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LAWYERS

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**For: Hillary Lennox**

Otago Regional Council
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Dear Hillary

**Request for Further Information under section 92(1) of the Resource Management Act 1991 (the Act) - Application Number RM10.351 by Oceana Gold (New Zealand) Limited for Various Consents Associated with Macraes Phase III**

1. On 3 May Oceana Gold (New Zealand) Limited (OceanaGold) lodged an application for resource consent with the Otago Regional Council (ORC) to expand the mining operation at the Macraes Mine. Following an initial assessment of the application the ORC determined that it required further information under section 92(1) of the Act to make a full assessment of the application.

2. The ORC's request for further information was sent to OceanaGold on 30 May 2011. The information requested and OceanaGold's responses are set out below:

**ORC Section 92 Response**

**Discharges to Air**

1) Previous consents for the discharge of contaminants to air from mining activities have included a condition that states, "There shall be no emission of visible dust from the mining activities that, in the opinion of an enforcement officer, is offensive or objectionable to such an extent that it has an adverse effect on the environment." Is there any reason why such a condition has not been recommended as part of the current application?

   *In the assessment report the only conditions from previous air consents that are specifically mentioned are those that are proposed to change due to the MPIII project. It was assumed that all previous air consent conditions, aside from those highlighted for change would continue. This would include the condition that states "There shall be no emission of visible dust from the mining activities that, in the opinion of an enforcement officer, is offensive or objectionable to such an extent that it has an adverse effect on the environment." Section 13 of Appendix 31 states "OceanaGold proposes that the current conditions of consent 96785_V4 are included in the new consent with some minor changes."*

2) On Page 39 of Appendix 31 (Assessment of Environmental Effects of Air Discharges, Beca Infrastructure Limited), it is stated that the new nephelometer-type monitor will be run in conjunction with a high-volume sampler at Macraes for one year. This is for calibration purposes. However, it is stated earlier in the same report that use of all three

existing high-volume samplers is to be discontinued. Please clarify how the new nephelometer-type monitor is to be calibrated on-site.

*To clarify, what is proposed is that the three existing high-volume samplers required as part of existing consent conditions be disestablished and replaced by one nephelometer-type monitor at Site 15 in the Macraes village. The nephelometer-type monitor will be operated in conjunction with a high volume sampler for one year for calibration purposes.*

3) Section 10.2, on page 40 of Appendix 31, describes the proposed revised configuration of dust pots. Please confirm whether Dust Pot No.3, as shown on Figure 10.1, is the same dust pot as Dust Pot 6, as discussed in Section 10.2. Will monitoring of Dust Pot 3 be maintained in the dust monitoring regime?

*Dust Pot 6 is located adjacent to the Golden Point Historic Reserve. It is proposed to remove this site from the monitoring regime and to retain Dust Pots 7 and 17 (refer Section 10.2 of Appendix 31). Dust Pot 3 is located adjacent to Golden Point Road and the Mining Offices. It is not the same site as Dust Pot 6. It is proposed to continue monitoring Dust Pot 3. Figure 8.1 of Appendix 31 shows the locations of the existing depositional dust monitoring sites. Figure 10.1 of Appendix 31 shows the proposed monitoring sites. Figures 8.1 and 10.1 are attached for reference.*

4) Section 10.2.1 of Appendix 31 discusses current and future meteorological data at the site. What will the time resolution be for the meteorological monitoring? Will the data collected be able to be viewed real-time?

*The current meteorological data recorded at the climate station located on Golden Point Road can be viewed real-time. The proposed climate station to be operated alongside the nephlometer-type monitor at Site 15 will also be able to be viewed real-time. Data from both stations is recorded at 15 minute intervals.*

5) Proposed consent conditions are discussed in Section 13 of Appendix 31.

    a. In proposed consent Conditions 8 and 10, it is stated that in the event of consent limits being exceeded, "the consent holder shall undertake an immediate review of dust mitigation methods unless it can be demonstrated that sources other than mining have contributed to the majority of downwind deposition". A report outlining the findings of this review shall be provided to the Consent Authority within 1 month of the high result(s) being received. Please can you advise what investigation would be undertaken to determine whether the source of the dust/TSP was attributable to non-mining activities, and in the event of other sources being identified as the cause, please can you discuss whether a report will be provided that details the investigation work undertaken to make such a determination.

        *Investigation into an exceedance of consent limits would include reviewing the following;*

        - *the dust levels recorded and where they occurred,*
        - *the validity of the data,*
        - *weather conditions (in particular wind direction and rainfall) for the monitoring period and conditions prior to monitoring,*
        - *what mining activities were occurring near the monitoring point and what the level of overall mine activity was like,*
        - *the dust chemistry, and*
        - *any other activities in the immediate area surrounding the monitoring location – e.g. – agricultural activities such as ploughing of the paddocks near the monitoring instrumentation*

*Once the above information is compiled and investigated, the probable source of the dust can be determined. If the source is found to be non-mining related then the investigation will be concluded. If the source is deemed to be attributable to mining activities then a full review of mitigation measure and their effectiveness will be conducted. The results of the investigation for either outcome will be provided in a written report to the ORC. Independent advice may be sought to assist the investigation.*

b. In Condition 12, TSP monitoring is discussed. In order to use a real-time monitor for compliance monitoring purposes, a robust correlation to the high-volume sampler must be made. Running the high-volume sampler 1 day in 3 during the warmer months (November to February) would allow for a greater number of samples to be collected for comparison, with the majority of samples coming from the more problematic months. Please discuss why this approach has not been proposed.

*The monitoring proposed is consistent with existing resource consent conditions which require 1 day in 6 monitoring. As highlighted, 1 day in 3 monitoring for the months of November to February inclusive for the purposes of real-time monitor calibration is more appropriate and OceanaGold agrees with this approach.*

c. In the application it is proposed that monitoring reports shall be provided on an annual basis rather than on a quarterly basis. Council has historically considered quarterly monitoring reporting to be acceptable. Please provide discussion to justify the proposed approach of providing monitoring reports annually rather than quarterly.

