BRIEF OF EVIDENCE OF SCOTT WILLIAM SUTHERLAND

Qualifications and Experience

1 My full name is Scott William Sutherland.

2 I hold a Bachelor of Engineering degree with First Class Honours in Civil Engineering from the University of Canterbury (2010). I am a Chartered Professional Engineer (CPEng) and a Chartered Member of Engineering New Zealand (CMEngNZ).

3 I have over 10 years' experience in geotechnical engineering. I have been employed by Tonkin & Taylor Ltd since 2010. My present roles are:

a) Geotechnical engineer,

b) Project Manager, and,

c) Team Leader.

4 I have experience in slope stability analysis and assessment. My experience in this field includes:

a) **NZTA Memorial Avenue (Christchurch) and Waitaki (Kurow) bridges** – embankment and abutment stability analysis and design, including design for seismic scenarios, effects of groundwater and surface water, and soil-structure interaction with bridge foundations.

b) **Lyttelton Port Company Cashin Quay breakwater** – analysis of tipped fill breakwater under crane surcharge loads.

c) **Port Otago Multipurpose Wharf Extension tender design** – tipped reclamation fill slope stability analysis considering effects of adjacent dredging, crane surcharge loads, and soil-structure interaction with wharf foundations.

5 I have acted as a peer reviewer several times. My experience in this field includes provision of technical support to the Geotechnical Auditor for the Christchurch Northern Corridor motorway project, and geotechnical peer review for a number of stormwater infrastructure projects (including detention bund and basin slope stability) for Christchurch City Council. I have also carried out technical reviews of geotechnical and vibration aspects of resource consent applications for other projects at Macraes (Coronation North project).

6 I have experience in environmental vibration monitoring and assessment of effects on structures for various activities including blasting (EQC foundation trials), rapid impact compaction ground improvement, stone column ground improvement, pile driving, and traffic movements.

7 In relation to strength properties for intact rock I have consulted with a Senior Engineering Geologist with extensive experience specific to the strength properties of intact schist characteristic of the Macraes area.

Code of Conduct

8 I have read the Code of Conduct for expert witnesses contained in the 2014 Environment Court Practice Note and that I agree to comply with it. I have considered all the material facts that I am aware of that might alter or detract from the opinions I express. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not intentionally omitted to consider material facts known to me that might alter or detract from the Opinions I Express.

Oceana Gold Ltd

9 On instruction from ORC I, and stuff under my direction, have reviewed the geotechnical and airblast vibration aspects of an application by Oceana Gold NZ Ltd for the Deepdell North Stage III project, and prepared a report entitled: Review of Engineering Aspects of Resource Consent Application, Deepdell North Stage III Project, dated 14 April 2020.

10 I produce a copy of my report attached and marked **SWSU1** and am happy to answer any questions you may have**.**

Signature: _____ **Date: 15 July 2020** _____

Scott William Sutherland

Attachment SWSU1:
Review of Engineering Aspects of Resource Consent Application, Deepdell North Stage III Project, dated 14 April 2020.

Tonkin+Taylor

Job No: 51640.032
14 April 2020

Otago Regional Council
70 Stafford Street
Dunedin

Attention: Elyse Neville

Dear Elyse

Review of Engineering Aspects of Resource Consent Application
Deepdell North Stage III Project

1 Introduction

This letter summarises our review of geotechnical and airblast vibration reports which have been prepared by others as part of the resource consent application for the proposed Deepdell North stage III project.

This work has been carried out in accordance with the agreement between ORC and T+T dated 17 December 2019[1].

2 Scope

Our scope required review of the following documents:

1 Report, Macraes Gold Project, Deepdell East Waste Rock Stack Design Report, by Engineering Geology Ltd, 8 November 2019 (97 pages),

2 Report, RE: Geotechnical review of updated Deepdell Stage 3 Pit, by Pells Sullivan Meynink (PSM Consult PTY Ltd); 5 June 2019 (12 pages excluding appendices)

3 Report, Mining Airblast Assessment – Deepdell North Stage III Project, Macraes New Zealand with revised WRS, by techNick Consulting P/L Consulting Explosives Engineers, 24 May 2019.

In addition to the above reports information gaps and uncertainties were identified as outlined in our letter dated 23 January 2020[2]. The applicant provided additional information in response to the Section 92 request. The following document has also been reviewed by T+T:

4 Letter Report, RE: Oceana Gold (NZ) Ltd - Deepdell North Stage III – Request for further information - Section 92(1), by Mitchell Daysh; 1 April 2020 (10 page letter in addition to pertinent appendices: B, C and D).

T+T review has focused on the validity and robustness of the inputs and assumptions, and the validity of the conclusions drawn from the assessment provided in the reviewed reports. It does not extend to a full peer review or detailed assessment of the reports, and our services do not constitute a means by which principal design responsibility can be passed on to T+T.

[1] T+T letter, Review of Engineering Aspects of Resource Consent Application; Deepdell North Stage III Project, 17 December 2019, Job No: 51640.032.
[2] T+T Letter, Section 92 Requests for Additional Information, Deepdell North Stage III Project, 23 January 2020, Job No: 51640.032.

