9. STATUTORY CONSIDERATIONS

9.1 INTRODUCTION

This chapter of the AEE assesses the Deepdell North Stage III Project against the relevant statutory planning framework. The relevant statutory considerations under the RMA are addressed in the following sections:

Section 9.2	Identifies the information requirements for the resource consent applications in accordance with section 88 of the RMA;
Section 9.3	Addresses the gateway test for non-complying activities in accordance with section 104D of the RMA;
Section 9.4	Addresses the matters the consent authorities must have regard to in accordance with section 104 of the RMA;
Section 9.5	Assesses the proposal against the provisions of the relevant national level statutory planning documents
Section 9.6	Assesses the proposal against the provisions of the Partially Operative Regional Policy Statement;
Section 9.7	Assesses the proposal against the provisions of the Regional Policy statement and relevant Regional Plans;
Section 9.8	Assesses the proposal against the provisions of the Waitaki District Plan;
Section 9.9	Assesses the proposal against the provisions of the Kāi Tahu ki Otago Natural Resource Management Plan 2005; and
Section 9.10	Assesses the proposal against relevant matters within Part 2 of the RMA.

9.2 INFORMATION REQUIREMENTS

Section 88(2) of the RMA stipulates that a resource consent application must be made in the prescribed form and manner. It must also include an assessment of environmental effects in such detail as corresponds with the scale and significance of the effects that the activity may have in accordance with Schedule 4 of the RMA.

The resource consent applications for the Deepdell North Stage III project are in the prescribed form as set out in Form 9 of Schedule 1 to the Resource Management (Forms, Fees, and Procedure) Regulations 2003. OceanaGold has also complied with the application forms requirements of the District Council and Regional Council.

With respect to the information requirements in Schedule 4 of the RMA, it is noted that Clauses (2), (3), 6) and (7) specify information requirements that are directly relevant to the resource consent applications required for the Deepdell North Stage III Project. These matters have been addressed throughout this AEE and in the relevant technical assessments.

9.3 SECTION 104D OF THE RESOURCE MANAGEMENT ACT 1991

As outlined in Section 4.3 of this AEE, the resource consents required from the Waitaki District Council for the Deepdell North Stage III Project are classified as non-complying activities under the Waitaki District Plan due to the activity not meeting the District Plan noise standards at the boundary of the site. While there are reasons identified in Section 4.3 of this AEE why unbundling of the activities requiring consent under the Waitaki District Plan is considered possible, the approach taken here for this assessment is conservative in bundling all of the Waitaki District Council matters together as non-complying activities under the 'bundling principle' and therefore being subject to the section 104D gateway test. As outlined in Section 4.3 of Chapter 4, the Otago Regional Council matters do not overlap with noise non compliances and can be appropriately and effectively considered as discretionary activities.

Section 104D of the RMA establishes restrictions on the ability of a consent authority to grant resource consents for non-complying activities. It states:

> *(1) Despite any decision made for the purpose of notification in relation to adverse effects, a consent authority may grant a resource consent for a non-complying activity only if it is satisfied that either—*
>
> > *(a) the adverse effects of the activity on the environment (other than any effect to which section 104(3)(a)(ii) applies) will be minor; or*
> >
> > *(b) the application is for an activity that will not be contrary to the objectives and policies of—*
> >
> > > *(i) the relevant plan, if there is a plan but no proposed plan in respect of the activity; or*
> > >
> > > *(ii) the relevant proposed plan, if there is a proposed plan but no relevant plan in respect of the activity; or*
> > >
> > > *(iii) both the relevant plan and the relevant proposed plan, if there is both a plan and a proposed plan in respect of the activity.*

The objectives and policies of the Waitaki District Plan are identified and assessed in Section 9.8 of this AEE. As is noted in that section, the Deepdell North Stage III Project will not be contrary to any objectives or policies of the Waitaki District Plan.

As such, the requirements of section 104D(1)(b) of the RMA are met. The resource consent applications to Waitaki District Council can, therefore, be considered alongside the resource consent applications to Otago Regional Council in the broader context in accordance with section 104 of the RMA.

In light of the above, it is not necessary to form an overall conclusion as to whether the adverse effects of the Deepdell North Stage III Project on the environment will be 'more than minor' in order to satisfy the first gateway test of section 104D(1) of the RMA.

9.4 SECTION 104 OF THE RESOURCE MANAGEMENT ACT 1991

9.4.1 Introduction

Section 104 of the RMA identifies the matters that a consent authority must have regard to, subject to Part 2 of the Act, when considering an application for resource consent. It states:

> *(1) When considering an application for a resource consent and any submissions received, the consent authority must, subject to Part 2, have regard to–*
>
> > *(a) any actual and potential effects on the environment of allowing the activity; and*
> >
> > *(ab) any measure proposed or agreed to by the applicant for the purpose of ensuring positive effects on the environment to offset or compensate for any adverse effects on the environment that will or may result from allowing the activity; and*
> >
> > *(b) any relevant provisions of—*
> >
> > > *(i) a national environmental standard:*
> > >
> > > *(ii) other regulations:*
> > >
> > > *(iii) a national policy statement:*
> > >
> > > *(iv) a New Zealand coastal policy statement:*
> > >
> > > *(v) a regional policy statement or proposed regional policy statement:*
> > >
> > > *(vi) a plan or proposed plan; and*
> >
> > *(c) any other matter the consent authority considers relevant and reasonably necessary to determine the application.*
>
> *(2) When forming an opinion for the purposes of subsection (1)(a), a consent authority may disregard an adverse effect of the activity on the environment if a national environmental standard or the plan permits an activity with that effect.*
>
> *(2A) When considering an application affected by section 124 or 165ZH(1)(c), the consent authority must have regard to the value of the investment of the existing consent holder.*
>
> *(2B) ...*

Section 104 of the RMA does not give primacy to any of the matters to which a consent authority is required to have regard. All of the relevant matters are to be given such weight as the consent authority deems appropriate in the circumstances, and all matters listed in section 104(1) are subject to Part 2 of the RMA (which is further discussed in Section 9.10 of this AEE).

An assessment of the Deepdell North Stage III Project against the relevant matters set out in section 104 of the RMA is provided in the sections below.

9.4.2 Actual and Potential Effects on the Environment

With respect to Section 104(1)(a) of the RMA, an assessment of the actual and potential effects on the environment associated with the project is provided in Chapter 5 of this AEE and in the technical assessments commissioned by OceanaGold.

Offset and Compensation

OceanaGold is proposing an offset to address the residual adverse effects on wetland habitat and biodiversity values that remain from the proposed development after avoidance, remediation and mitigation. This offset must be had regard to, pursuant to section 104(1)(ab) of the RMA.

9.5 RELEVANT STATUTORY PLANNING DOCUMENTS

With respect to section 104(1)(b) of the RMA, the national, regional and district planning documents of relevance to Deepdell North Stage III Project are:

Resource Management (National Environmental Standard for Air Quality) Regulations 2004 (**NESAQ**);

Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (**NESCS**);

- Resource Management (National Environmental Standard for Sources of Human Drinking Water) Regulations 2007 (**NESHDW**);
- The National Policy Statement for Freshwater Management (**NPSFM**);
- The Otago Regional Policy Statement (**RPS**);
- The Regional Plan: Water for Otago (**Water Plan**);
- The Regional Plan: Air for Otago (**Air Plan**);
- The Regional Plan: Waste for Otago (**Waste Plan**);
- The Waitaki District Plan (**District Plan**)

An assessment of the project against the relevant provisions of these statutory planning documents and regulations is provided in the sub-sections below.

The relevant provisions of the Kāi Tahu Ki Otago Natural Resource Management Plan 2005 (**KTONRMP**) are also examined below within section 9.9.

9.5.1 National Environmental Standards

National environmental standards prescribe standards for environmental matters in accordance with Section 43 of the RMA. Each local authority must administer the national environmental standards. Where specified, a local authority can impose stricter or more lenient standards than those set out in a national environmental standard.

The national environmental standards potentially relevant to the Deepdell North Stage III Project are discussed in the sub-sections below.

9.5.1.1 National Environmental Standard for Air Quality

The NESAQ sets out ambient air quality standards for a number of contaminants for the protection of public health - including fine particulates (PM_{10}), sulphur dioxide (SO_2), carbon monoxide (CO) and nitrogen dioxide (NO_2). It applies where people are likely to be exposed for periods commensurate with the relevant assessment averaging period. The NESAQ also includes concentration limits and the specified number of occasions that those concentration limits may be exceeded within any year.

The standards specified in the NESAQ are considered in Section 5.15 of this AEE. This section concludes that the concentrations of PM_{10}, NO_2, CO and SO_2 associated with any air discharges from the project and the existing mining operations are expected to remain within the relevant standards.

As such, the NESAQ is not an impediment to the granting of the air discharge permits required for the project.

9.5.1.2 National Environmental Standard for Assessing and Managing Contaminants in Soil

The NESCS seeks to ensure that land affected by contaminants in soil is appropriately identified and assessed before it is developed. If necessary, affected land will need to be remediated or the contaminants contained to make it safe for human use.

Mining industries are included on the Hazardous Activities and Industries List, although it is understood that the continuation of existing uses is not affected by the NESCS.

Extensive studies associated with mining on site to date have demonstrated that the human health effects of extracting ore from the ground on the site and subsequent disposal are able to be controlled adequately using established on-site methodologies and rehabilitation so that human health is protected appropriately. The waste rock to be discharged to land for this proposal is of a similar nature and amount to other waste rock stacks consented previously and as such would have similar, negligible effects on human health.

As such, the NESCS is not an impediment to granting a land use consent for disturbance of a site that been subject to HAIL activities.

8.4.1.1 National Environmental Standard for Sources of Human Drinking Water

The NESHDW sets requirements for the protection of sources of human drinking water from contamination. A human drinking water source is a natural water body that is used to supply a community with drinking water.

The closest water supply is the Palmerston community water take from the Shag River, and the Project will manage its impact on water quality such that it avoids adverse effects on the Palmerston water supply.

9.5.2 National Policy Statement for Freshwater Management

The NPSFM is a relevant statutory planning document under Section 104(1)(b) of the RMA as the project involves the pumping of groundwater to dewater the pit and to provide water for dust suppression, and the discharge of contaminants to land where they may enter ground and surface water associated with runoff and seepage from the worked areas.

The relevant objectives and policies of the NPSFM can be grouped into the following topics:

- Water quality;
- Water quantity;
- Integrated management; and
- The role and interests of tangata whenua.

It is noted that a number of the policies in the NPSFM direct the ORC to undertake specific actions in order to achieve the desired outcomes (e.g. developing or changing regional policy statements or regional plans).[65] These policies are not considered directly relevant to the consideration of the resource consent applications for this project.

The relevant objectives and policies are discussed in the sub-sections below.

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[65] For example, Policies AA1, A1, A2, A3, A5, A6, B1, B2, B3, B4 and B6 of the NPSFM.

9.5.2.1 Water Quality

The objectives and policies relating to the management of water quality seek the following outcomes:

- The safeguarding of the life-supporting capacity, ecosystem processes and indigenous species of freshwater, and the health of people and communities as affected by contact with freshwater;[66]
- The maintenance or improvement of the overall quality of freshwater, while protecting outstanding freshwater bodies and wetlands;[67]
- The improvement of the quality of freshwater so it is suitable for primary contact more often; and[68]
- The enablement of communities to provide for their economic wellbeing within limits.[69]

Runoff water from the operational WRS will be directed to sediment retention (silt) ponds as outlined in the erosion and sediment control report. Rainfall runoff water and ground water infiltration within the operational pit will be dewatered through pumping and discharged to the existing drain that runs to the Deepdell North Silt Pond for treatment. The WRS will be rehabilitated so run off contaminants will be primarily rainfall runoff and any seepage of leachate from the WRS that enters surface flows. These waters will flow through silt ponds for treatment prior to being discharged to receiving surface waters.

The water quality in the receiving surface and ground waters will continue to be monitored in order to maintain water quality and ensure compliance with existing consent conditions. Modelling also confirms that the water quality downstream in the catchment is predicted to sit comfortably within the NPSFM Attribute Band B with regard to nitrogen. Ryder (2019) confirms that this limit is acceptable on the basis that the limit will provide ample protection for the aquatic community in the Deepdell Creek catchment (it is far below species toxicity levels).

After mining has finished, the proposed pit will not be dewatered and will become a sink for rainfall runoff with some discharges from the pit to ground water. The pit is not modelled to overflow until the year 2120 (GHD 2019). Within this timeframe the water quality within the lake will be monitored and adaptively managed if necessary, to ensure an acceptable outcome in this regard.

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66 Objective A1 of the NPSFM.

67 Objective A2 of the NPSFM.

68 Objective A3 of the NPSFM.

69 Objective A4 of the NPSFM.

The proposal will result in the loss of some drainage channels and seven ephemeral wetlands from within the Project footprint. The values of these features are currently degraded by the dominance of exotic vegetation and damage arising from stock access. However, in order to address effects of the proposal on the wetland features, OceanaGold will, as part of an overall mitigation and management package, implement an ecological offsetting programme within yet to be confirmed sites which will be protected in perpetuity through covenanting or a similar legal mechanism. Offsetting the impact of the loss of ephemeral wetlands will be an 'improved-condition' offset with the improvement work informed by a research project investigating ephemeral wetland form, function and threats. This offset will involve using weed control to produce a 25% improvement in indigenous vegetation cover at ephemeral wetlands at 5-7 sites totalling at least 2ha and an improvement in indigenous plant indigenous plant diversity to at least 11 indigenous plant species which are characteristic of Macraes ephemeral wetlands within a 10-year timeframe.[70] Overall, this will result in an improvement in the protection and quality of these types of water resources which is considered to be consistent with the requirements of the NPSFM.

9.5.2.2 Water Quantity

The objectives and policies relating to the management of water quantity seek the following outcomes:

- To safeguard the life-supporting capacity, ecosystem processes and indigenous species of freshwater in sustainably managing the taking, use, damming or diversion of freshwater;[71]
- Avoid any further over-allocation of freshwater and phase out existing over-allocation;[72]
- To improve and maximise the efficient allocation and efficient use of water;[73]
- To protect significant values of wetlands and of outstanding freshwater bodies; and[74]
- To enable communities to provide for their economic wellbeing within limits.[75]

The non-consumptive water abstractions associated with the project are critical to ensure mining activities are undertaken in a safe manner and that post-mining rehabilitation

70 These outcomes are outlined in attached Appendix D (Ahika 2019).
71 Objective B1 of the NPSFM.
72 Objective B2 of the NPSFM.
73 Objective B3 of the NPSFM.
74 Objective B4 of the NPSFM.
75 Objective B5 of the NPSFM.

activities occur in a timely manner. GHD (2019) has provided comments that anecdotal evidence of the streams running very low in dry periods infers that there is little connectivity between groundwater flows and surface water bodies. This observation infers that groundwater drawdown will not be at such an extent that there will be adverse effects on the functioning of surrounding wetlands or stream features.

The proposal will result in the loss of 350m of shallow ephemeral drainage systems and small seepage habitat within the Highlay Creek catchment with the loss of a small reach (approximately 150m) of likely intermittent creek bed at the downstream end of the Highlay Creek tributaries. These drainage networks will provide only a very minor contribution to flow and therefore are not considered to have any adverse effects on the functioning of downstream Highlay Creek tributaries or Highlay Creek itself.

The loss of an approximately 480m length of a Camp Creek tributary can be offset via the establishment of a new drainage channel and diversion.

An extensive ecological offsetting programme is also proposed to appropriately manage the adverse effects on ephemeral and seepage wetlands within the footprint of the site.

9.5.2.3 Integrated Management

Objective C1 of the NPSFM seeks to improve the integrated management of freshwater and the use and development of land in whole catchments, including the interactions between freshwater, land and associated ecosystems.

While the policies that accompany Objective C1 are focused on actions to be undertaken by the ORC, it is noted that the technical assessments commissioned by OceanaGold have considered the actual and potential effects of the Project on land and freshwater resources in an integrated manner. This includes considering the potential effects of the seepage and runoff from the mining activities and the WRS, both in terms of water quality and aquatic ecology.

9.5.2.4 Takata Whenua Roles and Interests

Objective AA1 of the NPSFM refers to the consideration and recognition of Te Mana o te Wai in the management of freshwater. Further, Objective D1 seeks to provide for the involvement of iwi and hapu in the management of freshwater and to ensure that takata whenua values and interests are identified and reflected.

The policies that accompany Objectives AA1 and D1 are focussed on actions to be undertaken by the ORC. In this regard, they direct that regional policy statements and regional plans be amended or that local authorities work with iwi and hapu to involve them in the management of, and decision-making on, freshwater issues.

Notwithstanding the above, it is understood that upholding Te Mana o te Wai acknowledges and protects the mauri of water and that in using water there is also a need to provide for Te Hauora o te Taiao (the health of the environment), Te Hauora o te Wai (the health of the waterbody) and Te Hauora o te Tangata (the health of the people). Given the conclusions regarding the water quality and aquatic ecological effects associated with the proposal as set out in section 5.13 and 5.14 of this AEE, and the offsetting programme that is proposed to improve the quality of indigenous vegetation, wetland resources and other stream resources in the areas selected, the overall health and wellbeing of the water resources within the catchment will continue to be maintained.

9.6 PARTIALLY OPERATIVE REGIONAL POLICY STATEMENT

9.6.1 Introduction

The Otago Regional Council issued decisions on its Proposed Regional Policy Statement (**Proposed RPS**) on 1 October 2016. A significant number of appeals on various provisions were filed in the Environment Court. ORC, appellants, and section 274 parties negotiated throughout 2017 on the issues raised in appeals. Two substantive issues were not resolved through negotiations and became the subject of Environment Court hearings.

Resolved matters became the subject of 19 separate memoranda and associated court orders, lodged with the Environment Court through the first half of 2018. The Court has granted 17 of these consent orders. The Environment Court did however note in a procedural decision[76] that it had some reservations with the content of the Proposed RPS and ruled that *prima facie* proposed amendments to Chapter 3 of the Proposed RPS did not achieve the purpose of the Act when read as a whole with the partially operative RPS. The Environment Court reserved leave in that decision for amended wording to be proposed to rectify the problems identified. The ORC has appealed the Environment Court decision to the High Court and the appeal has yet to be heard. At the same time amended wording has been proposed to the Environment Court to rectify the problems the Court identified with Chapter 3. The Environment Court suggested some further amendments to the wording in a Minute dated 29 August 2019 and directed the ORC to confer with the other parties and lodge a memorandum on the way forward to resolve the wording. The ORC has not yet complied with this direction and as a consequence the wording of Chapter 3 remains uncertain.

The two appeal points that were not resolved out of court concerned ports, and indigenous biodiversity offsetting and compensation in relation to mining. These appeals were heard by the Environment Court in February 2018, and decisions were released by the Environment Court in early 2019. Both decisions were subject to appeals on questions of law to the High Court. The High Court appeal in relation to the mining and indigenous biodiversity offsetting and compensation was held in November 2019 and a decision has not been made, although all parties in the High Court (including ORC) agreed that an error

[76] Alliance Group Limited v Otago Regional Council [2019] NZEnvC 42.

of law had been made by the Environment Court that requires the Environment Court to revisit at least one aspect of its decision.

As a result of the outstanding legal challenges to aspects of the RPS, it is considered that limited weight should be given to those provisions that currently sit within Chapter 3 or those provisions relating to mining, offsetting or compensation (with the exception of Policy 5.3.1(b)) of the Proposed RPS. With regard to these matters the provisions of the Operative RPS are considered applicable. This is reflected in the assessment below.

9.6.2 Chapter 1 – Different Parts of the Natural and Physical Environment are interconnected

Chapter 1 of the Partially Operative RPS seeks to recognise that different parts of the natural and physical environment are interconnected. Relevant objectives and policies relate to the following:

- Otago's resources are used sustainably to promote economic, social, and cultural wellbeing for its people and communities[77]
- Provide for the economic wellbeing of Otago's people and communities by enabling the resilient and sustainable use and development of natural and physical resources.[78]
- Social and cultural wellbeing and health and safety[79]
- Recognise and provide for the integrated management of natural and physical resources to support the wellbeing of people and communities in Otago[80]
- Integrated resource management[81]

The technical assessments that have been commissioned by OceanaGold have considered the actual and potential effects of the project on physical and natural resources in an integrated manner. This includes considering the potential effects of seepage and runoff from the activity on the surrounding water resources. Modelling has been completed which has enabled OceanaGold to test the impact of ongoing and future mine development on downstream water quality. This modelling has confirmed that water quality is expected to remain within compliance limits and within recommended acceptable environmental limits for the existing aquatic ecosystem health and wellbeing.

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77 Objective 1.1.
78 Policy 1.1.1.
79 Policy 1.1.2.
80 Objective 1.2.
81 Policy 1.2.1.

The proposal has also been considered in terms of its contribution to the social and economic wellbeing of the community and Otago region. It will continue to provide employment and income and contribute to expenditure in the region and involvement of the workforce in community groups and clubs. The project will also promote sustainable and integrated management by being able to utilise the existing mine infrastructure to access the ore.

9.6.3 Chapter 2 - Kāi Tahu Values and interests are recognised and Kaitiakitaka is expressed

Relevant provisions within Chapter 2 relate to the following matters:

- The principles of Te Tiriti o Waitangi are taken into account in resource management processes and decisions.[82]
- Treaty principles.[83]
- Kāi Tahu values, interests and customary resources are recognised and provided for[84]
- Kāi Tahu wellbeing [85]

These above provisions generally direct that the principles of Te Tiriti o Waitangi are acknowledged and taken into account for resource management decisions. They also direct that the values of Takata Whenua are also taken into account. In keeping with the principles of Te Tiriti o Waitangi, the relevant Kāi Tahu iwi mana whenua authority (through Aukaha) have been consulted and this will continue throughout the resource consent process and beyond. This consultation process will seek to recognise and provide for Kāi Tahu values, interests, customary values and wellbeing as outlined in the consultation correspondence received from the relevant iwi representative. A Cultural Impact Assessment (CIA) has also been commissioned and it is intended that this will provide OceanaGold with greater understanding of the impacts of the proposal on Kāi Tahu values and concerns.

Further, the relevant provisions of the Kāi Tahu Ki Otago Natural Resource Management Plan 2005 (**KTONRMP**) have been given regard to in applying for this proposal and while these are not considered to be an appropriate replacement for consultation, they provide a suitable initial guide to the relevant Kāi Tahu environmental management issues and achieving the general policy direction of the provisions regarding Kāi Tahu values, interests and wellbeing.

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82 Objective 2.1.
83 Policy 2.1.2.
84 Objective 2.2.
85 Policy 2.2.1.

9.6.4 Chapter 4 – Communities in Otago are resilient, safe and healthy

Chapter 4 matters which are relevant to this proposal relate to the following:

- Risk that natural hazards pose to Otago's communities are minimised.[86]
- Minimising increase in natural hazard risk[87]
- Reduce existing natural hazard risk to people and communities, ...[88]
- Hazardous substances, contaminated land and waste materials do not harm human health or the quality of the environment in Otago.[89]
- Hazardous substances[90]
- Managing contaminated land and new contaminated land [91]

'Natural hazard' is defined in the RMA as any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding), the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment. The proposal does not constitute a natural hazard, but it is noted that mining activities can potentially exacerbate natural hazard risks. Slope stability is actively managed by OceanaGold and geotechnical reporting has assessed that the pit walls and proposed works will be stable and safe both during operation and following rehabilitation in both a static and tectonic effects scenario.

With regard to hazardous substances and contaminated land the following is noted:

- Naturally occurring contaminant levels in waste rock resulting from weathering are known from extensive studies relating to previous and ongoing mining at site and can be managed using established and appropriate methodologies to contain and minimise effects on the environment or human health.
- The use and storage of hazardous substances as part of the proposal is being carried out using safe and appropriate methodologies and will not contaminate the site.

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[86] Objective 4.1.
[87] Policy 4.1.6.
[88] Policy 4.1.7.
[89] Objective 4.6.
[90] Policy 4.6.1.
[91] Policies 4.6.5 and 4.6.9.

9.6.5 Chapter 5 – People are able to use and enjoy Otago's natural and built environment

Relevant provisions within this chapter seek to recognise:

- Historic heritage as being characteristic or important to Otago's historic heritage[92]
- That sufficient land is managed and protected for economic production[93]
- Adverse effects of using and enjoying Otago's natural and physical resources are minimised[94]

There are no significant historic heritage features that will be directly affected by the proposal.

Due to the location of the mineral resource, there is a functional need for this activity to locate in rural areas. The majority of the site is zoned for mining purposes, and the part that extends into the rurally zoned land will not affect the surrounding land to be utilised for primary production purposes. Upon closure and rehabilitation of the mine activity, the land will be able to be re-utilised for farming activities. During the operational phase of the project adverse effects will be actively managed according to a cascading approach of avoid, remedy, mitigate, then offset. A rehabilitation and closure strategy will ensure appropriate measures are implemented such that any ongoing adverse effects of the proposal are appropriately avoided, remedied or mitigated.

9.7 OPERATIVE RPS

As noted above a number of provisions within the Operative RPS have not yet been revoked and remain relevant to the consideration of this project. This includes the provisions of Chapter 5 (land), Chapter 6 (water), Chapter 7 (air) and Chapter 10 (Biota).

In Chapter 5, Issue 5.3.2 identifies that the primary productive capacity of Otago's land resource may be compromised by activities which result in loss of vegetation cover, or the spread of plant and animal pests or degradation of the soil resource.

Objective 5.4.1 seeks to promote the sustainable management of Otago's land resource to maintain and enhance primary productive capacity and life-supporting capacity and meet the present and reasonably foreseeable needs of people and communities. This project is consistent with the purpose of sustainable management. The areas of disturbed land will progressively be rehabilitated into pasture and this therefore preserves the future use of the land. The mining itself helps support the economic and social wellbeing of the

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[92] Policy 5.2.1.
[93] Objective 5.3.
[94] Objective 5.4.

Macraes community and wider area by the provision of jobs, expenditure in the region and involvement of the workforce in community groups and clubs. Objective 5.4.5 specifically refers to promoting the sustainable management of Otago's mineral resources in order to meet the needs of Otago's communities. This project will promote sustainable management by being able to utilise the existing mine infrastructure to access the ore.

The RPS seeks diversification of the use of land resources in Otago[95] and one form of land use is mining. The RPS recognises that mineral deposits are a finite resource and consideration needs to be given to preserve access to such deposits[96]. Following this policy approach the Waitaki District Plan also acknowledges the importance of known mineral deposits and seeks to discourage activities or development that are likely to compromise such resources[97]. Other Land Chapter policies within the RPS require the need to maintain/enhance the land resource[98] and minimise effects on water resources from land use[99].

Water modelling reports indicate that water quality downstream of the project will remain within consented limits that were deemed appropriate for other activities on the site and will remain well within recommended environmental limits for protection of the water body and species that live within it.

The RPS contains policies requiring the efficient consumptive use of water[100] (Policy 6.5.3) and the desire to reduce the adverse effects of contaminant discharges into water bodies[101]. OceanaGold recycles water around the Macraes site, both to reduce the impact on water resources in terms of the volume of water that is taken, and to reduce the volume of contaminated water that is discharged, directly or indirectly, into surrounding water bodies and ground water. The same approach will be applied to the Deepdell North Stage III Project. Contamination levels will not be increased beyond the proposed compliance limits, and this will continue to be monitored throughout the life of the project and beyond. Overall it can be concluded that the application is consistent with the purpose and principles of Chapter 6 of the RPS.

The maintenance or practicable enhancement of the diversity of significant indigenous vegetation and significant habitat of indigenous fauna, trout and salmon[102], and the maintenance and enhancement of the life-supporting capacity and diversity of Otago's biota are promoted in the RPS[103]. Objective 10.4.3 seeks that the natural character of areas

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95 Policy 5.5.4.
96 Policy 5.5.8.
97 Refer Policy 16.7.2 of the Waitaki District Plan.
98 Policy 5.5.3.
99 Policy 5.5.5.
100 Policy 6.5.3.
101 Policy 6.5.5.
102 Policy 10.5.2.
103 Objective 10.4.1.

with significant indigenous vegetation and significant habitats of indigenous fauna is maintained and enhanced.

The terrestrial and aquatic ecological values and effects associated with the Project are described in sections 5.10 and 5.13 of this AEE. These assessments find that the site is highly modified due to the presence of existing farming and mining activities. The site is dominated by exotic plant species, however, there remain some areas with valued terrestrial and aquatic habitat and species that will impacted by the Project. More specifically, Ahika (2019) has identified that the producing grassland, seepage and ephemeral wetlands and shrubland vegetation meet the significance criteria listed in Policy 10.5.2 of the Operative RPS insofar as:

> *Habitat or vegetation that support the maintenance or recovery of indigenous species that are uncommon or threatened with extinction (rare, vulnerable, or endangered) regionally or nationally.*

Despite this finding it is noted that there are no sites within the Project footprint or surrounding environment that have been specifically scheduled or mapped in any lower order planning document as being of significance (i.e. the wetlands have not been identified as Regionally Significant in terms of Schedule 9 of the Regional Plan: Water for Otago).

A comprehensive analysis of available means to avoid, remedy or mitigate the adverse effects of the Deepdell North Stage III Project on the significant indigenous vegetation or habitat of indigenous fauna at the project site is provided in **Appendix D**. The following approach has been adopted in this regard:

- Avoidance of adverse effects by:
  - Siting infrastructure away from areas with high ecological value where this is practicable; and
  - Staging deposition of rock material into the WRS areas.
- Remediation of adverse effects by:
  - Constructing areas of the margins of the final WRS to provide habitat for lizards
- Mitigation of impacts by:
  - Minimising project effects of dust, noise, weeds, fire, sediment, contaminants on the surrounding area
  - Translocating plant species that are of moderate or high ecological important or that are of restricted distribution within the Maraes Ecological District to sites such as the Ecological Enhancement Areas covenanted by OceanaGold.

However, after implementing those options residual effects (direct loss of habitat) will remain and therefore a comprehensive offset is proposed at a nearby site with similar or better ecological values and provisions of funds for the ongoing protection and ecological management of this area is proposed. This is described in detail in the Impact Management Plan attached as **Appendix D** and will be secured by relevant conditions (refer **Appendix S**). It is considered that this management approach will ensure the overall adverse effects on significant indigenous vegetation and habitats of flora and fauna will be low. It will also ensure that overall biodiversity values will be maintained and enhanced within the Macraes Ecological District.

9.7.1 Regional Plan: Water for Otago

The RPW was made operative in its current form on 1 March 2016. It contains objectives and policies which seek to manage the following matters of relevance to the Deepdell North Stage III Project:

- The natural and human use values of lakes and rivers;
- Water quantity;
- Water quality;
- The beds and margins of lakes and rivers;
- Groundwater; and
- Wetlands.

An assessment of the Deepdell North Stage III Project against those provisions is provided below.

9.7.1.1 Natural and human use values of lakes and rivers

Key management objectives for the natural and human use values of Otago's rivers seek:

- To maintain or enhance the natural and human use values, identified in Schedules 1A, 1B and 1C.[104]
- To maintain or enhance the spiritual and cultural beliefs, values and uses of significance to Kai Tahu, identified in Schedule 1D.[105]
- To protect the natural character of Otago's lakes and rivers and their margins from inappropriate subdivision, use or development.[106]

[104] Objective 5.3.1.
[105] Objective 5.3.2.
[106] Objective 5.3.3.

- To maintain or enhance the amenity values associated with Otago's lakes and rivers and their margins.[107]
- To provide for the sustainable use and development of Otago's water bodies, and the beds and margins of Otago's lakes and rivers.[108]
- To maintain the heritage values associated with Otago's lakes and rivers, and their margins.[109]
- To avoid the exacerbation of any natural hazard or the creation of a hazard associated with Otago's lakes and rivers.[110]

The most relevant policies in terms of providing direction on how the Deepdell North Stage III Project should manage its adverse effects in light of these objectives are: Policies 5.4.2, 5.4.3, 5.4.8 and 5.4.9. They state:

> ***5.4.2*** *In the management of any activity involving surface water, groundwater or the bed or margin of any lake or river, to give priority to avoiding, in preference to remedying or mitigating:*
>
> *(1) Adverse effects on:*
>
> *(a) Natural values identified in Schedule 1A;*
>
> *(b) Water supply values identified in Schedule 1B;*
>
> *(c) Registered historic places identified in Schedule 1C, or archaeological sites in, on, under or over the bed or margin of a lake or river;*
>
> *(d) Spiritual and cultural beliefs, values and uses of significance to Kāi Tahu identified in Schedule 1D;*
>
> *(e) The natural character of any lake or river, or its margins;*
>
> *(f) Amenity values supported by any water body; and*
>
> *(2) Causing or exacerbating flooding, erosion, land instability, sedimentation or property damage.*
>
> ***5.4.3*** *In the management of any activity involving surface water, groundwater or the bed or margin of any lake or river, to give priority to avoiding adverse effects on:*
>
> *(a) Existing lawful uses; and*

[107] Objective 5.3.4.
[108] Objective 5.3.6.
[109] Objective 5.3.7.
[110] Objective 5.3.8.

(b) *Existing lawful priorities for the use, of lakes and rivers and their margins.*

5.4.8 *To have particular regard to the following features of lakes and rivers, and their margins, when considering adverse effects on their natural character:*

(a) *The topography, including the setting and bed form of the lake or river;*

(b) *The natural flow characteristics of the river;*

(c) *The natural water level of the lake and its fluctuation;*

(d) *The natural water colour and clarity in the lake or river;*

(e) *The ecology of the lake or river and its margins; and*

(f) *The extent of use or development within the catchment, including the extent to which that use and development has influenced matters (a) to (e) above*

5.4.9 *To have particular regard to the following qualities or characteristics of lakes and rivers, and their margins, when considering adverse effects on amenity values:*

(a) *Aesthetic values associated with the lake or river; and*

(b) *Recreational opportunities provided by the lake or river, or its margins.*

The Deepdell North Stage III Project sits comfortably with these provisions, noting that:

- The relevant natural values in Schedule 1A are an absence of aquatic pest plants, and the presence of flathead galaxid.
- The closest water supply value identified in Schedule 1B is the Palmerston water take from the Shag river, and the Project will manage its impact on water quality such that it avoids adverse effects on the Palmerston water supply.
- There are no registered historic places in Schedule 1C nor any archaeological sites in, on, under or over the bed or margin of a lake or river that will be affected by the Deepdell North Stage III Project.
- As set out in Section 2.6, multiple Kāi Tahu values are attributed to the Shag River catchment. Based on consultation with Aukaha, OceanaGold is not currently aware of any effect on those values that is of particular concern to iwi. This will be further considered as a result of ongoing consultation and the contents of the CIA.

- With respect to natural character and effects on amenity values, neither Highlay Creek, Camp Creek nor Deepdell Creek is attributed any significance and will be limited to the infilling of small unnamed ephemeral (possibly intermittent) tributaries of Highlay Creek with the Deepdell East WRS. In the case of Camp Creek, the Project will involve the reclamation of a highly modified (straightened and channelised), intermittent section of stream bed for use in the WRS drainage network and the loss of ephemeral seepage length in the pit footprint. As noted, the affected lengths of these water bodies are already highly modified, are unlikely to support any significant aquatic habitat and species and are not known to support any notable recreation values that would be affected by the Project.
- Modelling indicates that downstream water quality on a cumulative basis will remain compliant with existing consent limits and recommended instream environmental limits for habitat and species protection.
- The Project will not exacerbate flooding, and a variety of measures are proposed to avoid erosion, land instability and sedimentation.
- No adverse effects on other existing lawful uses of water have been identified.

9.7.1.2 Water Quantity

The effects of the Deepdell North Stage III Project on water quantity will be limited to:

- Moderation of local flows due to changes in surface runoff patterns and groundwater flows by the Deepdell North Stage III Project activities;
- The dewatering of the Deepdell North Pit area prior to mining of the Deepdell North Stage III Pit commencing (this water is to be pumped to the silt ponds for storage, treatment and discharge or use for site dust suppression); and
- The damming of rainfall runoff water from part of the WRS and any groundwater flow ingress within the Deepdell North Stage III Pit lake once mining is complete.

These activities will cause a minor decrease in flows in Deepdell Creek on days with rainfall, and on days without rainfall (including low flow conditions) a small increase in flow due to release of attenuated seepage. These changes will not have an adverse impact on achieving the RPW management objectives for water quantity, including:

- To retain flows in rivers sufficient to maintain their life-supporting capacity for aquatic ecosystems, and their natural character.[111]

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[111] Objective 6.3.1.

- To provide for the water needs of Otago's primary and secondary industries, and community domestic water supplies.[112]

With respect to the water quantity policies, the most relevant is Policy 6.4.9(b) which provides for supplementary allocation of water provided:

- The take has no measurable effect on the flow at any Schedule 2 monitoring site, or any site established in terms of Policy 6.4.4, at flows at or below any minimum flow applying to primary allocation; and
- Any adverse effect on any aquatic ecosystem value or natural character of the source water body is no more than minor; and
- There is no adverse effect on any lawful existing take of water.

The take of water associated with the Deepdell North Stage III Project is consistent with these provisions, and as per other similar activities at the Macraes Gold Project, including the recently granted Coronation North Project consents, no minimum flow restrictions apply, nor are any residual flow conditions deemed necessary.

9.7.1.3 Water Quality

Key management objectives for water quality in Otago seek:

- To maintain water quality in Otago lakes, rivers, wetlands, and groundwater, but enhance water quality where it is degraded.[113]
- To enable the discharge of water or contaminants to water or land, in a way that maintains water quality and supports natural and human use values, including Kāi Tahu values.[114]
- To have individuals and communities manage their discharges to reduce adverse effects, including cumulative effects, on water quality.[115]

The most relevant policies in terms of providing direction on how the Deepdell North Stage III Project should manage its adverse effects in light of these objectives are:

- The following 'General' policies: 7.B.1, 7.B.4, 7.B.6, 7.B.7 and 7.B.8.

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[112] Objective 6.3.2.
[113] Objective 7.A.1.
[114] Objective 7.A.2.
[115] Objective 7.A.3.

- The following policies for discharges of hazardous substances, hazardous wastes and discharges from 'industrial and trade premises': 7.C.1, 7.C.2, 7.C.3 and 7.C.4.

Key policies state:

7.B.1 Manage the quality of water in Otago lakes, rivers, wetlands and groundwater by:

(a) Describing, in Table 15.1 of Schedule 15, characteristics indicative of good quality water; and

(b) Setting, in Table 15.2 of Schedule 15, receiving water numerical limits and targets for achieving good quality water; and

(c) Maintaining, from the dates specified in Schedule 15, good quality water; and

(d) Enhancing water quality where it does not meet Schedule 15 limits, to meet those limits by the date specified in the Schedule; and

(e) Recognising the differences in the effects and management of point and non-point source discharges; and

(f) Recognising discharge effects on groundwater; and

(g) Promoting the discharge of contaminants to land in preference to water.

7.B.4 When considering any discharge of water or contaminants to land, have regard to:

(a) The ability of the land to assimilate the water or contaminants; and

(b) Any potential soil contamination; and

(c) Any potential land instability; and

(d) Any potential adverse effects on water quality; and

(e) Any potential adverse effects on use of any proximate coastal marine area for contact recreation and seafood gathering.

7.B.6 When assessing any consent to discharge contaminants to water, consider the need for and the extent of any zone for physical mixing, within which water will not meet the characteristics and limits described in Schedule 15, by taking account of:

(a) The sensitivity of the receiving environment; and

(b) The natural and human use values, including Kāi Tahu values; and

(c) The natural character of the water body; and

(d) The amenity values supported by the water body; and

> (e) *The physical processes acting on the area of discharge; and*
>
> (f) *The particular discharge, including contaminant type, concentration and volume; and*
>
> (g) *The provision of cost-effective community infrastructure; and*
>
> (h) *Good quality water as described in Schedule 15.*
>
> *7.B.7 Encourage land management practices that reduce the adverse effects of water or contaminants discharged into water.*
>
> *7.B.8 Encourage adaptive management and innovation that reduces the level of contaminants in discharges.*

OceanaGold has undertaken water modelling to understand the potential extent of adverse effects of the Deepdell North Stage III Project in terms of discharges of contaminants to receiving water bodies. Compliance limits for contaminants in water that have been applied to other projects within the site will also be applied to the Deepdell North Stage III Project. Modelling also demonstrates that downstream water quality within the catchment is predicted to sit comfortably within appropriate environmental limits for the protection of aquatic plants and species that are known to locate in this environment. This is expected to generally achieve outcomes consistent with good water quality as described in Schedule 15 and Policy 7.B.6.