*No changes to reporting are proposed in relation to dust monitoring. As highlighted in Question 1 above, it is proposed to include the current conditions of consent 96785_V4 in the new consent with some minor changes. The proposed changes are documented in Section 13 of Appendix 31 and do not include any revision of the requirements for reporting.*

*Dust monitoring results are reported to the ORC as part of quarterly monitoring reporting in accordance with Condition 16 of 96785_V4 and an annual review and assessment of all dust monitoring data is completed in accordance with Condition 17 of 96785_V4. Conditions 16 and 17 of Consent 96785)V4 are reproduced below.*

*Consent 96785_V4 - Monitoring reports and quality assurance*

*16. Results of all dust deposition rate monitoring and all other monitoring shall be reported to the consent authority as set out in the General Provisions of Schedule II.*

*17. The consent holder shall commission an independent consultant to undertake an annual review and assessment of all dust monitoring data, and if the consent holder must initiate a review of dust mitigation measures to comply with condition 8 and 10 of this consent. The reviewers report shall include:*

*a) The name, qualifications, and experience of the reviewer.*

b) *the methods used and the investigations undertaken for the review*

c) *interpretation of the monitoring data reviewed*

d) *an assessment of the quality of the monitoring data*

e) *an assessment of the monitoring regime*

f) *a description and evaluation of each of the dust mitigation measures used by the consent holder.*

g) *recommendations on whether*

i) *the monitoring of dust is adequate or should be changed, and if changed the changes that are recommended*

ii) *the dust mitigation measures used by the consent holder are adequate, or should be changed, and the changes that are recommended.*

iii) *any changes should be made to the conditions of this consent.*

h) *any other matters which the reviewer considers should be drawn to the attention of the consent holder or the consent authority*

6) Best practice indicates that daily, signed checklists are helpful in ensuring completion of routine tasks, such as those noted in Table 5.1 of Appendix 31. Please discuss why this concept has not been included in the Dust Management Plan. Please also discuss why the "daily decision tree" does not apply to the entire MGP operation.

The Dust Management Plan includes many dust management techniques, but provides little detail as to how they will be applied on-site. The one specific practice mentioned is a speed limit of 60 km/hr. Best practice indicates this is about twice the optimal speed limit. Please discuss. Please also clarify whether this practice applies to light vehicles only, and whether there is strict control on the speed limit of full load trucks.

*The Dust Management Plan attached to Appendix 31 of the application is a draft document prepared for the MPIII application on recommendation of ORC Officers. Once finalised it will be subject to regular reviews as part of OceanaGold's environmental management system.*

*Daily signed checklists have not been included as conditions at the mine are dynamic and constantly changing. Completing a checklist at one point in time is not useful. Instead supervisory personnel and operators are trained to make continual on-the-job observations of road conditions, dust generation from exposed surfaces, speed of vehicles, location of activities and weather conditions. Changes to mining locations, use of haul roads, speed of vehicles and the use of water carts are made on the spot and communicated via the radio network and the Minestar control system.*

*The daily decision tree included in the Dust Management Plan applies specifically to the tailings impoundments. A daily decision tree has been drafted to cover the remainder of the mine and is attached. The Dust Management Plan will be updated to reflect the changes.*

*When travelling on mine haul roads there is a maximum speed limit of 60km/hr. This applies to both heavy and light vehicles. If conditions change (e.g. become very windy) speed restrictions can be revised downwards via the radio network or Minestar control system. Operational reductions in the speed limit are common and occur mainly in response to changes in environmental conditions such wind, rain, ice and snow. All vehicles operating within the mine must have an RT system installed and this is utilised, along with the Minestar control system to advise employees and contractors to limit their speed. Whilst the 60km/hr speed limit is greater than the best practice speed limit suggested, it has been in use for over 20 years of mine operations at Macraes and has been found to be appropriate. In determining the maximum speed limit the following has been taken into account; the types of vehicles, the type of road surface in use, the ongoing maintenance of road surfaces, the use of two dedicated water carts, existing dust management practices, historical performance and environmental and health and safety considerations.*

**Discharge to Surface Water**

7) Table 17 of Appendix 8 describes the surface water quality compliance criteria, which is based either on stockwater guidelines for sulphate or ANZECC guideline values for soluble metals to protect aquatic life. In the Shag River, monitoring points are based on the New Zealand Drinking Water Standards or ANZECC guidelines for soluble metals to protect aquatic life. Compliance limits set for $cyanide_{wad}$ at NB03 are not consistent with those set for other surface water monitoring locations. Please provide the rationale for this inconsistency.

*There is no compliance limit proposed for cyanide at NB03 because there is no tailings impoundment (the potential source of any cyanide contamination) located within the North Branch of the Waikouaiti catchment. A limit of 0.1g/m3 is proposed at the North Branch of the Waikouaiti River compliance monitoring point at Ross Ford (Table 1 below). Monitoring of this point would detect any cyanide long before it would reach NB03.*

Please note that that an initial staff review indicates that that the following compliance criteria could be set for each of the monitoring sites below (Table 1) and that monitoring should be undertaken on a monthly basis. Please note the compliance limits proposed for cyanide and iron at NB03.

*The compliance criteria proposed in Table 1 are identical to what is proposed in Table 17 of Appendix 8 with the following exceptions;*

*Site NB03*
*A compliance limit of 0.1g/m3 is proposed for cyanide versus no limit proposed in Table 17 and a compliance limit of 0.2g/m3 is proposed for iron versus a limit of 1.0g/m3 in Table 17.*

*There is no monitoring data for cyanide at site NB03. The preference would be to avoid monitoring of cyanide in instances where a site further upstream and closer to the mine is monitored (i.e. NBWRRF). This comment also applies to the Shag River at Loop Road(covered by DC08) and Shag River at McCormicks (covered by TC01).*

*Existing monitoring data for the NB03 site shows that iron levels have exceeded 0.2g/m3 on three occasions out of 31 records (2004 to 2011), most recently in 2006. Preliminary analysis of these results and upstream and side tributary data indicates that these levels are probably naturally occurring from within the North Branch of the Waikouaiti catchment. On this basis the proposed limit is acceptable however it is suggested that the proposed compliance criteria be subject to a condition that states "the consent holder shall comply with the water quality compliance criteria as outlined in Table 1, unless*

*evidence can be provided that the level of a parameter is either naturally occurring or unrelated to mining activities".*

*Site NBWRRF*

*Table 17 of Appendix 8 proposes the North Branch of the Waikouaiti River at Redbank Road(NBWRRB) to be the stockwater compliance point, however the site at Ross Ford (NBWRRF) is equally appropriate as it would also pick up any potential seepage losses from a NBWR tributary that flows directly west from the Frasers West Waste Rock Stack. The Ross Ford site also provides a reliable flow regime for sampling and as such is probably more appropriate for long-term compliance monitoring. The proposed water quality criteria are appropriate.*

