Yellowjacket Joint Venture
Suite 200, 16 - 11th Ave. S.
Cranbrook, BC
V1C 2P1

Mr. Loren Kelly
Chair NWMDRC

Re: Yellowjacket Gold Mine Project – Geotechnical Assessment

On April 29, 2009, Ramy Kamel – Geotechnical Engineer for MEMPR was contacted to discuss whether it would be necessary for the Yellowjacket Gold Mine Project to complete a geotechnical design of the TSF and/or small pit designs, given the current proposed design options for the project. A detailed summary of the project and its components in regards to the mine plan and tailing storage operations were discussed over the telephone with Mr. Kamel.

Points of discussion are listed below:

1. Pit and mine design were developed using good engineering practice.
2. Project haulage roads were designed to meet Part 6.9.1 of the Health, Safety and Reclamation Code for Mines in BC, 2008 (Code). The out of pit ramps will be equal to or greater in operating width than the in-pit haulage roads, which are 11 meters in width, including a 1.7 m high shoulder barrier for operation using 30 tonne articulating haulage trucks. The ramp grade is 10%, on which the Volvo A30E articulating trucks will have adequate braking capacity. Due to the short ramps sections of only 100 to 150 m, it is anticipated that Part 6.9.2 of the Code which requires construction of runaway lanes or retardation barriers for the project will not be needed, as the conditions/risks do not warrant this action. This may need to be further clarified following review by Mr. Kamel, and if necessary a Chief Inspector exemption to Part 6.9.2 could be applied for by the company.

   The in-pit haulage ramp design parameters are as follows:

Parameter	Widths
Total width	11 metres
Operating travel width	8.7 metres (includes 0.5 m ditch) – dual lane traffic
Shoulder Barrier	2.3 metres

   The design is for dual lane traffic, however as there will only be 2 or 3 radio controlled haulage trucks in the haulage cycle at any time, there will be limited interaction between traffic on the ramp systems. For additional safety, initially in

2009 the project will operate its internal pit ramps as a single lane traffic pattern as defined by Part 6.9.1 (2)(a) of the Code. The total 11 metre design width provides for ample room for drivers to pull over during the empty cycle, to provide additional travel width for the loaded haul trucks. This type of operation will ensure as well that speed limits are maintained within the pit boundaries.

Following initial operations and development of the bulk sample pit (Phase 1) ramp system, the Yellowjacket JV will re-evaluate the single lane operating philosophy. The operational solution will be on maintaining appropriate widths for safe operations, and on the requirement to meet Code.

3. The pit(s) are basically shallow quarry operations that in the opinion of the Yellowjacket JV did not require a detailed geotechnical assessment of the pit slopes mainly due to the shallow depth of the proposal. The overall slope angle of the pit is 40 degrees, which consists of a 10 metre 2:1 slope in the surficial material, a 3 metre width berm and a final 15 metre bedrock height. Along the south perimeter the pit the slope angle is only 35 degrees due to the addition of a 6 metre wide seepage control ditch.

   For completeness the general design parameters for the bedrock and surficial gravels are included below:

   The pit design parameters are as follows for the bedrock:

Parameter	Value
Bench Height	5 metres
Highwall Design	15 metres (10 m bench height + 5 m trench height)
Bench Face Angle	70 degrees

   Design parameters for the surficial material:

Parameter	Value
Bench Height	5 metres
Highwall Design	7 to 10 metres
Bench Face Angle	26 degrees or 2:1 slope
Factor of Safety	1.2
Dewatering	Toe drainage is pumped out of the pit

   It is expected that the current pit design parameters will be re-evaluated after additional geological information is acquired from the existing pit slope and/or based on operational conditions encountered during remaining development of the bulk sample pit. As additional data becomes available it will be integrated into

the pit design to allow for revisions to the design as needed and if necessary a geotechnical engineer could be contracted to evaluate the additional data. In addition, it should be noted that water management around the pit area will be undertaken, in order to divert surface and groundwater runoff away from the pit area to reduce pumping requirements for the project.

Figure 5-6, Section A in the small *Mines Act* Permit Application for the Yellowjacket Gold Mine Project illustrates the pit cross-section showing the above design parameters.

4. A discussion of the proposed waste dumps as per design standards of Parts 10.1.6 and 10.1.7 of the Code was not covered during the telephone conversation. However, with the proposed backfilling scenario for this project and utilization of relatively shallow dumps, this has led the Yellowjacket JV to the opinion that a detailed geotechnical (rigorous stability analysis) assessment of the dumps would not be necessary at this time. Since there will be adequate subsurface information upon completion of mining, some simple or qualitative assessments could be carried out prior to dumping, if necessary. The failure consequence for these small dumps are deemed to be very low for the Project as waste material will be in a confined condition with toe support on the level floor of the pits.

   In-pit dump slopes of 37 degrees will be short term, probably less than two (2) years before they will be resloped to 27 degrees (2:1 slopes). If any unfavorable performance is noted, simple slope flattening and/or selection of an alternative disposal scheme could be undertaken immediately.

   Additionally, further information and experience will become available during the construction of the dumps that shall be incorporated into the design, construction, re-grading, and reclamation of these structures. Mapping of the substrates, monitoring of instrumentation and dump performance during construction, and periodic review of design and construction is an integral part of the geotechnical design process and of corporate and environmental risk management.

