Before a joint hearing of the

Dunedin City Council	**LUC-2016-230 and LUC-2013-225/A**
Otago Regional Council	**RM16.138**
Waitaki District Council	**201.2016.779 and 201.2013.360-1**

Under	the Resource Management Act 1991
In the matter of	applications by Oceana Gold (New Zealand) Limited for resource consents for the Coronation North Project

Statement of evidence of Jeremy Yeats for Oceana Gold (New Zealand) Limited

14 October 2016

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Qualifications and experience

1 My name is Jeremy Alexander Yeats.

2 I am Consulting Engineer and Director of Engineering Geology Ltd specialising in Geotechnical Engineering.

3 I have the following qualifications: BSc (Civil Engineering) University of Natal (SA); MSc (Soil Mech) University of London (UK); DIC. Imperial College of Science and Technology (UK); Chartered Professional Engineer (CPEng); International Professional Engineer (NZ); Chartered Engineer (UK).

4 I hold the following professional memberships: The Institution of Professional Engineers New Zealand Inc; The Association of Consulting Engineers New Zealand Inc; NZ Geotechnical Society; Structural Engineering Society New Zealand; NZ Society on Large Dams; The Institution of Civil Engineers (UK).

5 I have been involved with providing OceanaGold engineering advice relating to the Macraes mine since 2004 and am familiar with both the mine and the general area around the mine. I carry out the ongoing investigation, design and monitoring review of tailings dams, waste rock stacks and associated infrastructure for OceanaGold's Macraes and Reefton Mines.

6 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Background

7 I have been involved in the following work for the Coronation North Project:

(a) Preparing a report on erosion and sediment control for the Coronation North Project, which was included in Appendix 14 of the Assessment of Environmental Effects (**AEE**) submitted in support of the resource consent applications;

(b) Preparing a report on the Coronation North Waste Rock Stack design, which was included in Appendix 18 of the AEE;

(c) Preparing an assessment of the Coal Creek Freshwater Dam, which was included in Appendix 21 of the AEE;

(d) Responding to section 92 requests for further information by the Otago Regional Council (**ORC**); and

(e) Reviewing an amendment to the Coronation North WRS footprint proposed by OceanaGold to avoid heritage and ecological features.

8 In preparing this evidence I have reviewed:

(a) The AEE lodged as part of the application for the Coronation North Project;

(b) The reports of other experts giving evidence relevant to my area of expertise; and

(c) The ORC's Recommending Report.

Scope of evidence

9 I have been asked by OceanaGold to prepare evidence in relation to the engineering aspects of the Coronation North Project, specifically:

(a) Waste Rock Stack Stability;

(b) Construction of Coal Creek Freshwater Dam; and

(c) Erosion and Sediment Control.

Waste rock stack stability

10 Engineering Geology Limited reported on the design and stability of the Coronation North WRS. My evidence provides an overview of main points, and I refer you to the report in Appendix 18 of the AEE for further detail.

11 The Coronation North WRS has been designed in accordance with accepted engineering practices.

(a) All final slopes have been designed for a static factor of safety against instability exceeding 1.5 for moderately conservative ground water levels.

(b) The WRS is designed for an Operating Base Earthquake (OBE) with a 150 year return period and a Maximum Design Earthquake (MDE) with a 2,500 year return period.

12 Existing WRS at Macraes Gold Project have been designed to similar standards and their performance has been satisfactory.

13 Construction procedures, including supervision and quality control practices, will meet accepted engineering standards. Progressive rehabilitation will be undertaken which includes spreading 0.3m of weathered rock plus 2.0m of topsoil and then planting. Ongoing monitoring will be undertaken in accordance with site specific plans.

14 In terms of the Coronation North WRS performance, minimal seismic deformation of the WRS is expected as a result of the OBE and satisfactory performance has been calculated in terms of seismic deformation under the MDE event. The WRS is sufficiently stable to remain suitable for the intended longterm use of pastoral farming post rehabilitation and mine closure.

15 Pells Sullivan Meynink analysed the stability of the existing Coronation and proposed Coronation North pits in their design for the pits. Their analyses conclude that the Coronation North WRS is a sufficient distance from the Coronation North Pit (about 190m) and extension of the Coronation Pit (about 80m) to not represent a significant stability risk. Their report is at Appendix 19 of the AEE.