*Site MC01*

*A compliance limit of 0.1g/m3 is proposed for cyanide versus no limit proposed in Table 17. Whilst it is unnecessary to monitor for cyanide in the Murphys Creek catchment due to lack of a source, the limit proposed for cyanide is acceptable.*

*The proposed monthly monitoring frequency is acceptable however an option to reduce the frequency of monitoring to quarterly or six monthly on evidence of an appropriate period of consistent results is requested.*

*A suggested consent condition is, "With the prior written approval of the consent authority the consent holder may reduce the frequency of monitoring or the number of contaminants being monitored in accordance with Table 1 where it is shown that maintenance of the original monitoring programme is not required provided always that the consent authority may by notice in writing at any time require the consent holder to resume the frequency or extent of monitoring as set out in Table 1."*

**Table 1: Proposed Surface Water Quality Compliance Criteria**

| Compliance Point | North Branch Waikouaiti River (NBO3) | Shag River at Loop Road | Shag River at MacCormicks | Deepdell Ck DC08 | North Branch Waikouaiti River (NBWRRF) | Murphys Creek (MC01) | Cranky Jim Creek (CJ01) | Tipperary Creek (TC01) |
|---|---|---|---|---|---|---|---|---|
| Potential Use | Drinking water | Drinking water | Drinking water | Stock water | Stock water | Stock water | Stock water | Stock water |
| pH | 6-9.5 | 7-8.5 | 7-8.5 | 6-9.5 | 6-9.5 | 6-9.5 | 6-9.5 | 6-9.5 |
| Arsenic | 0.01 | 0.01 | 0.01 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| $Cyanide_{WAD}$ | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Copper | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 |
| Iron | 0.2 | 0.2 | 0.2 | 1 | 1 | 1 | 1 | 1 |
| Lead | 0.0025 | 0.0025 | 0.0025 | 0.0025 | 0.0025 | 0.0025 | 0.0025 | 0.0025 |
| Zinc | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |
| Sulphate | 250 | 250 | 250 | 1000 | 1000 | 1000 | 1000 | 1000 |

8) The new and expanded WRSs and TSFs will require erosion and sediment control until they are completed and rehabilitated.

a. The main function of a silt pond is to stop sediment entering surface water. Suspended solids have not been included in the compliance monitoring programme. Please provide this detail or discuss why this has been omitted. Please also discuss the proposed sediment pond desludging regime, and how this will be reported to Council.

*Historically suspended solid monitoring has not been included in the compliance monitoring programme. The reason for this is that suspended solids levels are associated with rainfall events and routine monitoring is unlikely to provide useful data. Monitoring suspended solids within a silt pond does not provide particularly useful data as it simply gives a measure of how much sediment is suspended in the water at that point in time and does not give an indication of the effectiveness of the silt pond in reducing sediment. It would be more logical to sample for suspended solids following large rainfall events that have generated significant stormwater runoff to the silt ponds. In such situations suspended solids readings should be taken upstream of the silt pond, within the silt pond and at the downstream outlet.*

*In 20 years operational experience it has been found that significant stormwater runoff occurs relatively infrequently and is generally associated with moderate to major rainfall events. As a result sediment accumulation in existing silt ponds is visually quite minimal. To further support this, none of the silt ponds in use have been desludged and all show minimal evidence of significant sediment accumulation. In light of this OceanaGold is not proposing a desludging regime. Each silt pond is regularly inspected and should desludging be required then it will be undertaken using an excavator, taking care to avoid the embankment face and any unnecessary disturbance. Removed sediment would be transported to a waste rock stack for disposal. Any desludging works would be undertaken during summer when dry conditions prevail. Desludging activities would be reported to the ORC in the Quarterly Monitoring Reports.*

b. Please discuss why the Maori Tommy Gully silt pond is the only silt pond in which cyanide will be monitored.

*This is a historical carry-over from the early consents for the mine and the likely reason for the monitoring is that Maori Tommy Gully Silt Pond is located immediately downstream of the Mixed Tailings Impoundment, Sump B (tailings seepage collection sump) and the Environmental Sump (sump collecting run-off from the Processing Plant). Therefore if there was any overflow or loss from these structures it would be intercepted at the silt pond and monitoring for cyanide would detect if this had occurred. All other existing silt ponds are downstream of pits or waste rock stacks and there is no reason to monitor for cyanide.*

c. Regarding the silt ponds, as well as regular maintenance (desludging), to ensure consistency, the following monitoring regime could be adopted for every silt pond.

**Table 2: Proposed Silt Pond Monitoring Regime**

| | Quarterly | Annually |
|---|---|---|
| pH | ✓ | |
| Suspended sediment | ✓ | |
| Conductivity | ✓ | |
| Arsenic | ✓ | |
| Iron | ✓ | |
| Cyanide | ✓ | |
| Copper | | ✓ |
| Lead | | ✓ |
| Total inorganic nitrogen | | ✓ |
| Maintenance report | | ✓ |

Please confirm whether you agree with this maintenance and monitoring regime.

*The proposed silt pond monitoring regime is acceptable for all existing consented silt ponds and the proposed TTTSF silt pond/sump, with the exception of cyanide monitoring which is only required for Maori Tommy Gully Silt Pond. Once the TTTSF becomes operational the TTTSF silt pond coverts to a seepage collection sump so will no longer function as a silt pond. From that stage onwards water quality reporting to the TTTSF sump will be monitored as part of the TSF geotechnical seepage monitoring regime.*

*The MPIII application proposes a number of small permitted silt ponds surrounding the Back Road Waste Rock Stack and TTTSF. As these are small temporary structures it is not proposed to monitor water quality within them.*

**Camp Creek Dam**

9) Figure 11 of Appendix 23 shows that the outlet structure for the Camp Creek dam is located at the bottom of the dam. It has been acknowledged in the aquatic ecology assessment (Appendix 5, Page 37) that it is likely that the reservoir will vertically stratify, creating a layer of cold, poorly oxygenated water in the deeper parts of the dam. The release of this water from the bottom of the dam may have a negative impact on fish and invertebrates downstream of the dam until the water has travelled a sufficient distance downstream to become oxygenated.

Non-migratory galaxias populations are particularly susceptible to predation by trout. Summer flows in Camp Creek are currently too low to support a significant trout population, but the release of a stable flow of cold water from the Camp Creek dam will create a thermal refuge for trout, and allow them to persist in Camp Creek throughout the summer. This may result in the extinction of flathead galaxias in Camp Creek.

An intake structure that takes water from the surface of the lake will significantly reduce the impacts on the downstream environments. It is still likely that there will still be some increase in the trout population downstream of the dam as water is continuously released over the summer months.