   Dumps were designed to keep heights below 30 metres. The waste dump design components are as follows:

Parameter	Value
Heights	24 to 26 metres
Final resloping angle	27 degrees (2:1 slopes)
In-situ swell factor	30%
Dump angle of repose	37 degrees

Figure 5-5- Section B in the small *Mines Act* Permit Application for the Yellowjacket Gold Mine Project illustrates the final dump configuration and progression cross section of the dumps using the above parameters.

5. Discussed in detail the hydraulic conductivity of the surficial and bedrock materials as determined by BGC Engineering (BGC) and reported in the document entitled "BGC Hydrogeological Investigation and Analysis Report, June 2006." The following information was discussed over the telephone:

   - That the objective of the hydrogeological investigation was to obtain estimates of hydraulic conductivity (K) within the placer (surficial) material and shallow bedrock of the bulk sample pit, as well as to identify any hydrogeological layering that may be present in the placer material and then develop a conceptual hydrogeological model of the site.
   - Four (4) boreholes were drilled in the placer material, standpipe piezometers installed at selected depths and slug tests conducted (rising and falling heads) to obtain an estimate of K. Packer tests were performed at selected intervals in just one (1) borehole.

   Results of the slug tests in the shallow piezometers show:

   - 10^{-6} m/s in the upper coarse-grained unit (surface to about 5 m below surface)
   - 10^{-6} m/s to 10^{-8} m/s on lower fine-grained unit (5 m to 10 m below surface)
   - Results of the packer tests in the shallow bedrock of the bulk sample show K results from
     10^{-6} m/s to 10^{-8} m/s.

   Note: 10^{-6} m/s to 10^{-8} m/s are equivalent to 10^{-4}cm/s to 10^{-6} cm/s, which are the terms used in the following table.

Soil	Permeability Coefficient, k (cm/sec)	Relative Permeability
Coarse gravel	$>10^{-1}$	High
Sand, clean	10^{-1}-10^{-3}	Medium
Sand, dirty	10^{-3}-10^{-5}	Low
Silt	10^{-5}-10^{-7}	Very Low
Clay	$<10^{-7}$	Impervious

Mr. Kamel indicated that the soil encountered or tested by BGC are in the range of fine/dirty sand to silt soil (see table above for reference). The Yellowjacket JV supports these ranges for the lower fine-grained unit (5 m to 10 m below surface), however the upper 5 metres of surficial material is definitely loose gravel materials and is vey free draining based on field observations. As well, the Yellowjacket JV is of opinion that inflows into the pit maybe greater than the 50 m^3/day volumes calculated and reported by BGC in 2006. This was based on the pumping requirements during the initial development of the bulk sample pit, however as no pumping tests were run in 2007, this 50 m^3/day figure cannot be substantiated or dismissed at time. In 2009 when the pit is being pumped some tests and calculations will be undertaken to determine inflow rates and volumes.

6. The final topic discussion was the proposed plans for the TSF(s), in which it was pointed out that the Yellowjacket JV has not at this time completed any geotechnical assessments on the TSF(s). The reason was that there are no dam embankments or spillways and that the TSF are contemplated to leak like a "leaky" bathtub that exfiltrate into the surficial gravels and does not retain (store) significant amounts of supernatant. The main concern from the discussion was the lack of appropriate hydrogeological data to support the "leaky" bathtub scenario, given the calculated 2006 BGC hydraulic conductivity values. The Yellowjacket JV indicated that Lorax as part of the site water balance determination would be completing some assessment of the BGC boreholes and would further assess the hydrogeological characteristics of the TSF sites. This work is expected to be undertaken in May 2009.

   Based on information to date including the "*Process Plant Discharge Preliminary Impact Calculations" memo from Lorax, April 28, 2009*", there is unlikely any environmental impacts projected from the tailings slurry material, so the remaining potential issue with the proposed TSF(s) would be the exfiltration supernatant rates that are required to maintain current sizing of the TSF(s). A reduced ability of the TSF(s) to leak at an adequate exfiltration flow rate would result in the projected water (supernatant) balance of the TSF being in excess, thus impacting the space for the associated tailings. The Yellowjacket JV contingency plan to address this exfiltration issue includes:

   - complete a site water balance in May 2009, prior to excavation of the 2009 TSF, to properly evaluated the projected infiltration and exfiltration rates from the TSF(s);
   - evaluate site topography of the 2009 TSF, to accurately determine the depths and storage capabilities for the projected 30,000 tonnes of tailings and associated process plant water;

- complete pump tests from the pit, TSF and settling pond to determine the rates and volumes of infiltration and exfiltration;
- develop a contingency pumping plan, whereby the company could pump excess clarified supernant into the 2010 -2015 TSF site and/or visa-versa as a means to increase the time required for natural exfiltration and/or locate a separate exfiltration pond within vicinity of the TSF within the existing placer gravels that could be tested for exfiltration supernatant rates. It should be noted that the company will be completing water (supernant) quality sampling as part of the project environmental monitoring program, therefore the supernant that is being pumped to another TSF or exfiltration pond would be sampled as part of the normal monitoring; and
- complete additional engineering in 2009 to ascertain locations of alternative TSF sites, if required

Mr. Kamel indicated a review of the "*BGC Hydrogeological Investigation and Analysis Report, June 2006*" report and the Yellowjacket JV small *Mines Act* Permit Application would be necessary prior to finalizing any comments on the geotechnical aspects of the Yellowjacket Gold Mine Project.

Regards,

Charles "Chuck" Downie
Yellowjacket Joint Venture