It is noted in the aquatic ecology assessment (Ryder 2019), that Deepdell Creek would not meet the Schedule 15 target concentrations for nitrate-nitrite nitrogen, however, Ryder (2019) reports that a concentration limit below 0.075mg/L seems overly ambitious for this catchment given that the current concentrations levels are almost an order of magnitude higher. Ryder (2019) also recommends that management efforts in the catchment are focussed on managing phosphorous losses to water in order to help reduce the possibility of nuisance algae growth.

It is proposed that any runoff of silt and sediment from the proposed activities will be managed under an erosion and sediment control plan consistent with details provided in the EGL (2019) erosion and sediment control report attached as **Appendix R** and summarised in section 6 of this AEE.

OceanaGold also intend to monitor water quality in the catchment consistent with its existing consent requirements, and to adaptively manage and mitigate any potential water quality issues that might arise. This is consistent with Policy 7.B.8 of the Water Plan.

9.7.1.4 The Beds and Margins of Rivers and Lakes

Relevant RPW management objectives for the beds and margins of water bodies seek:

- To maintain the stability and function of existing structures located in, on, under or over the bed or margin of any lake or river; the stability of the bed and bank of any lake or river; and the flood and sediment carrying capacity of any lake or river.[116]
- To minimise reduction in water clarity caused by bed disturbance.[117]

The most relevant policies in terms of providing direction on how the Deepdell North Stage III Project should manage its adverse effects in light of these objectives are:

- General policies 8.4.1 and 8.4.2.
- Policy 8.5.1 and 8.5.3 which address structures.
- Policy 8.6.1 and 8.6.2 which address bed disturbance.
- Policy 8.8.1 and 8.8.2 which address reclamation.

The proposed activity sits comfortably with these policies noting that:

- Various best practice measures for managing sediment control, accidental spills, and the introduction of nuisance aquatic weed / algae will be implemented to minimise effects on water quality below the instream works;
- The tributaries within the Highlay Creek catchment immediately below the works are not identified in the aquatic ecology assessment by Ryder (2019) as being important for the spawning of indigenous fauna, trout or salmon, nor is that catchment attributed any notable amenity values; and
- There are no downstream water users in close proximity to the proposed works.

The relevant reclamation and deposition policies state:

> *8.8.1 To consider practical alternatives to:*
>
> > *(a) The reclamation of the bed of any lake or river; and*
> >
> > *(b) The deposition of any substance in, on or under, the bed or margin of any lake or river.*
>
> *8.8.2 To require only cleanfill be used to create any reclamation of the bed of a lake or river.*

In accordance with Policy 8.8.1 alternatives to the proposed Deepdell East WRS (which entails most of the proposed reclamation) were considered (refer to Section 7.2.2). One

116 Objective 8.3.1.

117 Objective 8.3.2.

alternative option (Option A) would have required less streambed reclamation. However, it was not favoured due to technical, land access and noise issues. The other alternative option considered (Option C) would have resulted in a much greater portion of Highlay Creek and its tributaries being reclaimed, and this is one reason this option was rejected in favour of the proposed WRS location.

The direction in Policy 8.8.2 to use cleanfill in reclamations is intended to reduce the discharge of contaminants which are likely to, or have the potential to, adversely affect water quality in Otago's lakes and rivers. Water quality modelling confirms that compliance with existing consents limits will be achieved with the addition of this Project at the site and in the long-term water quality will be generally maintained to ensure adequate protection of the aquatic flora and fauna that currently inhabits downstream reaches. This will be confirmed via ongoing water quality monitoring.

9.7.1.5 Groundwater

The abstraction of groundwater will be necessary to provide safe access to the mineral resources and prevent inundation of the mining operations at the bottom of the pit. It is not considered to be of a significant volume such that there will be any adverse effects on existing groundwater abstractions or surface water connections.

9.7.1.6 Wetlands

Objective 10.3.2 of the RPW seeks that Otago's wetlands and their individual and collective value and uses will be maintained or enhanced for present and future generations. Objective 10.3.2 and associated policies[118] are applicable to Regionally Significant Wetlands that are listed in Schedule 9 or higher than 800 m above sea level. There are no wetlands within the site footprint (or surrounds) that are listed in Schedule 9, nor are they situated above 800m sea level.

Policy 10.4.6 seeks to promote the conservation, creation and reinstatement of wetland areas and enhancement of individual and collective wetlands through a number of measures. It is considered that the offsetting that is proposed by OceanGold will align with the general outcomes sought in this policy and protect the overall wetland values within the protected areas and at the ecological district level.

9.7.2 Regional Plan: Air for Otago

The relevant objectives contained within the Air Plan seek:

- To maintain ambient air quality in part of Otago that have high air quality and to enhance ambient air quality in places where it has been degraded.119

[118] 10.4.1 – 10.4.2A.

[119] Objective 6.1.1.

- To avoid adverse localised effects of contaminant discharges.[120]
- To allow for the sustainable use of Otago's air resource.[121]

The assessment regarding air (refer section 5.14 of this AEE) concludes that the project is not expected to result in any significant adverse effects that will impact on the localised or surrounding air resource. Monitoring of PM10 in the vicinity of the current Macraes Gold Project mining activity has found that concentrations are well below the NES and Otago Goal Levels. The project is not expected to result in any significant increase in local concentrations of PM10.

The proposed operation will be very similar in scale and nature to the current mining operations and will generate the same discharges. OceanaGold proposes to continue to use the dust mitigation methods that are being used successfully at present. The effects of the proposed operation are also expected to be very similar to the effects of the current Coronation North project. The current operation has not caused any effects to date that have been considered to be noxious, dangerous, offensive or objectionable. It is therefore expected that the discharges from the proposed Deepdell North Stage III project will not result in discharges that are noxious, dangerous, offensive or objectionable. OceanaGold plans to continue to use the dust mitigation methods that it currently employs, and which have been demonstrated to be effective.

9.7.3 Regional Plan: Waste for Otago

9.7.3.1 Hazardous Waste

The key management objectives for hazardous waste are:

- To avoid, remedy and mitigate the risk to the environment and human health from hazardous substances and hazardous wastes.[122]
- To avoid, remedy and mitigate the harmful effects of hazardous substances and hazardous wastes on traditional water, land and mahika kai values of importance to Kai Tahu.[123]

The most relevant policies in terms of providing direction on how the Deepdell North Stage III Project should manage its adverse effects in light of these objectives are:

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[120] Objective 6.1.2.
[121] Objective 6.1.3.
[122] Objective 6.3.1.
[123] Objective 6.3.2.

- To promote the safe transportation, and the use, treatment, storage and disposal of hazardous substances and hazardous wastes in such a manner that avoids adverse environmental effects. [124]
- To recognise and provide for the relationship Kāi Tahu have with Otago's natural and physical resources through…[125]

As discussed earlier in this section extensive studies associated with mining on site to date have demonstrated that the human health effects of extracting ore from the ground on the site and subsequent disposal are able to be controlled adequately using established on-site methodologies and rehabilitation so that human health is protected appropriately. The waste rock to be discharged to land for this proposal is of a similar nature and amount to other waste rock stacks consented previously and as such would have similar, negligible effects on human health.

Operationally, an erosion and sediment control plan will be implemented on-site to appropriate capture and manage any discharges from the waste rock stack. Modelling has also demonstrated that the activity will not result in any significant contamination of downstream water resources.

The use and storage of hazardous substances at site such as diesel and explosives will be carried out in a manner that meets the relevant health and safety regulations and industry good practice. As such, the proposal is consistent with the above provisions.

9.7.3.2 Contaminated Sites

This site, having been subject to HAIL activities, is potentially contaminated. As such, the following provisions of the contaminated sites chapter of the Waste Plan are most relevant to this proposal.

- To avoid, remedy or mitigate any adverse effects of contaminated sites.[126]
- To contain contaminated sites and rehabilitate them to the extent that is practicable having regard to the use to which the land is to be put.[127]

The proposal will take the appropriate course of action based on the activities known to have been carried out at site and the results of the preliminary site investigation as well as the fact that the proposal is in itself, a continuation of previous HAIL activities at site. The waste rock is merely being moved from one part of the site to another and then being rehabilitated to its existing grazing use and contains naturally occurring contaminants

[124] Policy 6.4.1.
[125] Policy 6.4.12.
[126] Objective 5.3.1.
[127] Policy 5.4.3.

present in the local rock. As such, the proposal will be consistent with the above provisions.

9.8 WAITAKI DISTRICT PLAN

The Waitaki District Plan was deemed fully operative in 2010. The Waitaki District Plan contains 17 chapters with regards to zone specific and district wide issues, objectives and policies. There are no separate Mining Zone or Nature Conservation Value chapters and these matters which are central to the application are both addressed within Chapter 16 (Rural). The most relevant chapters to this proposal are therefore identified as:[128]

Chapter 1 – Takata Whenua

Chapter 2 – Heritage

Chapter 4 – Natural Hazards

Chapter 6 – Transport

Chapter 12 – Hazardous Substances

Chapter 16 – Rural (including mineral extraction, rural amenity and nature conservation values)

Part 2 of the District Plan contains its objectives and policies, and these cover the following relevant matters within the above chapters:

- Mineral extraction;
- Rural amenity;
- Landscape;
- Biological diversity;
- Heritage;
- Takata whenua;
- Hazardous substances,
- Macraes Township, and
- Transport.

The relevant Waitaki District Plan matters concerning this proposal are addressed here:

[128] Please note that the matter of Open Space and Recreation is not considered to be relevant to this proposal and the reason for this is outlined in section 5.5 of this AEE.

9.8.1.1 Mineral Extraction Provisions

Section 16.7.4 of the Plan sets out that:

> *The Council recognises the importance of the mineral extractive industry to the District and will seek to protect known deposits that are, to a greater or lesser extent, being extracted. This is particularly relevant to the gold mining at Macraes Flat, and the extraction of limestone for the purposes of cement manufacturing near Whitstone which was recognised in the previous Plan. Both these locations are considered as specific policy areas. The Council shall take into account the potential loss of access to these minerals when considering any applications for any future activities or developments. The Council however also considers that controls are necessary with respect to the extractive operations because the scale of the operations, the sensitivity of the area, and the management of the operations may vary considerably. For these issues to be adequately addressed, Council considers individual proposals need to be assessed on their merits. This will also enable the Council to set conditions on the management of the operation that are appropriate to the scale of the operation and sensitivity of the area.*

It is understood that the above means that mining (extractive) proposals, whether they occur in the Rural or Mining Zone, are given the same recognition for how important they are to the Waitaki District and that resource consent proposals will be assessed on their merits[129]. It is also understood that the above, along with the relevant Rural Zone and Mining Zone rules for mining activities, mean that being located either wholly or partly in the Mining Zone or the Rural Zone does not affect the merit of an open pit mining proposal.

The key management Objective 16.7.1.6 for mineral extraction states:

> *Extractive industries are given the ability to access minerals but in a way that avoids, remedies or mitigates adverse effects on the environment.*

Relevant policies include:

> ***16.7.2 Policies 6***
>
> *2* *To recognise the potential adverse effects of extractive operations, including mineral exploration, on the rural environment, and to control such operations in order that an assessment may be made as to the sensitivity of an existing area and the* degree to which an operation will avoid, remedy or mitigate any adverse effects on the amenity and environment of the rural area.

[129] It is noted that even within the Mining Zone at Macraes all mining activities undertaken by OceanaGold in connection with open pit mining require discretionary resource consent.

3 *To provide for a mining zone at Macraes Flat in recognition of the scale and intensity of the mining operation while ensuring the adverse effects of mining operations are avoided, remedied or mitigated.*

4 *To ensure that after mining, sites are rehabilitated sufficiently to enable the establishment of activities appropriate to the area.*

5 *To avoid, remedy or mitigate adverse effects on the rural amenity and environment by, where appropriate, encouraging extractive industries to continue in existing locations.*

The Deepdell North Stage III Project is considered to be consistent with and certainly not contrary to these provisions, noting that:

- The implementation of the Deepdell North Stage III Project aligns with the provisions which seek that mineral extraction occur in the district and including at Macraes Flat.
- In accordance with the Objective 16.7.1.6., and Policies 16.7.2.6.2, 16.7.2.6.3 and 16.7.2.6.5 an extensive suite of measures to avoid, remedy or mitigate and offset the adverse effects of the Deepdell North Stage III Project area also proposed (see Section 5 and 6 of this AEE) The proposal is also in a location of recent mining from the previous Deepdell projects.
- The technical assessments that have been prepared in support of this Project have carefully assessed the proposed activities against the existing environment, as well as taking into account any sensitivities that may be within or adjacent to the site. The assessments, where relevant, have also taken into account cumulative effects arising from this proposal and the other existing activities at the site. The assessments find that there is sufficient capacity within this environment to allow this activity, provided there is suitable control regarding certain operating parameters (e.g working hours), adherence to best practice mining and rehabilitation methodologies, and an appropriate suite of conditions to avoid, remedy, mitigate or offset any adverse effects identified. These are discussed in detail in sections 5 and 6 of this AEE.
- In accordance with Policy 16.7.2.6.4, the Deepdell North Stage III Project site will be rehabilitated to pastoral farmland. This accords with the existing surrounding land use and with the wishes of the local community so is considered to be an appropriate land use. As part of this proposal, the existing pit at Deepdell South will be almost all backfilled and rehabilitated as part of the proposal so that it more closely resembles the pre-mining landscape and will be able to be grazed after rehabilitation.

9.8.1.2 Rural Amenity Provisions

Chapter 16.5 of the District Plan notes the rural environment has particular amenity and environmental values which are important to rural people, including privacy, rural outlook, spaciousness, ease of access, and quietness. The associated objective and policies which are most relevant when considering the effects of the Deepdell North Stage III Project on rural amenity state:

> ***16.5.1 Objective 4 - Rural Amenity***
>
> *A level of rural amenity that is consistent with the range of activities anticipated in the rural areas, but which does not create unacceptably unpleasant living or working conditions for the District's residents and visitors, nor a significant deterioration of the quality of the rural environment.*
>
> ***16.5.2 Policies 4***
>
> *3 To set performance standards or to use enforcement provisions for activities that may cause unpleasant living or working conditions for other people in the rural community, or that could cause a significant adverse effect to the environment.*
>
> *6 To require that residential dwellings be setback from property boundaries so as to reduce the probability of dwellings being exposed to significant adverse effects from an activity on a neighbouring property.*

As outlined in Section 5 of this AEE, the project will be in keeping with the existing land use of the surrounding area which is dominated by the Macraes Gold Project activities and pastoral farming, and it will not impact on the privacy, rural outlook or spaciousness currently enjoyed by neighbours.

With respect to noise:

- the key outcome sought is that the project does not create unacceptably unpleasant living or working conditions on neighbouring properties; and
- the key policy direction for how this be achieved is through the setting of performance standards, and the separation of activities by requiring residential dwellings to be setback from property boundaries.

As outlined in Section 5 of this AEE and within the noise assessment report AES (2019) have completed a comprehensive assessment of the projects noise effects on neighbouring properties and outline why the Deepdell North Stage III Project will achieve the outcome sought by Objective 16.5.1. Key conclusions in that context are:

- The predicted noise levels in neighbouring farmland will not cause unacceptably unpleasant working conditions or significant adverse effects on that environment as the environment is already subject to hauling noise from existing operations and the proposal will not cause any reasonably noticeable increase in those cumulative noise levels.
- The predicted noise levels at neighbouring dwellings will not cause unacceptably unpleasant living conditions or significant adverse effects on that environment because:

- Daytime noise levels at all neighbouring residences will meet District Plan noise limits of 55dBA LA_{eq}.
- Night-time noise levels will meet the District Plan noise limits at all neighbouring residences except the Howard dwelling located 1.5 km west of the Deepdell North Stage III Pit boundary and 1.1 km west of the haul road.
- Night-time noise levels experienced at the Howard dwelling will for most of the time be 40 dB L_{Aeq} or less and meet District Plan noise limits.
- Over the 13 month period when rock extraction at the Deepdell North Stage III Project is at peak operation and haul trucks from Coronation North mine are using the haul road, noise levels of up to 42 dB L_{Aeq} as a result of this proposal may be experienced at the Howard dwelling when winds are from the north-east.
- The current cumulative noise level at the Howard dwelling as a result of existing consented operations (Coronation North) is 49dB L_{Aeq} and the addition of noise from this proposal will not increase this existing noise level.
- Double glazing and a mechanical ventilation system has also already been installed at the Howard residence as a means of further mitigating the noise levels experienced inside the dwelling.

Consultation with the Howards is ongoing, and it is hoped that an affected party approval will be forthcoming.

9.8.1.3 Landscape Provisions

No outstanding or significant natural features or outstanding landscapes are affected by the Deepdell North Stage III Project, and in turn the landscape provisions that address those areas are not relevant.

However, the District Plan contains provisions which address effects on landscape values of the Rural Scenic Zone which the Deepdell North Stage III Project is either located within or immediately adjacent to. The relevant provisions state:

16.8.2 Landscape Objective

Subdivision, use and development are managed so that: …

- *the overall landscape qualities of the Rural Scenic Zone are retained.*

16.8.3 Policies

…

3 To manage landscape change in the Rural Scenic Zone in a manner that maintains the overall character of the significant landscape, which forms the basis of the visual amenity associated with this Zone.

6 To assist in achieving the outcomes in Policies 2 to 5 above, the following policies are to be considered against any subdivision, use or development *applications:*

…

f) *Earthworks are encouraged to be located away from visually sensitive areas, and where practicable towards the edges of the landform and vegetation patterns;*

h) *Earthworks, where possible, should be restored and finished to a contour sympathetic to the surrounding physiography and should also, where possible, be revegetated with a cover appropriate to the site and setting;*

7 *To manage siting, design, trees species and the management of tree planting within the Rural Scenic Zone in order to prevent wilding spread.*

As outlined in Section 5 of this AEE and the WSP OPUS (2019) landscape and visual assessment report attached as **Appendix M**, the assessment finds that the Deepdell North Stage III Project will retain the overall landscape qualities of the Rural Scenic Zone through shaping of the WRS and back filling of Deepdell South Pit to resemble surrounding natural landforms and through reestablishment of pasture. The general shape, slopes and colour of the completed and revegetated landforms will be in sympathy with the natural slopes of the area which give the area its rural landscape qualities. This is on the basis that any potential adverse effects will be addressed via backfilling of the defunct Deepdell South open cut pit and by the progressive rehabilitation of the Deepdell East WRS as the WRS is developed, and by the completion of the Project's closure plan which will include shaping and 'naturalising' of the upper pit edge walls and creation of more gentle slopes accessing the pit lake shore. These measures will assist in moderating the overall visual effect of the Project and retaining the landscape values of the surrounding rural area. The proven measures listed above, already successful elsewhere at the Macraes Gold Project, will ensure that long term effects are at acceptable levels to retain the overall landscape qualities of the Rural Scenic Zone

The assessment also confirms the project will sit comfortably with Policy 16.8.2.3, noting that the effect on visual amenity values that will arise from the Project are minor relative to those effects already consented for the existing mining activities with Macraes Gold Project and the mining activities are recognised and accepted as contributing to the central landscape identity for the Macraes Land Unit. Cumulative effects are not considered to be significant nor adverse on the basis that any cumulative effects exceeding a Low to Negligible level will be restricted to a single view point location on Horse Flat Road, close to the proposal, Cumulative effects of the proposal at this location will reduce to Moderate after rehabilitation.

In accordance with Policy 16.8.2.6, extensive shaping and re-vegetation (rehabilitation) of the Deepdell North Stage III Project area is proposed. Once the final shaping and revegetation of the Deepdell East WRS has been completed, along with that of the redundant haul roads, the general shape, slopes and colour of the completed and revegetated landforms will be in sympathy with the natural slopes of the area.

In accordance with Policy 16.8.2.7, re-vegetation with, or planting of wilding tree species is not proposed as part of this project.

9.8.1.4 Biological Diversity Provisions

The effects of the Deepdell North Stage III Project on biological diversity, and the proposed means of managing those effects are set out in Section 5 and Ahika (2019).

The terrestrial and aquatic ecological values and effects associated with the Project are described in sections 5.10 and 5.13 of this AEE. These assessments find that the site is highly modified due to the presence of existing farming and mining activities. The site is dominated by exotic plant species, however, there remain some areas with valued terrestrial and aquatic habitat and species that will impacted by the Project. More specifically, Ahika (2019) has identified that the producing grassland, seepage and ephemeral wetlands and shrubland vegetation meet the significance criteria listed in Policy 16.9.3 of the District Plan insofar as:

Policy 16.9.3 Criteria	Description	Habitat within the Project Footprint
Representativeness	*The area supports an example of a particular vegetation type, habitat or ecological process that is typical of the ecological district relative to the pre-European baseline and contributes to maintaining the appropriate proportional representation of that feature*	Ephemeral wetlands Seepage wetland Low producing grassland Seasonal gully drainage channels Shrubland vegetation
Rarity and Distinctiveness	*The area supports an indigenous species, habitat or community, which is rare and vulnerable within the ecological district or threatened nationally.*	Ephemeral wetlands Seepage wetland Low producing grassland and shrubland vegetation

Given these findings the site is considered to contain species which are likely significant indigenous vegetation or habitats in terms of section 6 (c) of the RMA.

The District Plan provisions most relevant to the effects of the Project on that vegetation state:

16.9.2 Objectives

1 The maintenance of biological diversity, nature conservation values, and ecosystem functioning within the district by:

- *The protection of areas assessed as having significant indigenous flora and significant habitats of indigenous fauna…*

16.9.3 Policies

1 To manage the adverse effects of the use or development of land on significant indigenous vegetation or significant habitats of indigenous fauna so that the values of these areas are protected.

…

7 To promote long-term sustainable protection of areas that have significant indigenous vegetation and significant habitats of indigenous fauna by encouraging landowners to investigate management options which maintain or enhance these sites and by supporting farmers and local community groups in private or valley conservation initiatives.

As outlined in sections 5 and 6 of this AEE, OceanaGold has adopted a cascading approach to the management of adverse effects on these individuals or communities. Although alternative sites for the waste rock stack have been considered complete avoidance of these areas of potential significance cannot be practically achieved. The mitigation and offsetting measures that are proposed are however considered to be comprehensive, align with best practice and will ensure that there will be no residual adverse effects on these communities in the Ecological District.

In that context, while some individuals or communities within the Project footprint will be lost, the proposed management actions will mean the values attributed to that particular vegetation or habitat type will be suitably protected at the Ecological District scale. It has been assessed that through application of the proposed mitigation and offsetting proposals there will be, at worst, no net loss of important biodiversity values across the ecological district This is consistent with the outcomes required by Objective 16.9.2.1 and Policy 16.9.3.1 above.

With respect to the other effects of the Deepdell North Stage III Project on biological diversity, the most relevant objectives state:

16.9.2 Objectives

1 The maintenance of biological diversity, nature conservation values, and ecosystem functioning within the district by:

…

- *The maintenance of other indigenous flora and fauna associated with wetland, riparian areas, alpine areas and other areas that have other particular nature conservation values.*

2 The maintenance or enhancement of the quality of water and the coastal *environment, wetlands, lakes, rivers and their margins and the protection of these environments from inappropriate subdivision, use and development.*

As noted above, it is apparent from the technical assessments that the site is currently highly modified due to the presence of existing farming and mining activities. The site is dominated by exotic plant species. The assessments find that due to the existing modification and limited impact on any sites of significance, the proposed mining activity is not considered to be inappropriate.

A number of minor and highly modified water courses will be directly affected by the proposal. These water courses are minor in terms of their contribution to downstream hydrology and do not hold any significant aquatic ecological values. There may be some impacts on the habitat of koura, however this habitat (if such species are in fact present in the drainage channels currently) can be recreated. These directly affected water courses do have any notable natural character values identified in the land scape and visual assessment.

The isolated pockets of indigenous flora and fauna that may be removed or displaced as a result of this proposal will not result in any loss of overall ecological connectivity or species diversity. Furthermore the suite of remediation, mitigation and offsetting measures that are proposed will ensure that the indigenous flora and fauna that will be impacted upon by the project are properly accounted for and that overall such values and biological diversity will be sufficiently protected and maintained in the longer term at the ecological district level. This is considered to be entirely consistent with the management outcome set out in Objective 16.9.2.1. Due to the mitigation and offsetting measures outlined regarding the wetlands and streams affected by this proposal, it is considered to be consistent with the Objective 16.9.2.2 and will maintain and enhance the environment of these water bodies and their margins.

With respect to the other effects of the Deepdell North Stage III Project on biological diversity, the most relevant policies state:

16.9.3 Policies

2 *To manage the effects of land use activities so that they avoid, remedy or mitigate adverse effects on:*

- I *freshwater fish habitat, fish passage and aquatic ecosystems generally, and water quality and quantity and/or*
- Ii *important ecological functions such as connectivity and hydrology.*

4 *To recognise that indigenous vegetation communities and associated fauna, other than areas with significant indigenous vegetation or significant habitats of indigenous fauna, may have nature conservation values in:*

- *Maintaining connectivity between other indigenous vegetation and/or*

- *Providing important habitat for species reliant on patchwork of indigenous vegetation (e.g. birds, lizards)*

and to manage these areas so that the nature conservation values are maintained in those areas.

6 *To manage the effects of the use, development and protection of land on the natural character of wetlands, rivers and lakes and their margins, having regard to the indigenous vegetation or habitat for indigenous fauna at a locality and the water quality and quantity of the waterbody concerned.*

8 *When considering resource consents that come before the Council, to ensure that regard is given to any adverse effects of the activity on the natural character of the District's environment and on remaining indigenous vegetation and habitat; and that opportunities are taken to promote the retention of indigenous vegetation and habitat.*

9 *To manage the effects of the use, development and protection of land on the natural character of the coastal environment and the beds of rivers, streams and wetlands, and the margins of lakes, rivers, streams and their wetlands; and having regard to the indigenous vegetation and habitat for indigenous fauna at a locality and the quality of the water, and also having regard to those important landscapes identified under Issue 7.*

The proposal is consistent with Policy 16.9.3.2. As noted in the Aquatic ecology effects assessment (Ryder 2019), the proposal is avoiding, remedying and mitigating effects on water quality and aquatic ecosystems to a degree that the relevant effects will be adequately controlled and considered acceptable. Being located on a minor catchment divide, hydrological function and connectivity of the surrounding catchments is not affected by this proposal to any degree that results in the proposal being contrary to the above policy.

The proposal is consistent with Policy 16.9.3.4. in that significant indigenous plants and habitat for fauna is being recognised and provided for in the proposal. The proposal is located where it will have the least impact in those values out of the alternatives assessed. Further, the rehabilitation, mitigation and offsetting proposed is maintaining these values by saving some plants through transplanting, recreating habitat and enhancing indigenous vegetation (terrestrial and wetland). Lizard habitat is being remedied at the base of the rock stacks and the offset area will be managed for nature conservation (terrestrial ecology) values that will exceed those values being lost within the footprint of the proposal.

The proposal is consistent with Policy 16.9.3.6. in that the effects assessment of water quality and quantity in (GHD 2019) demonstrates that receiving waterbodies will maintain their water quality and quantity values. Ryder (2019) provides further information based on GHD (2019) that demonstrates that the water bodies concerned will remain suitable as habitat for the flora and fauna present. The natural character values of the receiving water bodies at the site are not assessed as notable by the landscape and visual assessment in WSP Opus (2019). Further, the location of the proposal being on a catchment divide ensures that the larger water bodies in the wider locality are only affected to a minor extent by the proposal and as such their natural character values are being can be assessed here to be appropriately managed.

The management approach proposed is also ensuring through offsetting of effects, that effects of the proposal on the wetlands and the associated vegetation values are had regard to and managed appropriately. For the same reasons that the proposal is consistent with the Policies 16.9.3.4 and 16.9.3.6 above it is also assessed that it is also consistent with Policies 16.9.3.8 and 16.9.3.9, where these policies are relevant.

9.8.1.5 Heritage Provisions

As set out in Section 5.11 of this AEE, the development will not impact on any heritage item listed in Appendix B of the District Plan. While the proposal will impact on historical features attributed some heritage value, these do not require Heritage NZ Pouhere Taonga Archaeological Authority to disturb or destroy.

The District Plan management objective for heritage states:

> ***2.3.1 Objective A***
>
> *The conservation and enhancement of the heritage values of the District, including historic places and areas, waahi tapu sites and areas, and archaeological sites, in order that the character and history of the District can be preserved and managed.*

The supporting policies of most relevance state:

> ***2.3.2 Policies A***
>
> 1. *To use the District Plan as a means of identifying and protecting important heritage buildings, objects, places and sites, in consultation with the N.Z.Historic Places Trust, Historical Societies within the District, and the local community.*
> 2. *To ensure that, through the implementation of appropriate procedures within the Council's administration, all development and building proposals in the vicinity of recorded waahi tapu and archaeological sites are notified to the takata whenua and to the N.Z.Historic Places Trust, in accordance with the Historic Places Act 1993, in order to enable the implementation of the archaeological provisions of that Act.*

In this case the District Plan has not identified any heritage items that would be affected by the Deepdell North Stage III Project, and in turn, the key management direction is that Heritage NZ (which has superseded the NZ Historic Places Trust) be notified of the Project as it will impact on a recorded archaeological site. This will allow the appropriate implementation of the archaeological provisions of the Heritage New Zealand Pouhere Taonga Act 2014 (which has replaced the Historic Places Act 1993).

As such, the proposal is assessed to be consistent with and not contrary to the relevant heritage provisions of the Waitaki District Plan.

9.8.1.6 Takata Whenua

Chapter 1.3 of the District Plan addresses Takata Whenua values. It contains two objectives.

Objective A focusses on the partnership between the District Council and mana whenua in the management of the Districts natural and physical resources. It is not directly relevant to this application, however, it is noted that principles it addresses have been implemented by OceanaGold in developing this project, whereby Kāi Tahu Whanui have been recognised as the mana whenua of the Project area, and their views on the project have been sought.

Objective B seeks the protection and, where appropriate, enhancement of waahi tapu, waahi taoka, cultural property and mahinga kai. Based on feedback received so far from Aukaha[130] OceanaGold is not aware of impacts on these values that are of particular concern. Consultation with iwi will continue once the applications have been prepared and will be ongoing throughout the resource consent process and Project.

9.8.1.7 Macraes Township

Macraes is listed as a township subject to the provisions of Chapter 15.3. The most relevant provisions state:

> ***15.3.2 Objective 2***
>
> *A spacious appearance and level of amenity necessary for the enjoyment of residents consistent with the efficient functioning of the townships within the rural area.*
>
> ***15.3.3 Policies***
>
> *5 To restrict intensive farming and extractive industries that are in close proximity to townships, so to protect the amenity of township residents.*

Macraes township is located approximately 3.6 km from the closest part of the Deepdell North Stage III Project and will not impact on the amenity of township residents, noting in particular that cumulative noise levels at the township will be well below District Plan noise levels at all times.

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130 Aukaha is the appointed representative of Nga Rūnaka - Te Rūnaka o Moeraki, Kati Hūirapa Rūnaka Ki Puketeraki and Te rūnaka o Ōtākou for resource consent matters.

9.8.1.8 Transport

The Waitaki District Plan has a number of relevant transport provisions regarding this proposal and these are listed below:

> ***6.2.2 Objective 1*** *To promote the efficient use of the District's existing and future transportation resource and of fossil fuel usage associated with transportation, and the maintenance and improvement of access, ease and safety of all vehicular, cycle and pedestrian movements.*
>
> ***6.3.2 Objective 2*** Avoid or mitigate adverse effects on the surrounding environment as a result of transport.
>
> ***6.3.3 Policies***
>
> *4* *To ensure new roads, railways, vehicle accessways and off-street parking are designed to visually complement the surrounding area and to avoid, remedy or mitigate adverse effects on the landscape, the coastal environment, waterways or areas which have significant conservation value.*
>
> *5* *To implement appropriate procedures, in conjunction with the takata whenua and Historic Places Trust, should any waahi tapu or waahi taonga be unearthed during roading construction.*
>
> *8* *To ensure trees are appropriately located to avoid or mitigate icing of road surfaces; obstruction of sight lines at intersections; or hazards from overhanging branches.*

The proposal is not contrary to any of the most relevant transport provisions which are listed above for reasons discussed below.

As outlined in the assessment of traffic public access and roading effects located at Section 5.4 of this AEE which is informed by Tim Kelly Transportation Planning Limited (2019) located at **Appendix P**, it is proposed that a pedestrian crossing point across the haul road and a new realignment of the existing Horse Flat Road (The existing alignment will be occupied by the WRS footprint) will be established and maintained as part of this development.

This will maintain and improve access to the eastern section of Horse Flat Road by motor vehicle and cycle and will maintain and improve access to Golden Point Historic Reserve.

This will be achieved through the maintenance of the existing manned crossing of the operational haul road and the realignment and construction of a newly formed 900m section of Horse Flat Road to be constructed to appropriate standards and to be vested with council as new road reserve contemporaneously with the stopping of the existing alignment. Pedestrian access from Horse Flat Road to the Golden Pojnt Historic reserve will also be improved through provision of a safe crossing point on the haul road and procedures to facilitate stopping haul traffic to facilitate pedestrian crossing and private vehicle access along the haul road to the reserve.

The new alignment of Horse Flat Road and it's crossing of the unnamed tributary of Highlay Creek will be constructed subject to appropriate sediment control measures to avoid and mitigate effects on this water course. An appropriate accidental discovery protocol condition is proffered as part of this proposal. This ensures that the proposal is consistent with Policies 6.3.3.4 and 6.3.3.5. Further, OceanaGold proffers a condition which mirrors the permitted activity standards for avoiding icing of roads through planting of trees near the new road alignment. This will ensure that the proposal is not contrary to Policy 6.3.3.8.

As such, it is assessed that the proposal is not contrary to any relevant transport provision of the Waitaki District Council.

9.8.1.9 Conclusion

Overall, the proposed activity is considered to be generally consistent with the most relevant provisions of the Waitaki District Plan and is not contrary to any relevant objective or policy of the Waitaki District Plan.

9.9 KĀI TAHU KI OTAGO NATURAL RESOURCE MANAGEMENT PLAN 2005

This is the principle planning document for Kāi Tahu Ki Otago and provides resource management guidance direction in accordance with the wishes of the rūnaka who hold mana whenua in Otago. While this assessment is in no way intended to be a replacement for consultation with the relevant mana whenua, it does contain provisions regarding certain relevant issues for this proposal.

The provisions of the Kāi Tahu ki Otago Natural Resource Management Plan 2005 that are assessed as being most relevant to this proposal include:

- The waters of the Otago Catchment are healthy and support Kāi Tahu ki Otago customs;[131]
- There is no discharge of human waste directly to water; [132]
- Contaminants being discharged directly or indirectly to water are reduced;[133]
- To require groundwater monitoring for all discharges to land;[134]
- To require all earthworks, excavation, filling or the disposal of excavated material to:

[131] Objective 5.3.3.ii.
[132] Objective 5.3.3.iii.
[133] Objective 5.3.3.iv.
[134] Policy 5.3.4.18.

i. Avoid adverse impacts on significant natural landforms and areas of indigenous vegetation;

ii. Avoid, remedy, or mitigate soil instability; and accelerated erosion;

iii. Mitigate all adverse effects[135]

- To require an assessment of instream values for all activities affecting water;[136]
- To protect and restore the mauri of all water;[137]
- To require monitoring of all discharges be undertaken on a regular basis and all information, including an independent analysis of monitoring results, be made available to Kāi Tahu ki Otago;[138]
- To encourage Management Plans for all discharge activities that detail the procedure for containing spills and including plans for extraordinary events.[139]

The proposal is considered to be consistent with the above relevant provisions of the Kāi Tahu ki Otago Natural Resource Management Plan 2005 on the basis that:

- All human waste as a result of the proposed activities is being contained in a septic system and trucked off-site to a municipal wastewater treatment facility.
- Discharges of untreated sediment laden water to surface water will be avoided and only treated water will be released to surface water bodies.
- Groundwater and surface water will be monitored in the area of this proposal and results will be provided to Kāi Tahu on request (consistent with current practice on-site at Macraes).
- The proposal is being sited through a detailed alternatives assessment to avoid the most significant indigenous vegetation. The proposal is being carried out in accordance with an erosion and sediment control plan and ifs being rehabilitated to ensure that topsoil is retained not lost to erosion. As detailed in the sections 5 and 6 of this AEE all effects are being avoided remedied or mitigated and any remaining effects are being offset where considered appropriate.
- An instream assessment of aquatic values has been carried out. While some habitat will be lost, the values of this habitat are not considered to be significant and do not support a significant native fish or eel population. Water quality will also not be

135 Policy 5.6.3.19.
136 Policy 5.3.4.1.
137 Policy 5.3.4.4.
138 Policy 5.3.4.13.
139 Policy 5.3.4.15.

affected by the proposal such that appropriate environmental limits for instream species protection will be exceeded.

- The proposal is to be subject to a number of comprehensive management plans, some of which detail procedures for spills.

The proposal is not however entirely consistent with the following provision:

- To require indigenous re-vegetation with locally sourced species for all disturbed areas. Revegetation should be monitored by an assessment of the vegetative cover at one growing season after establishment and again at three seasons from establishment.[140]

Rehabilitation at the active mining site will be primarily to pasture so that farming can recommence in the affected areas after mining. However, the lost indigenous vegetation at site will be reinstated in a similar form through an improved condition offset, ecological enhancement area at a different site to be protected through a covenant or similar appropriate legal mechanism. This is outlined in the terrestrial ecology impact management plan summarised in section 5 and 6 of this AEE and attached as **Appendix D**. The outcomes to be achieved through this offset meet or exceed the intent of Policy 5.6.4.21 which is to protect indigenous vegetation values without being consistent with the methods within the policy. The offset will result in no net loss of shrubland, ephemeral and seepage wetland and low producing grassland communities. For instance, the proposal results in the loss of approximately 3.73 ha of shrubland (comprising 15 species) within the project footprint but will be offset with planting of 5 ha of new shrubland in the offset area that is comprised of at least 18 different shrub species and reaching 3 m in height and 75% canopy cover within 10 to 20 years. Monitoring of the vegetation establishment at the offset site will be carried out in accordance with a comprehensive monitoring program outlined in an ecological management plan which will meet and exceed the monitoring requirements of Policy 5.6.4.21

The waste rock stack will be vegetated (stabilised) as soon as possible following completion and will be sequentially rehabilitated as parts are completed.

9.10 PART 2 OF THE RESOURCE MANAGEMENT ACT 1991

It is understood that a consent authority is not generally required to consider Part 2 of the RMA beyond its expression in the relevant statutory planning documents. In effect, in most circumstances there is no requirement to refer back to Part 2 of the RMA in determining a resource consent application unless there is invalidity, incomplete coverage or uncertainty

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140 Policy 5.6.4.21.

of meaning within the statutory planning documents. In this case it is considered appropriate to undertake an assessment against Part 2 for the following reasons:

- The RPW does not give effect to the NPSFM
- The Proposed RPS remains unsettled in respect to a number of relevant provisions; and
- The use of offsetting to achieve biodiversity protection and enhancement is inadequately provided for in the existing statutory planning documents.

Therefore, for completeness and in accordance with Schedule 4(2)(1)(f) of the RMA, Part 2 of the RMA is considered in the following paragraphs.

The purpose of the RMA is to promote the sustainable management of natural and physical resources. In this regard, the Deepdell North Stage III project will enable the social and economic wellbeing of the local community and wider Dunedin/Otago region through the provision of continued and additional employment, and the generation of significant benefits to the local, regional and national economy. As noted in the AEE and above analysis at the district and regional level the Project will safeguard the life supporting capacity of air, water, soil and ecosystems.

The avoidance, remediation or mitigation of adverse effects does not require that there be no residual effects on the environment. Instead, Section 5(2)(c) of the RMA contemplates adverse effects, the acceptability of which depends on the circumstances of the particular case and is a question of fact and degree. Sections 5 and 6 of this AEE provide details on the measures proposed by OceanaGold to avoid, remedy or mitigate the actual and potential effects of the project on the environment and to manage effects on the wellbeing of people in accordance with section 5 of the RMA. These measures combined with the extensive offsetting programme that is proposed will ensure that any residual adverse effects resulting from the Project are sufficiently reduced.