The application briefly discusses the possibility of providing off-site management for a more high value non-migratory galaxias population (such as Central Otago roundhead galaxias). This may come in the form of trout removal and the installation of trout migration barriers from critical sites, such as in the Taieri catchment. This is considered to be the only effective mitigation measure for flathead galaxias discussed in the

application. However, there is insufficient detail at this stage to determine if it is an appropriate mitigation measure to offset the effect of the proposed dam.

Based on the above, please can you:

a. Provide a detailed plan for managing the effects of lake stratification, including options for an intake structure that allows water to be taken from the surface of the lake.

*In light of the likelihood of stratification occurring within the Camp Creek Reservoir, the options for managing this have been assessed and the most practical option is to modify the outlet system. Engineering Geology Ltd confirm that a floating decant system is appropriate and they have designed and operated similar systems on large irrigation dams. Figure 11 (Appendix 23 - Camp Creek Dam Technical Report) has been updated to show the use of a floating decant system. Please refer to the response to question 7a in the attached letter from Engineering Geology Ltd.*

b. Provide an effective mitigation plan for the potential loss of flathead galaxias populations from Camp Creek, which may include off site mitigation for high-value non-migratory galaxias populations.

*The work completed by Ryder Consulting Limited as part of the aquatic assessment for the MPIII application, indicated only one confirmed fish survey of Camp Creek in 2006 by DoC. No trout were identified during this survey. Surveys of Deepdell Creek upstream of the Golden Point weir over the past 20 years by Greg Ryder of Ryder Consulting Ltd have not revealed the presence of trout above the weir. It is likely the Golden Point Weir, installed in the 1980's provides a barrier for trout migration during low to moderate flows.*

*The use of a floating decant structure as discussed in the response to Question 9a) above, will remove the likelihood of deoxygenated water being discharged and of a cold water refuge forming during the summer months. As discussed in the aquatic assessment it is considered that augmentation of Deepdell Creek summer low flows via flow releases from the Camp Creek reservoir may in fact act to maintain the Deepdell Creek galaxias population through the maintenance of physical habitat and invertebrate food supply during critical drought periods.*

*The Camp Creek dam will provide a barrier for trout migration further up Camp Creek, hence any populations of non-migratory galaxias in the reaches above the dam will be protected from migratory trout indefinitely. It is noted in the aquatic assessment that the upper reaches of Camp Creek (approx. 0.6 to 3km upstream of Horse Flat Road) could not be surveyed at the time of the assessment due to lack of landholder access.*

*OceanaGold is currently in discussion with the Department of Conservation regarding the installation of a trout migration barrier in the Taieri catchment as mitigation for the loss of non-migratory galaxias populations. These discussions are ongoing and currently have not been finalised, however OceanaGold is committed to establishing effective mitigation. Once confirmed the outcome will be forwarded to ORC and WDC.*

**Hydrogeology**

10) A blanket recharge rate of 32 mm per year is specified for the conceptual model (Appendix 12, Sections 2.4 and 4.0) and the numerical modeling (Appendix 12, Section 5.2) of the TTTSF and the Deepdell Creek catchments. This value of recharge is thought to be derived from a catchment water balance for Deepdell Creek, integrating

recorded creek catchment yield and calculated riparian evapotranspiration. As such, the recharge rate may be highly averaged.

a. What variability in recharge rate would be expected to result from variations in existing terrain or vegetation?

*Please refer to the response to question 10a in the attached letter from Golder Associates.*

b. What changes to recharge rate would be expected to result from mining/infrastructure activities, and have these been incorporated within the model recharge (RCH) input layer?

*Please refer to the response to question 10b in the attached letter from Golder Associates.*

11) In relation to GoldSim (Appendix 10, Section 2.1.5), the groundwater recharge rate is not explicitly referred to or accounted for. The GoldSim modelling project takes input from the MODFLOW modelling of seepage to surface water. Please confirm whether the GoldSim model also incorporates groundwater recharge of 32 mm per year?

*Please refer to the response to question 11 in the attached letter from Golder Associates.*

12) As the AWBM is used for the hydrological simulation with the GoldSim model, a portion of catchment precipitation will be simulated as removed for evapotranspiration, interception and groundwater recharge. The groundwater recharge component is routed to the surface water system within the AWBM baseflow package (NEWBFLOW). Have the externalities and internal transfers been fully accounted for when including AWBM and MODFLOW groundwater exchanges?

*Please refer to the response to question 12 in the attached letter from Golder Associates.*

13) It has been proposed that a sump be installed in the bed of the truncated Tipperary Creek near the downstream foot of the TTTSF impoundment wall. The intention is that the sump would attract the flow of groundwater from beneath the tailings deposited onto the land surface and capture this groundwater seepage for re-circulation within the mine tailings water system. The following questions arise:

a. What extent and portion of groundwater emanating from beneath the TTTSF would become captured by the Tipperary Sump and why are other sumps proposed in the West Tipperary sub-catchment or Cranky Jims Creek headwaters abutting the TTTSF impoundment wall?

*A combined response from Engineering Geology Ltd and Golder Associates is presented. Please refer to the response to question 13a in the attached letter from Engineering Geology Ltd and the response to question 13a in the attached letter from Golder Associates.*

b. Figures show groundwater flow directions in the vicinity of the TTTSF. However, these tend to primarily obey gradients defined by topography and relative hydraulic head. To what extent were lateral and vertical anisotropy in hydraulic conductivity considered in the MODFLOW simulations?

*Please refer to the response to question 13b in the attached letter from Golder Associates.*

c. If anisotropy was incorporated in model simulations, how were the absolute or relative values of contributions from schist foliation, jointing, shears, crush zones or other rock defects included in the hydraulic conductivity field?

*Please refer to the response to question 13c in the attached letter from Golder Associates.*

14) The underground panels are being dewatered. The panels once mined, will ultimately collapse into the mined void. This is known from examples of deep underground metalliferous mining overseas which has caused a zone of enhanced artificial hydraulic conductivity in the overlying rock. The combination of enhanced permeability and secondary porosity, and the continuing need for dewatering of the operational workings would produce additional desaturation of the southern parts of the MGP. The Fraser Pit is to be expanded and pit base dewatering is to be maintained for the operational life of the pit. Time lags in the effects of dewatering of the Fraser Underground, Fraser Pit and others like such as Innes Mills III, could take years to fully exert themselves through the buffering effects of storage coefficients in the groundwater system. The following questions arise:

a. In view of the likelihood of a future deepened centre of desaturation of the schist, has a full analysis of the future groundwater hydrology considered the effects of desaturation in terms of shifting flow divides?

