

BRIEF OF EVIDENCE OF RICHARD CLARKE BRUNTON

Qualifications and Experience

- 1 My full name is Richard Clarke Brunton.
- 2 I hold a Bachelor of Engineering degree with First Class Honours in Natural Resources Engineering from the University of Canterbury (2009). I am a Chartered Professional Engineer (CPEng) and a Chartered Member of Engineering New Zealand (CMEngNZ).
- 3 I have over 10 years' experience in water resource engineering. I have been employed by Tonkin & Taylor Ltd since February 2020. My present role is Water Resource Engineer.
- 4 I have experience in hydrological and hydraulic analysis and assessment. My experience in this field includes:
 - a) **Rotorua Lakes Council** – Hydrological and 2D hydraulic analysis of the Ngongotaha Stream catchment to assess potential flooding to residential property caused by stream breakout and limitations to existing culverts, bridges, stormwater pipes and stop banks.
 - b) **Calder Stewart Industries** – Technical review of stormwater concept design and flood mitigation for a proposed industrial development in Milton, Otago. Technical review components included review of stormwater design concept, hydrological modelling, stormwater infrastructure and open channels/drains.
 - c) **City of Oshawa (Canada)** – Hydrological assessment, hydraulic analysis and design of twin box culverts to replace two existing corrugated steel pipe culverts beneath Bermuda Avenue.
 - d) **Silverstream Estates Limited** – 1D-2D hydrological and hydraulic modelling for the Silverstream Estates development in Kaiapoi, Canterbury. Determination of catchment runoff parameters and bridge, culvert and open channel hydraulics.
 - e) **Toronto and Region Conservation Authority (Canada)** – Decommissioning and removal of an earth dam and associated culvert control structures. Hydrological and hydraulic assessment of replacement arch span culvert and open channel.
- 5 I have acted as a peer reviewer several times. My experience in this field includes peer review for several stormwater infrastructure projects (including catchment hydrology and hydraulic design) for Rotorua Lakes Council. I have also carried out technical reviews of stormwater and flood hazard aspects of resource consent applications for Environment Canterbury.
- 6 I have experience in hydrological and hydraulic analysis of urban and rural catchments for various activities including river culvert and bridge crossings, residential development,

stormwater infrastructure, flood mitigation and irrigation reservoirs. I am experienced in a range of hydrological and hydraulic analysis methods and software.

Code of Conduct

- 7 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

- 8 On instruction from ORC I, have reviewed the hydrological and hydraulic aspects of the proposed culvert under Horse Flat Road and a series of diversion drains as part of an application by Oceana Gold NZ Ltd for the Deepdell North Stage III project, and prepared a report entitled: Technical Review of Deepdell North Stage III Project: Horse Flat Road Culvert and Diversion.
- 9 I produce a copy of my report attached and marked **RIBR1** and am happy to answer any questions you may have.

Signature: _____



Date: 17 July 2020

Richard Clarke Brunton

Attachment RIBR1:

Technical Review of Deepdell North Stage III Project: Horse Flat Road Culvert and Diversion, dated 17 July 2020.

Otago Regional Council
70 Stafford Street,
Private Bag 1954,
Dunedin 9054

Attention: Elyse Neville

Dear Elyse

Technical Review of Deepdell North Stage III Project: Horse Flat Road Culvert and Diversion Drains

1 Introduction

Oceana Gold (New Zealand) Limited has submitted an application for consent to construct a new 51 meter long culvert under Horse Flat Road and a series of diversion drains as part of the Deepdell North Stage III project. Otago Regional Council (ORC) have engaged Tonkin & Taylor Ltd (T+T) to complete a technical review of hydrology and hydraulic components of the consent application associated with the culvert and diversion drains. This work has been completed in accordance with our existing contract with ORC dated 29 April 2020, and our email of 14 July 2020¹.

We have reviewed the following documents:

- *Oceana Gold (New Zealand) Limited Deepdell North Stage III Horse Flat Road Realignment Technical Report for Resource Consent, EGL, 26 November 2019.*
- *Oceana Gold (New Zealand) LTD Macraes Gold Project Deepdell North Stage III Erosion and Sediment Control Report, EGL, 11 November 2019.*

The following letter summarises our review and provides our conclusions as to the validity and robustness of the inputs, assumptions, and conclusions drawn from the assessments.

2 Hydrology

The application includes a hydrological assessment undertaken by EGL to determine the design flow rates for the culvert and diversion drains.