Tonkin & Taylor Ltd | Level 3, PwC Centre, 60 Cashel Street, West End, Christchurch, 8013, New Zealand | PO Box 13-055, Christchurch 8141
P +64-3-363 2440 F +64-9-307 0265 E chc@tonkintaylor.co.nz

3 Findings

Our findings are summarised below in accordance with the three main reports reviewed for the proposed Deepdell North stage III project.

3.1 Deepdell East Waste Rock Stack

The Deepdell east Waste Rock Stack (WRS) comprises backfilling of the existing Deepdell south pit and raising of the ground level to the north. The current ground investigation identifies rockhead to be shallow, which is considered to provide a suitable foundation for the WRS; noting staff will conduct construction monitoring and ensure all soil (loess) is completely removed. The design WRS volume incorporates a volume contingency and based on the information provided, is considered appropriate to store the estimated waste rock. The geotechnical and geometric criteria adopted for design of the Deepdell east WRS are the same as those used for the existing consented Coronation Project WRS. The limit equilibrium analysis results presented indicate a satisfactory level of safety is achieved. The adopted methods are widely utilised in engineering practice. It is important the Applicant's design process includes safety in design considerations, the details of which are beyond T+T's scope.

The Applicant indicated that minor seismic displacements (horizontal and vertical) could occur post-closure, however this is unlikely to affect critical elements of the waste rock stack or the receiving environment. The post-seismic stability is also acceptable, as indicated by the Applicant.

3.2 Deepdell North Stage III Pit

Deepdell north stage III pit comprises an extension to the existing Deepdell North Pit. Staged pit development, observation of performance and modification of wall designs is proposed. This is an acceptable approach that has been applied in the past in Deepdell north pit stages 1 and 2. It is important the Applicant's design includes safety in design considerations, the details of which are beyond T+T scope.

The Applicant states that the WRS is sufficiently offset from the pit thus not to transfer any loading. A WRS site 'approximate' offset of 125 m north of the final pit boundary is stated within the PSM report. This level of information is considered acceptable; however, it is very important an appropriate offset is maintained to prevent adverse shear loads being transferred from the WRS onto the pit walls. Failure to maintain a suitable offset could invalidate the current pit wall slope stability analysis. We recommend that a condition be applied that a minimum 125 m offset be maintained between the final pit boundary and the adjacent WRS, unless further analysis and assessment is undertaken to demonstrate that pit wall stability can be maintained with a reduced offset.

Our review of the pit extension design including the geotechnical and geometric criteria identified requests for further information regarding geotechnical parameters for intact schist, which are different from the strength parameters for assessing the stability of the WRS which is founded on intact schist material. The Applicant's response compares the strengths of WRS material and intact schist, which we do not consider to be directly relevant, however additional justification of the adopted intact schist strength is also provided.

A request for further information regarding the potential for a wave (generated by a block failure into the pit lake under seismic conditions) was made. The Applicant's response states that the potential for this to occur is negligible due to provision of 35 m of freeboard, and references the following document: *PSM, Deepdell Stage III - Risk of flooding from the pit, PSM71-244L, 12 February 2020.* T+T have not been provided with this report for review, however we concur that the potential for a wave overtopping the pit wall is negligible if 35 m of freeboard is provided.

3.3 Environmental vibration effects

The information provided presents an assessment of estimated vibration and airblast levels at nearby private residences (i.e. not owned by OGL) in terms of human comfort limits published in AS2187.2-2006, Appendix J (the Standard). Likely vibration levels are estimated by the Applicant using equations provided in the Standard, based on explosive charge size, distance to the explosion source, and site constants. The Standard is considered appropriate for this application.

Site constants for estimating vibration levels (as per the method published in the Standard) have been adopted which are supported by historic vibration measurements and appear to be conservative.

Estimates of airblast overpressure have been made based on an adopted site constant which is within the range recommended in the Standard. It is unclear how estimates of overpressure (in units of kPa) have been converted into airblast sound pressure level (in units of decibels). T+T have undertaken a brief spot-check of the Applicant's calculation, which indicates that the resulting airblast sound pressure level values may exceed the acceptable level of 120 decibels at a 1500 m distance (Howard Residence). Further information as to how this calculation has been made was requested from the Applicant, who responded with a qualitative statement that measured airblast levels have never exceeded 115 decibels, and that airblast predictions are likely to be conservative for the blasting style employed at Macraes.

We would expect such a statement to be supported by numerical estimates, for example back-calculation of a revised site constant and/or exponent using measured airblast levels from the site, and use of the revised site constant and/or exponent for future estimates of airblast levels. This information has not been provided by the Applicant. As such we believe there is some potential that airblast levels exceed the published limits. Based on the statement provided by the Applicant that measured airblast levels have never exceeded 115 decibels, the likelihood of an exceedance is considered low, but this has not been appropriately justified. Alternatively, if the Applicant is adopting an observational approach then we would expect to see historic data presented as justification.