*Please refer to the response to question 14a in the attached letter from Golder Associates.*

b. Have the changed desaturation conditions been considered in the bulk system hydraulic conductivity of either the conceptual model or numerical groundwater model simulations?

*Please refer to the response to question 14b in the attached letter from Golder Associates.*

15) Evidence of arsenic concentration reduction between the MTI and groundwater monitoring wells is provided in Section 3.5.1 of Appendix 12. It is stated that this is one of the lines of evidence for the attenuation of arsenic in groundwater seepage. Currently, a groundwater plume of conservative contaminants is observed in monitoring down-gradient of the MTI. The following questions arise:

a. To what extent did the authors of Appendix 12 consider the alternative possibility of simple arsenic retardation in seepage?

*Please refer to the response to question 15a in the attached letter from Golder Associates.*

b. Could the transport of arsenic down-gradient of the MTI and TTTSF areas reach a geochemical threshold whereby a secondary break-through of groundwater-borne arsenic could eventuate?

*Please refer to the response to question 15b in the attached letter from Golder Associates.*

**Tailings Static and Kinetic Geochemical Assessment**

16) The following comments, questions and further information requests have arisen from a preliminary review of Appendix 13:

a. Please provide a detailed description of how tailings are deposited into the tailings impoundments. Please discuss where the sampling points are in relation to the discharge spigots, and whether there is any segregation of tailings particles upon discharge.

*Please refer to the response to questions 16a to 16j in the attached letter from Golder Associates.*

b. Please provide a map of the sampling locations, and also discuss the spatial variation for sulphate, arsenic, iron and other metals within the tailings impoundments.

*Please refer to the response to questions 16a to 16j in the attached letter from Golder Associates.*

c. Please provide assurance that the sampling sites chosen provided samples that were representative of tailings disposed at the site.

*Please refer to the response to questions 16a to 16j in the attached letter from Golder Associates.*

d. Please confirm whether the ores from which the "Macraes Tails" and "Reefton Tails" samples were derived had been subject to pressure oxidation.

*Please refer to the response to questions 16a to 16j in the attached letter from Golder Associates.*

e. Please confirm whether flotation only tailings were present in the impoundments from which the samples were collected.

*Please refer to the response to questions 16a to 16j in the attached letter from Golder Associates.*

f. There is no kinetic testing for sulphate, iron and other metals in the leachate. There is also no testing of material of higher sulphide content e.g. flotation tailings. Please discuss.

*Please refer to the response to questions 16a to 16j in the attached letter from Golder Associates.*

g. Not all the data were provided with the kinetic testing e.g. the solids data, mineralogy. Please provide this data where available.

*Please refer to the response to questions 16a to 16j in the attached letter from Golder Associates.*

h. Please discuss variations in the composition of the ore that has been processed to date and will be processed in the future, and how this effects likely tailings composition i.e. if the ore has been subjected to pressure oxidation it will be a source of sulphate, arsenic and other metals, whereas non-pressure oxidation tailings will have the same but will also potentially have acid forming properties is sulphides are allowed to oxidise.

*Please refer to the response to questions 16a to 16j in the attached letter from Golder Associates.*

i. Please discuss the likely composition of tailings in the future i.e. will it be similar to that sampled (low sulphides either from low sulphide ore due to pressure oxidation processing), or will it be more similar to the "Macraes Tails" sample?

*Please refer to the response to questions 16a to 16j in the attached letter from Golder Associates.*

j. The kinetic testing has presumably been selected to test the leachability of arsenic, however, if tailings are to be sulphidic it would be appropriate to undertake some leaching tests on this type of material. Please provide data from such testing, or provide explanation as to why this is not required.

*Please refer to the response to questions 16a to 16j in the attached letter from Golder Associates.*

**Geotechnical Aspect of MPIII**

17) The following questions and further information requests have arisen from a preliminary review of Appendix 20, due to the appendix's lack of detailed information. In particular:

a. Please confirm the basis for the selected design shear strength parameters for the embankment fill and waste rock materials.

*Please refer to the response to question 17a in the attached letter from Engineering Geology Limited.*

b. Please provide further description of the engineering properties required for the embankment zone fill materials, and basis for these design criteria.

*Please refer to the response to question 17b in the attached letter from Engineering Geology Limited.*

c. Please confirm the basis for the fill placement thicknesses of 350 mm (Type A1) and 600 mm (Type B), with specific comment on previous construction precedent used for the site.

*Please refer to the response to question 17c in the attached letter from Engineering Geology Limited.*

d. Figures D7 – D12 (appended to the report) show both yield accelerations and design loadings on the same figures. Please clarify the assessed yield accelerations and how these compare with the design earthquake loadings (i.e. OBE & MDE).

*Please refer to the response to question 17d in the attached letter from Engineering Geology Limited.*

e. Please provide a summary of SlopeW software results from the seismic analysis of the dam, including profiles showing the accelerations through the embankment (for comparison with the yield accelerations).

*Please refer to the response to question 17e in the attached letter from Engineering Geology Limited.*

18) The following questions and further information requests have arisen from a preliminary review of Appendix 40, due to the appendix's lack of detailed information. In particular::

a. Please confirm how the flood attenuation in McCormicks Creek was estimated (98 $m^3$/sec presented) and provide details of the design attenuation method and assumptions.

*Please refer to the response to question 18a in the attached letter from Engineering Geology Limited.*

b. Please provide further information to explain why breach failure towards the Frasers Pit was not considered further.

*Please refer to the response to question 18b in the attached letter from Engineering Geology Limited.*

c. Please confirm the source and accuracy of the downstream contour information presented.

*Please refer to the response to question 18c in the attached letter from Engineering Geology Limited and to the attached letter from Precision Aerial Surveys Ltd who provided the ground control survey and mapping for the dam break analysis.*

19) In regard to waste rock stacks, please provide discussion/comment/analysis on the following:
- Waste rock stack design, including foundation treatment, drainage and placement method;
- Performance observations of existing rock stacks and implications for proposed waste rock stacks; and
- Long term seismic performance of waste rock stacks.