The Rational Equation has been used to calculate the culvert design flow based on a rainfall intensity of 81.9 mm/hr (HIRDSV4 100-year 10-minute storm), 20 ha catchment area and a runoff coefficient of 0.376. The Rational Equation is a simplistic method for calculating flow but typically results in a conservatively high flow result.

¹ Email, from Richard Brunton (T+T), to Elyse Neville (ORC), 14 July 2020, 3:54pm, Subject: RE: RM20.024 - Deepdell North Stage III - Assessment of culvert and reclamation.

The HIRDSV4 database indicates that the rainfall intensity used in the EGL calculation is based on historical rainfall data and makes no allowance for climate change.

We recommend that the RCP6.0 for the period 2081-2100 climate change scenario is adopted when selecting rainfall intensities for the sizing/design of permanent works. The 100-year 10-minute rainfall intensity for RCP6.0 for the period 2081-2100 is 100 mm/hr (HIRDSV4 at location: Lat - 45.340, Long 170.424). We recommend that the RCP6.0 for the period 2032-2050 rainfall intensity is adopted for the sizing/design of works with an expected life that falls within that time horizon. We recommend that a rainfall intensity based on historical data should be used only for sizing/design of temporary works.

We consider that the composite method used to calculate the 0.376 runoff coefficient is suitable.

We conclude that the assessments undertaken for hydrology are robust provided that the rainfall intensity is updated to reflect the appropriate climate change scenario taking into account the anticipated life of the works.

3 Hydraulics

3.1 Culvert

The proposed culvert has been sized based on hydraulic calculations provided by EGL. No technical reference has been provided for the calculations however they appear to account for both inlet and outlet flow conditions. We have verified the EGL calculations using HY-8 Software (see outputs attached to this letter). This verification results in a maximum upstream headwater of 1.55 m at a design flow of 1.7 m³/s which is consistent with the EGL calculations. The culvert is under inlet control during the design flow.

As discussed in the hydrology section, we recommend that the rainfall intensity for sizing permanent works is increased to account for climate change. We recommend that the culvert is re-sized/designed to accommodate this increased flow.

We consider that the calculation method and assumptions, with exception of the design flow, used to calculate the culvert sizing are suitable.

The application makes mention of the requirement for rock protection to prevent erosion of the culvert outlet. However, no information detailing the size or extent of rock protection has been provided. Rock protection should be design based on a suitable methodology accounting for culvert outlet velocity and depth.

The construction of the earth embankment over the culvert will form a dam structure. In the event that the culvert inlet becomes blocked a significant volume of water will build up behind the embankment. No assessment of embankment failure has been provided in the application. We recommend that the Applicant completes an assessment of embankment failure as per the New Zealand Dam Safety Guidelines 2015.

We conclude that the assessments undertaken for the culvert are robust provided that the following items are addressed:

- The culvert design flow is updated with the appropriate climate change scenario rainfall intensity.
- Culvert outlet protection is suitably sized/designed based on culvert outlet velocity and depth; and
- An assessment of embankment failure as per the New Zealand Dam Safety Guidelines 2015 is completed.

3.2 Diversion drains

The proposed diversion drains have been sized based on the Manning's open channel flow equation with assumptions including design flow rate, drain geometry, roughness and slope.

As discussed in the hydrology section, we recommend that the rainfall intensity for the sizing of permanent works is increased to account for climate change. We recommend that the diversion drains are re-sized/designed to accommodate this increased flow.

Please note that we have not reviewed the final alignment of the diversion drains in detail as the information available in the application is only conceptual in nature.

We conclude that the assessments undertaken for the diversion drains are robust provided that the design flow rates are updated to reflect the appropriate climate change scenario taking into account the anticipated life of the works.

4 Applicability

The sole purpose of this report and the associated services performed by T+T is to undertake a limited review of, and comment on, the documents Oceana Gold (New Zealand) Limited Deepdell North Stage III Horse Flat Road Realignment Technical Report for Resource Consent and Oceana Gold (New Zealand) LTD Macraes Gold Project Deepdell North Stage III Erosion and Sediment Control Report (Reports) prepared by EGL (Principal Consultant) 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 letter, was developed with the Client.

T+T's review was a form of peer review, undertaken on a level-of-effort basis to determine validity and robustness of the inputs and assumptions, and the validity of the conclusions drawn from the assessments. The responsibility for the Reports remains fully with the Principal Consultant and T+T's review does not constitute a means by which that responsibility can be passed on to T+T. This letter 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:

Authorised for Tonkin & Taylor Ltd by:



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Richard Brunton
Water Resource Engineer

Tim Morris
Project Director

17-Jul-20

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