With respect to the key matters in Sections 6, 7 and 8 of the RMA, the following points are pertinent:

- The natural character of the drainage channels, the ephemeral and seepage wetlands, minor tributaries affected by the Project have already been modified and in some respects degraded by previous mining activities, and present-day farming activities.[141]
- The proposal is not considered to be inappropriate in the location proposed on the basis that it is largely zoned for mining purposes and the surrounding area has

[141] Section 6(a).

already been influenced by existing mining activities. The mining activity location is also constrained by the location of the mineral resource.[142]

- Water quality will be discharged in accordance with existing discharge compliance limits, such that there will be no change to the water quality or life supporting capacity of downstream receiving environments.[143]
- Some of the indigenous vegetation and habitats affected by the Project have been assessed as significant. These values are recognised and provided for in the proposal through the mitigation and offsetting measures that are proposed. At a district and regional level these values will be sufficiently protected via the proposal[144].
- A CIA is being commissioned as soon as possible post lodgement and consultation with iwi is ongoing. This will assist in identifying any issues, if any, which will then be able to be addressed.[145]
- The project will avoid areas of heritage significance.[146]
- The proposal will be managed to ensure any natural hazard risk will not be exacerbated. This is primarily through the incorporation of appropriate factors of safety in the design and management of the mining activity.[147]
- The proposal is considered an efficient use and development of the natural and physical resources associated with the wider Macraes mining activities. It utilises existing infrastructure to continue to deliver substantial benefits associated with the existing mining operations for another year of operation.[148]
- The amenity values of surrounding landowners have been considered and will be maintained by the imposition of appropriate limits on noise, vibration and dust from mining activities on the site.[149]
- Rehabilitation is also proposed that will ensure that the intrinsic values of key ecosystems present within the site currently are suitably recognised and existing activities (i.e. farming) are able to continue post mining closure.[150]
- OceanaGold is undertaking consultation with Iwi in good faith and in a manner that reflects the scale and significance of the proposal.[151]

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142 Section 6(a).
143 Section 6(a).
144 Section 6(b).
145 Section 7(a) & 7(aa).
146 Section 6(f).
147 Section 6(h).
148 Section 7(b).
149 Section 7(c).
150 Section 7(c).
151 Section 8.

Overall, and based on the technical assessments that have been commissioned by OceanaGold, it is considered that the Deepdell North Stage III will promote the sustainable management of natural and physical resources in accordance with Part 2 of the RMA.

A

APPENDIX A

Records of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **OT14C/1088**
Land Registration District **Otago**
Date Issued 24 July 1992

Prior References
OT12B/187

Estate	Fee Simple
Area	837.0942 hectares more or less
Legal Description	Lot 1 Deposited Plan 22318

Registered Owners
Cook Allan Gibson Trustee Company Limited, Marie Louise Howard and Colin Henry Howard

Interests

Subject to Section 8 Mining Act 1971

Subject to Section 5 Coal Mines Act 1979

810589.4 Easement Certificate specifying the following easements - 24.7.1992 at 10.39 am

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Lot 1 Deposited Plan 22318 - herein	A DP 22318	Section 13 Block IX Highlay Survey District - CT OT12C/562	
Right of way	Lot 1 Deposited Plan 22318 - herein	A DP 22318	Section 14 Block IX Highlay Survey District - CT OT12C/562	
Right of way	Lot 1 Deposited Plan 22318 - herein	A DP 22318	Section 18 Block IX Highlay Survey District - CT OT12C/562	
Right of way	Lot 1 Deposited Plan 22318 - herein	A DP 22318	Section 19 Block IX Highlay Survey District - CT OT12C/562	

810589.5 Transfer creating the following easements - 24.7.1992 at 10.39 am

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Convey electric power	Lot 1 Deposited Plan 22318 - herein	A-B-C-D Transfer 810589.5	Section 19 Block IX Highlay Survey District - CT OT12C/562	

5001552.3 Mortgage to Rabobank New Zealand Limited - 8.5.2000 at 2:33 pm

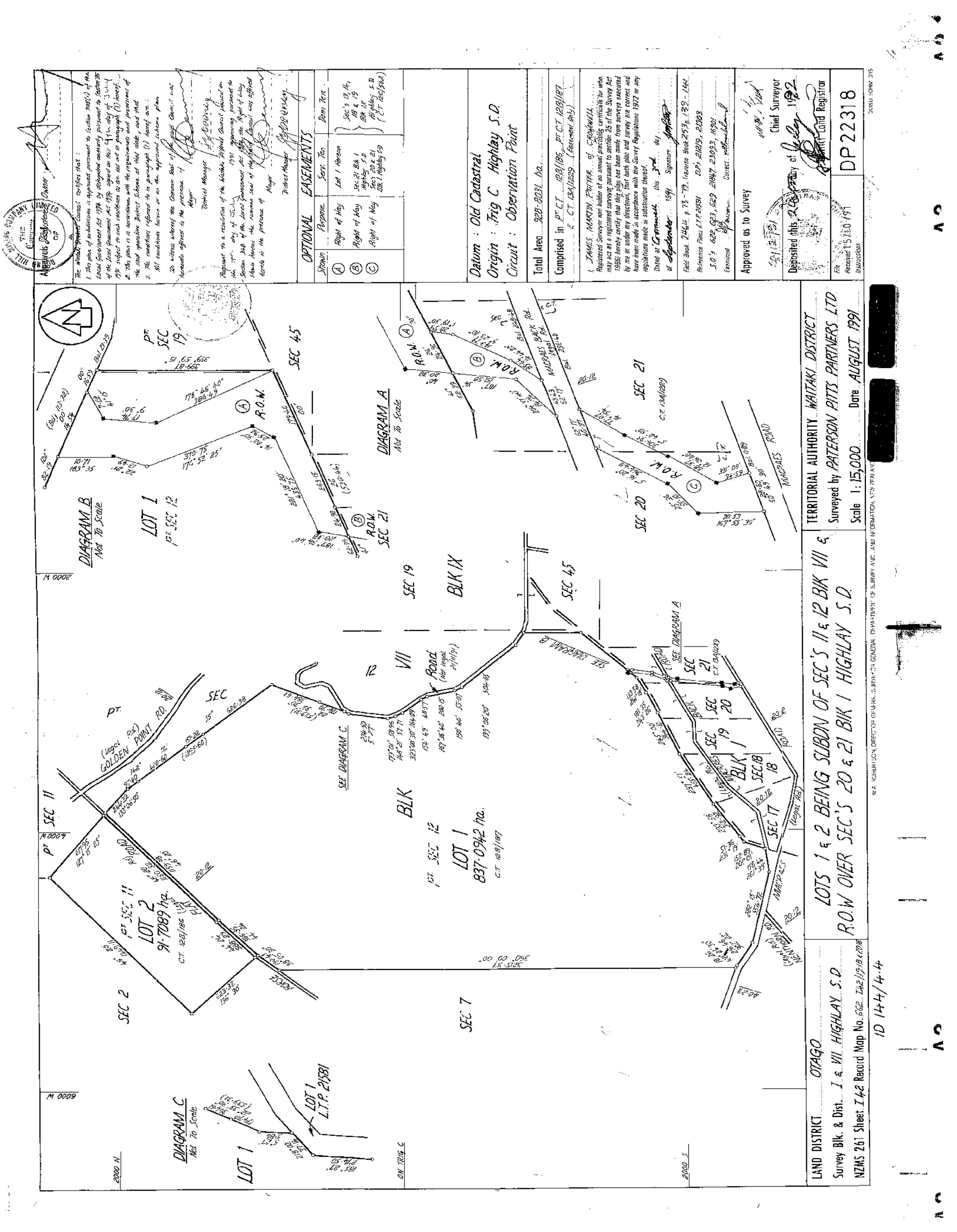
6594160.1 Variation of Mortgage 5001552.3 - 3.10.2005 at 9:00 am

7383362.1 Notice of Access Arrangement pursuant to Section 83 Crown Minerals Act 1991 Term 2 years from 11.12.2006 - 23.5.2007 at 9:00 am

9016623.3 CAVEAT BY OCEANA GOLD (NEW ZEALAND) LIMITED - 21.3.2012 at 9:23 am

9016623.4 CAVEAT BY OCEANA GOLD (NEW ZEALAND) LIMITED - 21.3.2012 at 9:23 am

Identifier **OT14C/1088**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**OT16B/854**
Land Registration District	**Otago**
Date Issued	07 July 1999

Prior References
OT14C/1006

Estate	Fee Simple
Area	1589.5633 hectares more or less
Legal Description	Part Section 1 Block VIII Highlay Survey District

Registered Owners
Oceana Gold (New Zealand) Limited

Interests

Subject to Section 3 Petroleum Act 1937

Subject to Section 8 Atomic Energy Act 1945

Subject to Section 3 Geothermal Energy Act 1953

Subject to Section 6 Mining Act 1971

Subject to Section 8 Mining Act 1971

Subject to Section 5 Coal Mines Act 1979

Subject to Section 261 Coal Mines Act 1979

9D/435 Mining Permit embodied in register OT9D/435 - 7.5.1993 at 9.43 am

937830.1 Notice of Access Rights under Section 83 Crown Minerals Act 1991 - 10.10.1997 at 10.30 am

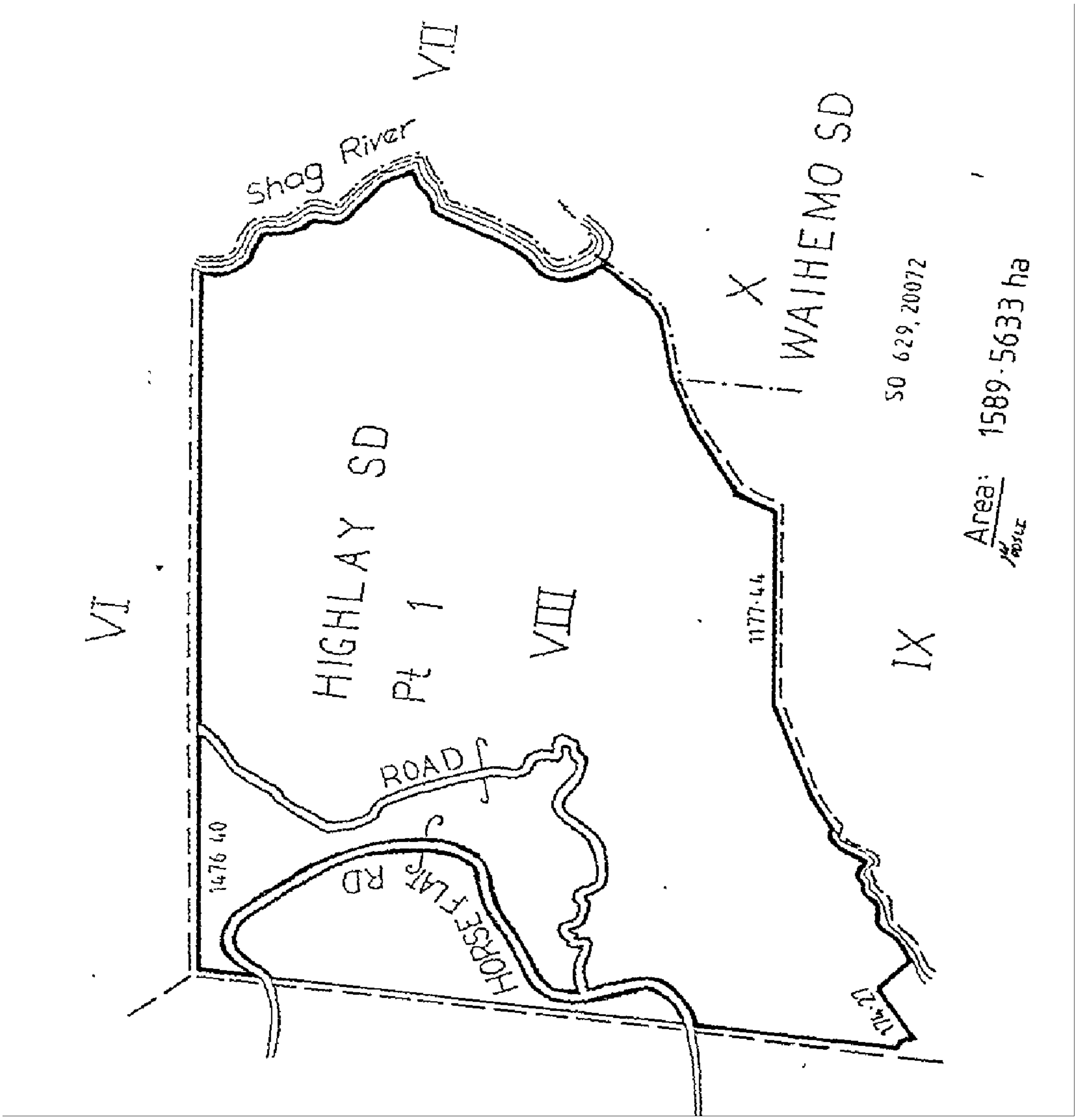
5008716.1 Certificate extending Mining Permit embodied in Register as OT9D/435 to include Part Section 1 Block VIII Highlay Survey District herein marked A SO PLan 24996 - 11.9.2000 at 10:25 am

9172704.9 Mortgage to BNP Paribas - 12.9.2012 at 3:53 pm

9870363.2 Open Space Covenant pursuant to Section 22 Queen Elizabeth The Second National Trust Act 1977 - 21.10.2014 at 3:48 pm.

10528364.1 Heritage Covenant pursuant to Section 39 Heritage New Zealand Pouhere Taonga Act 2014 - 11.8.2016 at 10:25 am

Identifier **OT16B/854**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **OT16B/855**
Land Registration District **Otago**
Date Issued 07 July 1999

Prior References
OT15A/591

Estate	Fee Simple
Area	419.1495 hectares more or less
Legal Description	Part Section 11-12 Block VII Highlay Survey District

Registered Owners
Oceana Gold (New Zealand) Limited

Interests

Subject to Section 8 Mining Act 1971

Subject to Section 5 Coal Mines Act 1979

754321.17 Easement Certificate specifying the following easements - 15.5.1990 at 10.21 am

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Lot 1 Deposited Plan 21303 - CT OT13B/223	B DP 21303	Part Section 11 Block VII Highlay Survey District - herein	Section 309(1)(a) Local Government Act 1974

754321.18 Transfer creating the following easements - 15.5.1990 at 10.21 am

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Discharge septic tank effluent	Part Section 12 Block VII Highlay Survey District - herein	C DP 21303	Lot 1 Deposited Plan 21303 - CT OT13B/223	Section 309(1)(a) Local Government Act 1974
Right of way	Part Section 10 Block VII Highlay Survey District - CT OT18C/1099	A DP 21303	Part Section 11 Block VII Highlay Survey District - herein	Section 309(1)(a) Local Government Act 1974

Mining Permit embodied in Register OT9D/435 - 7.5.1993 at 9.43 am (affects part of the within land)

937830.1 Notice of Arrangement for access to land pursuant to Section 83 Crown Minerals Act 1991 - 10.10.1997 at 10.30 am

5008716.1 Certificate extending Mining Permit embodied in Register as OT9D/435 to include Part Section 12 Block VII Highlay Survey District herein marked A SO PLan 24996 - 11.9.2000 at 10:25 am

7666279.1 Heritage Covenant pursuant to Section 8 Historic Places Act 1993 (diagram attached) - 20.12.2007 at 9:00 am

9172704.9 Mortgage to BNP Paribas - 12.9.2012 at 3:53 pm

Appurtenant hereto is a right to covey water created by Easement Instrument 9464153.1 - 19.7.2013 at 11:46 am

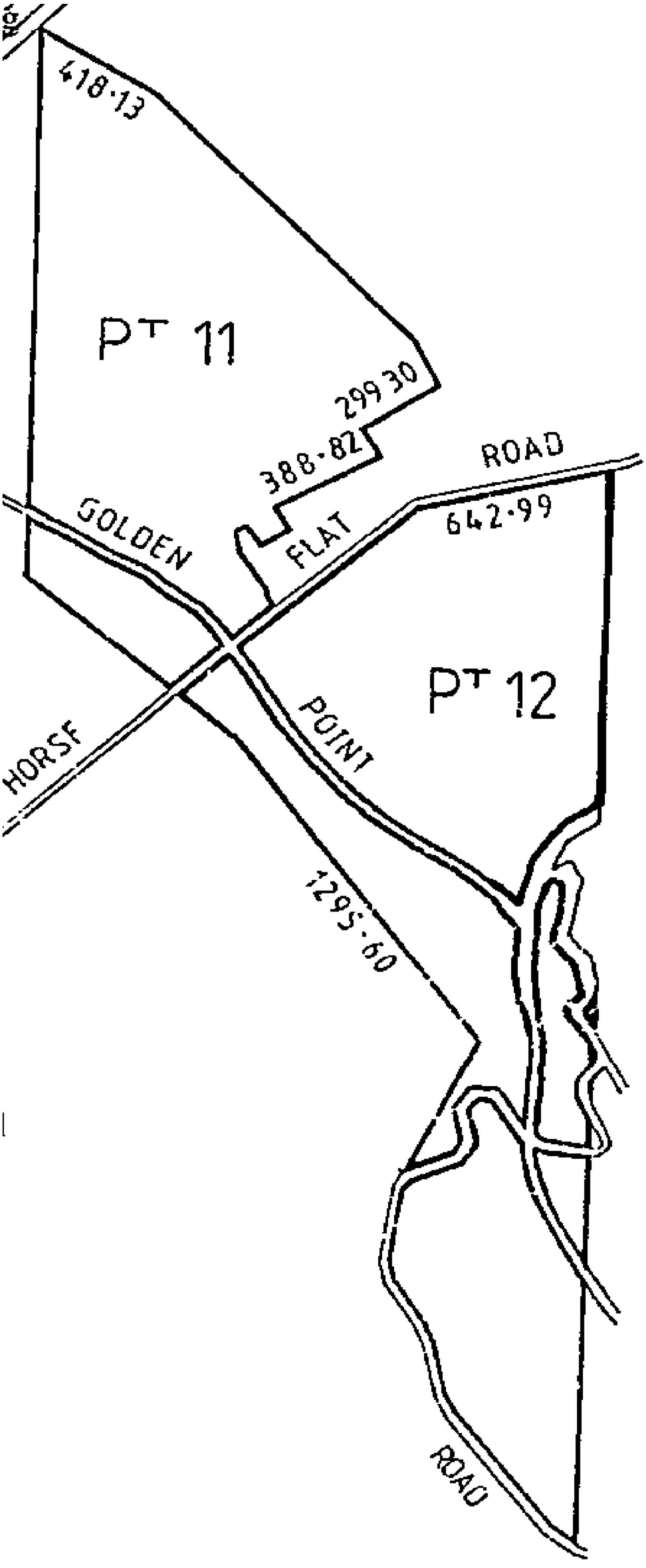
Appurtenant to part Section 12 Block VII Highlay Survey District is a right to convey water created by Easement Instrument 9527532.11 - 18.10.2013 at 12:52 pm

Land Covenant in Easement Instrument 9527532.13 - 18.10.2013 at 12:52 pm

10871969.1 Compensation Certificate pursuant to Section 19 Public Works Act 1981 by Waitaki District Council - 10.8.2017 at 7:00 am

11355719.1 Variation of Covenant 7666279.1 - 19.2.2019 at 8:47 am

Identifier **OT16B/855**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**OT18C/1099**
Land Registration District	**Otago**
Date Issued	22 June 1999

Prior References
OT13A/1378

Estate	Fee Simple
Area	346.4594 hectares more or less
Legal Description	Part Section 10 Block VII Highlay Survey District

Registered Owners
Oceana Gold (New Zealand) Limited

Interests

754321.17 Easement Certificate specifying the following easements - 15.5.1990 at 10.21 am

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Lot 1 Deposited Plan 21303 - CT OT13B/223	B DP 21303	Part Section 10 Block VII Highlay Survey District - herein	Section 309(1)(a) Local Government Act 1974

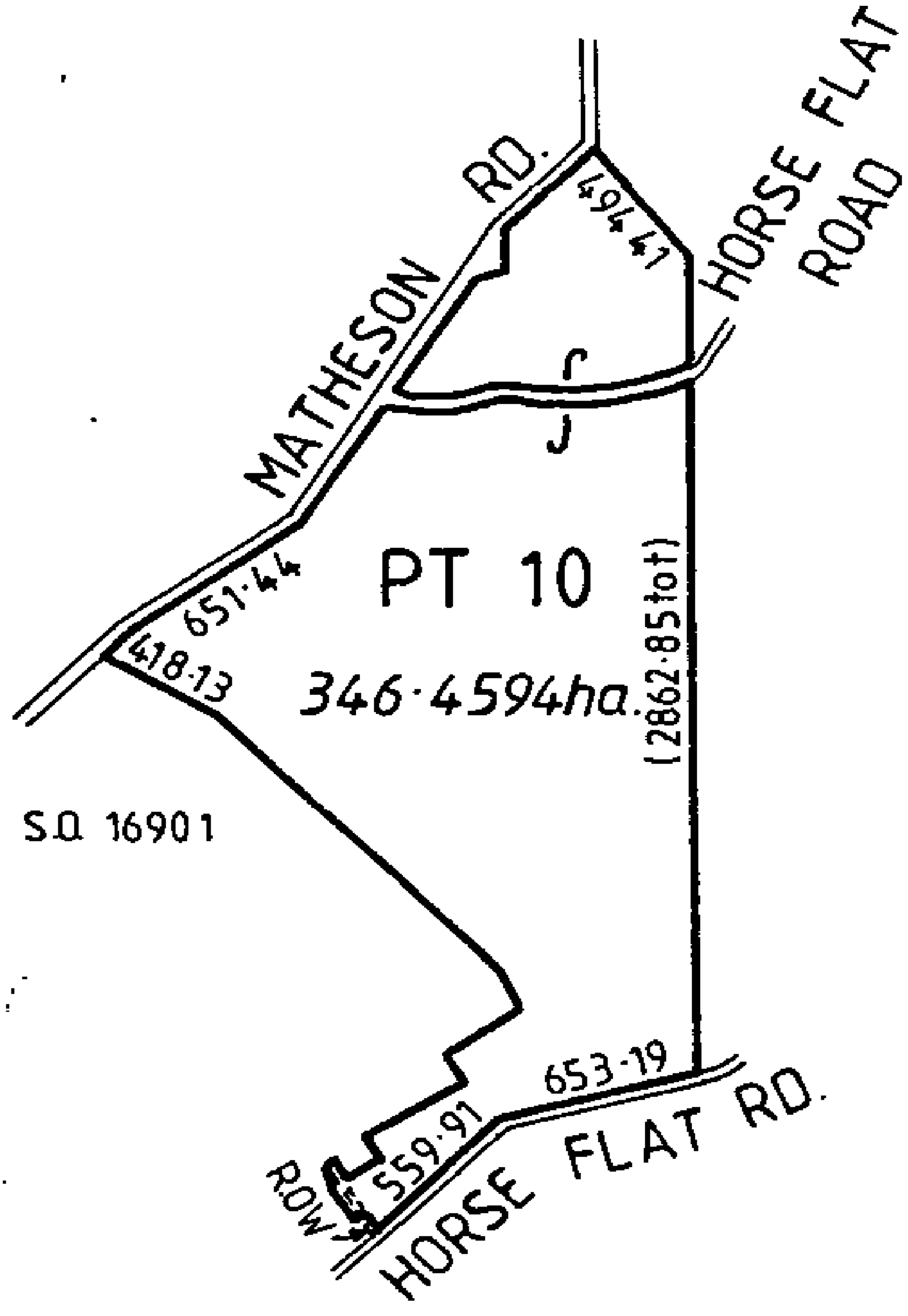
754321.18 Transfer creating the following easements - 15.5.1990 at 10.21 am

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Part Section 10 Block VII Highlay Survey District - herein	A DP 21303	Part Section 11 Block VII Survey District Highlay - CT OT155A/591	Section 309(1)(a) Local Government Act 1974

5007022.1 Exploration Permit 40 468 to GRD Macraes Limited term 5 years commencing 8.8.2000 CIR 63221 issued - 10.8.2000 at 9:56 am

8637602.1 Notice of Access Rights pursuant to Section 83 Crown Minerals Act 1991 - 10.12.2010 at 10:59 am

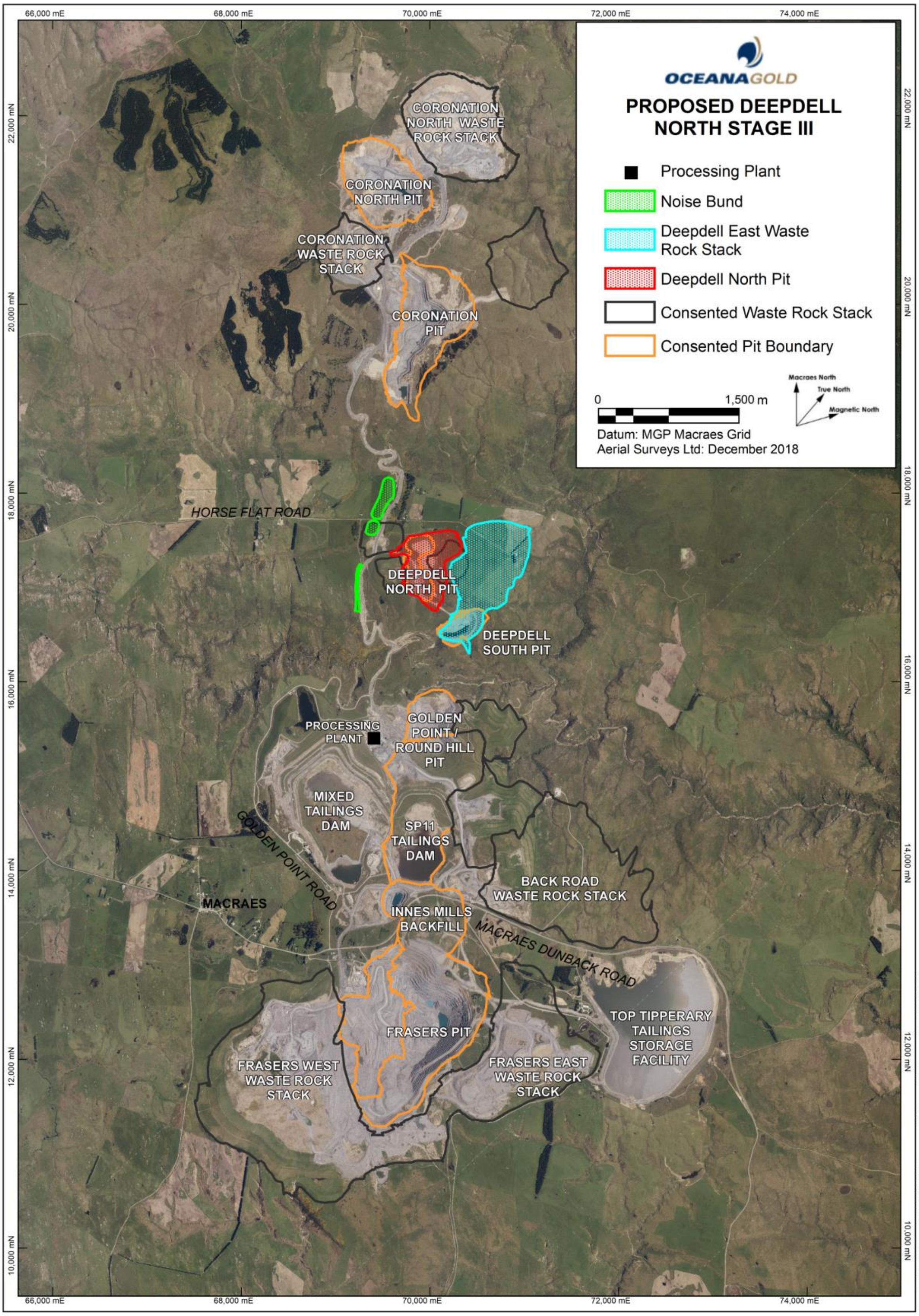
Identifier **OT18C/1099**



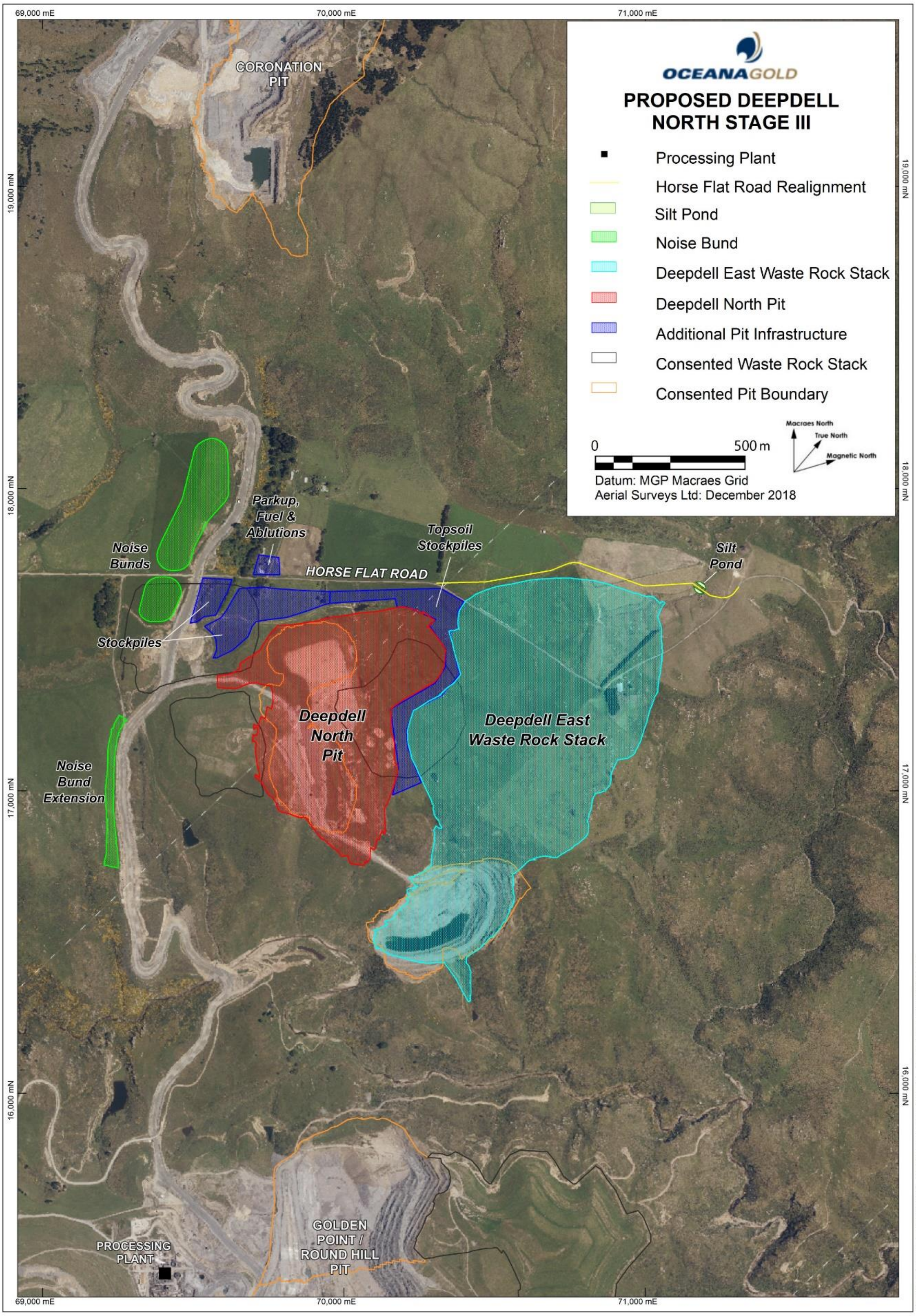
B

APPENDIX B

Plan Drawings of Proposal



Created by H.Petry 20190919. Workspace: M_Deepdell_Consenting_20190919.wor



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C

APPENDIX C

Relevant existing consent certificates

WAITAKI DISTRICT COUNCIL AND DUNEDIN CITY COUNCIL

LAND USE CONSENT “Coronation North Pit and Trimbells Waste Rock Stack” – OCEANA GOLD (NEW ZEALAND) LTD

WDC Reference: 201.2019.1241
DCC Reference: LUC-2019-42

Pursuant to the Resource Management Act 1991, the Waitaki District Council and Dunedin City District Council grants its consent to Oceana Gold (New Zealand) Limited for gold mining operations involving:

(a) The extraction of minerals and overburden by mechanical means from the Coronation North pit shown on “Coronation North Extension, WDC/DCC LUC Consents, Map 1” attached to and forming part of this consent;
(b) The transport, treatment and processing of minerals extracted from the Coronation North pit and expanded Coronation Pit;
(c) The stacking, deposit and storage of substances considered to contain any mineral from the Coronation North pit and expanded Coronation Pit;
(d) The deposit of waste rock produced by Coronation North pit and expanded Coronation Pit on the Trimbells Waste Rock Stack shown on “Coronation North Extension WDC/DCC LUC Consents Map 1” annexed and described at (a) above and the deposit of waste rock as backfill into the Coronation North and Coronation pits;
(e) The construction, maintenance and use of a haul road from Coronation North area to the gold processing plant;
(f) The use of two haul road crossings (approximately centered at grid reference NZTM 2000 1397100E 4975800N Horse Flat Road and NZTM 2000 1398200E 4974200N Golden Point Road);
(g) The use and storage of diesel and explosives;
(h) The construction and use of temporary buildings;
(i) The de-commissioning, rehabilitation, de-construction or dismantling of the mine and of any structures and works resulting from activities set out in paragraphs (a) –(h) above;
(j) The construction, operation and maintenance of silt ponds and silt control facilities necessary for controlling runoff from the Coronation and Coronation North mining operation;
(k) The formation of a pit lake in the Coronation North pit and the formation of a pit lake in the expanded Coronation pit.

The duration of this consent shall be 25 years.

DEFINITIONS

"Act" means the Resource Management Act 1991, and includes all amendments to the Act, and any enactments made in substitution for the Act

"Project Overview and Annual Work and Rehabilitation Plan" means the Project Overview and Annual Work and Rehabilitation Plan required by Condition 3.

"Building" means any temporary or permanent structure.

"Building Work" means work for or in connection with the construction, alteration, operation, demolition or removal of a building and includes site work.

"Councils" means the Waitaki District Council and the Dunedin City Council and includes its successors, and also includes any person to whom the consent authorities delegate or transfer any of its functions, powers and duties as a consent authority under the Act.

"**Disturbed Land**" means any land where the soil has been removed or modified and includes any waste rock stacks, or any other structures that have not been rehabilitated with soil and vegetation;

"Exploration" means any activity undertaken for the purpose of identifying mineral deposits or occurrences and evaluating the feasibility of mining particular deposits or occurrences of one or more minerals; and includes any drilling, dredging, or excavations (whether surface or sub-surface) that are reasonably necessary to determine the nature and size of a mineral deposit or occurrence; and "to explore" has a corresponding meaning.

"**Heavy Vehicle**" means a vehicle with a gross vehicle mass of more than 3,500 kilograms.

"Landscape Architect" means a professional member of the New Zealand Institute of Landscape Architects Inc or equivalent body.

"**Life of the Macraes Gold Project**" means the period ending when all mining operations at Macraes cease.

"Macraes Ecological District" means the area described by the Department of Conservation (James Bibby), 1997: *Macraes ecological district: survey report for the Protected Natural Areas Programme*, ISBN 0478019254, 9780478019254 and as also defined in McEwen, W.M. (1987): *Ecological regions and districts of New Zealand, incorporating third revised edition in four 1:500 000 maps (Part 4)*. New Zealand Biological Resources Centre publication No. 5. 125p + maps.

"Mining" means to take, win, or extract, by whatever means, a mineral existing in its natural state in land, or a chemical substance from that mineral, for the purpose of obtaining the mineral or chemical substance; but does not include prospecting or exploration; and "to mine" has a corresponding meaning.

"Mining Operations" means operations in connection with mining, exploring, or prospecting for any mineral, gold, including –

(a) The extraction, transport, treatment, processing, and separation of any gold mineral; and

(b) The construction, maintenance, and operation of any works, structures, and other land improvements, and of any machinery, and equipment, connected with such operations; and

(c) The removal of overburden by mechanical or other means, and the stacking, deposit, storage, and treatment of any substance considered to contain any mineral; and
(d) The deposit or discharge of any mineral, material, debris, tailings, refuse, or wastewater produced from or consequent on, any such operations; and
(e) The doing of all lawful acts incidental or conducive to any such operations - when carried out at or near the site where the mining, exploration, or prospecting is carried out.

“Nga Rūnanga” means Te Rūnanga o Moeraki, Kati Huirapa Runaka ki Puketeraki and Te Rūnanga o Otakou.

"ORC" means the Otago Regional Council and includes its successors, and also includes any person to whom the council delegates or transfers any of its functions, powers and duties under the Act

"Prospecting" means any activity undertaken for the purpose of identifying land likely to contain exploitable mineral deposits or occurrences; and includes:

(a) Geological, geochemical, and geophysical surveys;
(b) The taking of samples by hand or hand held methods; and
(c) Aerial Surveys, -

and "to prospect" has a corresponding meaning.

“Service Truck” means a heavy vehicle that operates during the daytime and in one return trip at night to transport mine equipment (including parts, oils and fuels) to service the Coronation or Coronation North mine site.

"Site work" means work on a building site, including earthworks, preparatory to or associated with the construction, alteration, demolition or removal of a building.

"Structure" includes a dam and a waste rock stack.

"Supporting documents" means the supporting documents listed as Appendices A -E attached to the application lodged 1st February 2019, listed as Appendices II, III, V, and VI attached to a response for further information lodged 5 April 2019 and Appendices II and III attached to a response for further information lodged 1st August 2019 , and also includes all other material (including statements of evidence and submissions) provided by the applicant to the consent authorities in support of the application for the consent.

"Rehabilitation objectives and terms" means the rehabilitation, objectives and terms set out in Condition 4.

"Works" includes any excavation, drilling and includes a road.

1 GENERAL

1.1 This consent shall be exercised substantially in accordance with the Coronation North Extension application for resource consent lodged to, and receipted by, the Councils in February 2019, including the Assessment of Environmental Effects and all Supporting Documents (which are deemed to be incorporated in, and form part of this consent), except:

a) that the pit footprint has been reduced by 6.5ha from that applied for in order to avoid a number of seepage wetlands; and
b) to the extent that any condition in this consent is inconsistent with such material. If there is an inconsistency the conditions and terms of this consent shall prevail.

1.2 Pursuant to Section 125(1) of the Resource Management Act 1991 this consent shall lapse on the expiry of five years after the date of issue of the consent unless the consent is given effect to before the end of that period or upon application in terms of Section 125 (1) (b) of the Act, the Councils may grant a longer period of time.

1.3 The consent holder shall notify the Councils in writing of the first exercise of this consent.

1.4 In the event of any non-compliance with the conditions of this consent, the consent holder shall notify the Councils within 24 hours of the non-compliance being detected. Within five working days the consent holder shall provide written notification to the Councils providing details of the non-compliance. This notification will at a minimum include an explanation of the cause of the non-compliance, the steps taken to remedy the situation and steps taken to avoid any future occurrence of the non-compliance.

1.5 The Councils may, in accordance with sections 128 and 129 of the Act, serve notice on the consent holder of its intention to review the conditions in the last week of March in any year for the purposes of:

(a) Dealing with any adverse effect on the environment (including cultural values) which may arise from the exercise of this consent and which is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent,
(b) Ensuring the conditions of this consent are appropriate,
(c) Ensuring rehabilitation is completed in accordance with the rehabilitation conditions of this consent;
(d) Requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment arising as a result of the exercise of this consent.

1.6 The consent holder shall remedy or adequately mitigate any adverse effect on the environment from the exercise of this consent which becomes apparent after the expiry of this consent.

1.7 Prior to the expiry of this consent, the consent holder shall ensure that all rehabilitation and everything necessary to comply with the conditions of this consent has been completed.

Advice Note

In addition to the fees payable for the processing of this application, where further site inspections are required to monitor compliance with any of the conditions, the Councils may render an account to the consent holder for additional monitoring fees at the rate prescribed in the Annual Plan on the basis of time involved.

2 LOCATION OF VARIOUS MINING ACTIVITIES

2.1 The pits, waste rock stacks, water reservoir and haul road shall not materially exceed those footprints shown on ""Coronation North Extension Project WDC/DCC LUC Consents Map 1" attached to and forming part of this consent.

