of the access road. Therefore, the Board has concern that the downstream toe [of SD1] will be flooded by runoff and that water will enter the rockfill of the dam with the potential to degrade the ice rich foundation. The question that has to be addressed is whether this is significant and if so, can it be prevented?*

Response: The downstream seepage collection ditch and sump will be constructed to mitigate this concern. However, it should be noted that no earthworks will be possible in this area before freshet. If required, ponding water will be evacuated by pumping during this time.

5.3 General Comments on Geomembrane Liners

Comment: *The composition of modern liner materials is such as to resist the degradation from ultraviolet radiation, and a liner type with lower coefficient of thermal expansion can be selected. Ice impact and abrasion can be resisted by rub sheets of smooth membranes such as HDPE. By careful design and execution, the construction of subsequent dike raises can be carried out with limited risk of material falling or rolling onto the liner (berms and zones of finer material at the outside of the fill). Smooth surfaces will discourage the passage of animals.*

The construction activity necessary to place a cover could, by and of itself, constitute a potential risk for perforation and tearing of the liner. An additional aspect to consider is that the cover materials, from the finer protective layer to the outer rip-rap, are pervious materials and, even when covered eventually by tailings, can constitute a seepage collector which can feed to any anomaly. GAL is to evaluate the pros and cons of a cover zone on the geomembrane liners in the TSF and further discussions will ensue.

Response: It is Golder/AEM's opinion, that an HDPE rub sheet will not provide adequate protection to the underlying geomembrane from ice loading as the layers will freeze together. Further, damage to the rub sheet from animal passage and/or chewing is

expected (see below).

The raising of the rub sheet as the structure is raised may also be challenging and result in damage to the underlying geomembrane.

Golder's experience shows that animals are not discouraged from walking over smooth geomembranes. The passage of caribou results in significant damage to HDPE geomembranes. Additionally, carnivores chew plastic-based geomembranes should an edge be available.

The current design has a cover of tailings will be hydraulically placed over the geomembrane through the construction of a rockfill berm upstream of the Saddle Dams of the North Cell. The tailings beach will be developed during summer months to limit ice damage to the geomembrane.

6.0 TAILINGS STORAGE FACILITY 2010 INVESTIGATION PLAN

Comment:	<p><i>The Board considers the [2010 investigation] program to be well conceived and should provide the required information to advance the detailed design of these structures. The interaction between the design and the investigation work, including any adjustments to the latter as the work progresses, should consider the following aspects:</i></p> <ul style="list-style-type: none"><i>• In future, it would be advantageous to provide detailed information on "Issued for Construction" level drawings to define anchor trench geometry and sequences of dewatering/construction. There is a need to evaluate how to work as much as possible in-the-dry to ensure good quality execution.</i><i>• There is also a need to understand potential glacial fluvial deposits in the basin and their influence on the design, construction and performance. There is a particular need to understand the site geology for cut-off design</i>
Response:	<p>Golder/AEM agrees with the Board's comment. The above noted points will be considered during the development of the design and construction drawings.</p>
Comment:	<p><i>The Board understands that the project team will re-evaluate the liner alternatives (Coletanche vs LLDPE) for all failure modes and adopt the appropriate design details.</i></p>
Response:	<p>Golder/AEM has decided to proceed with LLDPE geomembranes for the remainder of the Saddle Dams. The design details will be updated accordingly.</p>
Comment:	<p><i>The Board recommends a re-assessment of the length of the upstream geomembrane seal to control seepage gradients and minimize the potential for piping.</i></p>
Response:	<p>Golder/AEM agrees with the Board's comment. This will be considered during the design of the structures.</p>

7.0 NEXT MEETINGS

Comment:

The following meetings are to be planned/confirmed:

- *Teleconference call in April concerning the preliminary results of the Bay-Goose investigations and the design of the cut-off for the Southern sector;*
- *Site visit for July 26 to 29.*

Response:

Golder agrees with Board's comment. Details to follow at a later date.

8.0 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.

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