16 The reduced Coronation WRS has not been redesigned because it will fall within the envelope of the original WRS design and have the same final batter slopes. Consequently the factor of safety (stability) of the reduced WRS will be equal to or greater than that of the original WRS design.

Review of altered Coronation North WRS Footprint

17 OceanaGold has altered the footprint of the Coronation North WRS that was original proposed in order to avoid some identified heritage and ecological features. I have reviewed the altered footprint and confirm that it does not alter my original assessment regarding the stability of the WRS.

Coal Creek Freshwater Dam

18 We assessed the feasibility of constructing the Coal Creek Freshwater Dam. My evidence provides an overview of the key points, for further detail I refer you to the report in Appendix 21 of the AEE.

19 The maximum height of the dam (crest to downstream toe) is about 27 to 30m with a reservoir area, at normal top water level, of about 9.3ha and a storage capacity of about 685,000m^3. The freeboard at normal top water level is 3m. The dam's crest level is RL487 and the normal top water level is RL484. The catchment area for the dam is approximately 650 hectares. The fill volume required for the embankment construction is about 30,000m^3.

20 The dam is to be designed in accordance with the New Zealand Society of Large Dams (**NZSOLD**) Dam Safety Guidelines. A layout plan for the proposed dam, including the reservoir is shown in Figure 3 of my report (at Appendix 21). It is formed by an embankment on the north eastern side of the reservoir within a "V" shaped incised gulley. A Medium Potential Impact Classification (PIC) for the dam has conservatively been adopted.

21 The objective of the design is to have an economical spillway with a capacity to safely discharge flood flows from a rare event (5000 year design rainfall). This is achieved by equipping the dam with a primary and auxiliary spillway. The primary spillway is located on the west abutment. There are two options for the auxiliary spillway.

22 We assessed the proposed location of the dam as being suitable.

(a) In 2005 Geological and Nuclear Sciences undertook a seismic hazard study for the Macreas Gold Project and this site specific information has been used for the seismic design. The Macraes Gold Project site is located in an area of relatively low historic seismic activity. However, there are some nearby faults that are capable of generating large earthquakes up to Mw 7 and the recurrence intervals for these faults are not known with great accuracy, ranging from about 1,600 to 25,000 years. The closest active fault to the site is the northern segment of the Taieri Ridge Fault, which is 11km east of the Coal Creek Freshwater Dam embankment.

(b) The geological conditions at site are expected to be similar to those elsewhere at the Macraes Gold Project where existing water retention dams, silt ponds and tailings storage facilities have been constructed and have performed successfully for a number of years. We would expect suitable materials for constructing low permeability fill to be obtained from locally derived weathered schist blended with loess and colluvial soils where necessary. As much fill as possible should be derived from within the spillway excavation and the reservoir area, as this will involve the least disturbance to adjacent ground and increase the water storage capacity. Rockfill for the shoulders of the dam and riprap can also be expected to be obtained locally, with most expected to be obtained from the auxiliary spillway excavation.

23 In order to address potential effects from stratification within the reservoir OceanaGold propose to connect a floating decant to the upstream end of the dam discharge pipe to act as a surface siphon for the discharge water. The dam discharge pipe extends to just beyond the downstream toe of the embankment. Further, OceanaGold propose to ensure that the released water gets as much aeration as possible in the area immediately downstream of the toe of the dam.

24 After confirmation that the dam is required for the development of the Coronation North project a detailed dam breach study will be carried out and then detailed design of the dam will be carried out for Building Consent. The detailed design will incorporate site specific geotechnical investigation and geological mapping.

25 An Operation, Maintenance and Surveillance Manual will be prepared that sets out the operational and maintenance requirements necessary to ensure the

ongoing safety of the dam. Monitoring and inspections are a fundamental part of the dam safety process and specific requirements in accordance with NZSOLD Dam Safety Guidelines will be prepared for the dam.

26 Construction of the dam is expected to take approximately 3 to 6 months, allowing for a favourable weather window. Construction will be under the direct supervision of staff from OceanaGold and Engineering Geology Ltd will carry out representative site inspections at the critical stages of construction to confirm compliance with the design. A number of OceanaGold staff, assisted by surveyors and the designer as necessary, will be dedicated to this task drawing from experience gained during the construction of the existing facilities at the Macraes Gold Project., like the recently constructed Tipperary Freshwater Dam. Staff assist the Contractor in planning construction activities and observe all construction activities. In addition, they undertake control testing of fill placed in the embankment as detailed in the Contract Specification and undertake regular visual inspections as part of the surveillance requirements.