3 PROJECT OVERVIEW AND ANNUAL WORK AND REHABILITATION PLAN

3.1 The consent holder shall submit a Project Overview and Annual Work and Rehabilitation Plan to the Councils by 31 March each year that will cover the upcoming year (1 July to 30 June). The consent holder may, at any time, submit to the Councils an amended Project Overview and Annual Work and Rehabilitation Plan. The Project Overview and Annual Work and Rehabilitation Plan shall include, but not be limited to:

(a) A description and timeline of intended mining activities for the duration of mining operations including a plan showing the location and contours of all existing and proposed structures at completion of mining;
(b) A description (including sequence, method and form) of mining operations, monitoring and reporting carried out in the last 12 months;
(c) A detailed description (including sequence, method and form) of all mining operations, monitoring and reporting, not covered by a separate management plan intended to be carried out in the next 12 months;
(d) An explanation of any departure in the last 12 months from the previous Project Overview and Annual Work and Rehabilitation Plan;
(e) Plans showing the contours (at 5 metre intervals) and footprints of all works and structures and any proposed changes at the end of the next 12 months;
(f) A description and analysis of any unexpected adverse effects on the environment that have arisen as a result of the exercise of the consent in the last 12 months and the steps taken to deal with it and the results of those steps;
(g) A description and analysis of any non-compliance with any conditions of consent that have occurred in the last 12 months and the steps that were taken to deal with it and the results of those steps;
(h) A full report describing and evaluating the mitigation measures used in the last 12 months and any that are proposed to be implemented in the next 12 months. This should detail where further mitigation is proposed or has been undertaken as a result of a non-compliance event and/or any adverse effects on the environment;
(i) A summary description of all Management Plans and Manuals required under this land use consent and any resource consents issued by ORC and details of any review or amendment of any of the Management Plans or Manuals;
(j) An overview of the monitoring and reporting programme for the previous 12 months and any changes proposed for the next 12 months;
(k) A detailed section on rehabilitation including, but not limited to the following:
    i. The total area of disturbed land during the mining of Coronation North, including the haul road, yet to receive rehabilitation and indicative rehabilitation dates for various areas of the mine site;
    ii. The area of additional disturbed land in the coming year that will require future rehabilitation;
    iii. The area of disturbed land rehabilitated in the previous year;
    iv. The area of disturbed land proposed to be rehabilitated in coming year;
    v. A description of rehabilitation planned for the life of mine at Coronation North;

vi. A description of proposed rehabilitation methods for any area, including proposed topsoil to be stripped and stockpiled, surface pre-treatment and re-use of topsoil on finished areas in the next 12 months.;
vii. The details of the location, design (including shape form and contour) and construction of all permanent structures;
viii. Drainage details for any disturbed land and recently rehabilitated areas;
ix. Details of any vegetation to be used as part of rehabilitation for the next 12 month period; and
x. Detailed results of any revegetation trials.

(l) A description of any rehabilitation problems encountered and the steps being taken to resolve these problems;
(m) An up to date and detailed calculation of the cost of dealing with any adverse effects on the environment arising or which may arise from the exercise of this consent;
(n) An up to date and detailed calculation of the costs of complying with all rehabilitation conditions of this consent;
(o) An up to date and detailed calculation of the costs of any monitoring required by the conditions of this consent;
(p) A contingency closure plan describing in detail the steps that would need to be taken if mining operations stopped in the next 12 months in accordance with Condition 20; and;
(q) Any other information required by any other condition of this consent and any related consent.

3.2 Each year the consent holder shall provide the Chair of Macraes Community Incorporated, Kāti Huirapa Rūnaka ki Puketeraki, Te Rūnanga o Ōtākou and Te Rūnanga o Moeraki with a copy of each Project Overview and Annual Work and Rehabilitation Plan.

3.3 The Project Overview and Annual Work and Rehabilitation Plan for this consent may be combined with any Project Overview and Annual Work and Rehabilitation Plan required by any other consent held by the consent holder for mining operations at Macraes Flat.

3.4 The consent holder shall provide the Councils with any further information, or report, which the Councils may request after considering any Project Overview and Annual Work and Rehabilitation Plan. This information or report shall be provided in the time and manner required by the Councils.

3.5 The consent holder shall exercise this consent in accordance with the Project Overview and Annual Work and Rehabilitation Plan.

3.6 The consent holder shall design and construct all permanent earthworks to the form shown in the Project Overview and Annual Work and Rehabilitation Plan.

4 REHABILITATION

4.1 The rehabilitation objectives to be achieved by the consent holder are:-

(a) To ensure short and long term stability of all structures and works and their surrounds;
(b) To avoid maintenance after completion of rehabilitation requirements;
(c) To protect soil from erosion and to protect water from contaminants affected by mining operations;

(d) To stabilise and rehabilitate the banks and surrounds of any waterbodies;
(e) To return land as closely as possible to its original condition, including any exotic pastoral and indigenous species appropriate to the area; and
(f) To visually integrate finished structures, land-forms and vegetation into the surrounding landscape so they appear to be naturally occurring features; and,
(g) To control invasive environmental weeds, including wilding conifers, in the Disturbed Land for the Life of the Macraes Gold Project.

Earth Shaping and Visual

4.2 The consent holder shall locate, form and shape all earthworks so that their profiles, contours, skylines and transitions closely resemble and blend with the surrounding natural landforms. If earthworks cannot be fully naturalised, the consent holder shall minimise the extent of their visibility and maximise their integration into the surroundings.

4.3 The consent holder shall use a Landscape Architect in the planning and design of all permanent earthworks and structures.

Waste Rock Stack

4.4 The consent holder shall design and construct the waste rock stack in accordance with the following principles:
(a) Slopes shall be suitably concave or convex in cross-profile to match nearby natural slopes;
(b) Slope gradients shall be no steeper than nearby natural surfaces;
(c) Transitions between natural and formed surfaces shall be rounded and naturalised;
(d) Contours should be curvilinear in plan form, in keeping with original natural contours in that area;
(e) The skyline shall be variable and curved, simulating natural skylines;
(f) New landforms shall be aligned and located so they seem to continue, not cut across, existing landscape patterns; and
(g) Silt ponds shall be removed and the site rehabilitated or be converted to stock water drinking ponds following completion of mining operations and rehabilitation.

4.5 Backfilling of Coronation North pit shall occur in the west section of the pit to a minimum height of mRL 575 as shown on 'Macraes Gold Project Coronation North Extension Figure 1' attached to and forming part of this consent.

4.6 Prior to the commencement of the Trimbells waste rock stack, the consent holder shall in consultation with the Councils, design the shape and construction details of the stack. The final design and construction details shall be lodged with the Councils and include a report prepared by a Landscape Architect that includes, but is not limited to, the following:

(a) A detailed description of the proposed waste rock stack;
(b) A detailed description of the adjoining landforms; including their slopes and transitions; and
(c) A detailed discussion on how the proposed waste rock stack meets the principles set out in condition 4.4 (a) – (f).

4.7 If after commencement of the construction of the Trimbells waste rock stack, the consent holder wishes to change the design or construction details it shall design the changes in consultation with the Councils. The design or construction changes shall be lodged with the Councils. The change document shall include a report by a Landscape

Architect that details the proposed changes and reassess whether the design changes better meet the principles set out in Condition 4.4 (a) – (f).

Soil

4.8 The consent holder shall, as far as practicable, stockpile soil from any disturbed land, unless the soil is required to be left in place to protect water and soil values.

4.9 All salvaged soil shall be used on disturbed land for rehabilitation purposes.

Revegetation

4.10 The consent holder shall in accordance with the rehabilitation objectives undertake progressive rehabilitation of disturbed land as operational activities allow. It shall be revegetated with:

(a) Exotic pastoral species; and
(b) Tussock species which are as far as practicable sourced from the Macraes Ecological District and include *Chionochloa rigida subsp. rigida* (narrow-leaved snow tussock) *Festuca novae-zelandiae* and *Poa cita*. Details of area, density and methods of planting are set out in the Ecological Management Plan required under Condition 15.

4.11 Within six months from the first exercise of this consent, the consent holder shall prepare and submit in writing to the Councils a Rehabilitation Management Plan (RMP) for the Trimbells Waste Rock Stack, the Coronation North Waste Rock Stack, and the Coronation North Pit backfill, the rehabilitated features shown on Figure 1 attached to and forming part of this consent.

The RMP shall be prepared by a suitably experienced and qualified person(s) in consultation with the Department of Conservation and Macraes Community Incorporated.

4.12 The purpose of the RMP is to, as far as practicable, ensure that the rehabilitated features described in Condition 4.11 are integrated with and maintain the landscape character of the surrounding tussock grasslands, consistent with the rehabilitation objectives set out in Conditions 4.1 (e) and (f). To achieve the purpose, the RMP shall include, but not be limited to, the following:

(a) Providing a detailed map and an associated inventory of the vegetation types and cover that either is yet to be disturbed or existed prior to disturbance;

(b) Detailing the proposed rehabilitation to be carried out into either exotic pasture, or into tussock grassland reflecting the original vegetation cover determined under paragraph (a) above;

(c) Describing the methodology to be used to rehabilitate into tussock grassland, which may include but not be limited to the direct transfer of soil containing tussock species or direct plantings at the densities reflecting the original cover;

(d) Describing the maintenance work to enable survival of the tussock grassland species used to rehabilitate the waste rock stacks; and

(e) Detailing the monitoring to be carried so the rehabilitation outcomes can be measured against the purpose of the RMP.

4.13 The RMP shall be certified if it meets the requirements of Conditions 4.11 and 4.12 above.

4.14 If in the opinion of the Council Officer with the delegated authority to certify the RMP it does not meet Conditions 4.11 and 4.12, it may be returned to the Consent Holder together with written reasons why the RMP does not meet these conditions.

4.15 If, after any amendments required under Condition 4.14 of this consent the Consent Authority fails to certify the RMP within 30 working days, the RMP will be regarded as being certified

4.16 The Consent Holder may at any time re-submit an updated or amended RMP for certification by the Consent Authority

4.17 This consent shall at all times be exercised in accordance with the certified RMP

4.18 The outcomes of the monitoring carried out in accordance with condition 14.12 (e) shall be reported in the Annual Ecology Report required under condition 15.2

4.19 The consent holder shall maintain vegetation cover until the expiry of this consent and ensure that the vegetation, including any vegetation established on disturbed land, shall be self-sustaining after expiry.

Soil and Vegetation Monitoring

4.20 At three yearly intervals, the consent holder shall complete a review of all soil and pasture on land that has been rehabilitated. The first review shall be not later than the third anniversary of the commencement of this consent. The review shall include, but not be limited to, the following:

(a) Monitoring for ground cover, species components, plant nutrition status, soil organic matter and concentrations of exchangeable nutrients in the soil;
(b) Analysis and interpretation of the monitoring results by a suitably qualified soil or agricultural scientist;
(c) Evaluation of the vegetation and its potential to be self-sustaining for pastoral farming after mining ceases; and
(d) Any necessary recommendations for future rehabilitation, including plant species or varieties to be used, cultivation and seeding methods to be introduced, or fertilisers to be used; and,
(e) A copy of the review will be forwarded to the Councils and Department of Conservation within three months of the review being completed.

5 SITE DECOMMISSIONING AND CLOSURE

5.1 The consent holder shall submit to the Councils a Site Decommissioning Plan, not less than 12 months before completion of the operations.

5.2 The Site Decommissioning Plan shall include but not be limited to:

(a) A plan(s) showing the final design and intended contours (at 5 metre intervals) of all permanent structures and works, including but not limited to, waste rock stacks, permanent earthworks, pit lakes, roads, water storage reservoirs or other works which under this consent or any related consent are authorised or required to remain after the relevant consents expire;
(b) A summary of rehabilitation completed to date, and details of rehabilitation required to fulfil the conditions of this consent and any related consents;

(c) Details on infrastructure to be decommissioned, such infrastructure may include buildings, plant, and equipment;
(d) Details of specific infrastructure to remain on-site post-closure. Such infrastructure may include buildings, plant, equipment and any monitoring structures required by this consent and any related consent to remain after the expiry of the consents;
(e) Details of management, any ongoing maintenance, monitoring and reporting proposed by the consent holder to ensure post-closure activities are carried out in accordance with the conditions of this consent;
(f) Details of measures to protect public safety, including any fencing yet to be completed;
(g) The costs of complying with (a)-(f) above.

5.3 The consent holder shall remove all buildings, plant and equipment (whether attached to the land or not) associated with site decommissioning. This condition does not apply to:
(a) Any waste rock stacks, permanent earthworks, silt pond, waterbody, road or other works and any associated plant and equipment which under this or any other resource consent is permitted or required to remain after decommissioning or after this consent expires;
(b) Any monitoring structure required by this or any other resource consent to remain after the expiry of this consent.

6 COMPLAINTS

6.1 The consent holder shall maintain a record of any complaints received regarding their operation. The register shall include, but not be limited to:
(a) name and location of site where the problem is experienced;
(b) nature of the problem;
(c) date and time problem occurred, and when reported;
(d) action taken by consent holder to remedy the situation and any policies or methods put in place to avoid or mitigate the problem occurring again.

6.2 The register of complaints shall be incorporated into the Project Overview and Annual Work and Rehabilitation Plan required by Condition 3 of this consent and provided to the Councils on request.

7 BLASTING AND VIBRATION

7.1 The consent holder shall ensure that blasting practices minimise air and ground borne vibration. Fly-rock shall be minimised and all blasting procedures shall be carried out so as to ensure the safety of employees and the public. No blasting shall occur when the weather is unsuitable.

7.2 Blasting shall be restricted to within the following hours:
Monday to Friday 9.00am to 5.30pm
Saturday and Sunday 10.00am to 4.30pm

7.3 Details of blasting method, strength of the blast and time of blast shall be entered into a record kept for that purpose and shall be available to the Councils on request. This information shall also be included in the monitoring report, required under Condition 9.

7.4 Vibration due to blasting or any other activity associated with the mining operation, when measured at any point within the notional boundary of any dwelling not owned by the consent holder, shall not exceed a peak particle velocity measured in the frequency range 3-12 Hz of 5 mm/sec provided this level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level shall not exceed 10 mm/sec at any time.

7.5 Airblast overpressure from blasting associated with the mining operation, when measured at any point within the notional boundary of any dwelling not owned by the consent holder shall not exceed a peak non-frequency-weighted (Linear or flat) level of 115 decibels (dB), provided this level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level shall not exceed 120 dB (Linear peak) at any time. For the purpose of this consent, C-frequency-weighting may be considered equivalent to the Linear or Flat-frequency-weighting.

Advice Note

The notional boundary is defined as a line 20 metres from the exterior wall of any rural dwelling or the legal boundary where this is closer to the dwelling.

8 NOISE

Noise limits

8.1 The consent holder shall ensure that all construction and operation activities associated with the mining operations are designed and conducted so that the following noise limits are not exceeded at the locations specified in Condition 8.2:

(a) On any day between 7 am to 9 pm (daytime): 50 dBA L_{Aeq}; and

(b) On any day between 9.00 pm to 7.00am the following day (night-time): 40dBA L_{Aeq}; and/or 70 dBA L_{Amax}.

Noise Management

8.2 No Heavy Vehicles other than a service truck shall use the haul road between the Coronation or Coronation North mine site and the gold processing plant as shown on Map 1 between the hours of 9.00 pm to 7.00am each day. Condition 8.2 ceases to have effect if the consent holder obtains an agreement with the residents of 406 Horse Flat Road that the condition is no longer necessary. The residents' consent to the cessation of condition 8.2 must be provided in writing to the Councils and their consent shall operate to amend the noise limit at their residence between those night-time hours to 51dBA LAeq, in this consent and also in consents LUC-2016-230/B, LUC-2013-225/B, 201.2016.779.1 and 201.2013.360.2

Measurement Locations

8.3 Noise measurements shall be taken at the notional boundary of any dwelling not owned by the consent holder.

Advice Note

The notional boundary is defined as a line 20 metres from the exterior wall of any rural dwelling or the legal boundary where this is closer to the dwelling.

Measurement and Assessment

8.4 All noise measurements referred to in Conditions 8.1 and 8.2 above shall be measured in accordance with the provisions of NZS 6801:2008 Acoustics: Measurement of Environmental Sound, and shall be assessed in accordance with the provisions of NZS 6802:2008 Acoustics: Environmental Noise.

9 MONITORING OF NOISE, AIRBLAST AND VIBRATION

9.1 Prior to exercise of this consent, the consent holder shall prepare a Noise, Airblast and Vibration Monitoring Plan. The plan shall include but not be limited to:

(a) Details of the monitoring locations, the frequency of monitoring and the method of measurement and assessment in accordance with Conditions 7.4, 7.5 8.1 and 8.2;

(b) Procedures for recording blasting method, strength of the blast and time of blast; and

(c) Procedures for addressing non-compliant results and notification of the Councils.

9.2 The Noise, Airblast and Vibration Monitoring Plan for this consent may be combined with any other Noise, Airblast and Vibration Monitoring Plan required by any other consent held by the consent holder for mining operations at Macraes Flat.

9.3 The consent holder shall exercise this consent in accordance with the Noise, Airblast and Vibration Monitoring Plan. The consent holder shall review the plan annually and if necessary update it. Confirmation of the review shall be included in the Project Overview and Annual Work and Rehabilitation Plan. The Councils shall be provided with any updates of the plan within one month of any update occurring.

9.4 The consent holder shall produce a report each year summarising the results of the Noise, Airblast and Vibration Monitoring. The report shall be included in the Project Overview and Annual Work and Rehabilitation Programme.

9.5 All measurements from the monitoring programmes shall be recorded and shall be made available to the Councils on request.

9.6 Within one month of Condition 8.2 ceasing to have effect the consent holder shall engage a suitably qualified and experienced person to complete a noise measurement compliance test at the notional boundary of 406 Horse Flat Road to assess compliance with the revised night-time noise limit of 51dBA LAeq. The consent holder shall report the results of the compliance test to the residents of 406 Horse Flat Road and the Councils.

10 LIGHTING

10.1 All flood lighting luminaires that could potentially cause a glare nuisance or a traffic hazard shall be fitted with shields and, as far as is practicable, orientated so that the principal output is directed away from residences and traffic.

11 WASTE ROCK STACKS

11.1 The Trimbells waste rock stack shall be designed for operating basis earthquake (OBE) with a recurrence interval of 150 years and maximum design earthquake (MDE) with a recurrence interval of 2,500 years and otherwise shall otherwise be designed in accordance with sound engineering practice.

11.2 The consent holder shall engage a suitably qualified geotechnical engineer to design the waste rock stack. A construction report shall be prepared for the waste rock stack and this report provided to the Councils prior to the commencement of construction of the waste rock stack. The report shall include details of site formation, design construction, appearance, and testing for stability of the waste rock stack, and shall include evaluation of the long-term stability and performance of the waste rock stack.

11.3 The Trimbells waste rock stack shown on "Coronation North Extension WDC/DCC LUC Consents Map 1" annexed shall not exceed the following height: 695mRL.

12 FINAL PIT LAKES

12.1 The pit lake shall, at all times, have sufficient freeboard to fully contain waves induced by landslides and earthquakes.

12.2 No less than twelve months prior to commencement of filling of the pit lake, the consent holder shall provide the Councils with a Closure Manual for the lake. The manual shall include, but not be limited to:

(a) Details of how Condition 12.1 shall be achieved;
(b) Details of the lake filling, including but not limited to mean flow-rates, location of inflows and the quality of the discharge; and
(c) Details of the long term pit wall stability.

12.3 The consent holder shall exercise this consent in accordance with the Closure Manual. The consent holder shall review the manual annually and if necessary update it. Confirmation of the review shall be included in the Project Overview and Annual Work and Rehabilitation Plan. The consent holder shall provide the Councils with any updates of the plan within one month of any update occurring.

13 ROADING

13.1 Within 12 months of the Coronation North ceasing excavation the consent holder shall reinstate for public use that part of Golden Point Road south of Horse Flat Road shown on "Coronation North Extension WDC/DCC LUC Consents Map 1" annexed.

13.2 To achieve the reinstatement the following work must be completed:

(a) The haul road shall be decommissioned, and replaced with a public road that has a minimum road reserve of 15 metres in width, and a carriageway of 5 metres in width;
(b) The public road shall be formed to a minimum 150 mm sub-base and a base course of 100mm AP4O with a wearing course of AP2O;
(c) The road shall also be delineated and marked to a public road standard; (d) Design and construction details shall be lodged with the Waitaki District Council for its approval.

13.3 Within six months of completion of mining operations in Coronation North and Coronation Pits and rehabilitation of the project areas to the point of decommissioning silt ponds, the consent holder shall define and take steps to vest to the respective Councils (and make lawfully available to the Councils pending completion of vesting) a legal road of no less than 20m wide that approximately follows the blue line shown on the annexed Figure 2 (as a replacement for the unformed Matheson Road). Depending on the extent of pit excavations, the road may be modified to be south or southwest of the blue line. The grade of Matheson Road shall be no more than 1 Vertical, 6 Horizontal at any location of the alignment. Prior to vesting, the road shall be graded to a standard enabling it to be used as a fine weather track for four wheel drive vehicles. The consent holder shall not have any ongoing responsibility to maintain the track or any form of public access along this unformed road as a consequence of this grading.

13.4 Where the road under Condition 13.3 crosses Trimbells waste rock stack, the consent holder shall design the road to avoid the road being scoured out or eroded. The detailed design shall be forwarded to the Compliance Manager at the Dunedin City Council.

13.5 Within six months of completion of mining operations in Coronation North and Coronation Pits ceasing and rehabilitation of the project areas to the point of decommissioning silt ponds, the consent holder shall define and take steps to vest to the Waitaki District Council (and make lawfully available to the Council pending completion of vesting) a legal road of no less than 20 metres wide that approximately follows the Coronation haul road alignment (as indicatively shown marked in orange on the annexed Figure 2) between Horse Flat Road and Matheson Road (as a replacement for the unformed Golden Point Road). Prior to vesting, the road shall be graded to a standard enabling it to be used as a fine weather track for four wheel drive vehicles. The consent holder shall not have any ongoing responsibility to maintain the track or any form of public access along this unformed road as a consequence of this grading.

Advice Note:
All road stopping, temporary road closures and vesting of new road reserve is to be completed under other relevant statutes.

14 HERITAGE

14.1 If the consent holder:

(a) Discovers koiwi tangata (human skeletal remains), or Maori artefact material, the consent holder shall without delay:

i. Notify the Councils, Tangata whenua and Heritage New Zealand Pouhere Taonga and in the case of skeletal remains, the New Zealand Police.

ii. Stop work within the immediate vicinity of the discovery to allow a site inspection by Heritage New Zealand Pouhere Taonga and the appropriate runanga and their advisors, who shall determine whether the discovery is likely to be extensive; if a thorough site investigation is required and whether an Archaeological Authority is required.

iii. Any koiwi tangata discovered shall be handled and removed by tribal elders responsible for the tikanga (custom) appropriate to its removal or preservation.

(b) Discovers any feature or archaeological material that predates 1900, or heritage material, or disturbs a previously unidentified archaeological or heritage site, the consent holder shall without delay:

i. Cease work immediately at that place and within 20m around the site;

ii. Shut down all machinery, secure the area, and advise the Site Manager;

iii. Secure the site and notify the Heritage New Zealand Regional Archaeologist and the Consent Authority. Further assessment by an archaeologist may be required;

iv. If the site is of Maori origin, notify the Heritage New Zealand Regional Archaeologist, the Consent Authority and the appropriate iwi groups or kaitiaki representative of the discovery and ensure site access to enable appropriate cultural procedures and tikanga to be undertaken, as long as all statutory requirements under legislation are met (Heritage New Zealand Pouhere Taonga Act 2014, Protected Objects Act 1975). Heritage New Zealand will determine if an archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014 is required for works to continue; and

v. Recommence site work following consultation with the Consent Authority, Heritage New Zealand and iwi, provided that any relevant statutory permissions have been obtained.

Advice note: An archaeological authority from Heritage New Zealand Pouhere Taonga may be required before work can proceed.

14.2 Site work shall recommence following consultation with the Councils, Heritage New Zealand Pouhere Taonga, Tangata whenua, and in the case of skeletal remains, the NZ Police, provided that any relevant statutory permissions have been obtained.

15 NATURE CONSERVATION AND LANDSCAPE VALUES

15.1 Within six months of exercising this consent the consent holder shall engage a suitably qualified and experienced ecologist to prepare and submit to the Councils an update of the Coronation North Project Ecological Management Plan ("EMP"). The EMP may be combined with any EMP required by any other consent held by the consent holder for mining operations at Macraes Flat. The purpose of the EMP is to ensure compliance with conditions of this consent and otherwise to minimise the actual and potential adverse effects on the threatened species and locally uncommon species and general ecological values. The EMP shall be developed and prepared in consultation with the Department of Conservation and the consent holder shall provide a copy to the Department of Conservation, Nga Runanga, ORC and Councils. The EMP shall:

(a) Include sections covering vegetation and threatened plant management, avifauna, lizard management and aquatic management;

(b) Have the following objectives:

i. To minimise the adverse effects from the implementation of the Coronation North Extension Project on amenity/landscape; indigenous vegetation; threatened plants; resident lizard populations; and aquatic biota;

ii. To protect indigenous flora, threatened, at risk and locally uncommon plants and vegetation types; resident lizard populations, and aquatic fauna where practicable.

(c) Detail the methods by which the objectives set out in Condition 15.1(b) shall be achieved, including:

i. propagation of three plant species as detailed in Condition 15.6;

ii. transplanting of the threatened plants identified in Condition 15.7;

iii. minimisation of construction effects including during construction of Trimbells Waste Rock Stack by keeping the area of disturbed land to a minimum; and

iv. monitoring.

(d) The consent holder shall implement the programme of activities specified in the EMP and in any subsequent EMP reports created pursuant to condition 15.2(c)

15.2 The consent holder shall engage a suitably experienced and qualified ecologist, to prepare an annual report:

(a) describing the works and other actions completed by the consent holder in the previous twelve months in order meet the purpose and objectives of the EMP; and

(b) evaluating the progress of the tussock species planting on rehabilitated land, transplanting of threatened plant species and the propagation and subsequent planting of the three rare plant species listed in Condition 15.6(a).

(c) Describing what methods are to be implemented in the following 12 months in order to meet the purpose and objectives of the EMP.

The consent holder shall provide the Councils, Nga Runanga and Department of Conservation with a copy of the report by no later than 31 July each year. The report may be combined with any EMP report required by any other consent held by the consent holder for mining operations at Macraes Flat.

15.3 The consent holder shall, using a suitably qualified person or persons, fund measures for the translocation and/or cultivation of seeds, cuttings or other cultivation material from a selection of at least 2 of the following plant species taken from plants located within the impacted footprint of the Coronation North project ("salvage species") for planting out in areas undisturbed by mining activities:

Aciphylla subflabellata (target for establishment: 10 plants)

Deyeuxia quadriseta (target for establishment: 5 plants)

Epilobium insulare (target for establishment: 20 plants)

and the translocation areas will be mapped in the next update of the EMP.

15.4 Translocation will be carried out in accordance with the Coronation North Plant Propagation, Translocation and Management Manual.

15.5 The consent holder shall monitor the success of all plantings annually for five years following planting and report progress in its annual Ecological Monitoring Report. In this context success means the successful survival and growth of the plant species so that they may form potentially viable populations and shall be monitored by recording the survival and growth of individual plants and noting any flowering and recruitment of new individuals. Success shall be demonstrated by at least 75% of established plants surviving, and at least 50% increasing in size compared with their establishment. Where success is not attained a further round of translocation work in accordance with Conditions 15.3 and 15.4 will be carried out by the consent holder. If suitable material cannot be sourced from the affected area then seeds will as far as practicable be sourced from the Macraes Ecological District.

15.6 The consent holder shall conduct a survey of lizards, at a minimum in the ‘give up” area shown in Figure 1 and the catchments that are connected to it, to confirm the extent and relative abundance of cryptic skink population (and other rare skinks (e.g. green skink) if they are detected). The survey shall:

(a) occur during spring to autumn and will only be undertaken during appropriate weather conditions that maximise the chance of detection;
(b) occur over a minimum of three person days;
(c) focus around the known cryptic skink location and radiate out from that centre to similar/preferred habitat;
(d) be undertaken by an appropriately qualified herpetologist with proven experience in lizard surveys; and
(e) the consent holder will consult with the Department of Conservation on the survey design and methodology.

15.7 The consent holder will report on the results of the lizard survey required by Condition 15.6 as part of the annual Coronation North Ecological Monitoring Report.

15.8 Within six months of the exercise of this consent, the consent holder will conduct an invertebrate survey of the Trimbells Gully Recommended Area of Protection (RAP). The survey shall:
  (a) occur during spring to autumn;
  (b) occur over a minimum of three person days;
  (c) be undertaken by an appropriately qualified entomologist with proven experience in invertebrate survey; abd
  (d) the consent holder will consult with the Department of Conservation on the survey design and methodology.

15.9 The consent holder will report on the results of the invertebrate survey required by Condition 15.8 as part of the annual Coronation North Ecological Monitoring Report.

15.10 Within six months of the exercise of this consent, the consent holder shall remove approximately 3.6 ha of pine forest and remove any subsequent pine seedlings for a minimum period of three years in the vicinity of Coronation Haul Road and the pine forest / wilding pine removal area will be mapped in the next update of the EMP.

15.11 The objective of Condition 15.10 is to improve habitat for lizards and invertebrates and allowing populations to grow in extent and abundance while removing any pine seedlings or wilding pines that establish.

15.12 In consultation with the Department of Conservation the consent holder shall develop and implement a monitoring programme to provide evidence to support or otherwise the stated objective. The monitoring programme shall:

  (a) include the frequency of lizard and invertebrate monitoring surveys to be conducted
  (b) be conducted for a minimum of three years and then a decision to extend will be based on a comparison of the results against the objective.

15.13 The consent holder will report on the results of the monitoring programme required by Condition 15.10 as part of the annual Coronation North Ecological Monitoring Report.

Advice Note

The actions set out in conditions 15.3 to 15.12 are additional to the actions required under Condition 15 of resource consent LUC-2016-230/B and 201.2016.779.1. The Coronation North Project Ecological Management Plan will retain all original content required from the 2016 consents as well as the additional actions required under these conditions.

15.14 As volunteered as part of the Coronation North Extension proposal, within two weeks of the commencement of this consent the consent holder shall, pursuant to section 138 of the Resource Management Act 1991, provide the Councils a written notice of surrender of the 52 hectares of land shown on the attached map ‘Macraes Gold Project – Coronation North Extension Figure 1’ and marked ‘waste rock stack give up boundary’, being land that is consented for disturbance under Coronation North consents LUC 2016-234 and 201.2016.779.

15.15 Annually, as part of the consent holder’s Project Overview and Annual Work and Rehabilitation Plan, the area of land to be disturbed in the following 12 months shall be assessed for the presence of the species identified in Condition 15.6 above and a programme for cultivating and planting out and/or translocating a selection of plants taken from those species identified shall be determined by the consent holder in consultation with the Department of Conservation.

16 FENCING

16.1 Stock-proof fencing shall be used to keep livestock away from all working areas.

16.2 On the completion of mining operations the consent holder shall ensure that all fences, required to restrict people and/or stock for safety purposes, are installed and maintained. This shall include fences to be installed and maintained around Coronation North and Coronation pit lakes.

17 MANAGEMENT OF HAZARDOUS SUBSTANCES

17.1 The Consent Holder shall ensure that all fuels and oils used at the site are contained in appropriately bunded facilities and that all fuel/oil dispensers are fitted with non-return valves.

17.2 Refuelling, lubrication and any mechanical repairs shall be undertaken in a manner that provides sufficient mitigation measures to ensure that no spillages onto the land surface or into water occur.

18 BONDS

Obligations to be secured

18.1 The consent holder shall provide and maintain in favour of the Councils one or more bonds to secure:

(a) The performance and completion of rehabilitation in accordance with the conditions of this consent; and
(b) The carrying out of the monitoring required by the conditions of this consent; and
(c) The remediation of any adverse effect on the environment that may arise from the exercise of this consent; and
(d) Compliance with conditions 18.13 - 18.17 of this consent.

When bonds to be provided

18.2 Before the commencement of this consent, the consent holder shall provide to the Councils one or more bonds required by Condition 18.1

Form of bond

18.3 Subject to the other provisions of this condition, any bond shall be in the form and on the terms and conditions approved by the Councils.

Surety

18.4 Any bond shall be given or guaranteed by a surety acceptable to the Councils.

18.5 The surety shall bind itself to pay for the carrying out and completion of the conditions of consent which are the subject of the bond on default by the consent holder or the occurrence of any adverse environment effect requiring remedy during or after the expiry of this consent.

Amount

18.6 The amount of each bond shall be fixed annually by the Councils which will take into account any calculations and other matters submitted by the consent holder relevant to the determination of the amount to be bonded in the Project Overview and Annual Work and Rehabilitation Plan, or otherwise.

18.7 The amount of the bond(s) shall include:

(a) The estimated costs of complete rehabilitation in accordance with the conditions of consent on the completion of the mining operations proposed for the next year and described in the Project Overview and Annual Work and Rehabilitation Plan.

(b) The estimated costs of:

i. Monitoring in accordance with the monitoring conditions of the consent;

ii. Monitoring for and of any adverse effect of the activity authorised by this consent which may become apparent during or after expiry of this consent;

iii. Monitoring any rehabilitation required by this consent.

(c) Any further sum which the consent authority considers necessary for monitoring and dealing with any adverse effect on the environment that may arise from the exercise of the consent whether during or after the expiry of this consent.

18.8 The amount shall be calculated for the duration of this consent and for a period of 20 years after its expiry.

18.9 If, on review, the total amount of bond to be provided by the consent holder is greater or less than the sum secured by the current bond(s), the consent holder, surety and the Councils may, in writing, vary the amount of the bond(s).

General

18.10 While the liability of the surety is limited to the amount of the bond(s), the liability of the consent holder is unlimited.

18.11 Any bond may be varied, cancelled, or renewed at any time by written agreement between the consent holder, surety and Councils.

Costs

18.12 The costs (including the costs of the consent authority) of providing, maintaining, varying and reviewing any bond shall be paid by the consent holder.

Bonding on expiry or surrender of this consent

18.13 For a period of 20 years from the expiry or surrender of this consent the consent holder shall provide in favour of the Councils one or more bonds.

18.14 The amount of the bond to be provided under Condition 18.13 shall include the amount (if any) considered by the Councils necessary for:

(a) Completing rehabilitation in accordance with the conditions of this consent.

(b) Monitoring for and of any adverse effect on the environment that may arise from the exercise of the consent.

(c) Monitoring any measures taken to prevent, remedy or mitigate any adverse effect on the environment that may arise from the exercise of this consent.
(d) Dealing with any adverse effect on the environment which may become apparent after the surrender or expiry of this consent.
(e) Contingencies.

18.15 Without limitation, the amount secured by the bond given under Condition 18.13 may include provision to deal with structural instability or failure, land and water contamination, and the failure of rehabilitation in terms of the rehabilitation objectives and conditions of this consent. Costs shall include costs of investigating, preventing, remedying or mitigating any adverse effect.

18.16 The bond(s) required by Condition 18.13 must be provided on the earlier of:
(a) 12 months before the expiry of this consent;
(b) Three months before the surrender of this consent.

18.17 Conditions 18.3, 18.4, 18.5, 18.8, 18.9, 18.10 and 18.11 apply to the bond(s) required by Condition 18.13.

19 PUBLIC LIABILITY INSURANCE

19.1 The consent holder shall effect and keep current public liability insurance for an amount not more than twenty million dollars. The amount shall be determined by the Councils in consultation with the consent holder.

19.2 The indemnity expressed in the insurance policy shall be sufficiently wide in its coverage so as to include claims arising from damage caused by structural failure, or damage resulting from fire or explosion and all fire fighting costs resulting from the consent holder's operations in respect of the land and from any accidental or otherwise spillage of any chemical or reagent and/or resulting clean up and restoration costs and the costs of mitigation of those events.

19.3 The consent holder shall on request provide the Councils a copy of the insurance policy and the receipt evidencing payment of the premium in respect of any such policy.

19.4 The consent holder shall also indemnify the Councils against any claim arising from the public use of public roads for the time being under control of the consent holder.

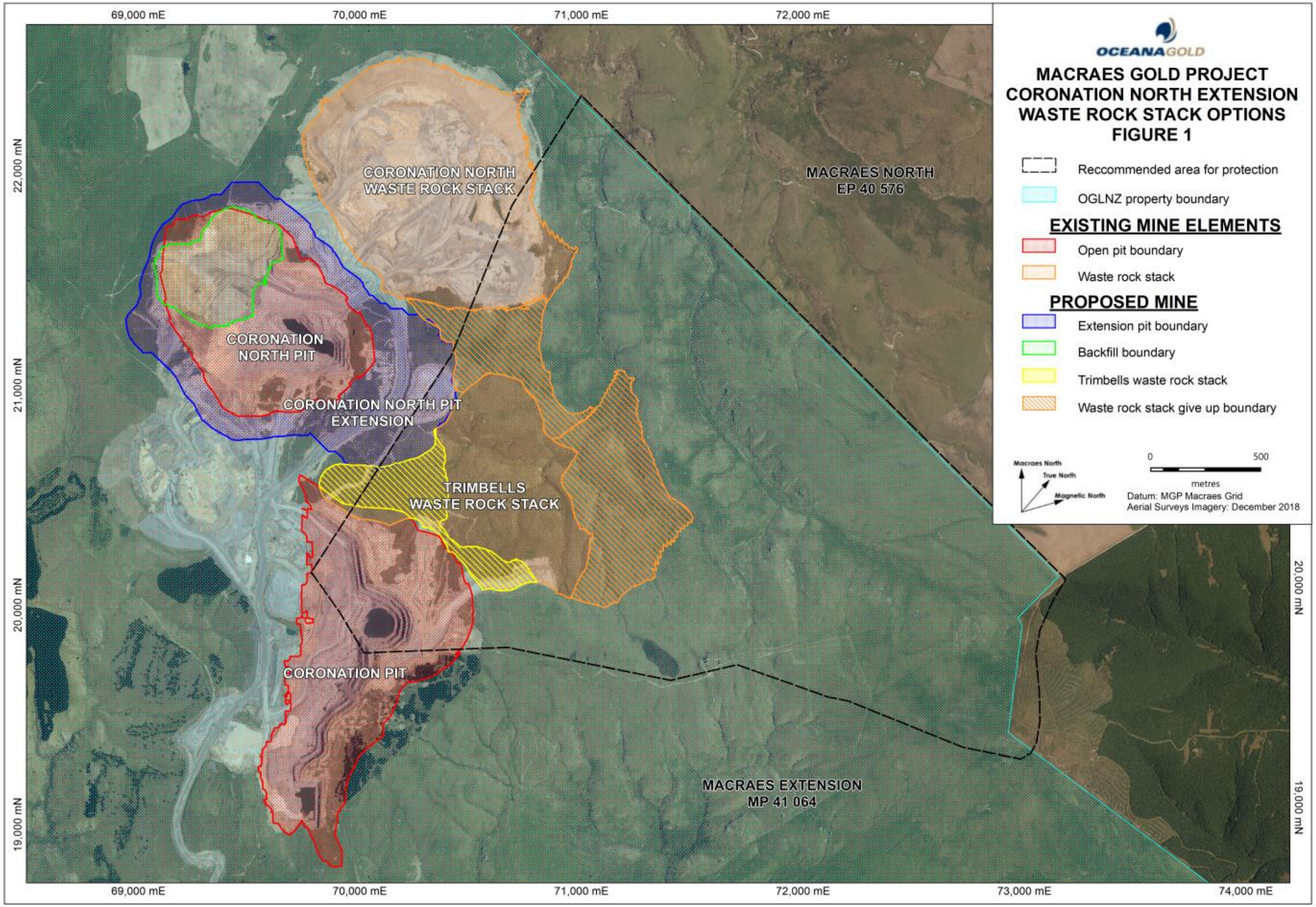
20 CLOSURE OF OPERATIONS

20.1 The consent holder shall annually supply to the Councils a contingency plan for the early closure of the mine, as part of the Project Overview Annual Work and Rehabilitation Programme. This contingency plan shall be updated annually. The plan shall address the objectives listed in Condition 4 and include:
(a) An evaluation of the residual risk of the operation with regard to the neighbouring community and environment; and
(b) A plan for the long term management of the site, in particular the area of open pits or consequent lakes and the Coal Creek water reservoir, and include details of on-going maintenance and monitoring requirements and restrictions on future use.
(c) Describe in detail what needs to be done to:
i. Decommission the mine site in accordance with this consent;

ii. Rehabilitate the mine site in accordance with this consent;
iii. Comply with other conditions relevant to cessation of mining; and
iv. The costs needed to comply with (i)-(iii).