We concur with the conclusion of techNick Consulting, that for the scenarios considered, ground-borne vibration levels are expected to be below the published limits at the residence located nearest to Coronation Pit (Howard's residence) which is not owned by OGL.

It is important that actual vibration and airblast levels are monitored during blasting operations, in order to confirm compliance with the published limits. It is also important to appreciate that the response to blasting will vary if different conditions to those analysed eventuate (for example explosive charge size). We note that OGL have suggested resource consent conditions which require compliance with a Noise, Airblast and Vibration Monitoring Plan. Recommended consent conditions, which should be addressed by the Noise, Airblast and Vibration Monitoring Plan comprise:

1 **Prior to exercise of this consent, the consent holder shall submit to the Consent Authority a Noise, Airblast and Vibration Monitoring Plan for the Coronation North Project. The Noise, Airblast and Vibration Monitoring Plan shall include, but not be limited to:**

- **Details of monitoring locations, frequency and methodology targeted at recording the likely worst case noise/vibration/airblast conditions representative of nearby residences;**
- **Procedures for recording blast details corresponding with monitoring periods;**
- **Maximum noise, vibration and airblast compliance limits which are in accordance with the relevant recommended limits published in AS 2187.2-2006;**

- **Key responsibilities relating to implementation of the plan;**
- **Reporting procedures for notifying relevant Councils at regular intervals and in the event of non-compliant results;**
- **Procedures for addressing non-compliant results;**
- **Certification from a suitably qualified professional that the proposed erosion and sediment control measures works comply with the conditions of the consent.**

2 **Not less than three weeks prior to the commencement of blasting or other activities which may generate significant vibration, the consent holder shall submit to relevant Councils for acceptance the Noise, Airblast and Vibration Monitoring Plan. The works shall not proceed until the Noise, Airblast and Vibration Monitoring Plan is accepted by the relevant Councils. If required, the consent holder shall amend the Noise, Airblast and Vibration Monitoring Plan prior to acceptance by the relevant Councils. The consent holder shall exercise this consent in accordance with the Noise, Airblast and Vibration Monitoring Plan.**

3 **The consent holder shall review the Noise, Airblast and Vibration Monitoring Plan annually and if necessary, update it. The Consent Authority shall be provided with any updates of the plan within 1 month of any update occurring. Any amendment to the Noise, Airblast and Vibration Monitoring Plan shall be subject to acceptance by the relevant Councils.**

4 **Not less than one year following exercise of the consent, and annually thereafter, the consent holder shall submit to the relevant Councils a Noise, Airblast and Vibration annual compliance report. The annual compliance report shall include the results of all monitoring activities undertaken within the preceding one year together with a reconciliation of all results and outcomes against the requirements of the Noise, Airblast and Vibration Monitoring. The annual compliance report shall include discussion of any non-conformance with the Noise, Airblast and Vibration Monitoring Plan. From time to time following review of the annual compliance report by the relevant Councils, and if required, the Noise, Airblast and Vibration Monitoring Plan shall be amended as may be considered appropriate by the relevant Councils.**

4 Conclusions

Based on the documentation provided we have reviewed the following aspects of the proposed Deepdell North Stage III Project:

- Waste rock stack stability,
- Pit wall stability, and,
- Mining airblast assessment.

In regards to waste rock stack and pit wall stability, and ground-borne vibration, we conclude that:

- The investigations are generally suitable,
- The assessments provided generally appear appropriate, and,
- The assumptions and conclusions are considered to be valid.

We have also provided comment on what we believe to be suitable consent conditions, as appropriate, given the information that we have reviewed.

Regarding the airblast assessment, parts of the calculation of predicted airblast levels are unclear, and the Applicant has provided a qualitative statement indicating that airblast levels are typically lower than predicted at Macraes. While this is likely to be correct, appropriate supporting justification has not been provided in this instance.

Applicability

The sole purpose of this report and the associated services performed by Tonkin & Taylor Limited ("T+T") is to undertake a limited review of, and comment on, the geotechnical and airblast vibration reports which have been prepared by others as part of the resource consent application for the proposed Deepdell North stage III project ("Design") prepared by Engineering Geology Ltd, PSM Consult PTY Ltd, and techNick Consulting P/L Consulting Explosives Engineers ("Principal Consultants") in accordance with the scope of services set out in the contract between Otago Regional Council (the "Client") and T+T. That scope of services, as described in this report, was developed with the Client.

T+T's review was a form of peer review, undertaken on a level-of-effort basis, to provide additional assurance to the Client as to the quality of the Design. The responsibility for the Design remains fully with the Principal Consultants and T+T's review does not constitute a means by which that design responsibility can be passed on to T+T. This report has been prepared on behalf of, and for the exclusive use of, T+T's Client, and is subject to, and issued in accordance with, the provisions of the contract between T+T and the Client. T+T accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:

pp.....

Danny Beasant
Geotechnical Engineer

Report prepared by:

.....

Scott Sutherland
Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:

.....

Tim Morris
Project Director

14-Apr-20
\\ttgroup.local\corporate\christchurch\tt projects\51640\51640.0320\issueddocuments\2020-04-14 letter for tgm review.docx