Technical Memorandum

Date: 16 June 2007

To: **Louise Grondin, Agnico-Eagle Mines Ltd.**

Cc: **Roy Lindsay (AE), Laurier Roy (AE), Paul-Henri Girard (AE), Harvey Blouin (Nuna), Wes Danielson (Nuna), Len McHale (Nuna)**

From: **Gary Mann**

RE: **AWPAR Stream Crossing Monitoring Reconnaissance, 15 June 2007**

Gary Mann (Azimuth) and Laurier Roy (Agnico-Eagle) conducted a monitoring reconnaissance of water-related issues (e.g., bridges and culvert locations) along the All-Weather Private Access Road (AWPAR) to near the construction terminus as of 1300hrs, 15 June 2007 (i.e., approximately 43 km). Duane Hudd (North/South) joined us in the afternoon at R02 to discuss the planned mitigation. The goal of the reconnaissance was to visit each location and conduct a brief visual inspection to evaluate the current status, identify unstable areas potentially susceptible to erosion, and to prioritize issues to support timely risk management.

Overall Impressions – No significant sedimentation-related issues were seen during the reconnaissance. Turbidity measurements were taken at crossing R02; turbidity levels were slightly higher downstream relative to upstream background conditions, but the results were well within the acceptable range (i.e., 8 NTU above background). These measurements corroborate our visual observations (i.e., water down gradient of the road did not generally have any signs of significant sediment loading). Notwithstanding, issues were identified that could result in the introduction of unacceptably high sediment concentrations as hydrological conditions change towards peak freshet. Risk management measures and implementation priorities were recommended for all outstanding issues. Additional issues may become apparent as we continue monitoring (e.g., as the freshet strengthens).

The most significant issue facing the team is how to address the next two crossings (R09 and R13), both of which are likely to be reached during the critical period for fish. Further reading of the DFO Operational Statement for Clearspan Bridges (appended to our sediment control guidance) indicates that their position is that the “one time over, one time back” policy for machinery does not apply to the critical window for fish. We will be meeting with Roy on 17 June 2007 to discuss options for R09.

General Conditions - Streams have only recently started flowing due to the delayed onset of spring thaw in the region. In addition, the unseasonably cool temperatures continue to moderate melting rates, likely resulting in a more gradual increase in stream flow and discharge rates. Notwithstanding, discharge and flow rates have risen substantially in only the past two days, particularly at crossing R02. This underscores the importance of timely action to mitigate identified risks in order of priority.

Bridges – Three bridges have been installed to date: R02, R05 and R06.

- **All** – While not our area of expertise, we provide the following suggestion as a point of risk management that could be significant for the aquatic environment in the event of a failure. Abutment armouring (material size, slope, etc.) should be verified relative to design specifications to ensure that they are adequate to withstand the peak discharge as estimated by Golder.

- **R02** – Water was clear downstream of the crossing. Turbidity measurements confirmed that induced turbidity was well within acceptable limits. Background turbidity levels were measured at approximately 2 NTU, resulting in a guidance level of 10 NTU (i.e., background + 8 NTU). Three issues were identified that could contribute to significant sediment loading as freshet progresses:

    - Stockpiled materials in or immediately adjacent to the currently wetted channel (one U/S N side[1]; two D/S S side) (**Photos 1 and 2**) – these materials consist of a range of size classes including relatively fine grains. The piles should be removed with a backhoe and moved well away from the stream channel. Larger material (e.g., boulders) from the stockpiles should be retained and used for increased stabilization of abutment on the U/S S side. Work from the N side will require entering the stream for access, however the substrate in the access zone consists primarily of boulders and the activity poses much less risk than the inevitable consequences of inaction[2].

    - Unstable bank/riparian area associated with ice bridge approach (U/S S side) (**Photos 3 and 4**) – machinery crossing this area has resulted in localized soil instability which would likely become a significant source of fines to the stream and possibly even a zone of severe erosion. Given the proximity to the S abutment, this area should be stabilized with larger material free of fines.

    - Construction-related materials on snow/ice present within the overall confines of the channel (U/S N side; D/S N and S sides) (**Photos 5 and 6**) - without action, this material will eventually be deposited in the stream channel with continued melting of in-stream snow/ice. As much material as possible should be removed, but balanced against causing damage to the stream bank. Where possible, access may be improved working off the existing snow covering the bank (i.e., to reach further into the channel). Some material will remain out of reach and should not be attempted.