ANNEXES

MAP 1



ORC Reference: RM16.138
DCC Reference: LUC-2016-234 and LUC-2013-225A
WDC Reference: 201.2016.779 and 201.2013.360.1

Erratum of Joint Notified Decision by the Hearing Committee of the Otago Regional Council, Dunedin City Council and Waitaki District Council on Resource Consent Applications RM16.138, LUC-2016-234, LUC-2013-225A, 201.2016.779 and 201.2013.360.1

After the decision for resource consent on the aforementioned applications was made, the Panel became aware that the agreed to condition 15.2(b) requiring the consent holder to engage a suitably experienced and qualified ecologist, to prepare an annual Coronation North Ecological Monitoring Report that evaluates the progress of the tussock species planting on rehabilitated land, transplanting of threatened plant species and the propagation and subsequent planting of the twelve rare plant species, instead stated that fifteen rare plant species should be propagated and planted.

As such, the following erratum has been prepared to correct this error. The new condition to be inserted on DCC & WDC Consent and conditions reads as follows:

"15.2 The consent holder shall engage a suitably experienced and qualified ecologist, to prepare an annual Coronation North Ecological Monitoring Report:

(a) describing the works and other actions completed by the consent holder in the previous twelve months in order meet the purpose and objectives of the EMP; and

(b) evaluating the progress of the tussock species planting on rehabilitated land, transplanting of threatened plant species and the propagation and subsequent planting of the twelve rare plant species listed in condition 15.6(a).

(c) Describing what methods are to be implemented in the following 12 months in order to meet the purpose and objectives of the EMP.

The consent holder shall provide the Councils, Nga Runanga and Department of Conservation with a copy of the report by no later than 31 July each year. The report may be combined with any EMP report required by any other consent held by the consent holder for mining operations at Macraes Flat"

Consequently, Dunedin City Council and Waitaki District Council condition 15.2 shall be amended to include this erratum. The amended Dunedin City Council and Waitaki District Council Consent and conditions is attached.

Brent Cowie

Signed by Brent Cowie (Chair)

Cmr Brent Cowie, Chair Hearing Panel

22 December 2016

OCEANA GOLD CORONATION AND CORONATION NORTH PROJECT
DCC & WDC CONSENT AND CONDITIONS
20 December 2016

WAITAKI DISTRICT COUNCIL AND DUNEDIN CITY COUNCIL
LAND USE CONSENT "CORONATION & CORONATION NORTH" – OCEANA GOLD (NEW ZEALAND) LTD
WDC Reference: 201.2016.779 and 201.2013.360.1
DCC Reference: LUC-2016-234 and LUC-2013-225A

Pursuant to the Resource Management Act 1991, the Waitaki District Council and Dunedin City Council grants its consent to Oceana Gold (New Zealand) Limited for gold mining operations involving:

(a) The extraction of minerals and overburden by mechanical means from the Coronation North pit and expanded Coronation Pit shown on "Coronation & Coronation North Project WDC/DCC LUC Consents Map 1" annexed;

(b) The transport, treatment and processing of minerals extracted from the Coronation North pit and expanded Coronation Pit;

(c) The stacking, deposit and storage of substances considered to contain any mineral from the Coronation North pit and expanded Coronation Pit;

(d) The deposit of waste rock produced by Coronation North pit and expanded Coronation Pit on the Coronation and Coronation North waste rock stacks shown on "Coronation & Coronation North Project WDC/DCC LUC Consents Map 1" annexed and described at (a) above and the deposit of waste rock as backfill into the Coronation North and Coronation pits;

(e) The construction and use of the Coal Creek Reservoir shown on "Coronation & Coronation North Project WDC/DCC LUC Consents Map 1" annexed and described at (a) and (d) above;

(f) The construction, maintenance and use of a haul road from Coronation North area to the gold processing plant;

(g) The construction and use of two haul road crossings (approximately centred at grid reference NZTM 2000 1397100E 4975800N Horse Flat Road and NZTM 2000 1398200E 4974200N Golden Point Road);

(h) The use and storage of diesel and explosives;

(i) The construction and use of temporary buildings;

(j) The de-commissioning, rehabilitation, de-construction or dismantling of the mine and of any structures and works resulting from activities set out in paragraphs (a) – (i) above;

(k) The construction, operation and maintenance of silt ponds and silt control facilities necessary for controlling runoff from the Coronation and Coronation North mining operation;

(l) The formation of a pit lake in the Coronation North pit and the formation of a pit lake in the expanded Coronation pit.

The duration of this consent shall be 35 years.

DEFINITIONS

"Act" means the Resource Management Act 1991, and includes all amendments to the Act, and any enactments made in substitution for the Act.

"Project Overview and Annual Work and Rehabilitation Plan" means the Project Overview and Annual Work and Rehabilitation Plan required by Condition 3.

"Building" means any temporary or permanent structure.

"Building Work" means work for or in connection with the construction, alteration, operation, demolition or removal of a building and includes site work.

"Councils" means the Waitaki District Council and the Dunedin City Council and includes its successors, and also includes any person to whom the consent authorities delegate or transfer any of its functions, powers and duties as a consent authority under the Act.

"**Disturbed Land**" means any land where the soil has been removed or modified and includes any waste rock stacks, or any other structures that have not been rehabilitated with soil and vegetation.

"Exploration" means any activity undertaken for the purpose of identifying mineral deposits or occurrences and evaluating the feasibility of mining particular deposits or occurrences of one or more minerals; and includes any drilling, dredging, or excavations (whether surface or sub-surface) that are reasonably necessary to determine the nature and size of a mineral deposit or occurrence; and "to explore" has a corresponding meaning.

"Landscape Architect" means a professional member of the New Zealand Institute of Landscape Architects Inc. or equivalent body.

"**Life of the Macraes Gold Project**" means the period ending when all mining operations at Macraes cease.

"Macraes Ecological District" means the area described by the Department of Conservation (James Bibby), 1997: *Macraes ecological district: survey report for the Protected Natural Areas Programme*, ISBN 0478019254, 9780478019254 and as also defined in McEwen, W.M. (1987): *Ecological regions and districts of New Zealand, incorporating third revised edition in four 1:500 000 maps (Part 4)*. New Zealand Biological Resources Centre publication No. 5. 125p + maps.

"Mining" means to take, win, or extract, by whatever means, a mineral existing in its natural state in land, or a chemical substance from that mineral, for the purpose of obtaining the mineral or chemical substance; but does not include prospecting or exploration; and "to mine" has a corresponding meaning.

"Mining Operations" means operations in connection with mining, exploring, or prospecting for any mineral, gold, including –

(a) The extraction, transport, treatment, processing, and separation of any gold mineral; and

(b) The construction, maintenance, and operation of any works, structures, and other land improvements, and of any machinery, and equipment, connected with such operations; and

(c) The removal of overburden by mechanical or other means, and the stacking, deposit, storage, and treatment of any substance considered to contain any mineral; and

(d) The deposit or discharge of any mineral, material, debris, tailings, refuse, or wastewater produced from or consequent on, any such operations; and

(e) The doing of all lawful acts incidental or conducive to any such operations - when carried out at or near the site where the mining, exploration, or prospecting is carried out.

"Nga Runanga" means Te Runanga o Moeraki, Kati Huirapa Runaka ki Puketeraki and Te Runanga o Otakou.

"ORC" means the Otago Regional Council and includes its successors, and also includes any person to whom the council delegates or transfers any of its functions, powers and duties under the Act.

"Prospecting" means any activity undertaken for the purpose of identifying land likely to contain exploitable mineral deposits or occurrences; and includes:

(a) Geological, geochemical, and geophysical surveys;

(b) The taking of samples by hand or hand held methods; and

(c) Aerial Surveys, - and "to prospect" has a corresponding meaning.

"Site work" means work on a building site, including earthworks, preparatory to or associated with the construction, alteration, demolition or removal of a building.

"Structure" includes a dam and a waste rock stack.

"Supporting documents" means the supporting documents listed as Appendices 1 - 22, and Addendums to the application lodged and receipted by the Councils in May 2016, and also includes all other material (including further information in response to s92

RMA requests, statements of evidence and submissions) provided by the applicant to the consent authorities in support of the application for the consent.

"Rehabilitation objectives and terms" means the rehabilitation, objectives and terms set out in Condition 4.

"Works" includes any excavation, drilling and includes a road.

1. GENERAL

1.1 This consent shall be exercised substantially in accordance with the Coronation North application for resource consent lodged to, and receipted by, the Councils in May 2016, including the Assessment of Environmental Effects and all Supporting Documents (which are deemed to be incorporated in, and form part of this consent), except to the extent that any condition in this consent is inconsistent with such material. If there is an inconsistency the conditions and terms of this consent shall prevail.

1.2 Pursuant to Section 125(1) of the Resource Management Act 1991 this consent shall lapse on the expiry of five years after the date of issue of the consent unless the consent is given effect to before the end of that period or upon application in terms of Section 125 (1) (b) of the Act, the Councils may grant a longer period of time.

1.3 The consent holder shall notify the Councils in writing of the first exercise of this consent.

1.4 In the event of any non-compliance with the conditions of this consent, the consent holder shall notify the Councils within 24 hours of the non-compliance being detected. Within five working days the consent holder shall provide written notification to the Councils providing details of the non-compliance. This notification will at a minimum include an explanation of the cause of the non-compliance, the steps taken to remedy the situation and steps taken to avoid any future occurrence of the non-compliance.

1.5 The Councils may, in accordance with sections 128 and 129 of the Act, serve notice on the consent holder of its intention to review the conditions in the last week of March in any year for the purposes of:

(a) Dealing with any adverse effect on the environment (including cultural values) which may arise from the exercise of this consent and which is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent,

(b) Ensuring the conditions of this consent are appropriate,

(c) Ensuring rehabilitation is completed in accordance with the rehabilitation conditions of this consent;

(d) Requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment arising as a result of the exercise of this consent.

1.6 The Councils may, within 6 months of receipt of the Coronation North Project Cultural Impact Assessment prepared by Kai Tahu Ki Otago on behalf of Te Rūnanga o Moeraki, Te Runanga o Otakou and Kāti Huirapa Rūnaka ki Puketeraki, commissioned in 2016, serve notice of its intention under Sections 128 and 129 of the Act to review the conditions of this consent for the purpose of amending or adding conditions to address mitigation of the effect(s) from activities authorised under this consent on cultural values and associations.

1.7 The consent holder shall remedy or adequately mitigate any adverse effect on the environment from the exercise of this consent which becomes apparent after the expiry of this consent.

1.8 Prior to the expiry of this consent, the consent holder shall ensure that all rehabilitation and everything necessary to comply with the conditions of this consent has been completed.

Advice Note

In addition to the fees payable for the processing of this application, where further site inspections are required to monitor compliance with any of the conditions, the Councils may render an account to the consent holder for additional monitoring fees at the rate prescribed in the Annual Plan on the basis of time involved.

2. LOCATION OF VARIOUS MINING ACTIVITIES

2.1 The pits, waste rock stacks, water reservoir and haul road shall not materially exceed those footprints shown on "“Coronation & Coronation North Project WDC/DCC LUC Consents Map 1” annexed.

2.2 (a) Coronation waste rock stack shall be formed so that the whole footprint of the stack is used as shown on “Coronation Project WDC/DCC LUC Consents Map 1” annexed unless the waste rock stack is reduced proportionally.
(b) Coronation North waste rock stack shall be formed in accordance with Condition 4.5.

3. PROJECT OVERVIEW AND ANNUAL WORK AND REHABILITATION PLAN

3.1 The consent holder shall submit a Project Overview and Annual Work and Rehabilitation Plan to the Councils by 31 March each year that will cover the forthcoming year (1 July to 30 June). The consent holder may, at any time, submit to the Councils an amended Project Overview and Annual Work and Rehabilitation Plan. The Project Overview and Annual Work and Rehabilitation Plan shall include, but not be limited to:

(a) A description and timeline of intended mining activities for the duration of mining operations including a plan showing the location and contours of all existing and proposed structures at completion of mining;
(b) A description (including sequence, method and form) of mining operations, monitoring and reporting carried out in the last 12 months;
(c) A detailed description (including sequence, method and form) of all mining operations, monitoring and reporting, not covered by a separate management plan intended to be carried out in the next 12 months;
(d) An explanation of any departure in the last 12 months from the previous Project Overview and Annual Work and Rehabilitation Plan;
(e) Plans showing the contours (at 5 metre intervals) and footprints of all works and structures and any proposed changes at the end of the next 12 months;
(f) A description and analysis of any unexpected adverse effects on the environment that have arisen as a result of the exercise of the consent in the last 12 months and the steps taken to deal with it and the results of those steps;
(g) A description and analysis of any non-compliance with any conditions of consent that have occurred in the last 12 months and the steps that were taken to deal with it and the results of those steps;
(h) A full report describing and evaluating the mitigation measures used in the last 12 months and any that are proposed to be implemented in the next 12 months. This should detail where further mitigation is proposed or has been undertaken as a result of a non-compliance event and/or any adverse effects on the environment;
(i) A summary description of all Management Plans and Manuals required under this land use consent and any resource consents issued by ORC and details of any review or amendment of any of the Management Plans or Manuals;
(j) An overview of the monitoring and reporting programme for the previous 12 months and any changes proposed for the next 12 months;
(k) A detailed section on rehabilitation including, but not limited to the following:
    i. The total area of disturbed land during the mining of Coronation North, including the haul road, yet to receive rehabilitation and indicative rehabilitation dates for various areas of the mine site;
    ii. The area of additional disturbed land in the coming year that will require future rehabilitation;
    iii. The area of disturbed land rehabilitated in the previous year;
    iv. The area of disturbed land proposed to be rehabilitated in coming year;
    v. A description of rehabilitation planned for the life of mine at Coronation North;
    vi. A description of proposed rehabilitation methods for any area, including proposed topsoil to be stripped and stockpiled, surface pre-treatment and re-use of topsoil on finished areas in the next 12 months.;
    vii. The details of the location, design (including shape form and contour) and construction of all permanent structures;
    viii. Drainage details for any disturbed land and recently rehabilitated areas;
    ix. Details of any vegetation to be used as part of rehabilitation for the next 12 month period;
    x. Detailed results of any revegetation trials.

(l) A description of any rehabilitation problems encountered and the steps being taken to resolve these problems;
(m) An up to date and detailed calculation of the cost of dealing with any adverse effects on the environment arising or which may arise from the exercise of this consent;
(n) An up to date and detailed calculation of the costs of complying with all rehabilitation conditions of this consent;
(o) An up to date and detailed calculation of the costs of any monitoring required by the conditions of this consent;
(p) A contingency closure plan describing in detail the steps that would need to be taken if mining operations stopped in the next 12 months in accordance with Condition 20; and
(q) Any other information required by any other condition of this consent and any related consent.

3.2 Each year the consent holder shall provide the Chair of Macraes Community Incorporated, Kāti Huirapa ki Puketeraki, Te Runanga o Otakou and Te Rūnanga o Moeraki with a copy of the Project Overview and Annual Work and Rehabilitation Plan.

3.3 The Project Overview and Annual Work and Rehabilitation Plan for this consent may be combined with any Project Overview and Annual Work and Rehabilitation Plan required by any other consent held by the consent holder for mining operations at Macraes Flat.

3.4 The consent holder shall provide the Councils with any further information, or report, which the Councils may request after considering any Project Overview and Annual Work and Rehabilitation Plan. This information or report shall be provided in the time and manner required by the Councils.

3.5 The consent holder shall exercise this consent in accordance with all defined conditions and the current Project Overview and Annual Work and Rehabilitation Plan.

3.6 The consent holder shall design and construct all permanent earthworks to the form shown in the Project Overview and Annual Work and Rehabilitation Plan.

4. REHABILITATION

4.1 The rehabilitation objectives to be achieved by the consent holder are:-

(a) To ensure short and long term stability of all structures and works and their surrounds;

(b) To avoid maintenance after completion of rehabilitation requirements;

(c) To protect soil from erosion and to protect water from contaminants affected by mining operations;

(d) To stabilise and rehabilitate the banks and surrounds of any waterbodies;

(e) To return land as closely as possible to its original condition, including any exotic pastoral and indigenous species appropriate to the area; and

(f) To visually integrate finished structures, land-forms and vegetation into the surrounding landscape so they appear to be naturally occurring features; and,

(g) To control invasive environmental weeds, including wilding conifers, in the Disturbed Land for the Life of the Macraes Gold Project.

Earth Shaping and Visual

4.2 The consent holder shall locate, form and shape all earthworks so that their profiles, contours, skylines and transitions closely resemble and blend with the surrounding natural landforms. If earthworks cannot be fully naturalised, the consent holder shall minimise the extent of their visibility and maximise their integration into the surroundings.

4.3 The consent holder shall use a Landscape Architect in the planning and design of all permanent earthworks and structures.

Waste Rock Stack

4.4 The consent holder shall design and construct the waste rock stack in accordance with the following principles:

(a) Slopes shall be suitably shaped in cross-profile to match nearby natural slopes;

(b) Slope gradients shall be no steeper than nearby natural surfaces;

(c) Transitions between natural and formed surfaces shall be rounded and naturalised;

(d) Contours should be curvilinear in plan form, in keeping with original natural contours in that area;

(e) The skyline shall be variable and curved, simulating natural skylines;

(f) New landforms shall be aligned and located so they seem to continue, not cut across, existing landscape patterns; and

(g) Silt ponds shall be removed and the site rehabilitated or be converted to stock water drinking ponds following completion of mining operations and rehabilitation.

4.5 The consent holder shall stage the construction of Coronation North Waste Rock Stack (WRS) as follows:

(a) Waste rock deposition will commence in Area A shown on “Coronation North Waste Rock Stack Option Figure 1” annexed.

(b) Once Area A is constructed to its maximum practicable extent, the consent holder shall next deposit waste rock in Area B shown on “Coronation North Waste Rock Stack Option Figure 1” annexed.

(c) When Area B is constructed to its maximum practicable extent the consent holder shall finally deposit waste rock in Area C shown on “Coronation North Waste Rock Stack Option Figure 1” annexed.

Advice Note:

The purpose of staging construction of the WRS is to avoid the deposit of waste rock in Area B or Area C, or as a minimum to defer the waste rock deposit in those areas. The consent holder has committed to examine the feasibility of expanding Area A of the waste rock stack as a means to reduce encroachment into an area recommended for protection (RAP).

4.6 Where practicable the waste rock shall be backfilled into pits in order to minimise the size of waste rock stack.

4.7 Prior to the commencement of the Coronation North waste rock stack, the consent holder shall in consultation with the Councils, design the shape and construction details of the stack. The final design and construction details shall be lodged with the Councils and include a report prepared by a Landscape Architect that includes, but is not limited to, the following:

(a) A detailed description of the proposed waste rock stack;

(b) A detailed description of the adjoining landforms; including their slopes and transitions; and

(c) A detailed discussion on how the proposed waste rock stack meets the principles set out in condition 4.4 (a) – (f).

4.8 If after commencement of the construction of the Coronation North waste rock stack, the consent holder wishes to change the design or construction details it shall design the changes in consultation with the Councils. The design or construction changes shall be lodged with the Councils. The change document shall include a report by a Landscape Architect that details the proposed changes and reassess whether the design changes better meet the principles set out in condition 4.4 (a) – (f).

<u>Soil</u>

4.9 The consent holder shall, as far as practicable, stockpile soil from any disturbed land, unless the soil is required to be left in place to protect water and soil values.

4.10 All salvaged soil shall be used on disturbed land for rehabilitation purposes.

Revegetation

4.11 The consent holder shall in accordance with the rehabilitation objectives undertake progressive rehabilitation of disturbed land as operational activities allow. It shall be revegetated with:

(a) Exotic pastoral species; and

(b) Tussock species which are as far as practicable sourced from the Macraes Ecological District and include *Chionochloa rigida subsp. rigida* (narrow-leaved snow tussock) *Festuca novae-zelandiae* and *Poa cita*. Details of area, density and methods of planting are set out in the Ecological Management Plan required under Condition 15.

4.12 The consent holder shall maintain vegetation cover until the expiry of this consent and ensure that the vegetation, including any vegetation established on disturbed land, shall be self-sustaining after expiry.

Soil and Vegetation Monitoring

4.13 At three yearly intervals, the consent holder shall complete a review of all soil and pasture on land that has been rehabilitated. The first review shall be not later than the third anniversary of the commencement of this consent. The review shall include, but not be limited to, the following:

(a) Monitoring for ground cover, species components, plant nutrition status, soil organic matter and concentrations of exchangeable nutrients in the soil;

(b) Analysis and interpretation of the monitoring results by a suitably qualified soil or agricultural scientist;

(c) Evaluation of the vegetation and its potential to be self-sustaining for pastoral farming after mining ceases; and

(d) Any necessary recommendations for future rehabilitation, including plant species or varieties to be used, cultivation and seeding methods to be introduced, or fertilisers to be used; and,

(e) A copy of the review will be forwarded to the Councils and Department of Conservation within three months of the review being completed.

5. SITE DECOMMISSIONING AND CLOSURE

5.1 The consent holder shall submit to the Councils a Site Decommissioning Plan, not less than 12 months before completion of the operations.

5.2 The Site Decommissioning Plan shall include but not be limited to:

(a) A plan(s) showing the final design and intended contours (at 5 metre intervals) of all permanent structures and works, including but not limited to, waste rock stacks, permanent earthworks, pit lakes, roads, water storage reservoirs or other works which under this consent or any related consent are authorised or required to remain after the relevant consents expire;
(b) A summary of rehabilitation completed to date, and details of rehabilitation required to fulfil the conditions of this consent and any related consents;
(c) Details on infrastructure to be decommissioned, such infrastructure may include buildings, plant, and equipment;
(d) Details of specific infrastructure to remain on-site post-closure. Such infrastructure may include buildings, plant, equipment and any monitoring structures required by this consent and any related consent to remain after the expiry of the consents;
(e) Details of management, any ongoing maintenance, monitoring and reporting proposed by the consent holder to ensure post-closure activities are carried out in accordance with the conditions of this consent;
(f) Details of measures to protect public safety, including any fencing yet to be completed;
(g) The costs of complying with (a)-(f) above.

5.3 The consent holder shall remove all buildings, plant and equipment (whether attached to the land or not) associated with site decommissioning. This condition does not apply to:

(a) Any waste rock stacks, permanent earthworks, silt pond, waterbody, road or other works and any associated plant and equipment which under this or any other resource consent is permitted or required to remain after decommissioning or after this consent expires;

(b) Any monitoring structure required by this or any other resource consent to remain after the expiry of this consent.

6. COMPLAINTS

6.1 The consent holder shall maintain a record of any complaints received regarding their operation. The register shall include, but not be limited to:

(a) name and location of site where the problem is experienced;
(b) nature of the problem;
(c) date and time problem occurred, and when reported;
(d) action taken by consent holder to remedy the situation and any policies or methods put in place to avoid or mitigate the problem occurring again.

6.2 The register of complaints shall be incorporated into the Project Overview and Annual Work and Rehabilitation Plan required by Condition 3 of this consent and provided to the Councils on request.

7. BLASTING AND VIBRATION

7.1 The consent holder shall ensure that blasting practices minimise air and ground borne vibration. Fly-rock shall be minimised and all blasting procedures shall be carried out so as to ensure the safety of employees and the public. No blasting shall occur when the weather is unsuitable.

7.2 Blasting shall be restricted to within the following hours: Monday-Friday 9am to 5.30pm Saturday and Sunday 10am to 4.30pm

7.3 Details of blasting method, strength of the blast and time of blast shall be entered into a record kept for that purpose and shall be available to the Councils on request. This information shall also be included in the monitoring report, required under Condition 9.

7.4 Vibration due to blasting or any other activity associated with the mining operation, when measured at any point within the notional boundary of any dwelling not owned by the consent holder, shall not exceed a peak particle velocity measured in the frequency range 3-12 Hz of 5 mm/sec provided this level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level shall not exceed 10 mm/sec at any time.

7.5 Airblast overpressure from blasting associated with the mining operation, when measured at any point within the notional boundary of any dwelling not owned by the consent holder shall not exceed a peak non-frequency-weighted (Linear or flat) level of 115 decibels (dB), provided this level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level shall not exceed 120 dB (Linear peak) at any time. For the purpose of this consent, C-frequency-weighting may be considered equivalent to the Linear or Flat-frequency-weighting.

Note: The notional boundary is defined as a line 20 metres from the exterior wall of any rural dwelling or the legal boundary where this is closer to the dwelling.

8. NOISE

Noise limits

8.1 The consent holder shall ensure that all construction and operation activities associated with the mining operations are designed and conducted so that the following noise limits are not exceeded at the locations specified in Condition 8.2:

(a) On any day between 7 am to 9 pm (daytime): 50 dBA L_{Aeq}; and

(b) On any day between 9.00 pm to 7.00am the following day (night-time): 40dBA L_{Aeq}; and/or 70 dBA L_{Amax}.

Measurement Locations

8.2 Noise measurements shall be taken at the notional boundary of any dwelling not owned by the consent holder.

Note: The notional boundary is defined as a line 20 metres from the exterior wall of any rural dwelling or the legal boundary where this is closer to the dwelling.

Measurement and Assessment

8.3 All noise measurements referred to in Conditions 8.1 and 8.2 above shall be measured in accordance with the provisions of NZS 6801:2008 Acoustics: Measurement of Environmental Sound, and shall be assessed in accordance with the provisions of NZS 6802:2008 Acoustics: Environmental Noise.

9. MONITORING OF NOISE, AIRBLAST AND VIBRATION

9.1 Prior to exercise of this consent, the consent holder shall prepare a Noise, Airblast and Vibration Monitoring Plan, which shall be provided to the consent authorities The plan shall include but not be limited to:

(a) Details of the monitoring locations, the frequency of monitoring and the method of measurement and assessment in accordance with Conditions 7.4, 7.5 8.1 and 8.2;
(b) Procedures for recording blasting method, strength of the blast and time of blast; and
(c) Procedures for addressing non-compliant results and notification of the Councils.

9.2 The Noise, Airblast and Vibration Monitoring Plan for this consent may be combined with any other Noise, Airblast and Vibration Monitoring Plan required by any other consent held by the consent holder for mining operations at Macraes Flat.

9.3 The consent holder shall exercise this consent in accordance with the Noise, Airblast and Vibration Monitoring Plan. The consent holder shall review the plan annually and if necessary update it. Confirmation of the review shall be included in the Project Overview and Annual Work and Rehabilitation Plan. The Councils shall be provided with any updates of the plan within one month of any update occurring.

9.4 The consent holder shall produce a report each year summarising the results of the Noise, Airblast and Vibration Monitoring. The report shall be included in the Project Overview and Annual Work and Rehabilitation Programme.

9.5 All measurements from the monitoring programmes shall be recorded and shall be made available to the Councils on request.

10. LIGHTING

10.1 All flood lighting luminaires that could potentially cause a glare nuisance or a traffic hazard shall be fitted with shields and, as far as is practicable, orientated so that the principal output is directed away from residences and traffic.

11. WASTE ROCK STACKS

11.1 The Coronation North waste rock stack shall be designed for operating basis earthquake (OBE) with a recurrence interval of 150 years and maximum design earthquake (MDE) with a recurrence interval of 2,500 years and otherwise shall otherwise be designed in accordance with sound engineering practice.

11.2 The consent holder shall engage a suitably qualified geotechnical engineer to design the waste rock stack. A construction report shall be prepared for the waste rock stack and this report provided to the Councils prior to the commencement of construction of the waste rock stack. The report shall include details of site formation, design construction, appearance, and testing for stability of the waste rock stack, and shall include evaluation of the long-term stability and performance of the waste rock stack.

11.3 The Coronation North waste rock stack shown on "Coronation North Project WDC/DCC LUC Consents Map 1" annexed shall not exceed 695mRL.

12. FINAL PIT LAKES

12.1 The pit shall be designed such that at all times, the pit lake has sufficient freeboard to fully contain waves induced by landslides and earthquakes.

12.2 No less than twelve months prior to commencement of filling of the pit lake, the consent holder shall provide the Councils with a Closure Manual for the lake. The manual shall include, but not be limited to:

(a) Details of how Condition 12.1 shall be achieved;

(b) Details of the lake filling, including but not limited to mean flow-rates, location of inflows and the quality of the discharge; and

(c) Details of the long term pit wall stability.

12.3 The consent holder shall exercise this consent in accordance with the Closure Manual. The consent holder shall review the manual annually and if necessary update it. Confirmation of the review shall be included in the Project Overview and Annual Work and Rehabilitation Plan. The consent holder shall provide the Councils with any updates of the plan within one month of any update occurring.

13. ROADING

13.1 Within 12 months of the Coronation North and Coronation Pits ceasing excavation the consent holder shall reinstate for public use that part of Golden Point Road south of Horse Flat Road shown on "Coronation Project 2013 WDC/DCC LUC Consents Map 1" annexed. At the same time the consent holder shall define and take steps to vest to the Council (and make lawfully available to the Council pending completion of vesting) the legal road.

13.2 To achieve the reinstatement of that part of Golden Point Road under Condition 13.1 the following work must be completed:

(a) The haul road shall be decommissioned, and replaced with a public road that has a minimum road reserve of 15 metres in width, and a carriageway of 5 metres in width;

(b) The public road shall be formed to a minimum 150 mm sub-base and a base course of 100mm AP4O with a wearing course of AP2O;

(c) The road shall also be delineated and marked to a public road standard;

(d) Design and construction details shall be lodged with the Waitaki District Council for its approval.

13.3 Within 6 months of completion of mining operations in Coronation North and Coronation Pits and rehabilitation of the project areas to the point of decommissioning silt ponds, the consent holder shall define and take steps to vest to the respective Councils (and make lawfully available to the Councils pending completion of vesting) a legal road of no less than 20m wide that approximately follows the green line shown on the annexed Figure 2 (as a replacement for the unformed Matheson Road). Depending on the extent of pit excavations, the road may be modified to be south or southwest of the green line. Prior to vesting, the road shall be graded to a standard enabling it to be used as a fine weather track for four wheel drive vehicles. The consent holder shall not have any ongoing responsibility to maintain the track or any form of public access along this unformed road as a consequence of this grading.

13.4 Within 6 months of completion of mining operations in Coronation North and Coronation Pits ceasing and rehabilitation of the project areas to the point of decommissioning silt ponds, the consent holder shall define and take steps to vest to the Waitaki District Council (and make lawfully available to the Council pending completion of vesting) a legal road of no less than 20 metres wide that approximately follows the Coronation haul road alignment (as indicatively shown marked in orange on the annexed Figure 2) between Horse Flat Road and Matheson Road (as a replacement for the unformed Golden Point Road). Prior to vesting, the road shall be graded to a standard enabling it to be used as a fine weather track for four wheel drive vehicles. The consent holder shall not have any ongoing responsibility to maintain the track or any form of public access along this unformed road as a consequence of this grading.

13.5 The consent holder shall provide unformed access that generally follows the orange line south of Horse Flat Road shown on "Coronation Project 2013 WDC/DD LUC Consents Maps" annexed.

Advice Note: All road stopping, temporary road closures and vesting of new road reserve is to be completed under other relevant statutes.

13.6 The consent holder shall prepare a road maintenance plan. The purpose of the road maintenance plan is to monitor the condition of Horse Flat Road, Matheson Road, Longdale Road and Four Mile Road to ascertain whether the need for any maintenance on the road is indicated. The Plan shall be provided in writing to the Councils prior to first exercise of the consent. A copy shall be forwarded to the Chairperson of Macraes Community Incorporated.

The Plan shall include but not be limited to the following:

(a) Details of how road inspections, which are to be carried out before and at completion of mining extraction operations and at least annually during mining extraction operations;

(b) Measures to record any reported roading maintenance issues reported by staff or the public;

(c) Road condition standards to be reported against; and

(d) Details on reporting procedures to the Councils.

13.7 The consent holder shall prepare an annual road maintenance report that sets out the results of road inspections carried out in the previous year and any reported roading maintenance issues. The report shall be provided in writing to the Councils and a copy forwarded to the Chairperson of Macraes Community Incorporated.

14. HERITAGE

14.1 Prior to any land disturbance, the consent holder shall have engaged a suitably qualified and experienced archaeologist to complete a survey of pre and post-1900 archeological sites within the Disturbed Land concerned.

14.2 Within six months of the date of issue of consents, the consent holder shall update the consent holder's Heritage Management Plan for the Macraes site in consultation with Heritage New Zealand Pouhere Taonga to include the Coronation North Project area. The objective of the Heritage Management Plan shall be to avoid the modification or destruction of any identified heritage site unless there is no other reasonable option and to inform and guide the consent holder on the future management of heritage sites in consultation with Heritage New Zealand Pouhere Taonga that includes but is not limited to:

(a) Providing a map of the archaeological sites to be modified or destroyed, and a detailed plan and photographic record for each archaeological site;

(b) Providing a map of the archaeological sites that are to remain unaffected by the mining operation;

(c) Methods to record in situ material;

(d) Methods to recover artefacts discovered from historic workings and procedures to record and, if necessary, save material.

14.3 The consent holder shall provide a copy of the revised Heritage Management Plan to the Councils within 2 months of any update occurring.

14.4 The consent holder shall not modify or destroy those archaeological sites that are mapped as remaining unaffected in Condition 14.2 (b). Where possible, the sites shall be identified on the ground so mining staff are aware of their existence.

14.5 The mining operation shall be carried out in accordance with the updated Heritage Management Plan.

14.6 If the consent holder:

(a) Discovers koiwi tangata (human skeletal remains), or Maori artefact material, the consent holder shall without delay:

(i) Notify the Councils, Tangata whenua and Heritage New Zealand Pouhere Taonga and in the case of skeletal remains, the New Zealand Police.

(ii) Stop work within the immediate vicinity of the discovery to allow a site inspection by Heritage New Zealand Pouhere Taonga and the appropriate runanga and their advisors, who shall determine whether the discovery is likely to be extensive; if a thorough site investigation is required and whether an Archaeological Authority is required.

(iii) Any koiwi tangata discovered shall be handled and removed by tribal elders responsible for the tikanga (custom) appropriate to its removal or preservation.

(b) Discovers any feature or archaeological material that predates 1900, or heritage material, or disturbs a previously unidentified archaeological or heritage site, the consent holder shall without delay:

(i) Cease work immediately at that place and within 20m around the site;

(ii) Shut down all machinery, secure the area, and advise the Site Manager;

(iii) Secure the site and notify the Heritage New Zealand Regional Archaeologist and the Councils. Further assessment by an archaeologist may be required;

(iv) If the site is of Maori origin, notify the Heritage New Zealand Regional Archaeologist, the Councils nad the appropriate iwi groups or kaitiaki representative of the discovery and ensure site access to enable appropriate cultural procedures and tikanga to be undertaken, as long as all statutory requirements under legislation are met (Heritage New Zealand Pouhere Taonga Act 2014, Protected Objects Act 1975). Heritage New Zealand will determine if an archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014 is required for works to continue:

(v) Recommence site work following consultation with the Councils, Heritage New Zealand and iwi, provided that any relevant statutory permissions have been obtained.

Advice note: An archaeological authority from Heritage New Zealand Pouhere Taonga may be required before work can proceed.

14.7 Site work shall recommence following consultation with the Councils, Heritage New Zealand Pouhere Taonga, Tangata whenua, and in the case of skeletal remains, the NZ Police, provided that any relevant statutory permissions have been obtained.

15. NATURE CONSERVATION AND LANDSCAPE VALUES

15.1 Within 6 months of exercising this consent the consent holder shall engage a suitably qualified and experienced ecologist to prepare and submit to the Councils a Coronation North Project Ecological Management Plan ("EMP"). The EMP may be combined with any EMP required by any other consent held by the consent holder for mining operations at Macraes Flat. The purpose of the EMP is to ensure compliance with conditions of this consent and otherwise to minimise the actual and potential adverse effects on the threatened at risk and locally uncommon species and general ecological values. The EMP shall be developed and prepared in consultation with the Department of Conservation and the consent holder shall provide a copy to the Department of Conservation, Nga Runanga, ORC and Councils. The EMP shall:

(a) Include sections covering vegetation and threatened plant management, lizard management and aquatic management;

(b) Have the following objectives:

(i) To minimise the adverse effects from the implementation of the Coronation North Project on amenity/landscape; indigenous vegetation; threatened plants; resident lizard populations; and aquatic biota;

(ii) To protect indigenous flora, threatened, at risk and locally uncommon plants and vegetation types; resident lizard populations, and aquatic fauna where practicable.

(c) Detail the methods by which the objectives set out in Condition 15.1(b) shall be achieved, including:

(i) Legal protection, fencing and management of Island Block and Highlay Hill areas as described in conditions 15.3-15.5;

(ii) propagation of plant species as detailed in condition 15.6;

(iii) transplanting of the threatened plants identified in condition 15.7;

(iv) minimisation of construction effects including during construction of Coronation

North Waste Rock Stack by keeping the area of disturbed land to a minimum; and

(v) monitoring.

(d) The consent holder shall implement the programme of activities specified in the EMP and in any subsequent EMP reports created pursuant to condition 15.2(c).

15.2 The consent holder shall engage a suitably experienced and qualified ecologist, to prepare an annual Coronation North Ecological Monitoring Report:

(a) describing the works and other actions completed by the consent holder in the previous twelve months in order meet the purpose and objectives of the EMP; and

(b) evaluating the progress of the tussock species planting on rehabilitated land, transplanting of threatened plant species and the propagation and subsequent planting of the twelve rare plant species listed in condition 15.6(a).

(c) Describing what methods are to be implemented in the following 12 months in order to meet the purpose and objectives of the EMP.

The consent holder shall provide the Councils, Nga Runanga and Department of Conservation with a copy of the report by no later than 31 July each year. The report may be combined with any EMP report required by any other consent held by the consent holder for mining operations at Macraes Flat.

15.3 The consent holder shall set aside two areas of land comprising:

(a) Approximately 289 hectares known as Island Block as shown on the Plan annexed as Figure 3; and

(b) Approximately 99 hectares known as Highlay Hill as shown on the Plan annexed as Figure 4.

15.4 The consent holder shall fence and manage the areas identified in condition 15.3 to protect existing and naturally regenerating indigenous terrestrial flora and fauna located within the respective land areas. This purpose shall be achieved by:

(a) Fencing both areas as shown on Figures 3 and 4 attached to these conditions and removing all stock from both areas within 18 months of the exercise of this consent.

(b) Felling (but not removing) existing exotic wilding trees within 18 months of exercise of this consent.

(c) Maintaining stock-proof fencing as shown on Figure 4 attached to these conditions.

(d) Allowing natural ecological successional processes to occur on the land by undertaking no farming or mining activities.

15.5 The consent holder shall, within 18 months of the exercise of this consent, execute covenants in favour of the Minister of Conservation over the areas described at condition 15.3 pursuant to section 77 of the Reserves Act 1977, and register the covenants against the relevant land titles. The conservation purposes of the covenants shall be as described at condition 15.4 for protection of terrestrial and not aquatic values, and the obligations of the covenanter shall be limited to maintaining fencing and ensuring the covenanted land is not used for farming or mining purposes. The survey and legal costs associated with creating the covenants in registrable form shall be borne by the consent holder.

15.6 The consent holder shall, using a suitably qualified person or persons, fund measures for the translocation and/or cultivation of seeds, cuttings or other cultivation material from a selection of at least 12 of the following plant species taken from plants located within the impacted footprint of the Coronation North project ("salvage species") for planting out in areas undisturbed by mining activities:

Simplicia laxa;
Pachycladon cheesemanii;
Ranunculus ternatifolius;
Senecio dunedinensis;
Sonchus novae-zealandiae;
Carmichaelia corrugata;
Coprosma intertexta;
Deschampsia cespitosa;
Cardamine bilobata;
Largenophora barkeri;
Annogramma leptophylla;
Carex inopinata;
Aciphylla subflabellata;
Carex tenuiculmis;
Carmichaelia crassicaulis ssp. crassicaulis;
Carex kaloides;
Epilobium insulare
Olearia bullata; and
Rumex flexuosus.

15.7 Annually, as part of the consent holder's Annual Coronation North Ecological Monitoring Report, the area of land to be disturbed in the following 12 months shall be assessed for the presence of the species identified in condition 15.6 above and a programme for cultivating and planting out and/or translocating a selection of plants taken from those species identified shall be determined by the consent holder in consultation with the Department of Conservation.

