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Mr. Bill Dunn, P.Eng.  
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Dear Mr. Dunn:

Re: Geotechnical Review of Faro and Vangorda Pits and Grum Dump Areas

INTRODUCTION

As requested, Piteau Associates Engineering Ltd. has completed a review of geotechnical concerns in the Faro, Vangorda and Grum areas. This review and letter report follow similar reviews conducted in the past; the most recent letter report is dated August 17, 1992.

Mr. A. Stewart visited the mine site from September 22 to 24, 1992. During that time, geologic mapping was reviewed, inspections of the various areas were made, and results of ongoing pit monitoring were reviewed. Discussions were held with mine personnel regarding these matters.

The following summarizes the results of the geotechnical review. Some general aspects which have already been covered in previous letter reports will not be repeated herein.

FARO PIT

General

At the time of the site visit, mining had been completed in the Faro Pit and tailings was being deposited into the pit from the area of the southwest crest. The main activity in the pit was that related to servicing the underground mining, which is now due to cease operations at the end of October 1992. During the site visit, temperatures were slightly below freezing and the ground was covered for the most part by a thin layer of snow. All water in Faro Creek was being pumped around the diversion.



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### Slope Monitoring

Since our August 1992 report, eight prisms have been monitored on a regular basis. One prism in the calc-silicate area and seven prisms in the south slump area have been monitored every six days on average.

Results of monitoring in the south slump area indicate that Prisms 27, 30, 32 and 33 are continuing to decelerate. In this regard, movement rates of about 30 to 75mm/day in the last week of July have decelerated to between about 10 and 40mm/day. In the calc-silicate area, movement of Prism 19A has gradually slowed from about 50mm/day at the end of July to about 10 to 15mm/day at the present time. Prisms 35, 36 and 37 continue to show little or no movement.

Based on the monitoring results, and on the lack of mining in the pit, it is recommended that the monitoring frequency be reduced even further. After the underground mining is completed, a frequency of about once or twice a month for a few key prisms is probably adequate to maintain a general record of slope movement on the east wall. Where conditions and safety allow, the remaining prisms could be removed from the wall. However, it is recommended that Prisms 1 and 2, which have never indicated any movement, continue to be monitored. These two prisms can be used as control points and for long term assessment of the northeast wall of the pit.

### "AY" and "M" Targets

No new information regarding these two target areas was obtained. The comments and recommendations contained in our reports of July 5 and August 17 are still valid.

At the time of the site visit, a contractor (i.e. Canadian Gun Crete & Grouting Ltd.) was scaling the slope above the "AY" target. As discussed in our report of July 5, 1992, the scaling was being conducted to minimize the potential for rockfalls that could be dislodged by the proposed mining activity. Unfortunately, freezing conditions and a light snow cover were making it difficult to achieve optimum results from the scaling. Nonetheless, the larger potential rockfalls were being removed from the slope and a catch fence was to be installed above the proposed mining area to offer protection from small rockfalls and ravelling debris.



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## VANGORDA PIT

### General

At the time of the site visit, mining in the Vangorda Pit had almost been completed on the 1086m elevation and was starting on the 1080m level. Overburden mining was complete. Flow in the Vangorda Creek diversion flume was low and approximately the same as that observed during the last site visit at the end of July. Some leakage was observed from the flume. Considerable seepage was observed along the northern and western sides of the pit bottom and artesian conditions were observed in a "pond" in the centre of the pit floor. Mr. Dennis Brown had completed his geologic mapping of the pit walls and was no longer on site. However, mine geology personnel had been assigned to continue the mapping.

With regard to the pit design, it is understood that a minor change has been made to the safety berms. Rather than having a continuous safety berm at the 1086m elevation on the north and east walls, this safety berm will now be located at the 1080m level, except at the south end of the east wall where the berm will be at the 1092m level. It is also understood that the pit completion date has been revised to March 1993.

### Cross Fault

Since the previous site visit, the west wall corner at the entrance to the active pit has been trimmed back slightly to provide additional room. As the Cross Fault intersects this area of the pit wall, and some bench scale instability was experienced in this area during development of the original slope, there was some concern regarding the stability of the newly trimmed slope. However, the slope appears to be performing well. While a number of shear surfaces associated with the Cross Fault can be seen in the wall, the rock mass appears relatively intact and the face appears fairly clean. No obvious areas of instability were observed.

Other than the above, no additional information beyond that discussed in our July 5 report is available for the Cross Fault. Thus, the comments and recommendations contained in that report are still valid.

### Northwest Fault

Since our last letter report of August 17, no new information of any substance regarding the orientation and nature of the Northwest Fault has been obtained. Thus, no additional geologic structural interpretations or projections have been



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carried out and the conclusions and comments included in the August 17 report are felt to be valid.

In the eastern portion of the north wall, seepage was observed from the crest of the wall above the Vangorda Creek flume down to the pit bottom. This seepage is in the area where the Northwest Fault zone intersects the slope and where the rock mass is highly contorted and broken, as evidenced by the shovel being able to free dig a portion of the rock. While no ravelling was observed in this area during the site visit, mine personnel have reported erosion and ravelling over a short length of slope. As there is little or no catchment room available on any of the safety berms in this area, it is recommended that particular caution be exercised when working below this portion of the slope. Providing that the rock mass is sufficiently competent to stand, the development of the 1080m safety berm should help to mitigate any hazard from rockfalls and ravelling material. However, even with the 1080m safety berm in place, some risk will remain and caution should be used when working below this area.