  Conducting this work is considered **high priority**.

- **R05** – Water was clear downstream of the bridge, with no obvious ongoing significant sediment sources. The only issue observed was the unstable bank/riparian area (similar to

[1] Locations are presented assuming all crossings have upstream (U/S), downstream (D/S), and nominal cardinal direction (north [N] and south [S]) based on general south-to-north alignment of road (i.e., regardless of true orientation, the Baker Lake side of crossings is always S and the Mine side always N).

[2] While the DFO Authorization forbids in-water activity during fish sensitive periods, it is our opinion that the pros (i.e., removal of material that would eventually erode into the stream) outweigh the cons (i.e., minor introduction of fines prior to onset of critical fish migration period, which our past monitoring show occurs after peak freshet flows). DFO should be notified as soon as possible, which will be when their Iqaluit offices open on 18 June 2007.

R02) associated with the ice bridge approach (U/S S side) (**Photo 7**). Mitigation as per R02. **High priority**.

- **R06** – There were no significant erosional areas observed and water was clear downstream of the bridge. The installation looks good and no action items were identified.

Culverts – No culverts have been installed yet. Water is predictably pooling up-gradient of the road (not only in planned locations, but also in many other areas[3]), with two outcomes: (1) percolation through the coarse road bed material is allowing flow without introduction of fines in most locations (**Photos 8 and 9**); (2) water moving over the road (km 12, R07, near Quarry 7) is also resulting in generally clear flows (**Photos 10 and 11**), with the exception of brief spikes of turbidity associated with road traffic. While both situations may pose certain localized permafrost-related stability problems (which is outside our area of expertise), neither appears to be resulting in increased suspended sediment loading to fish bearing waters as there are long pathways (i.e., hundreds of meters) through braided grassy channels in the few areas where sediment-laden water is leaving the road (i.e., the areas with water over-topping the road). Furthermore, seeing exactly where water is running now will ensure that culverts are both adequately located.

Management of these areas should strongly consider not installing culverts until water levels drop, unless road stability is an issue or if road traffic is increasing sedimentation (e.g., R07). In the interim, silt fences should be installed where possible (and it may not be possible in areas with higher flows depending on the porosity of the material) to facilitate settling well away from fish bearing waters; this is **moderate priority** presently.

Further inspection of over-topping areas could be conducted to assess risks to fish bearing water from road-related sediment introductions. Our observations suggest that present risks are negligible, but further inspection and direct monitoring should be conducted for verification (**moderate priority**). It should be noted that risk levels and potential instability issues could substantially increase if melting rates accelerate in certain locations; continued monitoring will identify these areas. Should culvert installation be deemed necessary, measures should be taken to block flows from the upstream side (e.g., coffer dam) and entrain any sediments downstream (e.g., stacked silt fences); this should be conducted with the utmost care to avoid catastrophic road erosion.

Please feel free to contact me if you have any questions or comments.

/GSM

[3] The need for culvert installation in new locations should be made in light of NWB B Licence requirements for the road and any potential stability-related considerations.

AWPAR Reconnaissance Survey (15 June 2007) Photos

Photo 1. R02 – Stockpiled materials at stream margin (U/S N side).

Photo 2. R02 – Stockpiled materials at stream margin (D/S S side).

Photo 3. R02 – Unstable bank/riparian area (U/S S side)

Photo 4. R02 – Unstable bank/riparian area (U/S S side)

AWPAR Reconnaissance Survey (15 June 2007) Photos

Photo 5. R02 – Construction-related debris on snow/ice within channel (D/S N and S sides).

Photo 6. R02 – Construction-related debris on snow/ice within channel (U/S N and S sides).

Photo 7. R05 – Unstable bank/riparian area (U/S S side)

AWPAR Reconnaissance Survey (15 June 2007) Photos

Photo 8. R04 – Typical situation for most culvert locations (water pooling slightly U/S).

Photo 9. R04 – Water is flowing and generally free of sediment (D/S S side). This is typical of most locations.

Photo 10. Km 12 – Water flowing over road and turnout area.

Photo 11. Km 12 – D/S water generally clear with lots of travel distance to fish-bearing water.