***Waste Rock Stack Design***

*The design principles applied to the final design of the proposed waste rock stacks do not differ significantly from those applied to waste rock stacks that have been successfully constructed and operated during the operational history of the Macraes mine.*

*Initial design of waste rock stacks is based purely on volumetric requirements and haulage efficiency constraints relating to the proposed mining schedule. The proposed waste rock stacks (Frasers North (FNWRS), Frasers South (FSWRS), Back Road (BRWRS) are designed to contain all waste material from the proposed pits.*

*The initial design is then reviewed and if necessary modified further to take into account visual integration and landform features. A landscape architect is utilised to ensure the final design form is acceptable*

*The final rehabilitated form of the proposed waste rock stacks has been derived from previous resource consent conditions and site experience. One of the objectives relating to final form outlined in Resource Consents is that the waste rock stack is to be visually integrated into the surrounding landscape so it appears to be a naturally occurring feature. This is achieved through the waste rock stack design mimicking existing topography in terms of:*

- *cross section profile*
- *slope gradients*
- *rounding the transition between the natural and formed surface*
- *curvilinear plan form contours*
- *varied and curved skylines*

- *aligning waste rock stacks with the existing landforms*

*Final rehabilitation of the proposed waste rock stacks is to return the final rock stack surface to pasture this is achieved through applying 0.3m depth of oxidized/weathered schist and 0.2m depth of topsoil prior to establishing a vegetative cover.*

*Detailed design reports are prepared for each waste rock stack as part of the building consent process.*

***Foundation Treatment***

*Prior to placement of waste rock all topsoil, vegetation and any weak foundation material will be excavated and placed in stockpile. These materials are used later to rehabilitate the surface of the dump. On steeper foundation surfaces (steeper than 5:1 [H:V]) the foundations will be horizontally benched to ensure that no potential failure surfaces exist along weak surficial soils. The exception is within the base of steep gullies where they are incised and it is difficult to undertake benching.*

***Surface Drainage***

*A perimeter drain is generally constructed to collect runoff from the waste rock stacks and divert it to silt control structures before release to existing water courses. During initial construction 'clean' water that would normally flow into the area that has been cleared for waste rock deposition will be diverted away from the area into existing water courses and thereby reduce the amount of silt control capacity required. Progressive rehabilitation of final profile surfaces will also reduce the amount of silt control capacity required.*

*Run off from the waste rock stack during construction will pass through a silt control structure before release. The design of the proposed waste rock stacks do not show berms, but berms will be placed within the envelope of the final design to allow the safe discharge of runoff from the waste rock stack, either directly into the perimeter drain, or via rip-rap lined channels into the existing gullies.*

***Subsurface Drainage***

*Existing natural drainage channels within the proposed waste rock stack footprint are maintained through preferential placement of coarse fraction mine waste in these channels. This allows any naturally occurring seepage and/or groundwater to flow through the base of the waste rock stack. Due to the permeable nature of the material and the deposition method (20m high end tipping) there is a size segregation of the material within the waste rock stack with coarse material being concentrated at the base of each lift. This facilitates groundwater movement laterally through the waste rock stack into the coarse filled drainage channels. A depiction of this is shown in Figs 5 & 6 and plates 7 & 8 of Appendix 22 of the application.*

***Placement Method***

*The waste rock stacks will be constructed by end tipping rock in lifts up to 20m high. The waste rock stack will be constructed progressively in a series of lifts. The end tipped rock lies at the angle of natural repose (approx 37-42°). Once each lift is constructed to the 'as-dump' limit the rock-fill is bulldozed to the final profile (i.e. 3:1 [H:V] or 2.5:1 [H:V] where 5m wide berms are required for silt control or diversion drainage).*

*During the active life of the waste rock stack temporary stockpiles for soil stripped from the foundations may be formed within the footprint of the waste rock stack. These will be*

*utilised for rehabilitation of the waste rock stack as the waste rock stack is constructed and will be totally removed before the completion of the waste rock stack.*

***Performance observations of existing rock stacks and implications for proposed rock stacks***

*There have been no seismic or static stability related issues associated with the construction and operation of existing rock stacks throughout the current operational life of Macraes mine. This suggests that the current design, construction and rehabilitation strategies are suitable for conditions at the Macraes site.*

*The possibility of failure through weak surficial foundation soils is considered unlikely given the extent of foundation stripping and benching that is undertaken prior to placement of waste rock material.*

*The possibility of deep seated foundation failure is also considered highly unlikely as in the location of the current and proposed rock stacks there are/were no obvious signs of instability of the land and there are no known unfavourably orientated low angle shear zones that could provide a mechanism for deep seated instability.*

*Tip head slumping during construction within the waste rock stack footprint has occurred in some instances through either, material being coarser than normal and standing at a higher angle than the angle of repose, and/or tip heads being inactive for significant periods of time. This has been rectified through either the tip heads being actively modified by bulldozers (pushed down to a flatter angle) or through sheeting and re-establishment of the tip head. Once tip-heads have been pushed down to final profile there have not been any instances of slumping occurring.*

*Runoff from waste rock stacks over the operational history at Macraes is characterized as being relatively low in volume and low in suspended solids. This is due primarily to the permeable nature of the mine waste material which the rock stacks are constructed form. The material allows rainfall infiltration into the waste rock stack and in effect filters silt out as it travels slowly through the waste rock stack. This has implications for silt control in terms of draining surface runoff preferentially through the waste rock stack and not directing it away from the waste rock stack as traditionally designed (refer Appendix 22 of the application).*

***Long Term Seismic Performance of Waste Rock Stacks***

*Long term static stability analysis of the proposed waste rock stacks has been undertaken by Pells Sullivan Meynink (App 27 AEE). All the proposed waste rock stacks meet the recommended factor of safety (FoS $\geq$ 1.2).*

*Detailed seismic stability analysis is undertaken as part of Building Consent requirements. Seismic stability is assessed for several levels of shaking - the Design Basis Earthquake (DBE) equivalent to a 150 year return period event, and the Maximum Credible Earthquake (MCE). Some analyses in the past have also used an interim 450 year return period earthquake event for waste rock stack seismic stability assessment.*

*The proposed FNWRS and FSWRS are all in effect expansions of the existing Frasers West and East Waste Rock Stacks. The proposed rock stacks have been designed to be comparable with the existing WRS in terms of slope angles and geometric form (e.g. area, height, depth of fill). As such it is not anticipated that through constructing these waste rock stacks we are introducing any additional seismic stability risk to the proposed and existing waste rock stacks.*

*The Back Road Waste Rock Stack is located north of the extents of the Macraes Fault Zone as described in the Top Tipperary Site investigations and is a major expansion eastwards of the existing Back Road - Northern Gully Waste Rock Stack. The cross sectional form (overall slope angles, depth of fill) of the proposed BRWRS is very similar to that of the Northern Gully Waste Rock Stack – Southern Extension (NGWRS –SE) which was constructed during the period 1996 -2002.*

*There is no indication that the proposed waste rock stacks will require significant modification to meet seismic stability criteria as they are in effect continuations of the existing design principles and site experience gained from the successful construction and operation of all waste rock stacks on the Macraes Site.*

20) The interaction of pit extensions and tailings storages is complex and to an extent uncertain, as highlighted by pit review reports and in Appendix 21. To assist in understanding this interaction, please provide a summary and discussion of the key risk factors (to both mining and tailings facilities), uncertainties, consequences and probable management/mitigation, including implications for post mine closure. This could take the form of a large summary table with some supporting discussion, and could be assembled by the applicant based on consultant's reports/advice and in-house knowledge.