#### Northwest Corner of the Pit

In the northwest corner of the pit, where the overburden slope has been dozed to a relatively gentle angle, the overburden/bedrock contact appears to be about 6 to 8m below the dozed crest. It is understood that on the weekend of September 5 and 6, a 1.5cm wide arcuate crack opened up in the overburden about 20m behind the pit crest. In addition, slight seepage was observed on the pit face at the overburden/bedrock contact. A monitoring stake was installed just downslope of the crack and regular survey and visual monitoring conducted. Results of the monitoring apparently indicate that no further movement has taken place. While seepage along the contact apparently is only intermittent, it is understood that this corner of the pit has always been the source of considerable seepage. Vangorda Creek is diverted under the main haulroad just behind this area.

It would appear that even though no disturbance or cracking has been observed on the pit face, the crack behind the crest probably reflects movement as deep as the overburden/bedrock contact, which in this area dips toward the pit. It is also likely that the movement was initiated by a high groundwater level in the slope. Based on this, it is recommended that monitoring of the slope be continued. Besides the existing monitoring stake, it is recommended that two additional monitoring points be established; one near the crest of the slope and one behind the crack. Monitoring frequency should be at least once or twice a week, as well as following blasts in this corner of the pit. Visual monitoring of the crack and surrounding area, including the pit face immediately below the crack, should also be carried out on a regular basis.



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#### West Wall Overburden Slope

The general condition and configuration of the west wall overburden slope has been described in our reports of July 5 and August 17 and will not be repeated. Since our last site visit, a safety berm has been established at the 1092m elevation between about Sections 4E and 8E. It was also observed that some slumping of the overburden has recently occurred just south and below the survey base station on the west wall. While failure of the overburden in this area would likely result in most of the debris being caught on the 1092m safety berm, it is also likely that some of the debris would reach the present pit bottom. At least two other small sloughs, both less than one bench height in size, have occurred in overburden toward the south end of the south wall. All debris from these small failures has been caught on the safety berms.

Based on past performance of overburden slopes at the mine, it is likely that the occurrence of overburden failures will decrease in the winter months when the slopes are frozen. However, during the present period of freezing and thawing conditions, these slopes are particularly susceptible to instability. Thus, it is recommended that careful visual monitoring of these slopes be carried out at least twice a week and following blasts.

#### East Wall

The east wall of the Vangorda Pit appears slightly better than that observed during previous site visits. While the bench faces are still somewhat ragged in appearance, it was noticed that the bench face between the 1092m and 1086m levels is somewhat steeper and more competent than the bench faces higher up the wall. The 1104m safety berm continues to perform well with considerable catchment room available.

No change was observed in the potential wedge failure that was previously noted between about the 1110m and 1120m elevations. As previously discussed, even if this wedge should fail, it would likely fail as a number of small blocks, starting at the southern end of the wedge. Most of the debris would probably be retained on the 1104m safety berm. Regular visual inspections of this area of the slope are recommended.

#### Vangorda Creek Diversion Bench

The bench on which the Vangorda Creek diversion flume is located generally appears to be in good condition. No specific stability concerns are apparent at this time.



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### Slope Monitoring

None of the five prisms installed between the 1130m and 1152m elevations on the north and east walls of the pit in early July appears to have experienced any movement. As previously discussed, visual inspections of the pit walls, particularly of the flume bench and of the west overburden slope, should be carried out on a regular basis and after any blasts. The need for additional prisms should be evaluated on an ongoing basis.

It is noteworthy that the present survey base station for the prism monitoring is located on overburden at the crest of the west wall in the vicinity of recent slumping activity. It is very important that the stability of the survey base station be checked with each set of prism readings by surveying a known stable backsight.

### GRUM AREA

#### East Overburden Dump (Pelly Dump)

A brief inspection was conducted of the revised dumping program being carried out on the East Overburden Dump. As recommended in our report of August 14, 1992, dumping had been altered such that about a 6m thick lift of overburden waste was being advanced over native materials and all waste was being dumped short and pushed over the crest. No signs of instability were observed and the revised dumping scheme appeared to be working well.

#### Relocation of Haulroad Around Champ Zone

To accommodate the revised mine plans for the Grum Pit, the main haulroad to the Vangorda Pit is being relocated slightly westward around the Champ Zone. It is understood that during construction of the new portion of the haulroad, which crosses the Grum Creek drainage, failure of the haulroad fill occurred. At the time of the site visit, the new haulroad fill had been advanced over the area of instability and no evidence of failure was observed. However, during a reconnaissance and test pitting program carried out during the same site visit, it was observed that the surficial soils about 200m downslope of the relocated portion of the haulroad are comprised of a saturated silty sand with some gravel. Seepage was occurring in the test pits and the ground surface was relatively wet and swampy. It was estimated that as much as 15L/s may have been flowing in Grum Creek and from the numerous seepage areas.

Based on the above observations, it is likely that the haulroad fill failure was a foundation failure through the loose, saturated surficial soils. While the possibility of additional failures cannot be ruled out, no signs of instability



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were observed. Thus, it is recommended that visual monitoring of the relocated portion of the haulroad be carried out on a regular basis. The need for remedial measures can be determined based on the ongoing performance of the fill.

I hope the above is sufficient for your needs at this time. If you have any questions concerning the above, please do not hesitate to contact us.

Yours very truly,

PITEAU ASSOCIATES ENGINEERING LTD.

Alan F. Stewart, P.Eng.



AFS/ef

Att.