15.8 The consent holder shall monitor the success of all plantings annually for five years following planting and shall detail the plantings carried out and the "success" of the plantings in its annual Coronation North Ecological Monitoring Report. In this context success means the successful survival and growth of the plant species so that they may form potentially viable populations, and shall be monitored by recording the survival and growth of individual plants and noting any flowering and recruitment of new individuals. Success shall be demonstrated by at least 75% of established plants surviving, or at least 50% of transplants increasing in size compared with their establishment.

15.9 The consent holder shall include in its annual Coronation North Ecological Monitoring Report details of all costs incurred to date to fund the measures outlined in paragraphs 15.6 to 15.8, such funding to total not less than $50,000 (excluding GST) over a period not exceeding 4 years (cultivation and establishment) and 5 years (monitoring). If, upon assessment of the monitoring results for the fourth year of operations following (and including) the year in which the consent holder first exercises this consent, the consent holder in consultation with the Department of Conservation determines that fewer than 10 plants of each of 12 salvage species are growing, in a manner that is successful as described in Condition 15.8, then:

(a) the consent holder may discontinue any further measures under paragraphs 15.6 to 15.8; and
(b) whether the consent holder discontinues such measures or not, the difference (if any) between the total costs incurred to that time to fund the measures outlined in paragraphs 15.6 to 15.8 and the total budget for such measures of $50,000 shall be transferred to the Habitat Enhancement Fund.

15.10 The consent holder is under no obligation to continue any measures under paragraphs 15.6 to 15.8 beyond nine years from first exercise of this consent.

15.11 Within 6 months of the exercise of this consent the consent holder shall make provision for the total sum of NZ$75,000 to be available for use by an appropriately qualified researcher, Masters or PhD student over 3 years to:
(a) participate in the lizard habitat creation required by condition 15.12 below and to conduct research to determine the success of that or similar habitat; and
(b) conduct research into the effect of mitigation for mining activities on lizard populations as outlined in condition 15.13 below.

These monies shall be paid to the DCC for administrative purposes, and to ensure they are spent appropriately.

15.12 (a) The consent holder shall construct at least ten lizard habitat areas (each one approximately 10m x 10m or equivalent area) consisting of vegetated, deep rock piles and boulders. This lizard habitat shall be within:
(i) areas in and around the margins of the Coronation North Waste Rock Stack identified by the researcher referred to in condition 15.11 or a suitably qualified herpetologist as suitable for lizard habitat creation;
(ii) areas surrounding the Coronation North Project Area identified by the researcher referred to in condition 15.11 or a suitably qualified herpetologist as suitable for lizard habitat creation.
(b) The consent holder shall consult with the researcher referred to in condition 15.11 or a suitably qualified herpetologist when placing and designing lizard habitat.
(c) As a minimum, the consent holder shall create habitat designed and constructed to provide suitable refuge for the range of lizard species found within the Coronation North project footprint.
(d) The consent holder shall only plant fruit bearing shrubs and tussocks around the margins of rock piles to benefit lizards where it is recommended by the researcher referred to in condition 15.11 or a suitably qualified herpetologist.
(e) The consent holder shall arrange for the researcher referred to in condition 15.11 or a suitably qualified herpetologist to monitor lizard colonisation of new rock piles on an annual basis for five years from the creation of the

piles, using best practice techniques to detect changes in abundance over time. The results of this monitoring shall be reported each year in the annual Coronation North Ecological Monitoring Report.

15.13 The consent holder shall assist the researcher referred to in condition 15.11 to undertake research that has the objective of identifying the benefit of the conservation and preservation of the lizard species affected by the Coronation North project. This study may include survey of the footprint of the Coronation North waste rock stack before construction, survey of the Coronation North waste rock stack during construction and survey of a suitable control site to compare population numbers and diversity.

15.14 The consent holder shall establish a Habitat Enhancement Fund ("the Fund") of up to $250,000 to be paid by instalments pursuant to condition 15.16 below. The Dunedin City Council shall receive and administer the Fund, in consultation with Waitaki District Council for the purpose stated in condition 15.15 below.

15.15 The purpose of the Fund shall be to protect and enhance significant terrestrial ecology values, that are found in the Macraes Ecological District, which may include but are not limited to lizards and their habitat. For the avoidance of doubt, the Fund may be spent on a project or projects in accordance with the following priority order:

(a) It is related to land within the Macraes Ecological District.

(b) It is related to land within either or both the Dunedin City or Waitaki District local authority areas.

(c) It is related to land within the Otago region and significant terrestrial ecology values that are found within the Macraes Ecological District.

15.16 The Fund shall be endowed by the consent holder in instalments as follows:

(a) $117,000 shall be paid before, pursuant to condition 4.5(a) above, waste rock is first deposited in Area A shown on "Coronation North Waste Rock Stack Option" shown in Figure 1 attached to these conditions.

(b) $67,000 shall be paid on the earlier of:

1. Two (2) years from the date when waste rock is first deposited in Area A; or
2. The date upon which waste rock is first deposited in Area B shown on "Coronation North Waste Rock Stack Option shown in Figure 1 attached to these conditions.

(c) $66,000 shall be paid on the earlier of:

1. Four (4) years from the date when waste rock is first deposited in Area A; or
2. The date upon which waste rock is first deposited in Area C

PROVIDED THAT the payment required by Condition 15.16(c) shall not be required if, prior to either of the events described in condition 15.16(c)(1) and (2) occurring the consent holder provides written confirmation to the Councils that it does not intend to place waste rock in Area C and makes an application under s127 to vary this consent be removing the ability to place waste rock in Area C.

15.17 All of the payments made by the consent holder under condition 15.16 above shall be made to the Dunedin City Council, whose receipt of payment shall constitute fulfilment of the consent holder's responsibility.

16. FENCING

16.1 Stock-proof fencing shall be used to keep livestock away from all working areas.

16.2 On the completion of mining operations the consent holder shall ensure that all fences, required to restrict people and/or stock for safety purposes, are installed and maintained. This shall include fences to be installed and maintained around Coronation North and Coronation pit lakes.

17. MANAGEMENT OF HAZARDOUS SUBSTANCES

17.1 The Consent Holder shall ensure that all fuels and oils used at the site are contained in appropriately bunded facilities and that all fuel/oil dispensers are fitted with non-return valves.

17.2 Refuelling, lubrication and any mechanical repairs shall be undertaken in a manner that provides sufficient mitigation measures to ensure that no spillages onto the land surface or into water occur.

18 BONDS

Obligations to be secured

18.1 The consent holder shall provide and maintain in favour of the Councils one or more bonds to secure:

(a) The performance and completion of rehabilitation in accordance with the conditions of this consent; and

(b) The carrying out of the monitoring required by the conditions of this consent;
and

(c) The remediation of any adverse effect on the environment that may arise from the exercise of this consent; and

(d) Compliance with conditions 18.13 - 18.17 of this consent.

When bonds to be provided

18.2 Before the commencement of this consent, the consent holder shall provide to the Councils one or more bonds required by Condition 18.1

Form of bond

18.3 Subject to the other provisions of this condition, any bond shall be in the form and on the terms and conditions approved by the Councils.

Surety

18.4 Any bond shall be given or guaranteed by a surety acceptable to the Councils.

18.5 The surety shall bind itself to pay for the carrying out and completion of the conditions of consent which are the subject of the bond on default by the consent holder or the occurrence of any adverse environment effect requiring remedy during or after the expiry of this consent.

Amount

18.6 The amount of each bond shall be fixed annually by the Councils which will take into account any calculations and other matters submitted by the consent holder relevant to the determination of the amount to be bonded in the Project Overview and Annual Work and Rehabilitation Plan, or otherwise.

18.7 The amount of the bond(s) shall include:

(a) The estimated costs of complete rehabilitation in accordance with the conditions of consent on the completion of the mining operations proposed for the next year and described in the Project Overview and Annual Work and Rehabilitation Plan.

(b) The estimated costs of:

i. Monitoring in accordance with the monitoring conditions of the consent;

ii. Monitoring for and of any adverse effect of the activity authorised by this consent which may become apparent during or after expiry of this consent;

iii. Monitoring any rehabilitation required by this consent.

(c) Any further sum which the consent authority considers necessary for monitoring and dealing with any adverse effect on the environment that may arise from the exercise of the consent whether during or after the expiry of this consent.

18.8 The amount shall be calculated for the duration of this consent and for a period of 20 years after its expiry.

18.9 If, on review, the total amount of bond to be provided by the consent holder is greater or less than the sum secured by the current bond(s), the consent holder, surety and the Councils may, in writing, vary the amount of the bond(s).

General

18.10 While the liability of the surety is limited to the amount of the bond(s), the liability of the consent holder is unlimited.

18.11 Any bond may be varied, cancelled, or renewed at any time by written agreement between the consent holder, surety and Councils.

Costs

18.12 The costs (including the costs of the consent authority) of providing, maintaining, varying and reviewing any bond shall be paid by the consent holder.

Bonding on expiry or surrender of this consent

18.13 For a period of 20 years from the expiry or surrender of this consent the consent holder shall provide in favour of the Councils one or more bonds.

18.14 The amount of the bond to be provided under Condition 18.13 shall include the amount (if any) considered by the Councils necessary for:

(a) Completing rehabilitation in accordance with the conditions of this consent.

(b) Monitoring for and of any adverse effect on the environment that may arise from the exercise of the consent.

(c) Monitoring any measures taken to prevent, remedy or mitigate any adverse effect on the environment that may arise from the exercise of this consent.

(d) Dealing with any adverse effect on the environment which may become apparent after the surrender or expiry of this consent.

(e) Contingencies.

18.15 Without limitation, the amount secured by the bond given under Condition 18.13 may include provision to deal with structural instability or failure, land and water contamination, and the failure of rehabilitation in terms of the rehabilitation objectives and conditions of this consent. Costs shall include costs of investigating, preventing, remedying or mitigating any adverse effect.

18.16 The bond(s) required by Condition 18.13 must be provided on the earlier of:

(a) 12 months before the expiry of this consent;
(b) Three months before the surrender of this consent.

18.17 Conditions 18.3, 18.4, 18.5, 18.8, 18.9, 18.10 and 18.11 apply to the bond(s) required by Condition 18.13.

19. PUBLIC LIABILITY INSURANCE

19.1 The consent holder shall effect and keep current public liability insurance for an amount not more than twenty million dollars. The amount shall be determined by the Councils in consultation with the consent holder.

19.2 The indemnity expressed in the insurance policy shall be sufficiently wide in its coverage so as to include claims arising from damage caused by structural failure, or damage resulting from fire or explosion and all fire fighting costs resulting from the consent holder's operations in respect of the land and from any accidental or otherwise spillage of any chemical or reagent and/or resulting clean up and restoration costs and the costs of mitigation of those events.

19.3 The consent holder shall provide to the Councils annually a copy of the insurance policy and the receipt evidencing payment of the premium in respect of any such policy.

19.4 The consent holder shall also indemnify the Councils against any claim arising from the public use of public roads for the time being under control of the consent holder.

20. CLOSURE OF OPERATIONS

20.1 The consent holder shall annually supply to the Councils a contingency plan for the early closure of the mine, as part of the Project Overview Annual Work and Rehabilitation Programme. This contingency plan shall be updated annually. The plan shall address the objectives listed in Condition 4 and include:

(a) An evaluation of the residual risk of the operation with regard to the neighbouring community and environment; and

(b) A plan for the long term management of the site, in particular the area of open pits or consequent lakes and the Coal Creek water reservoir, and include details of on-going maintenance and monitoring requirements and restrictions on future use.

(c) Describe in detail what needs to be done to:

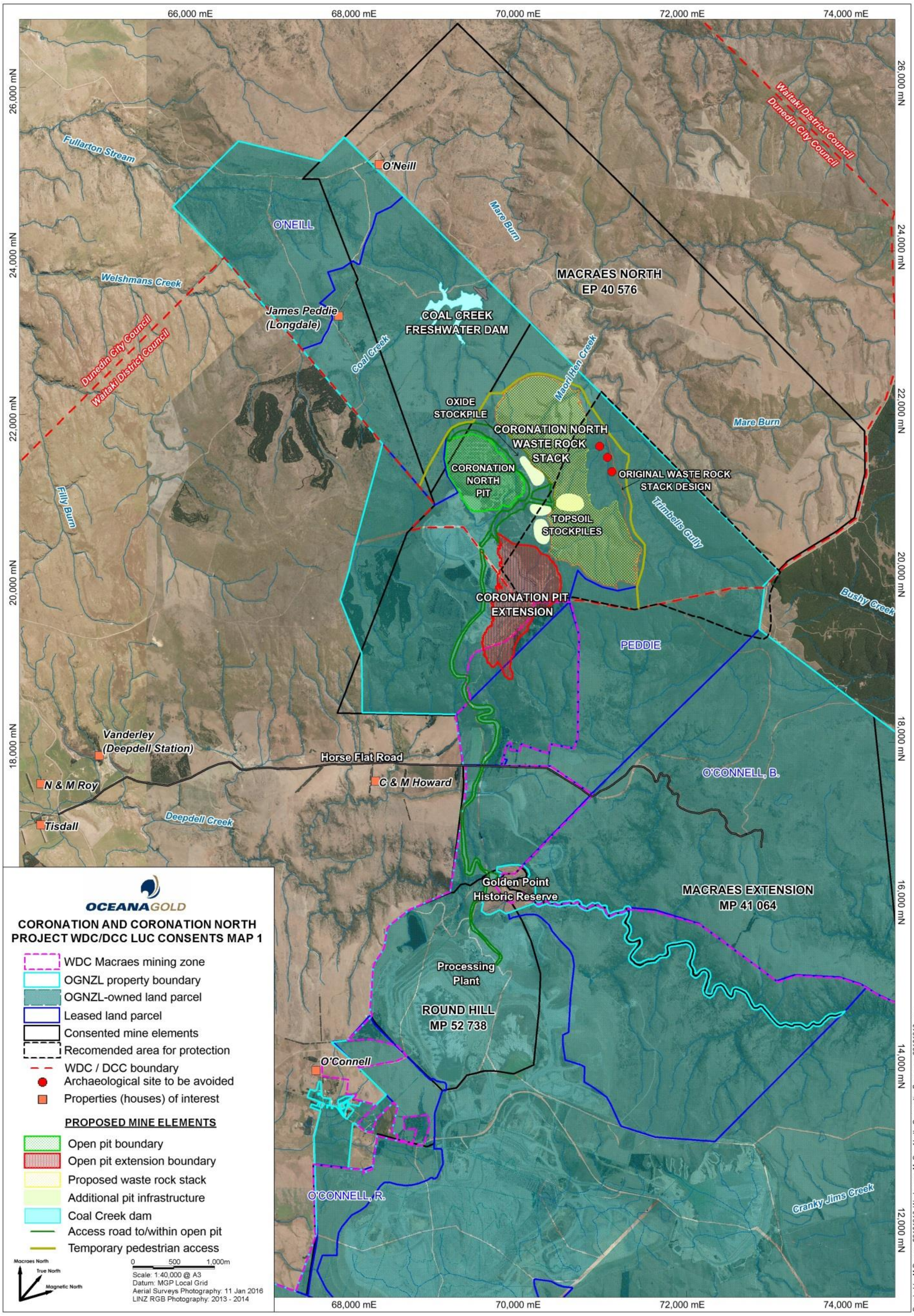
i. Decommission the mine site in accordance with this consent;

ii. Rehabilitate the mine site in accordance with this consent;

iii. Comply with other conditions relevant to cessation of mining; and

iv. The costs needed to comply with (i)-(iii).

ANNEXES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72,000 mE
74,000 mE
26,000 mN
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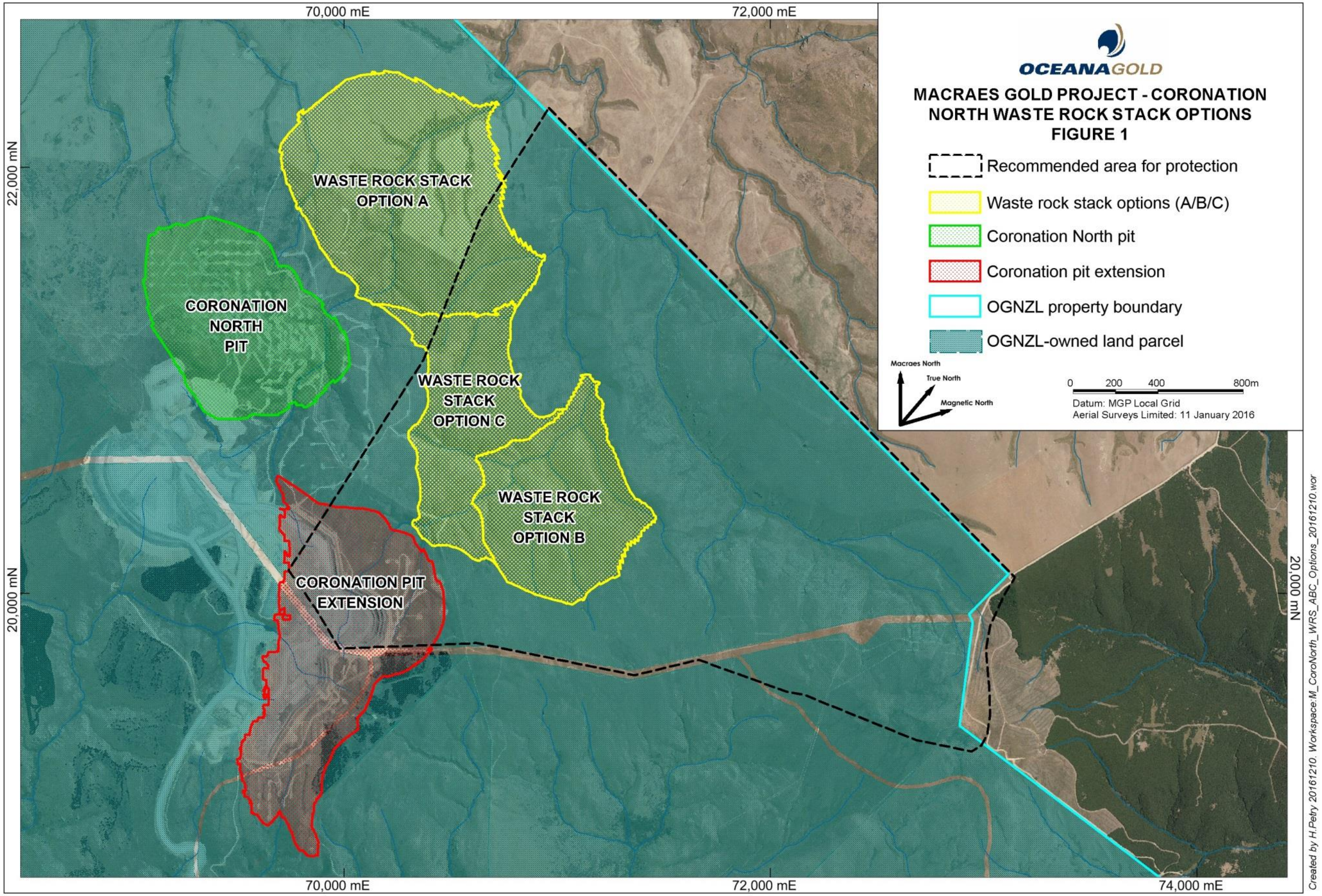
22,000 mN
20,000 mN
18,000 mN
16,000 mN
14,000 mN
12,000 mN
Fullarton Stream
O'Neill
O'NEILL
Mare Burn
Waitaki District Council
Dunedin City Council
Welshmans Creek
MACRAES NORTH
EP 40 576
James Peddie
(Longdale)
COAL CREEK
FRESHWATER DAM
Coal Creek
Maori Hen Creek
OXIDE
STOCKPILE
CORONATION NORTH
WASTE ROCK
STACK
CORONATION
NORTH
PIT
ORIGINAL WASTE ROCK
STACK DESIGN
TOPSOIL
STOCKPILES
Trimbells Gully
Filly Burn
CORONATION PIT
EXTENSION
Bushy Creek
PEDDIE
Vanderley
(Deepdell Station)
Horse Flat Road
N & M Roy
C & M Howard
O'CONNELL, B.
Tisdall
Deepdell Creek
Golden Point
Historic Reserve
MACRAES EXTENSION
MP 41 064
OCEANAGOLD
CORONATION AND CORONATION NORTH
PROJECT WDC/DCC LUC CONSENTS MAP 1
WDC Macraes mining zone
OGNZL property boundary
OGNZL-owned land parcel
Leased land parcel
Consented mine elements
Recomended area for protection
WDC / DCC boundary
Archaeological site to be avoided
Properties (houses) of interest
PROPOSED MINE ELEMENTS
Open pit boundary
Open pit extension boundary
Proposed waste rock stack
Additional pit infrastructure
Coal Creek dam
Access road to/within open pit
Temporary pedestrian access
Processing
Plant
ROUND HILL
MP 52 738
O'Connell
O'CONNELL, R.
Cranky Jims Creek
0
500
1,000m
Scale: 1:40,000 @ A3
Datum: MGP Local Grid
Aerial Surveys Photography: 11 Jan 2016
LINZ RGB Photography: 2013 - 2014



70,000 mE
72,000 mE
74,000 mE
22,000 mN
20,000 mN
OCEANAGOLD
MACRAES GOLD PROJECT - CORONATION NORTH WASTE ROCK STACK OPTIONS
FIGURE 1
Recommended area for protection
Waste rock stack options (A/B/C)
Coronation North pit
Coronation pit extension
OGNZL property boundary
OGNZL-owned land parcel
Macraes North
True North
Magnetic North
0 200 400 800m
Datum: MGP Local Grid
Aerial Surveys Limited: 11 January 2016
WASTE ROCK STACK OPTION A
CORONATION NORTH PIT
WASTE ROCK STACK OPTION C
WASTE ROCK STACK OPTION B
CORONATION PIT EXTENSION
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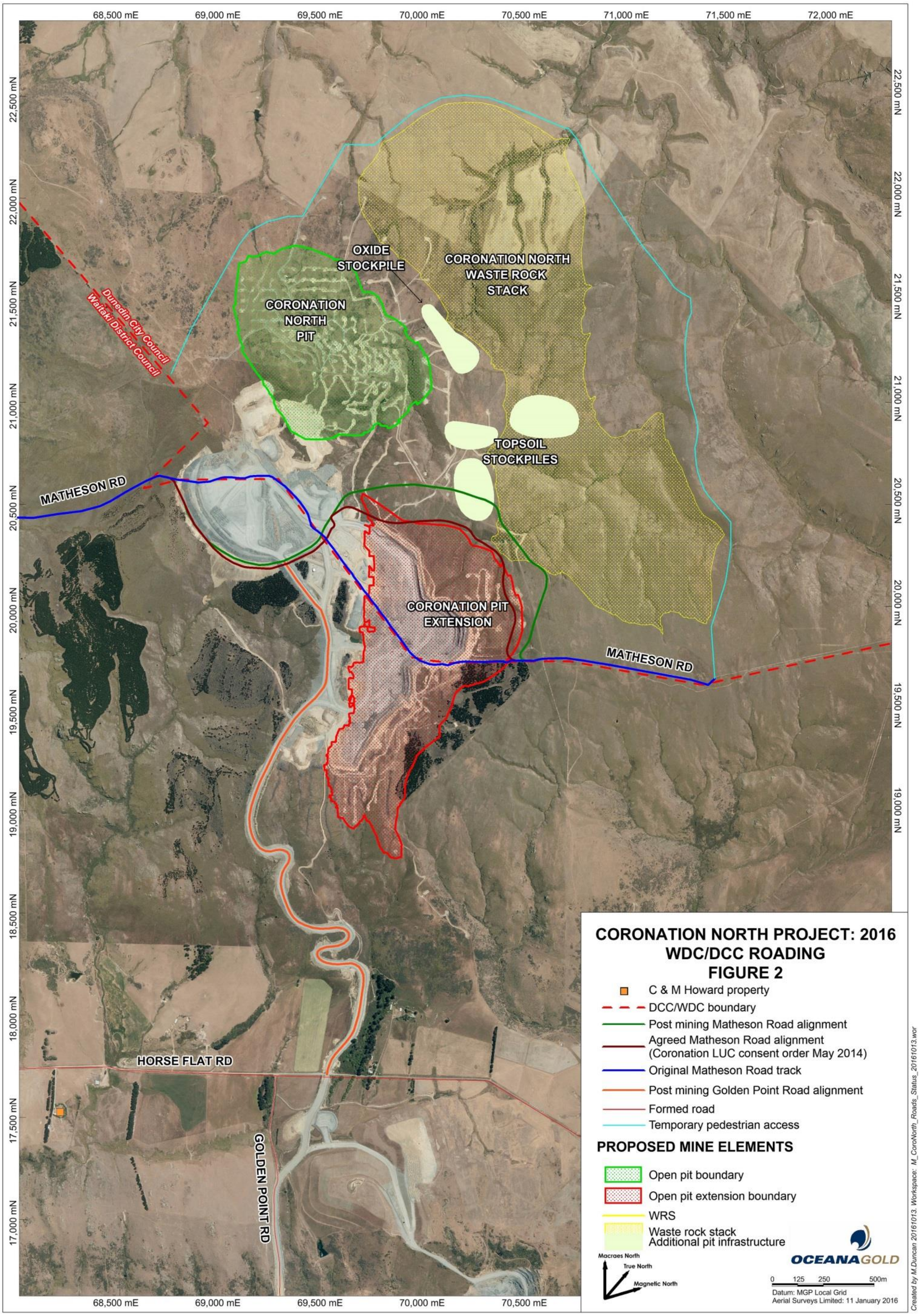
CORONATION NORTH PROJECT: 2016
WDC/DCC ROADING
FIGURE 2
C & M Howard property
DCC/WDC boundary
Post mining Matheson Road alignment
Agreed Matheson Road alignment (Coronation LUC consent order May 2014)
Original Matheson Road track
Post mining Golden Point Road alignment
Formed road
Temporary pedestrian access
PROPOSED MINE ELEMENTS
Open pit boundary
Open pit extension boundary
WRS
Waste rock stack
Additional pit infrastructure
OCEANAGOLD
Macraes North
True North
Magnetic North
0 125 250 500m
Datum: MGP Local Grid
Aerial Surveys Limited: 11 January 2016
Created by M.Duncan 20161013. Workspace: M_CoroNorth_Roads_Status_20161013.wor
CORONATION NORTH PIT
OXIDE STOCKPILE
CORONATION NORTH WASTE ROCK STACK
TOPSOIL STOCKPILES
CORONATION PIT EXTENSION
MATHESON RD
MATHESON RD
HORSE FLAT RD
GOLDEN POINT RD
Dunedin City Council
Waitaki District Council
68,500 mE
69,000 mE
69,500 mE
70,000 mE
70,500 mE
71,000 mE
71,500 mE
72,000 mE
22,500 mN
22,000 mN
21,500 mN
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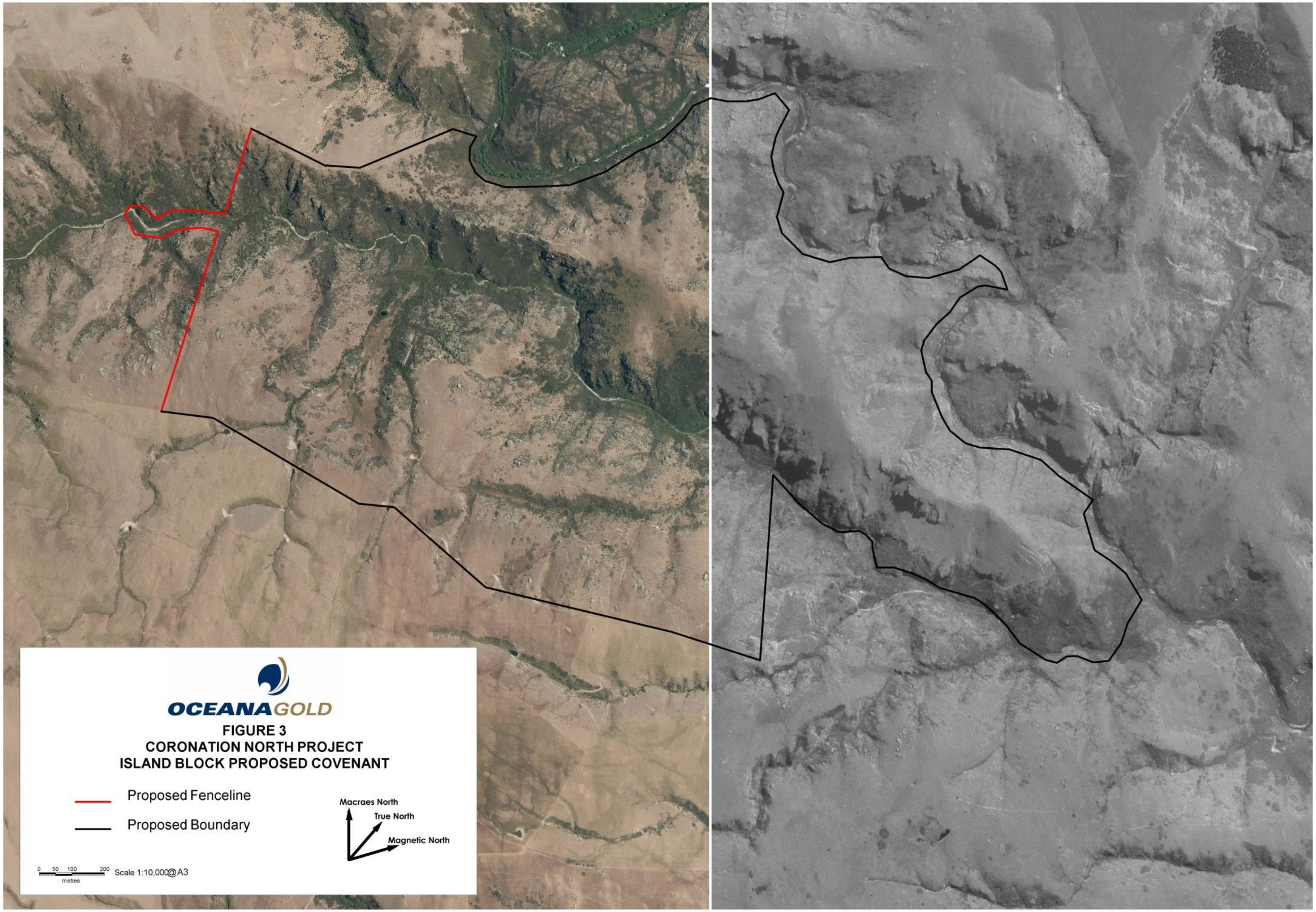
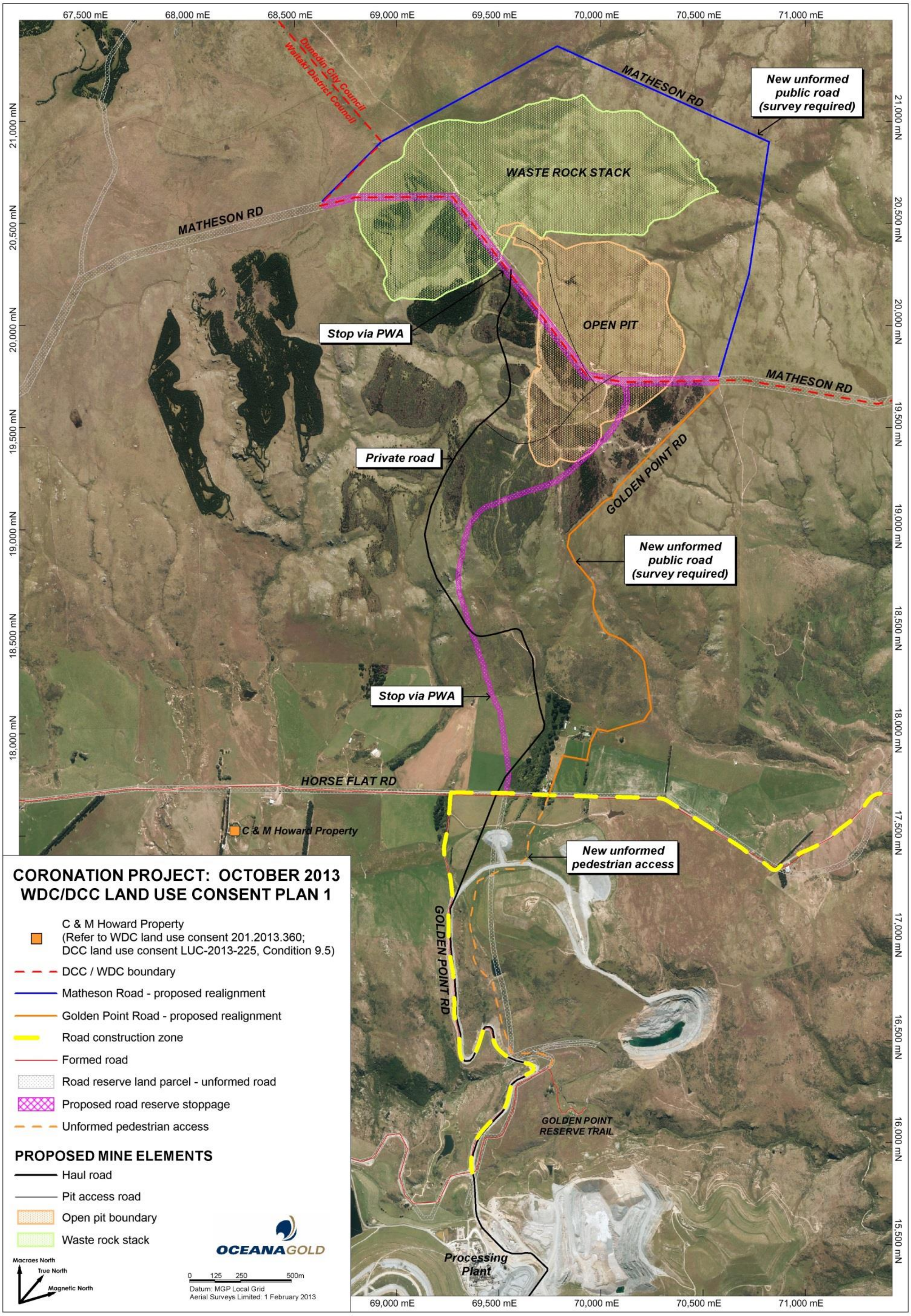
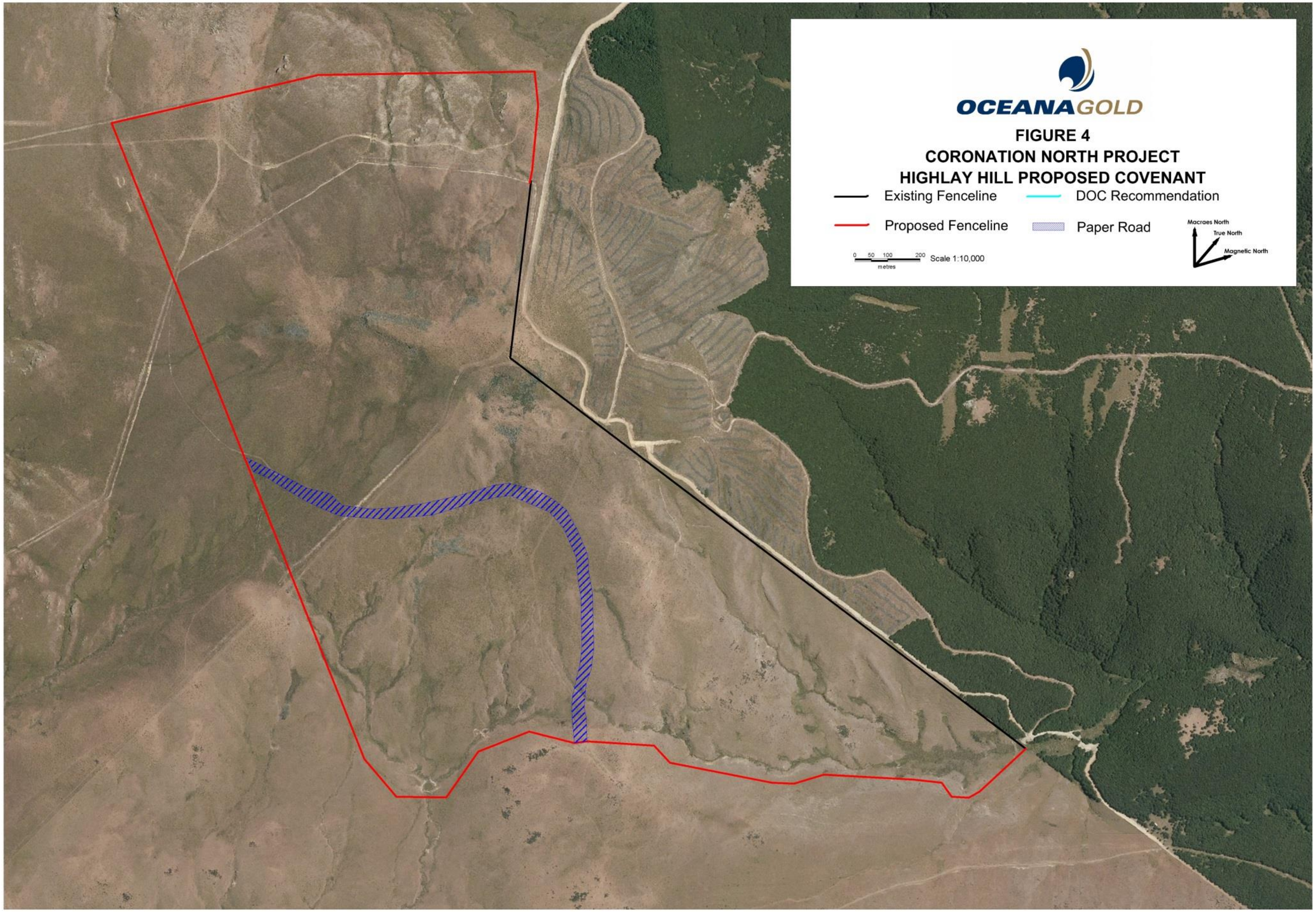

OCEANAGOLD
FIGURE 3
CORONATION NORTH PROJECT
ISLAND BLOCK PROPOSED COVENANT
Proposed Fenceline
Proposed Boundary
Macraes North
True North
Magnetic North
0 50 100 200
metres
Scale 1:10,000@A3



CORONATION PROJECT: OCTOBER 2013
WDC/DCC LAND USE CONSENT PLAN 1
C & M Howard Property
(Refer to WDC land use consent 201.2013.360;
DCC land use consent LUC-2013-225, Condition 9.5)
DCC / WDC boundary
Matheson Road - proposed realignment
Golden Point Road - proposed realignment
Road construction zone
Formed road
Road reserve land parcel - unformed road
Proposed road reserve stoppage
Unformed pedestrian access
PROPOSED MINE ELEMENTS
Haul road
Pit access road
Open pit boundary
Waste rock stack
OCEANAGOLD
Macraes North
True North
Magnetic North
0 125 250 500m
Datum: MGP Local Grid
Aerial Surveys Limited: 1 February 2013
Created by H.Petty 20131022. Workspace: M_Coro_Roads_Status_20131022.wor
67,500 mE
68,000 mE
68,500 mE
69,000 mE
69,500 mE
70,000 mE
70,500 mE
71,000 mE
21,000 mN
20,500 mN
20,000 mN
19,500 mN
19,000 mN
18,500 mN
18,000 mN
17,500 mN
17,000 mN
16,500 mN
16,000 mN
15,500 mN
Dunedin City Council
Waitaki District Council
MATHESON RD
New unformed
public road
(survey required)
WASTE ROCK STACK
OPEN PIT
Stop via PWA
Private road
GOLDEN POINT RD
HORSE FLAT RD
C & M Howard Property
New unformed
pedestrian access
GOLDEN POINT
RESERVE TRAIL
Processing
Plant


OCEANAGOLD
FIGURE 4
CORONATION NORTH PROJECT
HIGHLAY HILL PROPOSED COVENANT
Existing Fenceline
DOC Recommendation
Proposed Fenceline
Paper Road
0 50 100 200
metres
Scale 1:10,000
Macraes North
True North
Magnetic North

OCEANAGOLD
DCC & WDC CONSENT AND CONDITIONS
22 NOVEMBER 2013

Waitaki District Council and Dunedin City Council

LAND USE CONSENT "CORONATION" – OCEANA GOLD (NZ) LTD

WDC Reference: 201.2013.360
DCC Reference: LUC-2013-225

Pursuant to the Resource Management Act 1991, the Waitaki District Council and Dunedin City District Council grants its consent to Oceana Gold (New Zealand) Limited for gold mining operations involving:

(a) The extraction of minerals and overburden by mechanical means from the Coronation pit shown on "Coronation Project October 2013 WDC/DCC LUC Consents Map 1" annexed;

(b) The transport, treatment and processing of minerals extracted from the Coronation pit;

(c) The stacking, deposit and storage of substances considered to contain any mineral from the Coronation pit ;

(d) The deposit of waste rock produced by Coronation pit on the Coronation waste rock stack shown on "Coronation Project October 2013 WDC/DCC LUC Consents Map 1"annexed and described at (a) above and the deposit of waste rock as backfill into the Coronation pit;

(e) The construction, maintenance and use of a haul road from Coronation pit to gold processing plant;

(f) The construction and use of two haul road crossings (approximately centred at grid reference NZTM 2000 1397100E 4975800N Horse Flat Road and NZTM 2000 1398200E 4974200N Golden Point Road);

(g) The use and storage of diesel and explosives;

(h) The construction and use of temporary buildings;

(i) The de-commissioning, rehabilitation, de-construction or dismantling of the mine and of any structures and works resulting from activities set out in paragraphs a-g above;

(j) The construction, operation and maintenance of silt ponds and silt control facilities necessary for controlling runoff from Coronation mining operation;

(k) The formation of a pit lake in the Coronation pit.