27 At section 5.8 of the ORC Recommending Report it is recommended that dam safety consent conditions, consistent with NZSOLD Guidelines 2015, be applied as conditions of consent. This is acceptable.

Erosion and sediment control

28 We outlined the proposed concepts for managing erosion and sediment control in a report in Appendix 14 of the AEE. My evidence provides an overview of the concepts, for further detail I refer you to the report.

29 Good practice erosion and sediment control measures are routinely employed by OceanaGold at the Macraes Mine and will be utilised for the Coronation North project. They include:

(a) Managing surface water runoff around the pit, waste rock stack, haul road and dam construction borrow areas with clean water diversion drains and silt control ponds or other sediment control devices (e.g. silt fences, lined channels from silt ponds to natural water courses, silt traps along the haul road). The storage capacity of the silt ponds should be less than $20{,}000m^3$;

(b) Minimising areas of loose, uncompacted material;

(c) Locating permanent silt ponds as close as possible to the disturbed area to minimize effects on downstream habitats. There are specific design criteria for permanent silt ponds;

(d) Providing service and emergency spillways as required to pass large flow events;

(e) Sediment control will be installed prior to any disturbance within each catchment area;

(f) Shoulders of waste rock stacks will have benches designed to control runoff and minimise erosion of the rehabilitation layer where the slopes are steeper than about 1V:3H;

(g) Perimeter surface water drains will be installed around the waste rock stack to ensure runoff is conveyed to the base of gullies without erosion. Such drains may need to be lined where necessary and energy dissipation provided at high energy locations; and

(h) Surface water and groundwater collected in the pit during operations may need to be pumped out to a water sump adjacent to the pit and used for dust control. Any surplus water may need to be discharged to watercourses via silt ponds.

30 The Macraes Gold Project has a water deficit and this is advantageous for sediment control, in that excess water is not released from site. Runoff from pits and haul roads is generally collected in the base of pits and pumped to the Process Plant where it is used in the processing of ore, or used for dust control. Runoff seepage water from WRSs reports to silt ponds and is decanted and discharged downstream to existing watercourses, pumped to the process plant or used for dust suppression.

31 A site specific erosion and sediment control plan (**ESCP**) will be prepared before infrastructure is constructed which will detail specific requirements for construction and practices and procedures to minimise erosion and sedimentation. The ESCP will be consistent with the existing ESCP for the Macraes Gold Project. It will follow the principles embodied in the Environment Canterbury's Erosion and Sediment Control Guideline[1] but be adapted to suit local conditions and experience, in particular anticipated rainfall and soil type. For example, the ECAN 20% (1 in 5 year) ARI 10 hour event amounts to 55mm rainfall and our design approach using the 24 hour rainfall from a 72 hour duration 2 year ARI storm amounts to 70mm of rainfall, which means our approach is more conservative.

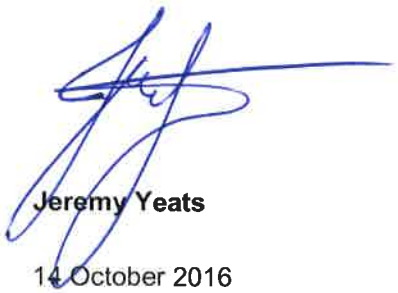
32 The ESCP will detail the design of specific erosion and sediment control devices, responsibilities for implementation, construction details and standards,

[1] Environment Canterbury (2007) 'Erosion and Sediment Control Guidelines for the Canterbury Region'

construction timetable, maintenance, monitoring and reporting procedures, response to storm events and contingency measures. There is an existing ESCP for the Macraes Gold Project and the Coronation North ESCP will follow the same good practice approach which has been successful in over 25 years of operation.

Conclusion

33 The ORC engaged Tonkin & Taylor Limited (**T&T**) to peer review engineering reports and further information I provided for the Coronation North project. T&T consider the methodology, design and level of analysis undertaken for the project to be acceptable and appropriate. I consider this should provide the hearing panel with confidence that the engineering aspects of the Coronation North Project are entirely satisfactory and the application can be approved, subject to conditions of consent.



Jeremy Yeats

14 October 2016