*Please refer to the response to question 20 in the attached letter from Engineering Geology Limited.*

21) The following questions and further information requests have arisen from a preliminary review of Appendix 23, due to the appendix's lack of detailed information. In particular:

a. Please provide specific comment on what effect the in-situ rock on the downstream shoulder will have on the seismic performance and structural integrity of the embankment.

*Please refer to the response to question 21a in the attached letter from Engineering Geology Limited.*

b. Please provide comment on the effects of wind induced wavelap on the proposed design, and confirm specific design criteria to account for wind induced waves.

*Please refer to the response to question 21b in the attached letter from Engineering Geology Limited.*

c. Provide details on the effects of the proposed reservoir on slope stability in the reservoir inundation area, and the assessed consequences of slope failure into the reservoir on the dam structure.

*Please refer to the response to question 21c in the attached letter from Engineering Geology Limited.*

d. Please confirm whether pressurised conduits will be used in the design.

*Please refer to the response to question 21d in the attached letter from Engineering Geology Limited.*

e. Please confirm the service spillway arrangements including routing the pipe through the abutment/embankment and present these on a drawing.

*Please refer to the response to question 21e in the attached letter from Engineering Geology Limited.*

f. Please confirm the basis for selecting a 10 year ARI design flood for construction diversion works capacity. Provide further details of the effects of flood flows exceeding the design criteria of 10 year ARI during construction of the dam.

*Please refer to the response to question 21f in the attached letter from Engineering Geology Limited.*

g. Please provide further details on construction diversion works including the location of the diversion culvert and whether this will remain within the embankment.

*Please refer to the response to question 21g in the attached letter from Engineering Geology Limited.*

h. Please confirm the basis for the fill placement thicknesses of 350 mm (Type A1) and 600 mm (Type B).

*Please refer to the response to question 21h in the attached letter from Engineering Geology Limited.*

i. Please provide further details on the long term operation and decommissioning of the dam.

*The Camp Creek dam will be part of post closure water quality mitigation measures until such time as sulphate and arsenic losses from the mine have reduced to a level where they meet compliance limits in Deepdell Creek and the Shag River. There are two long term operations options, one a constant discharge flow and the other the use of telemetry from a flow station on Deepdell Creek to manage discharge flows. As the dam is not required till near mine closure, monitoring of mine water quality for the period from the present to mine closure will allow further refinement of the options and operational requirements. The dam and associated infrastructure will be subject to regular inspections and maintenance. The dam will operate for many years until compliance limits can be met in Deepdell Creek. At the point the dam is no longer required for dilution its overall use will be reviewed however it is likely to remain in place as a water body with ongoing inspections and maintenance.*

22) The adopted PIC rating for the proposed Camp Creek Dam is a critical design standard. Please provide further information to demonstrate that the proposed Camp Creek Dam would be Low PIC. Specifically, the following is required:

a. Please confirm how the attenuation in Deepdell Creek was estimated and provide details of the design attenuation method and assumptions.

*Please refer to the response to question 22a in the attached letter from Engineering Geology Limited.*

b. Please confirm the source and accuracy of the downstream contour information presented.

*Please refer to the response to question 22b in the attached letter from Engineering Geology Limited and to the attached letter from Precision Aerial Surveys Ltd who provided the ground control survey and mapping for the dam break analysis.*

c. Please provide further comment on the expected itinerant population and how this has been accounted for in the PAR assessment, with specific comment on traffic

volumes on Golden Point Road at the crossing over Deepdell Creek, including predicted future traffic volumes.

*Please refer to the response to question 22c in the attached letter from Engineering Geology Limited.*

d. Please confirm the expected damage to Golden Point Historic Mining Reserve or other historic structures downstream due to dam failure, and comment on the potential for people to be within these areas during a dam failure event.

*Please refer to the response to question 22d in the attached letter from Engineering Geology Limited.*

e. Please provide comment on the likelihood of loss of life and provide supporting information to confirm whether the assessed loss of life is less than 1 person.

*Please refer to the response to question 22e in the attached letter from Engineering Geology Limited.*