The duration of this consent shall be 35 years.

DEFINITIONS

"Act" means the Resource Management Act 1991, and includes all amendments to the Act, and any enactments made in substitution for the Act.

"Project Overview and Annual Work and Rehabilitation Plan" means the Project Overview and Annual Work and Rehabilitation Plan required by Condition 3.

"Building" means any temporary or permanent structure.

"Building Work" means work for or in connection with the construction, alteration, operation, demolition or removal of a building and includes site work.

"Councils" means the Waitaki District Council and the Dunedin City Council and includes its successors, and also includes any person to whom the consent authorities delegate or transfers any of its functions, powers and duties as a consent authority under the Act.

"**Disturbed Land**" means any land where the soil has been removed or modified and includes any waste rock stacks, or any other structures that have not been rehabilitated with soil and vegetation;

"Exploration" means any activity undertaken for the purpose of identifying mineral deposits or occurrences and evaluating the feasibility of mining particular deposits or occurrences of one or more minerals; and includes any drilling, dredging, or excavations (whether surface or sub-surface) that are reasonably necessary to determine the nature and size of a mineral deposit or occurrence; and "to explore" has a corresponding meaning.

"Landscape Architect" means a professional member of the New Zealand Institute of Landscape Architects Inc or equivalent body.

"**Life of the Macraes Gold Project**" means the period ending when all mining operations at Macraes cease.

"Macraes Ecological District" means the area described by the Department of Conservation (James Bibby), 1997: *Macraes ecological district: survey report for the Protected Natural Areas Programme*, ISBN 0478019254, 9780478019254 and as also defined in McEwen, W.M. (1987): *Ecological regions and districts of New Zealand, incorporating third revised edition in four 1:500 000 maps (Part 4)*. New Zealand Biological Resources Centre publication No. 5. 125p + maps.

"Mining" means to take, win, or extract, by whatever means, a mineral existing in its natural state in land, or a chemical substance from that mineral, for the purpose of obtaining the mineral or chemical substance; but does not include prospecting or exploration; and "to mine" has a corresponding meaning.

"Mining Operations" means operations in connection with mining, exploring, or prospecting for any mineral, gold, including –

(a) The extraction, transport, treatment, processing, and separation of any gold mineral; and

(b) The construction, maintenance, and operation of any works, structures, and other land improvements, and of any machinery, and equipment, connected with such operations; and

(c) The removal of overburden by mechanical or other means, and the stacking, deposit, storage, and treatment of any substance considered to contain any mineral; and

(d) The deposit or discharge of any mineral, material, debris, tailings, refuse, or wastewater produced from or consequent on, any such operations; and

(e) The doing of all lawful acts incidental or conducive to any such operations - when carried out at or near the site where the mining, exploration, or prospecting is carried out.

"ORC" means the Otago Regional Council and includes its successors, and also includes any person to whom the council delegates or transfers any of its functions, powers and duties under the Act

"Prospecting" means any activity undertaken for the purpose of identifying land likely to contain exploitable mineral deposits or occurrences; and includes:

(a) Geological, geochemical, and geophysical surveys;

(b) The taking of samples by hand or hand held methods; and

(c) Aerial Surveys, -

and "to prospect" has a corresponding meaning.

"Site work" means work on a building site, including earthworks, preparatory to or associated with the construction, alteration, demolition or removal of a building.

"Structure" includes a dam and a waste rock stack.

"Supporting documents" means the supporting documents listed as Appendices 1- 17, and Addendums to the application lodged and receipted by the Councils on June 2013, and also includes all other material (including statements of evidence and submissions) provided by the applicant to the consent authority in support of the application for the consent.

"Rehabilitation objectives and terms" means the rehabilitation, objectives and terms set out in Condition 4.

"Works" includes any excavation, drilling and includes a road.

1 GENERAL

1.1 This consent shall be exercised substantially in accordance with the Coronation application for resource consent lodged to, and receipted by, the Councils in June 2013, including the Assessment of Environmental Effects and all Supporting Documents (which are deemed to be incorporated in, and form part of this consent), except to the extent that any condition in this consent is inconsistent with such material. If there is an inconsistency the conditions and terms of this consent shall prevail.

1.2 Pursuant to Section 125(1) of the Resource Management Act 1991 this consent shall lapse on the expiry of five years after the date of issue of the consent unless the consent is given effect to before the end of that period or upon application in terms of Section 125 (1) (b) of the Act, the Councils may grant a longer period of time.

1.3 The consent holder shall notify the Councils in writing of the first exercise of this consent.

1.4 In addition to the fees payable for the processing of this application, where further site inspections are required to monitor compliance with any of the conditions, the Councils may render an account to the consent holder for additional monitoring fees at the rate prescribed in the Annual Plan on the basis of time involved.

1.5 In the event of any non-compliance with the conditions of this consent, the consent holder shall notify the Councils within 24 hours of the non-compliance being detected. Within five working days the consent holder shall provide written notification to the

Councils providing details of the non-compliance. This notification will at a minimum include an explanation of the cause of the non-compliance, the steps taken to remedy the situation and steps taken to avoid any future occurrence of the non-compliance.

1.6 The Councils may, in accordance with sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions in the last week of March in any year:

for the purposes of:

(a) Dealing with any adverse effect on the environment which may arise from the exercise of this consent and which is appropriate to deal with at a later stage,

(b) Ensuring the conditions of this consent are appropriate,

(c) Ensuring rehabilitation is completed in accordance with the rehabilitation conditions of this consent;

(d) Requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment.

1.7 The Councils may, within 6 months of receipt of the Coronation Project Addendum to the MPIII Cultural Impact Assessment prepared by Kai Tahu Ki Otago on behalf of Te Rūnanga o Moeraki, Te Runanga o Otakou and Kāti Huirapa Rūnaka ki Puketeraki, commissioned in 2013, serve notice of its intention under Sections 128 and 129 to review the conditions of this consent for the purpose of amending or adding conditions to avoid, remedy or mitigate any adverse effects on cultural values and associations from activities authorised under this consent.

1.8 The consent holder shall remedy or adequately mitigate any adverse effect on the environment from the exercise of this consent which becomes apparent after the expiry of this consent.

1.9 Prior to the expiry of this consent, the consent holder shall ensure that all rehabilitation and everything necessary to comply with the conditions of this consent has been completed.

2 LOCATION OF VARIOUS MINING ACTIVITIES

2.1 The pit, waste rock stack and haul road shall not materially exceed those footprints shown on "Coronation Project October 2013 WDC/DCC LUC Consents Map 1" annexed.

2.2 All waste rock stacks shall be formed so that the whole footprint of the stack is used as shown on "Coronation Project October 2013 WDC/DCC LUC Consents Map 1" annexed unless the waste rock stack is reduced proportionally.

3 PROJECT OVERVIEW AND ANNUAL WORK AND REHABILITATION PLAN

3.1 The consent holder shall submit a Project Overview and Annual Work and Rehabilitation Plan to the Councils by 31 March each year that will cover the forthcoming year (1 July to 30 June). The consent holder may, at any time, submit to the Councils an amended Project Overview and Annual Work and Rehabilitation Plan. The Project Overview and Annual Work and Rehabilitation Plan shall include, but not be limited to:

(a) A description and timeline of intended mining activities for the duration of mining operations including a plan showing the location and contours of all existing and proposed structures at completion of mining;

(b) A description (including sequence, method and form) of mining operations, monitoring and reporting carried out in the last 12 months;

(c) A detailed description (including sequence, method and form) of all mining operations, monitoring and reporting, not covered by a separate management plan intended to be carried out in the next 12 months;

(d) An explanation of any departure in the last 12 months from the previous Project Overview and Annual Work and Rehabilitation Plan;

(e) Plans showing the contours (at 5 metre intervals) and footprints of all works and structures and any proposed changes at the end of the next 12 months;

(f) A description and analysis of any unexpected adverse effects on the environment that have arisen as a result of the exercise of the consent in the last 12 months and the steps taken to deal with it and the results of those steps;

(g) A description and analysis of any non-compliance with any conditions of consent that have occurred in the last 12 months and the steps that were taken to deal with it and the results of those steps;

(h) A full report describing and evaluating the mitigation measures used in the last 12 months and any that are proposed to be implemented in the next 12 months. This should detail where further mitigation is proposed or has been undertaken as a result of a non-compliance event and/or any adverse effects on the environment;

(i) A summary description of all Management Plans and Manuals required under this landuse consent and any resource consents issued by ORC and details of any review or amendment of any of the Management Plans or Manuals;

(j) An overview of the monitoring and reporting programme for the previous 12 months and any changes proposed for the next 12 months;

(k) A detailed section on rehabilitation including, but not limited to the following:

   i. The total area of disturbed land during the mining of Coronation, including the haul road, yet to receive rehabilitation and indicative rehabilitation dates for various areas of the mine site;
   ii. The area of additional disturbed land in the coming year that will require future rehabilitation;
   iii. The area of disturbed land rehabilitated in the previous year;
   iv. The area of disturbed land proposed to be rehabilitated in coming year;
   v. A description of rehabilitation planned for the life of mine at Coronation;
   vi. A description of proposed rehabilitation methods for any area, including proposed topsoil to be stripped and stockpiled, surface pre-treatment and re-use of topsoil on finished areas in the next 12 months.;
   vii. The details of the location, design (including shape form and contour) and construction of all permanent structures;
   viii. Drainage details for any disturbed land and recently rehabilitated areas;
   ix. Details of any vegetation to be used as part of rehabilitation for the next 12 month period;
   x. Detailed results of any revegetation trials.

(l) A description of any rehabilitation problems encountered and the steps being taken to resolve these problems;

(m) An up to date and detailed calculation of the cost of dealing with any adverse effects on the environment arising or which may arise from the exercise of this consent;

(n) An up to date and detailed calculation of the costs of complying with all rehabilitation conditions of this consent;

(o) An up to date and detailed calculation of the costs of any monitoring required by the conditions of this consent;

(p) A contingency closure plan describing in detail the steps that would need to be taken if mining operations stopped in the next 12 months in accordance with Condition 20; and

(q) Any other information required by any other condition of this consent and any related consent.

3.2 Each year the consent holder shall provide the Chair of Macraes Community Incorporated, Kāti Huirapa ki Puketeraki, Te Runanga o Otakou and Te Rūnanga o Moeraki with a copy of each Project Overview and Annual Work and Rehabilitation Plan.

3.3 The Project Overview and Annual Work and Rehabilitation Plan for this consent may be combined with any Project Overview and Annual Work and Rehabilitation Plan required by any other consent held by the consent holder for mining operations at Macraes Flat.

3.4 The consent holder shall provide the Councils with any further information, or report, which the Councils may request after considering any Project Overview and Annual Work and Rehabilitation Plan. This information or report shall be provided in the time and manner required by the Councils.

3.5 The consent holder shall exercise this consent in accordance with the Project Overview and Annual Work and Rehabilitation Plan.

3.6 The consent holder shall design and construct all permanent earthworks to the form shown in the Project Overview and Annual Work and Rehabilitation Plan.

4 REHABILITATION

4.1 The rehabilitation objectives to be achieved by the consent holder are:-

(a) To ensure short and long term stability of all structures and works and their surrounds;

(b) To avoid maintenance after completion of rehabilitation requirements;

(c) To protect soil from erosion and to protect water from contaminants affected by mining operations;

(d) To stabilise and rehabilitate the banks and surrounds of any waterbodies;

(e) To return land as closely as possible to its original condition, including any exotic pastoral and indigenous species appropriate to the area; and

(f) To visually integrate finished structures, land-forms and vegetation into the surrounding landscape so they appear to be naturally occurring features; and,

(g) To control invasive environmental weeds, including wilding conifers, in the Disturbed Land for the Life of the Macraes Gold Project.

<u>Earth Shaping and Visual</u>

4.2 The consent holder shall locate, form and shape all earthworks so that their profiles, contours, skylines and transitions closely resemble and blend with the surrounding natural landforms. If earthworks cannot be fully naturalised, the consent holder shall minimise the extent of their visibility and maximise their integration into the surroundings.

4.3 The consent holder shall use a Landscape Architect in the planning and design of all permanent earthworks and structures.

<u>Waste Rock Stack</u>

4.4 The consent holder shall design and construct the waste rock stack in accordance with the following principles:

(a) Slopes shall be suitably concave or convex in cross-profile to match nearby natural slopes;

(b) Slope gradients shall be no steeper than nearby natural surfaces;

(c) Transitions between natural and formed surfaces shall be rounded and naturalised;

(d) Contours should be curvilinear in plan form, in keeping with original natural contours in that area;

(e) The skyline shall be variable and curved, simulating natural skylines;

(f) New landforms shall be aligned and located so they seem to continue, not cut across, existing landscape patterns; and

(g) Silt ponds shall be removed and the site rehabilitated or be converted to stock water drinking ponds following completion of mining operations and rehabilitation.

4.5 Where practicable the waste rock shall be backfilled into pits in order to minimise the size of waste rock stack.

4.6 Prior to the commencement of the Coronation waste rock stack, the consent holder shall in consultation with the Councils, design the shape and construction details of the stack. The final design and construction details shall be lodged with the Councils and include a report prepared by a Landscape Architect that includes, but is not limited to, the following:

(a) A detail description of the proposed waste rock stack;

(b) A detailed description of the adjoining landforms; including their slopes and transitions; and

(c) A detailed discussion on how the proposed waste rock stack meets the principles set out in condition 4.4 (a) – (f).

4.7 If after commencement of the construction of the Coronation waste rock stack, the consent holder wishes to change the design or construction details it shall design the changes in consultation with the Councils. The design or construction changes shall be lodged with the Councils. The change document shall include a report by a Landscape Architect that details the proposed changes and reassess whether the design changes better meet the principles set out in condition 4.4 (a) – (f).

Soil

4.8 The consent holder shall, as far as practicable, stockpile soil from any disturbed land, unless the soil is required to be left in place to protect water and soil values.

4.9 All salvaged soil shall be used on disturbed land for rehabilitation purposes.

Revegetation

4.10 The consent holder shall in accordance with the rehabilitation objectives undertake progressive rehabilitation of disturbed land as operational activities allow. It shall be revegetated with:

(a) Exotic pastoral species; and

(b) Tussock species which are as far as practicable sourced from the Macraes Ecological District.

4.11 The consent holder shall maintain vegetation cover until the expiry of this consent and ensure that the vegetation, including any vegetation established on disturbed land, shall be self-sustaining after expiry.

<u>Soil and Vegetation Monitoring</u>

4.12 At three yearly intervals, the consent holder shall complete a review of all soil and pasture on land that has been rehabilitated. The first review shall be not later than the third anniversary of the commencement of this consent. The review shall include, but not be limited to, the following:

(a) Monitoring for ground cover, species components, plant nutrition status, soil organic matter and concentrations of exchangeable nutrients in the soil;

(b) Analysis and interpretation of the monitoring results by a suitably qualified soil or agricultural scientist;

(c) Evaluation of the vegetation and its potential to be self-sustaining for pastoral farming after mining ceases; and

(d) Any necessary recommendations for future rehabilitation, including plant species or varieties to be used, cultivation and seeding methods to be introduced, or fertilisers to be used; and,

(e) A copy of the review will be forwarded to the Councils and Department of Conservation within three months of the review being completed.

5 SITE DECOMMISSIONING AND CLOSURE

5.1 The consent holder shall submit to the Councils a Site Decommissioning Plan, not less than 12 months before completion of the operations.

5.2 The Site Decommissioning Plan shall include but not be limited to:

(a) A plan(s) showing the final design and intended contours (at 5 metre intervals) of all permanent structures and works, including but not limited to, waste rock stacks, permanent earthworks, pit lakes, roads, water storage reservoirs or other works which under this consent or any related consent are authorised or required to remain after the relevant consents expire;
(b) A summary of rehabilitation completed to date, and details of rehabilitation required to fulfil the conditions of this consent and any related consents;
(c) Details on infrastructure to be decommissioned, such infrastructure may include buildings, plant, and equipment;
(d) Details of specific infrastructure to remain on-site post-closure. Such infrastructure may include buildings, plant, equipment and any monitoring structures required by this consent and any related consent to remain after the expiry of the consents;
(e) Details of management, any ongoing maintenance, monitoring and reporting proposed by the consent holder to ensure post-closure activities are carried out in accordance with the conditions of this consent;
(f) Details of measures to protect public safety, including any fencing yet to be completed;

(g) The costs of complying with (a)-(f) above.

5.3 The consent holder shall remove all buildings, plant and equipment (whether attached to the land or not) associated with site decommissioning. This condition does not apply to:

(a) Any waste rock stacks, permanent earthworks, silt pond, waterbody, road or other works and any associated plant and equipment which under this or any other resource consent is permitted or required to remain after decommissioning or after this consent expires;

(b) Any monitoring structure required by this or any other resource consent to remain after the expiry of this consent.

6 COMPLAINTS

6.1 The consent holder shall maintain a record of any complaints received regarding their operation. The register shall include, but not be limited to:

(a) name and location of site where the problem is experienced;

(b) nature of the problem;

(c) date and time problem occurred, and when reported;

(d) action taken by consent holder to remedy the situation and any policies or methods put in place to avoid or mitigate the problem occurring again.

6.2 The register of complaints shall be incorporated into the Project Overview and Annual Work and Rehabilitation Plan required by Condition 3 of this consent and provided to the Councils on request.

7 BLASTING AND VIBRATION

7.1 The consent holder shall ensure that blasting practices minimise air and ground borne vibration. Fly-rock shall be minimised and all blasting procedures shall be carried out so as to ensure the safety of employees and the public. No blasting shall occur when the weather is unsuitable.

7.2 Blasting shall be restricted to within the following hours:

Monday-Friday 9am to 5.30pm

Saturday and Sunday 10am to 4.30pm

7.3 Details of blasting method, strength of the blast and time of blast shall be entered into a record kept for that purpose and shall be available to the Councils on request. This information shall also be included in the monitoring report, required under Condition 9.

7.4 Vibration due to blasting or any other activity associated with the mining operation, when measured at any point within the notional boundary of any dwelling not owned by the consent holder, shall not exceed a peak particle velocity measured in the frequency range 3-12 Hz of 5 mm/sec provided this level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level shall not exceed 10 mm/sec at any time.

7.5 Airblast overpressure from blasting associated with the mining operation, when measured at any point within the notional boundary of any dwelling not owned by the consent holder shall not exceed a peak non-frequency-weighted (Linear or flat) level of 115 decibels (dB), provided this level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level shall not exceed 120 dB (Linear peak) at any time. For the purpose of this consent, C-frequency-weighting may be considered equivalent to the Linear or Flat-frequency-weighting.

Note: The notional boundary is defined as a line 20 metres from the exterior wall of any rural dwelling or the legal boundary where this is closer to the dwelling.

8 NOISE

Noise limits

8.1 The consent holder shall ensure that all construction and operation activities associated with the mining operations are designed and conducted so that the following noise limits are not exceeded at the locations specified in Condition 8.2:

(a) On any day between 7 am to 9 pm (daytime): 50 dBA L_{Aeq}; and

(b) On any day between 9.00 pm to 7.00am the following day (night-time): 40dBA L_{Aeq}; and/or 70 dBA L_{Amax}.

Measurement Locations

8.2 Noise measurements shall be taken at the notional boundary of any dwelling not owned by the consent holder.

Note: The notional boundary is defined as a line 20 metres from the exterior wall of any rural dwelling or the legal boundary where this is closer to the dwelling.

Measurement and Assessment

8.3 All noise measurements referred to in Conditions 8.1 and 8.2 above shall be measured in accordance with the provisions of NZS 6801:2008 Acoustics: Measurement of Environmental Sound, and shall be assessed in accordance with the provisions of NZS 6802:2008 Acoustics: Environmental Noise.

8.4 Prior to the commencement of mining, the consent holder shall install double glazing on the dwelling at 406 Horse Flat Road owned by C A and E M Howard. The glazing shall include one layer of 6mm laminated glass for noise reduction purposes. A mechanical ventilation system shall also be installed in the dwelling that will supply supplementary fresh air ducted from outside to bedrooms and living spaces.

9 MONITORING OF NOISE, AIRBLAST AND VIBRATION

9.1 Prior to exercise of this consent, the consent holder shall update the Noise, Airblast and Vibration Monitoring Plan. The plan shall include but not be limited to:

(a) Details of the monitoring locations, the frequency of monitoring and the method of measurement and assessment in accordance with Conditions 7.4, 7.5 8.1 and 8.2;

(b) Procedures for recording blasting method, strength of the blast and time of blast; and

(c) Procedures for addressing non-compliant results and notification of the Councils.

9.2 The consent holder shall exercise this consent in accordance with the Noise, Airblast and Vibration Monitoring Plan. The consent holder shall review the plan annually and if necessary update it. Confirmation of the review shall be included in the Project Overview and Annual Work and Rehabilitation Plan. The Councils shall be provided with any updates of the plan within one month of any update occurring.

9.3 The consent holder shall produce a report each year summarising the results of the Noise, Airblast and Vibration Monitoring. The report shall be included in the Project Overview and Annual Work and Rehabilitation Programme.

9.4 All measurements from the monitoring programmes shall be recorded and shall be made available to the Councils on request.

9.5 In addition to conditions 9.1 to 9.4, noise monitoring shall be conducted by a suitably qualified and experienced acoustic expert to verify that the trucking activities associated with the mining operations comply with the noise limits set out Condition 8 at the notional boundary of the dwelling shown on “Coronation Project October 2013 WDC/DCC LUC Consents Map 1” annexed are complied with. The monitoring is to be carried out within one month of the haul trucks carrying ore to the processing plant and once 12 months later, and at any other time requested by the Waitaki District Council. The results are to be provided to the Councils within one week of undertaking the measurements.

10 LIGHTING

10.1 All flood lighting luminaires that could potentially cause a glare nuisance or a traffic hazard shall be fitted with shields and, as far as is practicable, orientated so that the principal output is directed away from residences and traffic.

11 WASTE ROCK STACKS

11.1 The Coronation waste rock stack shall be designed for operating basis earthquake (OBE) with a recurrence interval of 150 years and maximum design earthquake (MDE) with a recurrence interval of 2,500 years and otherwise shall otherwise be designed in accordance with sound engineering practice.

11.2 The consent holder shall engage a suitably qualified geotechnical engineer to design the waste rock stack. A construction report shall be prepared for the waste rock stack and this report provided to the Councils prior to the commencement of construction of the waste rock stack. The report shall include details of site formation, design construction, appearance, and testing for stability of the waste rock stack, and shall include evaluation of the long-term stability and performance of the waste rock stack.

11.3 The Coronation waste rock stack shown on “Coronation Project October 2013 WDC/DCC LUC Consents Map 1” annexed shall not exceed the following height 730mRL.

12 FINAL PIT LAKES

12.1 The pit lake shall, at all times, have sufficient freeboard to fully contain waves induced by landslides and earthquakes.

12.2 No less than twelve months prior to commencement of filling of the pit lake, the consent holder shall provide the Councils with a Closure Manual for the lake. The manual shall include, but not be limited to:

(a) Details of how Condition 12.1 shall be achieved;

(b) Details of the lake filling, including but not limited to mean flow-rates, location of inflows and the quality of the discharge; and

(c) Details of the long term pit wall stability.

12.3 The consent holder shall exercise this consent in accordance with the Closure Manual. The consent holder shall review the manual annually and if necessary update it. Confirmation of the review shall be included in the Project Overview and Annual Work and Rehabilitation Plan. The consent holder shall provide the Councils with any updates of the plan within one month of any update occurring.

13 ROADING

13.1 Within 6 months of pit excavations ceasing the consent holder shall reinstate for public use that part of Golden Point Road south of Horse Flat Road shown on “Coronation Project October 2013 WDC/DCC LUC Consents Map 1” annexed.

13.2 To achieve the reinstatement the following work must be completed:

(a) The haul road shall be decommissioned, and replaced with a public road that has a minimum road reserve of 15 metres in width, and a carriageway of 5 metres in width;
(b) The public road shall be formed to a minimum 150 mm sub-base and a base course of 100mm AP4O with a wearing course of AP2O;
(c) The road shall also be delineated and marked to a public road standard;
(d) Design and construction details shall be lodged with the Waitaki District Council for its approval.

13.3 The consent holder shall provide unformed legal public access of a width not less than 15m that generally follows the blue line, and orange line north of Horse Flat Road shown on “Coronation Project October 2013 WDC/DCC LUC Consents Map 1” annexed.

13.4 The consent holder shall provide unformed pedestrian access that generally follows the orange line south of Horse Flat Road shown on “Coronation Project October 2013 WDC/DCC LUC Consents Map 1” annexed.

Advice Note: All road stopping, temporary road closures and vesting of new road reserve is to be completed under other relevant statutes.

14 HERITAGE

14.1 Prior to commencement of any land disturbance, the consent holder shall engage a suitably qualified and experienced archaeologist to complete an archeological survey of the Coronation mine site and shall include all land proposed to be disturbed.

14.2 Within six months of the date of issue of consents, the consent holder shall update the consent holder's Heritage Management Plan for the Macraes site in consultation with the New Zealand Historic Places Trust to include the Coronation Project area. The objective of the Heritage Management Plan shall be to avoid the modification or destruction of any identified heritage site unless there is no other reasonable option and to inform and guide the consent holder on the future management of heritage sites in consultation with the New Zealand Historic Places Trust that includes but is not limited to:

(a) Providing a map of the archaeological sites to be modified or destroyed, and a detailed plan and photographic record for each archaeological site;

(b) Providing a map of the archaeological sites that are to remain unaffected by the mining operation;

(c) Methods to record in situ material;

(d) Methods to recover artefacts discovered from historic workings and procedures to record and, if necessary, save material

14.3 The consent holder shall provide a copy of the revised Heritage Management Plan to the Councils within 2 months of any update occurring.

14.4 The consent holder shall not modify or destroy those archaeological sites that are mapped as remaining unaffected in Condition 14.2 (b). Where possible, the sites shall be identified on the ground so mining staff are aware of their existence.

14.5 Within three months after pit excavations have ceased, the consent holder shall provide a report that summarises the material recorded and/or recovered and interpretation of the historic mine gleaned from the recordings. A copy shall be forwarded to the New Zealand Historic Places Trust.

14.6 The mining operation shall be carried out in accordance with the updated Heritage Management Plan.

14.7 If the consent holder:

(a) Discovers koiwi tangata (human skeletal remains), or Maori artefact material, the consent holder shall without delay:

(i) Notify the Consent Authority, Tangata whenua and New Zealand Historic Places Trust and in the case of skeletal remains, the New Zealand Police.

(ii) Stop work within the immediate vicinity of the discovery to allow a site inspection by the New Zealand Historic Places Trust and the appropriate runanga and their advisors, who shall determine whether the discovery is likely to be extensive; if a thorough site investigation is required and whether an Archaeological Authority is required.

(iii) Any koiwi tangata discovered shall be handled and removed by tribal elders responsible for the tikanga (custom) appropriate to its removal or preservation.

Advice note: An archaeological authority from the Trust may be required before work can proceed.

14.8 Site work shall recommence following consultation with the Councils, the New Zealand Historic Places Trust, Tangata whenua, and in the case of skeletal remains, the NZ Police, provided that any relevant statutory permissions have been obtained.

14.9 If the consent holder disturbs any feature or archaeological material discovered that predates 1900, or heritage material, or disturbs a previously unidentified archaeological or heritage site, the consent holder shall without delay:

(a) Stop work within the immediate vicinity of the discovery or disturbance; and

(b) Advise the New Zealand Historic Places Trust, and in the case of Maori features or materials, the Tangata whenua, and if required, shall make an application for an Archaeological Authority pursuant to the Historic Places Act 1993; and

(c) Arrange for a suitably qualified archaeologist to undertake a survey of the site.

(d) The results of the survey shall be forwarded to the Councils and the New Zealand Historic Places Trust.

15 NATURE CONSERVATION AND LANDSCAPE VALUES

15.1 Prior to exercising this consent the consent holder shall engage a suitably qualified and experienced ecologist to prepare and submit to the Councils a Coronation Project Ecological Management Plan ("EMP"). The purpose of the EMP is to ensure compliance with conditions of this consent and otherwise to minimise the actual and potential adverse effects on the threatened species and general ecological values. The EMP shall be developed and prepared in consultation with the Department of Conservation and the consent holder shall provide a copy to the Department of Conservation, ORC and Councils. The EMP shall:

(a) Include sections covering vegetation management, lizard management, avifauna management and aquatic management;

(b) Have the following objectives:

(i) To minimise the adverse effects from the implementation of the Coronation Project on indigenous vegetation; resident lizard populations; indigenous avifauna and aquatic biota;

(ii) To protect and enhance indigenous flora and vegetation types; resident lizard populations, indigenous avifauna and aquatic fauna.;

(iii) To maintain and enhance riparian systems and man-made waterbodies.

(c) Detail the methods by which the objectives set out in Condition 15.1(b) shall be achieved, including:

(i) protection and enhancement of Cranky Jims wetland area;

(ii) transplanting of threatened plants;

(iii) rehabilitation planting of Disturbed Land with species including *Chionochloa rigida* subsp. *rigida* (narrow-leaved snow tussock), *Festuca nz* and *Poa cita*; and

(iv) fencing of areas to be protected (if any);

(v) environmental weed control, including wilding conifer;

(vi) minimisation of construction effects;

(vii) monitoring;

(viii) mammalian herbivore control;

(ix) relocation of lizard species, if necessary;

(x) investigation of existing waste rock stacks for potential lizard habitat.

(d) Address aquatic mitigation required to ensure the objectives set out in condition 15.1(b) are achieved, , including:

(i) identifying populations of aquatic fauna that are to be protected. This shall include, but not be limited to, freshwater crayfish (Koura) and flathead galaxiids.

(ii) identifying the threatening processes that are affecting the identified populations, including assessing whether reduced flows arising from the exercise of this consent will adversely affect galaxiid populations between the project area and monitoring point MB01;

(iii) identifying the location of the new habitat that the populations will be translocated to. Preference will be given to translocating Koura to within the Maori Hen Creek catchment unless in the expert opinion of the ecologist this would result in a poorer outcome for the Koura than translocating them elsewhere;

(iv) identifying threats to any translocated populations in their new habitat, such as predation and seasonal flow variations;

(v) providing a detailed methodology that identifies how and when the identified populations are to be protected or how adverse effects on identified populations will be mitigated;

(vi) providing a framework for the monitoring and reporting of mitigation activities; and

(vii) providing a methodology to allow for the evaluation of the effectiveness of the mitigation activities.

(e) The consent holder shall implement the programme of activities specified in the EMP and in any subsequent EMP reports created pursuant to condition 15.2(c).

(f) Any translocation of species undertaken shall not adversely affect any existing population of native fish.

15.2 The consent holder shall engage a suitably experienced and qualified ecologist, to prepare an annual report:

(a) describing the works and other actions completed by the consent holder in the previous twelve months in order meet the purpose and objectives of the EMP; and

(b) evaluating the progress of the rehabilitation planting of disturbed land and enhancement planting of offsite areas, and its potential to be self-sustaining after mining ceases.

(c) Describing what methods are to be implemented in the following 12 months in order to meet the purpose and objectives of the EMP.

The consent holder shall provide the Councils and Department of Conservation with a copy of the report by no later than 31 July each year.

15.3 The consent holder shall set aside one area of approximately 95ha of indigenous vegetation and wetlands in the Cranky Jims wetland area (as indicatively shown marked in red on the Cranky Jims wetland area (plan annexed as appendix 2) and protect, fence and manage these as appropriate to provide:

(a) Protection and enhancement of Cranky Jims wetland though the control of exotic rushes, fostering of rare species characteristic of the Macraes Ecological District and through plantings of indigenous plants such as *Carex tenuiculmis, Isolepsis basilaris, Gratiola concinna, Tetrachondra hamiltonii, Cardamine "Tarn", Crassula speciss and Iphegenia nz; and* [

(b) Protection and enhancement of rare and endangered plants includin*g Celmisia hookeri, Olearia bullata, Chionochloa rubra* subsp*. cuprea* as appropriate; and

(c) Protection and enhancement of bird and lizard habitat; and

(d) For grazing by cattle and sheep to be limited to no more than one stock unit per hectare and for farming activities that would adversely effect the area, namely ploughing, fertilising, burning and vegetation clearance, to be prohibited.

(e) The area may be sown with pasture seed, but the decision as to how much area is to be sewn, and pasture type shall be made in consultation with the Department of Conservation.

(f) All plantings shall be maintained and mortalities above 20% within 12 months of planting shall be replaced.

15.4 The Department of Conservation shall be consulted over the location of any fence lines required to achieve the objectives contained in condition 15.3 above.

15.5 The final boundaries of the areas to be set aside in accordance with 15.3 above shall be determined, in consultation with the Department of Conservation, by the ecologist engaged under Condition 15.2 and a plan showing the areas shall be submitted to the Consent Authority within 6 months of the commencement of this consent. The required fencing work shall be completed within 12 months of the consent holder exercising this consent.

15.6 In relation to the areas set aside under 15.3 above, within 12 months of completion of fencing, in order to control invasive environmental weeds in the areas the consent holder, in consultation with the Department of Conservation, shall develop and implement a monitoring and management programme for the control of invasive environmental weeds during the life of the Macraes Gold Project. The purpose of the programme will be to ensure that invasive environmental weeds are targeted for control. To achieve this, the consent holder shall identify and document the extent of invasive environmental weeds within the site at the commencement of the consent and target the environmental weeds to zero density using manual and/or herbicide treatment. Thereafter, each spring, during the term specified within this condition, the consent holder engage a suitably experienced and qualified ecologist, who is familiar with the Macraes Ecological District to survey the extent of invasive environmental weed species and recommend control measures as appropriate. A copy of the recommendations shall be forwarded to the Councils and the consent holder shall carry out the recommended control measures

15.7 In relation to the areas set aside under conditions 15.3 above, within 12 months of completion of fencing, to control mammalian herbivores the consent holder, in consultation with the Department of Conservation, shall engage a suitably qualified and experienced ecologist to recommend a mammalian herbivore control programme. The consent holder shall carry out a mammalian herbivore control programme in accordance with recommendations made by the ecologist. Control measures may include but will not be limited to trapping and baiting. The purpose of the programme will be to ensure the density of mammalian herbivores such as rabbits, possums, pigs and deer are at the following densities during the life of the Macraes Gold Project:

(a) Rabbits- Modified McLeans scale 2 or less;

(b) Possums- residual trap catch of 4% or less;

(c) Pigs and deer- zero density.

15.8 The consent holder shall within 36 months of exercising the consent register a QEII covenant, or equivalent covenant approved by the Councils such as a conservation covenant under the Reserves Act 1977, against the relevant land titles, recognising the protection of the areas referred to in Condition 15.3 above.

16 FENCING

16.1 Stock-proof fencing shall be used to keep livestock away from all working areas.

16.2 On the completion of mining operations the consent holder shall ensure that all fences, required to restrict people and/or stock for safety purposes, are installed and maintained. This shall include fences to be installed and maintained around Coronation pit lake.

17 MANAGEMENT OF HAZARDOUS SUBSTANCES

17.1 The Consent Holder shall ensure that all fuels and oils used at the site are contained in appropriately bunded facilities and that all fuel/oil dispensers are fitted with non-return valves.

17.2 Refuelling, lubrication and any mechanical repairs shall be undertaken in a manner that provides sufficient mitigation measures to ensure that no spillages onto the land surface or into water occur.

18 BONDS

Obligations to be secured

18.1 The consent holder shall provide and maintain in favour of the Councils one or more bonds to secure:

(a) The performance and completion of rehabilitation in accordance with the conditions of this consent; and

(b) The carrying out of the monitoring required by the conditions of this consent; and

(c) The remediation of any adverse effect on the environment that may arise from the exercise of this consent; and

(d) Compliance with conditions 18.13 - 18.17 of this consent.

When bonds to be provided

18.2 Before the commencement of this consent, the consent holder shall provide to the Councils one or more bonds required by Condition 18.1

Form of bond

18.3 Subject to the other provisions of this condition, any bond shall be in the form and on the terms and conditions approved by the Councils.

Surety

18.4 Any bond shall be given or guaranteed by a surety acceptable to the Councils.

18.5 The surety shall bind itself to pay for the carrying out and completion of the conditions of consent which are the subject of the bond on default by the consent holder or the occurrence of any adverse environment effect requiring remedy; during or after the expiry of this consent.

Amount

18.6 The amount of each bond shall be fixed annually by the Councils which will take into account any calculations and other matters submitted by the consent holder relevant to the determination of the amount to be bonded in the Project Overview and Annual Work and Rehabilitation Plan, or otherwise.

18.7 The amount of the bond(s) shall include:

(a) The estimated costs of complete rehabilitation in accordance with the conditions of consent on the completion of the mining operations proposed for the next year and described in the Project Overview and Annual Work and Rehabilitation Plan.

(b) The estimated costs of:

i. Monitoring in accordance with the monitoring conditions of the consent;

ii. Monitoring for and of any adverse effect of the activity authorised by this consent which may become apparent during or after expiry of this consent;

iii. Monitoring any rehabilitation required by this consent.

(c) Any further sum which the consent authority considers necessary for monitoring and dealing with any adverse effect on the environment that may arise from the exercise of the consent whether during or after the expiry of this consent.

18.8 The amount shall be calculated for the duration of this consent and for a period of 20 years after its expiry.

18.9 If, on review, the total amount of bond to be provided by the consent holder is greater or less than the sum secured by the current bond(s), the consent holder, surety and the Councils may, in writing, vary the amount of the bond(s).

General

18.10 While the liability of the surety is limited to the amount of the bond(s), the liability of the consent holder is unlimited.

18.11 Any bond may be varied, cancelled, or renewed at any time by written agreement between the consent holder, surety and Councils.

Costs

18.12 The costs (including the costs of the consent authority) of providing, maintaining, varying and reviewing any bond shall be paid by the consent holder.

Bonding on expiry or surrender of this consent

18.13 For a period of 20 years from the expiry or surrender of this consent the consent holder shall provide in favour of the Councils one or more bonds.

18.14 The amount of the bond to be provided under Condition 18.13 shall include the amount (if any) considered by the Councils necessary for:

(a) Completing rehabilitation in accordance with the conditions of this consent.

(b) Monitoring for and of any adverse effect on the environment that may arise from the exercise of the consent.

(c) Monitoring any measures taken to prevent, remedy or mitigate any adverse effect on the environment that may arise from the exercise of this consent.

(d) Dealing with any adverse effect on the environment which may become apparent after the surrender or expiry of this consent.

(e) Contingencies.

18.15 Without limitation, the amount secured by the bond given under Condition 18.13 may include provision to deal with structural instability or failure, land and water contamination, and the failure of rehabilitation in terms of the rehabilitation objectives and conditions of this consent. Costs shall include costs of investigating, preventing, remedying or mitigating any adverse effect.

18.16 The bond(s) required by Condition 18.13 must be provided on the earlier of:

(a) 12 months before the expiry of this consent;

(b) Three months before the surrender of this consent.

18.17 Conditions 18.3, 18.4, 18.5, 18.8, 18.9, 18.10 and 18.11 apply to the bond(s) required by Condition 18.13.

19 PUBLIC LIABILITY INSURANCE

19.1 The consent holder shall effect and keep current public liability insurance for an amount not more than twenty million dollars. The amount shall be determined by the Councils in consultation with the consent holder.