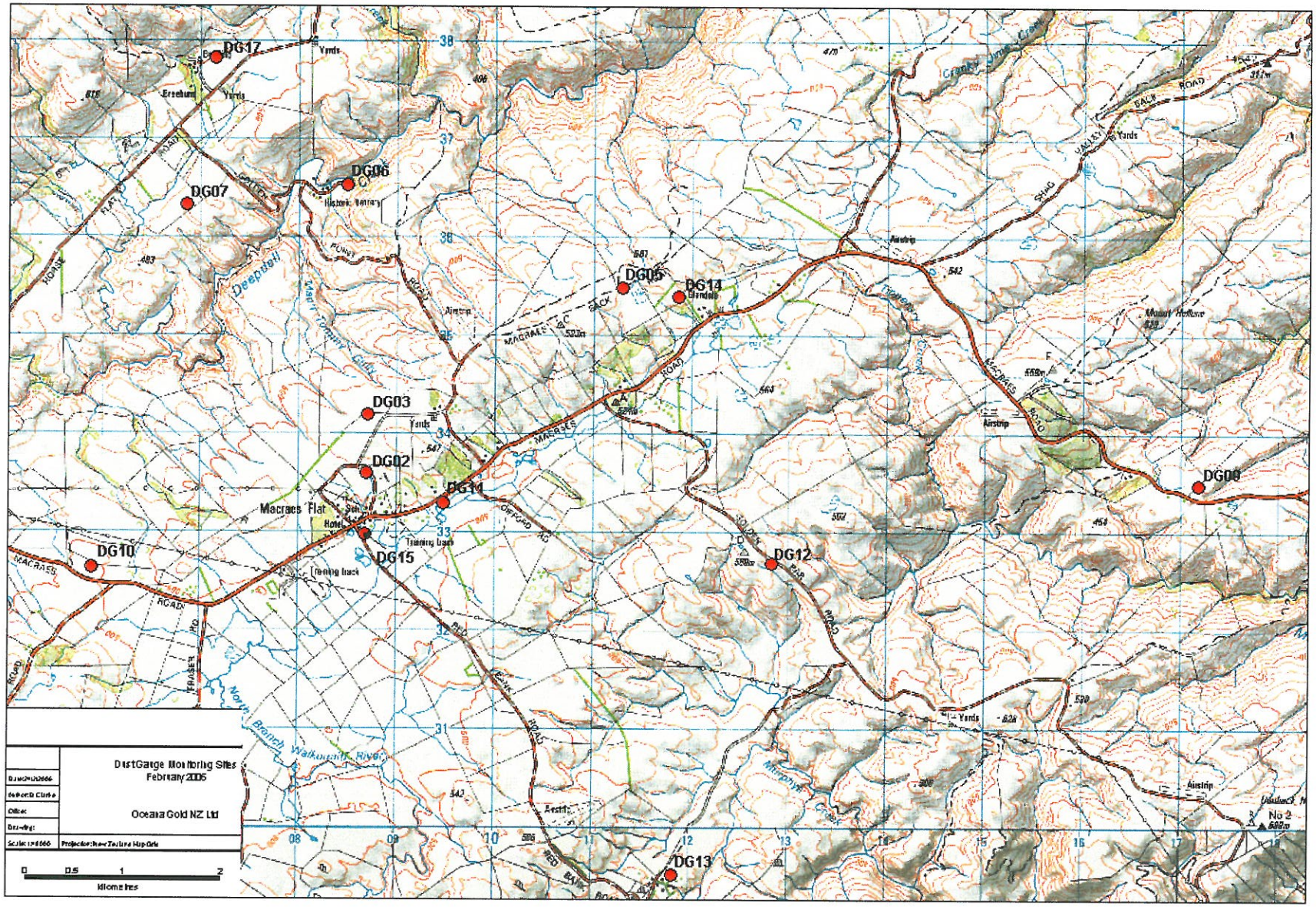


**Figure 8.1 Map Showing Locations of Deposited Dust Monitoring Stations**

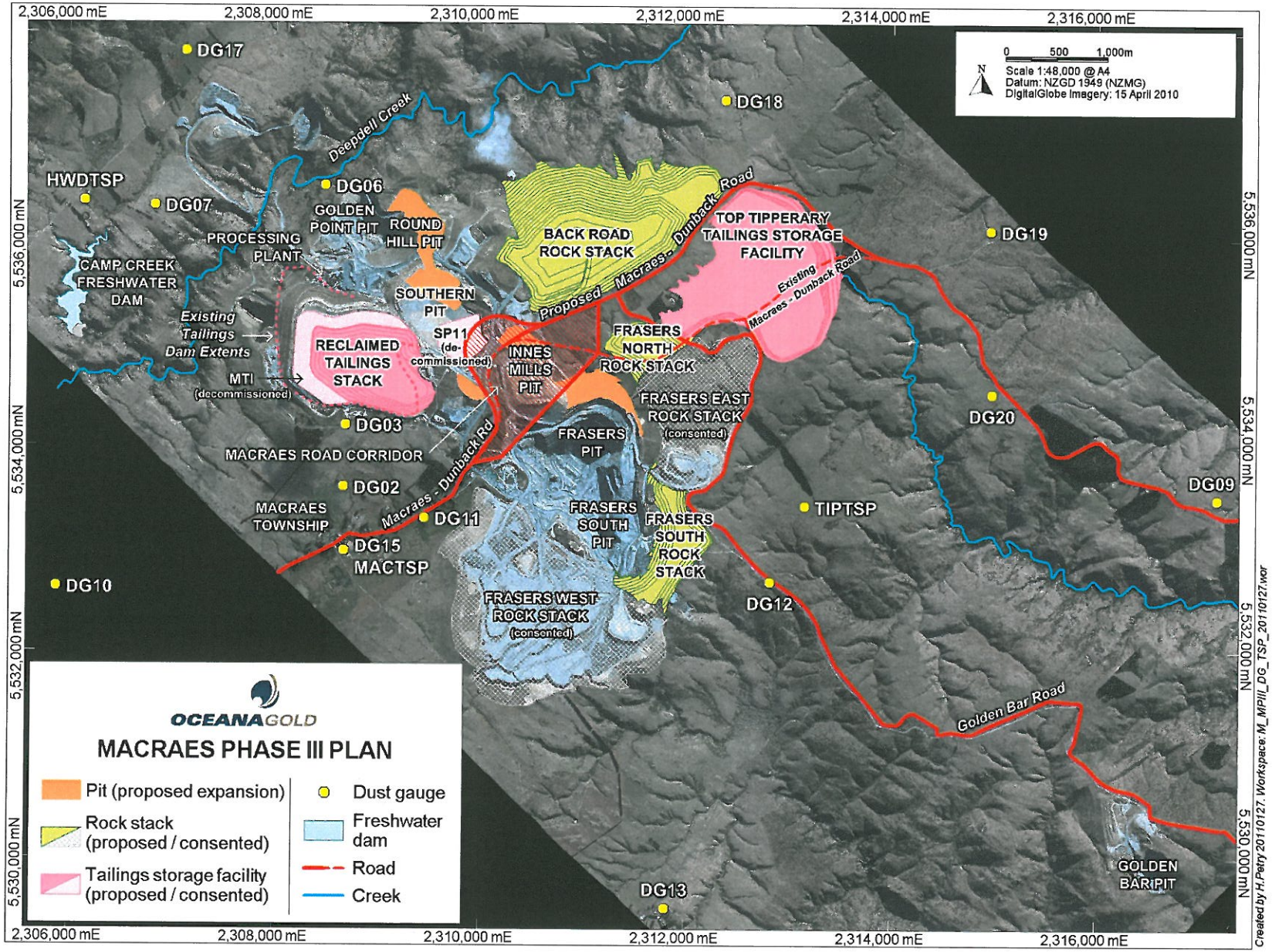


**Figure 10.1 Map Showing Locations of New Monitoring Sites**

**Figure 10.1 Map Showing Locations of New Monitoring Sites**

3. OceanaGold considered the information supplied with this letter adequately addresses the ORC's further information requests and enables the ORC to make a full assessment of the application. Under section 88C(2)(b)(i) OceanaGold consider the application to be taken off hold. The application can now proceed to notification.

4. Please contact us if you wish to discuss this letter further.

Yours faithfully
**Anderson Lloyd**

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