19.2 The indemnity expressed in the insurance policy shall be sufficiently wide in its coverage so as to include claims arising from damage caused by structural failure, or damage resulting from fire or explosion and all fire fighting costs resulting from the consent holder's operations in respect of the land and from any accidental or otherwise spillage of any chemical or reagent and/or resulting clean up and restoration costs and the costs of mitigation of those events.

19.3 The consent holder shall on request provide the Councils a copy of the insurance policy and the receipt evidencing payment of the premium in respect of any such policy.

19.4 The consent holder shall also indemnify the Councils against any claim arising from the public use of public roads for the time being under control of the consent holder.

20 CLOSURE OF OPERATIONS

20.1 The consent holder shall annually supply to the Councils a contingency plan for the early closure of the mine, as part of the Project Overview Annual Work and Rehabilitation Programme. This contingency plan shall be updated annually. The plan shall address the objectives listed in Condition 4 and include:

(a) An evaluation of the residual risk of the operation with regard to the neighbouring community and environment; and

(b) A plan for the long term management of the site, in particular the area of open pits or consequent lakes and include details of on-going maintenance and monitoring requirements and restrictions on future use.

(c) Describe in detail what needs to be done to:

   i. Decommission the mine site in accordance with this consent;

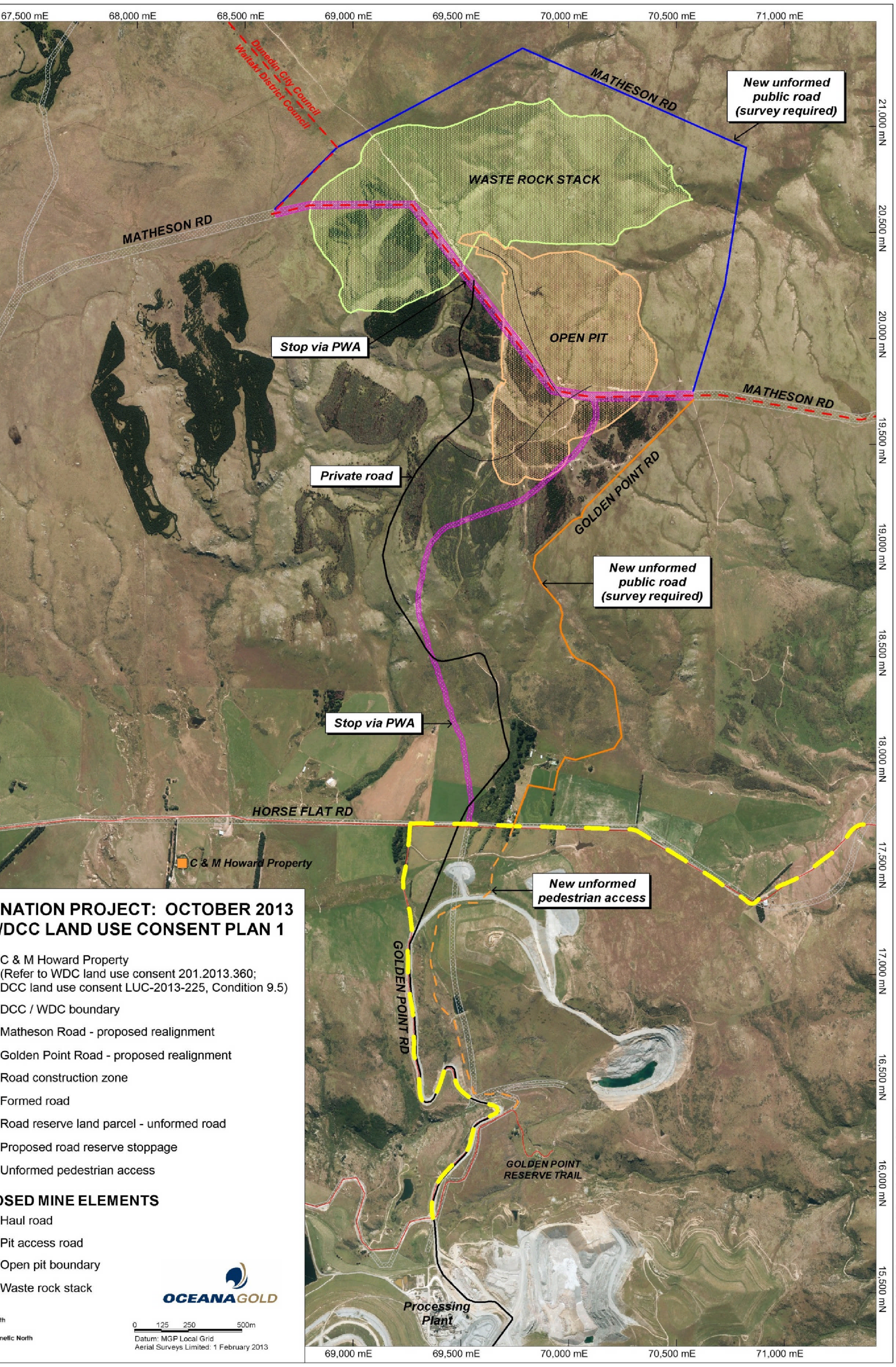
   ii. Rehabilitate the mine site in accordance with this consent;

   iii. Comply with other conditions relevant to cessation of mining; and

   iv. The costs needed to comply with (i)-(iii).

Appendix I

Coronation Project October 2013 WDC/DCC LUC Consents Map 1

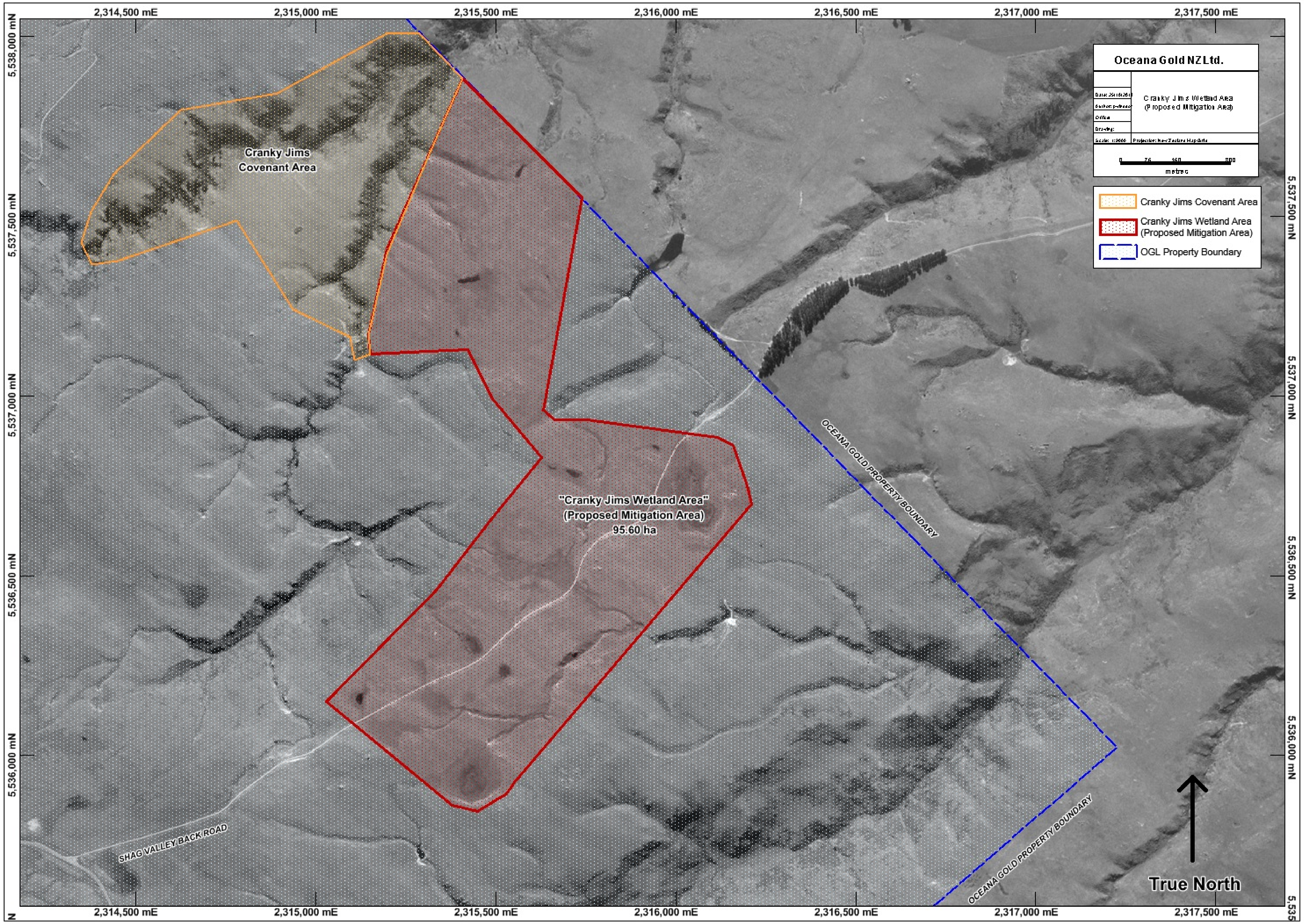


NATION PROJECT: OCTOBER 2013
/DCC LAND USE CONSENT PLAN 1
C & M Howard Property
(Refer to WDC land use consent 201.2013.360;
DCC land use consent LUC-2013-225, Condition 9.5)
DCC / WDC boundary
Matheson Road - proposed realignment
Golden Point Road - proposed realignment
Road construction zone
Formed road
Road reserve land parcel - unformed road
Proposed road reserve stoppage
Unformed pedestrian access
OSED MINE ELEMENTS
Haul road
Pit access road
Open pit boundary
Waste rock stack
OCEANAGOLD
0 125 250 500m
Datum: MGP Local Grid
Aerial Surveys Limited: 1 February 2013
WASTE ROCK STACK
OPEN PIT
MATHESON RD
MATHESON RD
MATHESON RD
GOLDEN POINT RD
GOLDEN POINT RD
HORSE FLAT RD
New unformed public road (survey required)
New unformed public road (survey required)
New unformed pedestrian access
Stop via PWA
Stop via PWA
Private road
C & M Howard Property
Dunedin City Council
Waitaki District Council
GOLDEN POINT RESERVE TRAIL
Processing Plant
67,500 mE
68,000 mE
68,500 mE
69,000 mE
69,500 mE
70,000 mE
70,500 mE
71,000 mE
21,000 mN
20,500 mN
20,000 mN
19,500 mN
19,000 mN
18,500 mN
18,000 mN
17,500 mN
17,000 mN
16,500 mN
16,000 mN
15,500 mN
Created by H.Petty 20131022. Workspace: M_Coro_Roads_Status_20131022.wor

Appendix II

Cranky Jims Wetland Area

October 2013



2,314,500 mE
2,315,000 mE
2,315,500 mE
2,316,000 mE
2,316,500 mE
2,317,000 mE
2,317,500 mE
5,538,000 mN
5,537,500 mN
5,537,000 mN
5,536,500 mN
5,536,000 mN
Oceana Gold NZ Ltd.
Cranky Jims Wetland Area
(Proposed Mitigation Area)
Drawing:
0
75
150
300
metres
Cranky Jims Covenant Area
Cranky Jims Wetland Area
(Proposed Mitigation Area)
OGL Property Boundary
Cranky Jims
Covenant Area
"Cranky Jims Wetland Area"
(Proposed Mitigation Area)
95.60 ha
OCEANA GOLD PROPERTY BOUNDARY
OCEANA GOLD PROPERTY BOUNDARY
SHAG VALLEY BACK ROAD
True North

D

APPENDIX D

Terrestrial Ecology Reports

Oceana Gold (NZ) Ltd

Macraes Gold Project

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Deepdell North III Project

Summary of Project Impacts and Management of Effects

December 2019

Report prepared for Oceana Gold (New Zealand) Ltd by Dr M. J. Thorsen,

5 December 2019

Report number: 0219-21

2 Dowling Street
Dunedin 9016
New Zealand

1 Overview

The Deepdell North III project will remove approximately 54.79 ha of indigenous vegetation comprising of low producing grassland, shrubland, seasonal gully drainages, ephemeral wetlands and a seepage wetland. These are inhabited by 71 indigenous plants (including 13 rare species), twenty bird species (nine indigenous and one rare species), four reptile species (three rare species) and a largely unknown invertebrate community. The project will also impact on 54.09 ha of cultivated pasture and shelterbelts. There may be some effect on a further 88.71 ha of indigenous vegetation and 26.47 ha of cultivated pastures, but these effects are expected to be minimal if appropriate controls are employed. The indigenous vegetation communities trigger the significant criteria with regard to representativeness, rarity or distinctiveness as set out within proposed Otago Regional Policy Statement, and all but the seasonal gully drainage are significant under representativeness or rarity criteria of the Waitaki District Plan. The vegetation communities are habitat for 13 At Risk or Rare plant, bird or lizard or species and are underlain by 3 Threatened LENZ. The ephemeral wetland vegetation community is Historically Rare and Critically Endangered and the seepage wetland is Historically Rare and Endangered. Both are priorities for protection. The indigenous vegetation communities are generally of low species diversity and most are characterised by high weed representation. The populations of the At Risk or Rare species are mostly small, except for the Declining Matagouri which is dominant in the shrubland vegetation community and frequent in the low producing grassland plant community. There is doubt concerning the national conservation assessment for this species.

It is assessed that the Deepdell North III project will have low to very low effect on most of the terrestrial ecological features

Table 4). Exceptions to this are a moderate impact on the plant communities together (mainly a result of the presence of the LENZ, rare species, and the Nationally Critical ephemeral wetland) and a high impact on the seven ephemeral wetlands as these will be lost within the Project's footprint.

Project effects will be addressed through the implementation of an Impact Management plan that details actions that follow the impact mitigation hierarchy and consist of avoiding effects through siting of the WRS and isolating important areas, remedy effects through creation of new lizard habitat and a new pit lake, mitigate effects by employing Standard Operating Procedures and rescue of two plant species and to (mainly) offset impacts through funded actions at two offset locations, one for ephemeral wetlands and supported by a research programme and the other in a high value mixed shrubland and tussockland area. These actions will, if implemented correctly, fully address all non-minor project effects excepting some minor impacts on individuals of some rare plants and common indigenous bird species, or mostly exotic plant-dominated plant communities. It is also considered that benefit of the offset covenant containing a higher quantity of the Macraes biodiversity more than compensates for the impact of the Deepdell North III project on these features.

2 Setting

The Deepdell North III project (Figure 1) is situated on the northern end of the Taieri Ridge in the Macraes Ecological District (E.D.). Past vegetation cover of the Macraes E.D. is thought to have comprised of montane short tussockland grading into subalpine tall tussockland, with areas of mixed hardwood and podocarp forest, kanuka forest and *Coprosma*-flax scrub. Since European settlement in the 1850's, areas have been burnt (sometimes repeatedly) and exotic grasslands induced by ploughing, oversowing, and applying fertiliser and approximately 75% of the district is now dominated by exotic vegetation types (mainly improved pastureland) with the remainder being indigenous plant communities that, despite often being heavily modified, are botanically diverse with a high number of species of conservation concern. Invasion by exotic shrub and tree species, particularly gorse and broom, is an increasing problem in the area.

Of the fauna, the area is noted for its high population densities and diversity of seven lizard species and the invertebrate communities are diverse (for a region at moderate altitude) and contain some rare species. Fifty-four species of birds have been recorded from the Macraes E.D., of which thirty-four are indigenous and twenty are introduced. The area's avifauna and lizard populations are likely being impacted through predation from exotic mammals and by changes to their habitats, however the impact on lizards is somewhat moderated by the abundance of rocky habitats offering safer retreat sites. Some catchments provide habitat for populations of non-migratory galaxiids, freshwater crayfish and longfin eel, which are being affected through predation by trout and changes to their habitats, particularly in the lower reaches of watercourses.

The activities that are permitted in regional and district plants to occur within the project area and that are likely to be having some influence on the site's ecological condition (the permitted baseline) are farming activities such as grazing of stock, topdressing, pasture grass establishment and maintenance and vegetation clearance (up to the extent specified in plans).

3 Assessment methodology

Information gathered during inventory surveys was used to evaluate the ecological importance of the vegetation, birds, reptiles and invertebrates and their habitats within and surrounding the Project Impact Area (PIA), against the following criteria (based on those recommended in the Environment Institute of Australia and New Zealand's 2018 Ecological Impact Assessment Guidelines available at http://www.eianz.org/resources/publications):

- Representativeness of communities.
- Distinctiveness of communities.
- Ecological functionality of communities (intactness, connectivity, buffering).
- Rarity of communities.
- Community diversity.
- Role in ecosystem servicing.
- Sites or communities of significance at
  - National (Threatened Land Environments, National Priorities for Conservation, Historically Rare or Threatened Ecosystems, Wetlands of National Importance, Ramsar Sites).
  - Regional (as identified in the Regional Plan), or
  - Local (as identified in District Plans) scales.
- Sites identified as worthy of protection.
- Presence of rare, At Risk or Threatened species.
- Presence of species of biogeographical interest.
- Presence of genetically or morphologically distinct forms.

A summary table of the magnitude of the project's effects is provided in Table 4.

4 Project impacts

The project impact area (PIA) for the Deepdell North project in total covers 169.9 ha. There will be a loss of around 104.9 of vegetation (both indigenous and exotic) associated with the active mining areas (pit and WRS)(Figure 1).This equates to less than 1% of the extent of these communities within the E.D.

4.1 Project activities likely to affect ecological features

The following have been identified as project activities that have the potential to result in an effect on the PIA's ecological features:

- Excavation of the pit – vegetation and invertebrate community loss, displacement of birds, potential mortality of reptiles;
- Deposition of rock material – covering vegetation and invertebrate communities, displacement of birds, potential mortality of reptiles;
- Sediment runoff (if unmanaged)
- Encroachment of weeds (if unmanaged)
- Potential displacement of indigenous animals through noise, vibration and lighting;
- Wind blown dust accumulation affecting or covering plant species;
- Potential for accidental fire (if unmanaged);
- Changes to surrounding hydrological regimes may result in decreased surface and subsurface flow of water into some wetlands and water courses.

4.2 Impact on vegetation communities

The Deepdell North III project will remove approximately 54.79 ha of indigenous vegetation comprising of low producing grassland, shrubland, seasonal gully drainages, ephemeral wetlands and a seepage wetland inhabited by 71 indigenous plants (including 13 rare species), twenty bird species (nine indigenous and one rare species), four reptile species (three rare species) and a largely unknown invertebrate community (Figure 1, Table 1). The project will also impact on 54.09 ha of cultivated pasture and shelterbelts. There may be some effect on a further 88.71 ha of indigenous vegetation and 26.47 ha of cultivated pastures that occurs in the buffer area, but these effects are expected to be minimal if appropriate controls are employed. The indigenous vegetation communities are generally of low species diversity and most are characterised by high weed representation.

Overall, the indigenous vegetation communities present within the PIA are assessed as being of **high** ecological importance, though the importance of each vegetation community varies between **negligible** for cultivated pasture and shelterbelts, **moderate** for the low producing grasslands and shrublands and **high** for the ephemeral wetlands and seepage wetland. Though the indigenous plant communities are of moderate to low representation and ecosystem service importance, and moderate diversity and moderate integrity, there are remnants of rare vegetation communities present, the ephemeral wetland vegetation communities and seepage wetlands are a national priority for protection, are Naturally Uncommon and classified as Threatened, there are three Threatened Level IV land environments that are overlain by some natural vegetation and it provides habitat for Threatened, At Risk, or rare plant and animal species.

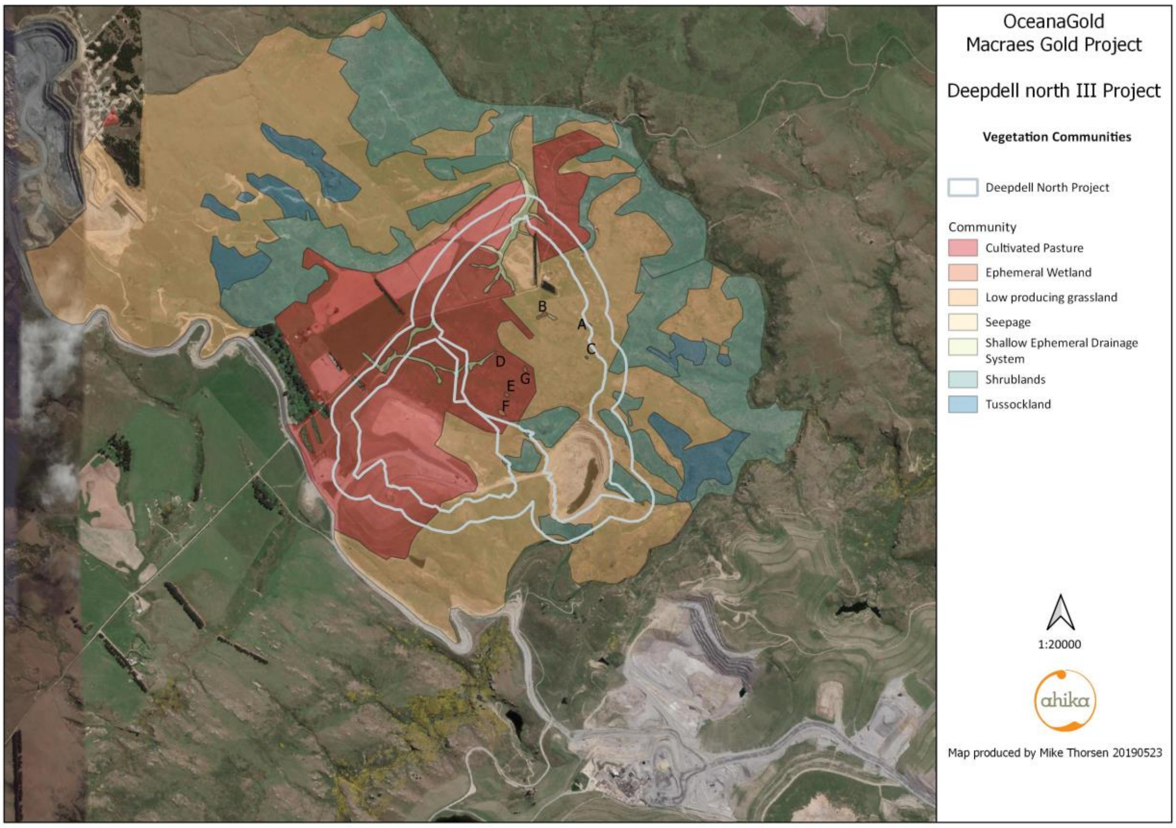

Figure 1. Vegetation communities within the PIA. The seven ephemeral wetlands are labelled A-G.

Vegetation Community	Pit	WRS	Buffer	PIA	Area within	Estimated % loss from E.D.

					Macraes E.D.[1]	
Exotic vegetation communities	*29.16*	*25.46*	*26.47*	*81.1*		
Cultivated Pasture	29.16	24.93	26.39	80.49	79635.17	0.10
Shelterbelts & Exotic Trees		0.53	0.08	0.61	4607.59	0.01
Semi-natural vegetation communities	*9.34*	*45.4*	*33.99*	*88.71*		
Ephemeral Wetland		0.30	0.02	0.31	30.73[2]	<1.01
Low producing grassland	8.76	39.47	24.82	73.04	11957.08	0.61
Seepage		0.07		0.07	43.23[3]	0.16
Shallow Ephemeral Drainage System	0.50	1.91	1.79	4.20	?	?
Shrublands	0.08	3.65	7.36	11.09	3547.15	0.31
Total	**38.49**	**70.85**	**60.46**	**169.81**	**99820.95**	**0.17**

Table 1. Extent of vegetation types in area where loss is expected to be total (within the pit and WRS boundaries) and area where there may be some impact from project activities (area within 100 m buffer).

4.2.1 *Ephemeral wetlands*

The seven ephemeral wetlands cover 0.02 ha within the buffer zone and 0.30 ha within the WRS zone of the PIA. All are of the type which forms on schist pans in some areas of Central Otago and are dominated by exotic grasses with scattered representation by indigenous species including clumps of indigenous rushes, herbs and a fern relative. The coverage and diversity of indigenous species in the sites varies from 1-5 species and at least two are thought to be functionally almost completely transformed into an exotic species-based wetland. The Declining herb *Lobelia ionantha* and Locally Uncommon sedge *Carex resectans* is present in one site.

The result of project effects will be a loss of 0.32 ha of this vegetation community from 7 sites. The extent of this vegetation community in the Otago region is unknown, but mapping of this community in the Macraes E.D. identified at least 1,360 ephemeral wetlands covering 162.39 ha (and at least a further 218 possible examples) mostly in the southern and western parts of the ecological district. The ecological integrity of the ephemeral wetlands in this area is unknown, but nearly all are dominated by exotic grasses and the majority have only 1-4 indigenous species present. Ephemeral wetlands are known habitat for a number of rare plants, but these

[1] As mapped in Landcover Database 4.1 from 2012 satellite imagery,

[2] Based from incomplete mapping

[3] Based on results from Landcare map of vegetation of Macraes E.D.

are present only in a few of the sites and seem to be lost from sites following invasion by sward farming grasses. They may be particularly at risk of this if grazing is also removed. Therefore, it is considered that the impact of this project on ephemeral wetlands of this type will result in an approximately 0.2% reduction in extent of the vegetation community in the Macraes E.D. and about a 0.5% reduction in the number of sites within the Macraes E.D. The loss in the PIA being represented by sites with mostly moderate indigenous plant component and including some rare plant species.

4.2.2 *Seepage wetlands*

A seepage wetland occurs over 0.07 ha at one site within the WRS zone. This community is visually dominated by the Declining indigenous rush *Juncus distegus* and lower-growing exotic grasses and rushes.

The result of project effects will be a loss of 0.07 ha of this vegetation community at 1 site. The extent of this vegetation community in the Otago region is unknown. Wetlands (of which seepage wetlands are a subclass) are mapped by Manaaki Whenua as covering 43.23 ha in the Macraes E.D., though the accuracy of this map is yet to be evaluated. The extent of the seepage wetland in the PIA represents 0.16% of the mapped wetlands in the Macraes E.D. The example in the PIA is highly degraded but is dominated by one At Risk indigenous rush. This vegetation community is a Historically Rare and Threatened plant community.

4.2.3 *Seasonal gully drainage*

The shallowly-incised, flat-bottomed gullies on the road-side terrace are not ephemeral wetlands in the normal sense in that they are connected to the normal gully drainage system, but as they are shallow and of limited water catchment they frequently dry over much of the summer. They cover 4.20 ha within the PIA, and are dominated by exotic grasses, rushes and sedges, and have frequent pukio *Carex secta* pedestals.

The result of project effects will be a reduction by 2.41 ha of this vegetation community in the extent of this community and minor changes to the 1.79 ha in the buffer area. The extent of this community locally or nationally is not known, and therefore the consequence of this reduction in area is difficult to assess. However, this vegetation community in the PIA is heavily modified by exotic species.

4.2.4 *Low-producing grassland*

This predominantly exotic vegetation community, produced by oversowing and top-dressing recently burned tussockland, covers 73.04 ha over much of the PIA. The main species present are exotic grasses and herbs with scattered individuals and areas of short tussock *and* low matagouri and *Coprosma propinqua* shrubs and scattered indigenous herbs and grasses.

The result of project effects will be a reduction by 48.23 ha in the extent of this community and minor changes to the 24.82 ha in the buffer area. This vegetation community has been mapped from satellite photography as covering 11,957 ha in the Macraes E.D., and the area within the PIA represents 0.6% of this extent. Between 2008 and 2012, low-producing grassland coverage decreased by 80% in the Macraes E.D. and this loss appears to be continuing with ongoing conversion to high-producing exotic pasture and reversion to exotic or indigenous shrubland.

4.2.5 *Shrubland*

Areas of shrubland occur as scattered patches over 11.09 ha of the PIA, mainly in the WRS and Buffer areas. The main species present are abundant matagouri, *Coprosma propinqua,* with scattered *Rubus schmidelioides* subsp. *subpauperatus* and *Muehlenbeckia complexa* and a few individuals of the Declining grass *Anthosachne falcis*, coral broom and desert broom, and the Locally Uncommon *Melicope simplex* and *Myrsine divaricata*. Much of the shrublands are of very short stature (to 1.5 m canopy height) with low shrub species diversity interspersed with low-producing exotic grassland tending towards scattered narrow-leaved tussock on slopes above Deepdell Creek.

The result of project effects will be a reduction by 3.73 ha in the extent of this community and minor changes to the 7.36 ha in the buffer area. This vegetation community has been mapped from satellite photography as covering 3,547 ha in the Macraes E.D., and the area within the PIA represents 0.3% of this extent. Between 2008 and 2012, shrubland coverage increased by 0.7% in the Macraes E.D. This vegetation community is well-known as being seral and quickly invading farmland in the Macraes E.D., unless prevented from doing so. The extent of this type of vegetation community is probably greatly affected by farming profitability (especially funds available for vegetation control) and extent decreases when farm profitability is high and large areas of low-diversity and low stature shrublands develop when farm profitability is low.

4.2.6 *Cultivated pasture and shelter belts*

Exotic pasture (including shelter belts) has been induced over 86.5 ha throughout much of the PIA through ploughing and oversowing on the flatter areas. Exotic pastures are comprised exclusively of exotic grasses and herbs. Shelter belts, comprised of macrocarpa and pines cover 0.61 ha, mainly within the WRS area. These vegetation communities are not known to harbour any indigenous plant species but do provide habitat for some common exotic bird species and the cultivated pasture may be used for foraging by indigenous harrier hawks, paradise shelduck, black-backed gull and spur-winged plover.

The result of project effects will be a reduction by 54.09 ha in the extent of this exotic vegetation community and minor changes to the 26.39 ha in the buffer area. This vegetation community provides habitat for some common exotic and indigenous bird species. This vegetation community has been mapped from satellite photography as covering 79,635 ha in the Macraes E.D., and the area within the PIA represents 0.1% of this extent. Between 2008 and 2012, cultivated pasture coverage increased by 166% in the Macraes E.D.

4.2.7 *Notable vegetation communities or sites*

Three Level IV LENZ categories are present in the PIA (Table 2, Figure 2), all of which are currently classified as Threatened Land Environments[4] that have less than ≤20% remaining in indigenous cover: the Acutely Threatened L1.3a and N3.1e, and the Chronically Threatened Q4.3b and some areas of which have indigenous vegetation cover (Table 3).

LENZ	Deepdell North III Buffer	Deepdell North III Pit	Deepdell North III WRS	Total
Acutely Threatened	**44.7**	**37.5**	**59.6**	**141.9**
L1.3a	28.6	24.4	35.3	88.3
N3.1e	16.1	13.1	24.3	53.5
Chronically Threatened	**15.8**	**1.0**	**11.2**	**28.0**
Q4.3b	15.8	1.0	11.2	28.0
Total	**60.5**	**38.5**	**70.9**	**169.9**

[4] Ministry for Environment and Department of Conservation 2007, Walker et al. 2007, 2008.

Table 2. Areas of Level IV LENZ categories within the PIA.

Plant community	L1.3a	N3.1e	Q4.3b	Total
Ephemeral Wetland	0.1	0.2		0.3
Low-producing grassland	17.7	32.5	22.9	73.0
Seepage	0.1			0.1
Seasonal Gully Drainage	4.2			4.2
Shrublands	0.0	6.0	5.1	11.1
Total	22.1	38.7	27.9	88.7

Table 3. Extent of natural vegetation in the PIA occurring on mapped extent of LENZ classified as having less than 20% of their national area being covered by indigenous vegetation.

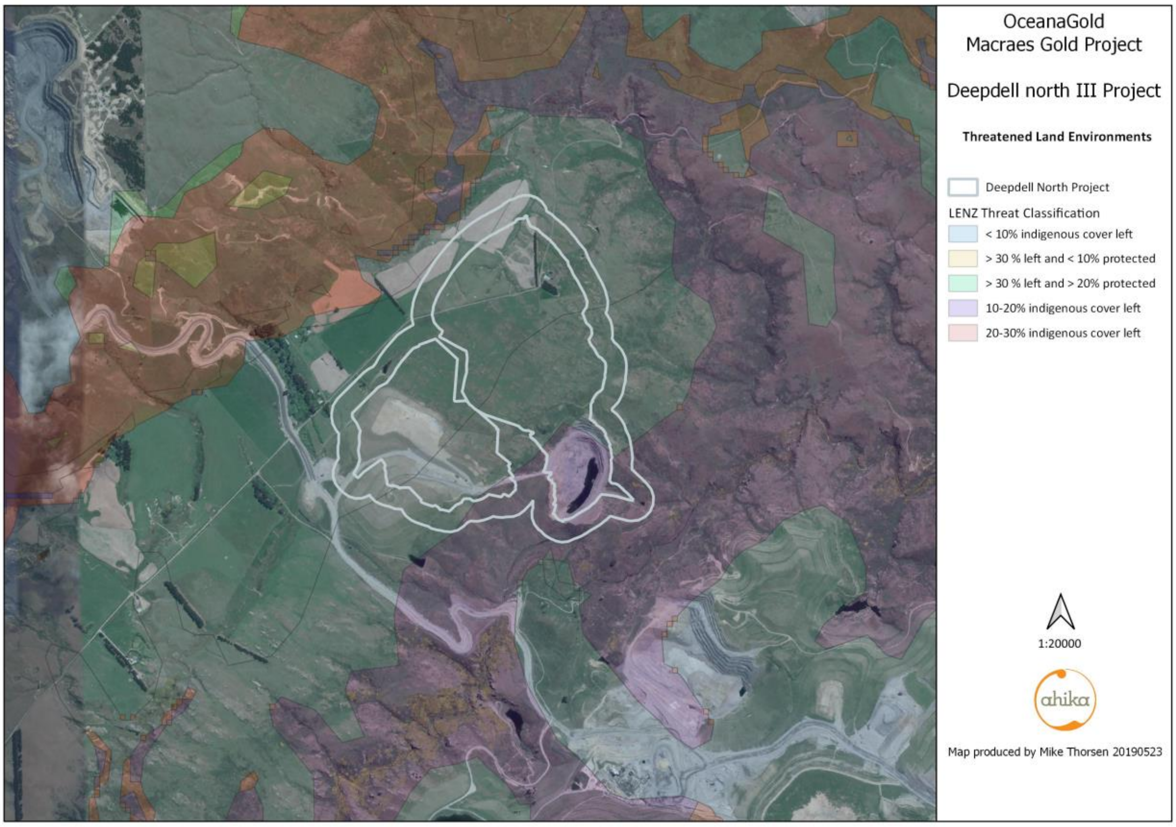

Figure 2. LENZ classification of the PIA at Level IV.

The PIA includes two vegetation communities that are a National Priority for Protection[5]: the ephemeral wetlands and the seepage wetland.

The PIA includes two wetland vegetation communities that are Naturally Uncommon[6] (= Historically Rare): the ephemeral wetlands and the seepage wetland. Both are Threatened ecosystems[7]: the ephemeral wetlands are Critically Endangered and the seepage wetland is Endangered.

4.3 Impact on birds

Twenty bird species were recorded from within the PIA, nine of which are indigenous: grey teal, black-backed gull, pipit, harrier hawk, grey warbler, paradise shelduck, welcome swallow, kereru, and spur-winged plover, and eleven of which are exotic: blackbird, skylark, goldfinch, starling, yellowhammer, chaffinch, redpoll, house sparrow, magpie, mallard, and song thrush.

Of the indigenous birds, a pair of pipit was observed on the existing recently revegetated Deepdell WRS and are assumed to be breeding there. One harrier hawk was seen on most visits to the site. It is assumed that they regularly use the area for hunting and feeding but are unlikely to be breeding there. A pair of grey warbler was seen in the WRS zone near the existing Deepdell North pit. It is assumed that there are likely to be other birds present and they are breeding in some of the more intact shrubland areas. Six paradise shelduck were observed in the WRS zone. A flock of 6 grey teal were observed on the farm pond in the Pit zone and it is assumed they are using this site for feeding, though they may be nesting in the willows outside of the PIA. A group of welcome swallow were also observed feeding over this pond and may be nesting in nearby buildings or rock overhangs. Welcome swallows are probably migrant into the area for breeding over the summer months. Spur-winged plover were vocally conspicuous in the Pit and WRS zones (particularly in the latter). It is estimated that several pairs were present, and it is likely that they breed there. A colony of black-backed gulls is breeding adjacent to the existing Deepdell South pit lake: 45 adults and 15 juveniles were present on the 7 April visit and they are foraging in the surrounding farmland. A single kereru was seen flying 150 m overhead. It is not thought that this species is using this area and is excluded from further consideration. No falcon have been seen or heard during the Deepdell North III or Coronation surveys, though

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[5] Ministry for Environment and Department of Conservation 2007

[6] Ministry for Environment and Department of Conservation 2007, Williams et al. 2007

[7] Holdaway et al. 2012.

they are known from further afield in this area. It is possible the species uses this area occasionally for hunting.

Of the exotic birds, blackbird, song thrush and house sparrow are present in gullies in the shrubland and are nesting in these areas or the nearby derelict buildings. Skylark, goldfinch, yellowhammer, starling magpie and redpoll are scattered throughout the PIA in areas of open vegetation. Mallards are using the farm pond for feeding and probably nesting.

The result of project effects will be the displacement of bird individuals from within the PIA, with a temporary increase in competition with neighbouring resident birds leading to the mortality of some individuals. Longer term there is likely to be avoidance of the area by harrier hawks and paradise shelduck. Disruption to the black-billed gull colony is thought to be temporary as they are nesting in an artificial habitat, which will be re-created in the Deepdell North III pit. The overall result of these effects is some disruption of local bird populations, most of which are common on a national scale, and the displacement of a pair of At Risk pipit which are inhabiting an artificial habitat.

4.4 Impact on reptiles

Four reptile species were recorded in the PIA: the skinks *Oligosoma maccanni* (clade 4 genotype)*, Oligosoma polychroma* (clade 5 genotype) and *Oligosoma inconspicuum* and the gecko *Woodworthia* “Otago/Southland large”. Densities of all species are low with 0.6 individuals sighted per kilometre/1.2 individuals sighted per hour of search effort. All except the McCann’s skink are considered to be represented by small populations within the PIA when compared with those known at other nearby sites. This appears to be a result of the lack of high-quality habitat. The McCann’s skink *O. maccanni* (clade 4 genotype) is present in low to moderate numbers throughout the shrubland vegetation community and is commoner in rocky sites and areas with good cover in the WRS zone. The total population of this species within the PIA is estimated at 150 individuals based on encounter rate and quantity of habitat present.

The result of project effects will be the death of an estimated 185 reptile individuals from within the project area and some short-term disruption to reptile populations in the area immediately surrounding the project. As the populations within the PIA of these lizards are relatively small (for the area), it is assessed that the project will have a moderate effect on local lizard populations. As the lizard species concerned are widespread and often numerous, the project is considered to have a minor impact on lizard populations at a national scale.

4.5 Impact on Invertebrates

Sixty-eight invertebrate species were recorded in or near the PIA. The invertebrate community identified to date is mainly a mix of exotic and indigenous species that inhabit pasture, shrublands, low producing grassland, gullies and rock outcrops. The invertebrate diversity in the groups sampled is moderate as the number of species observed is 84% of the 81 species recorded for the Taieri Ridge area. However, only 7 species are shared between these lists. This result is likely because of a paucity of invertebrate survey in this area, rather than a real difference in community between sites.

The invertebrate communities (both exotic and indigenous) are likely to be playing a very important role in their ecosystems through pollination, as disease vectors, competition, herbivory, predation, litter decomposition, soil formation, and as a food source for fish, birds and reptiles. Some species (both exotic and indigenous) are likely to be serious pasture pests. None of the invertebrate species identified to date from within the PIA is currently classified as Threatened, At Risk or rare. However, the ephemeral wetlands could harbour distinctive invertebrate communities.

The result of project effects will be the loss of invertebrate communities within the project area and some disruption to some species in the wider PIA. As most the invertebrate species concerned are widespread and often numerous, the project is considered to have a minor impact on invertebrate communities at a national scale.

4.6 Threatened, At Risk, or rare species

4.6.1 *Plants*

Thirteen plant species that occur within the PIA are either currently classified as At Risk (10 species), or are thought to be rare in the Macraes E.D. (3 species) (Figure 3).

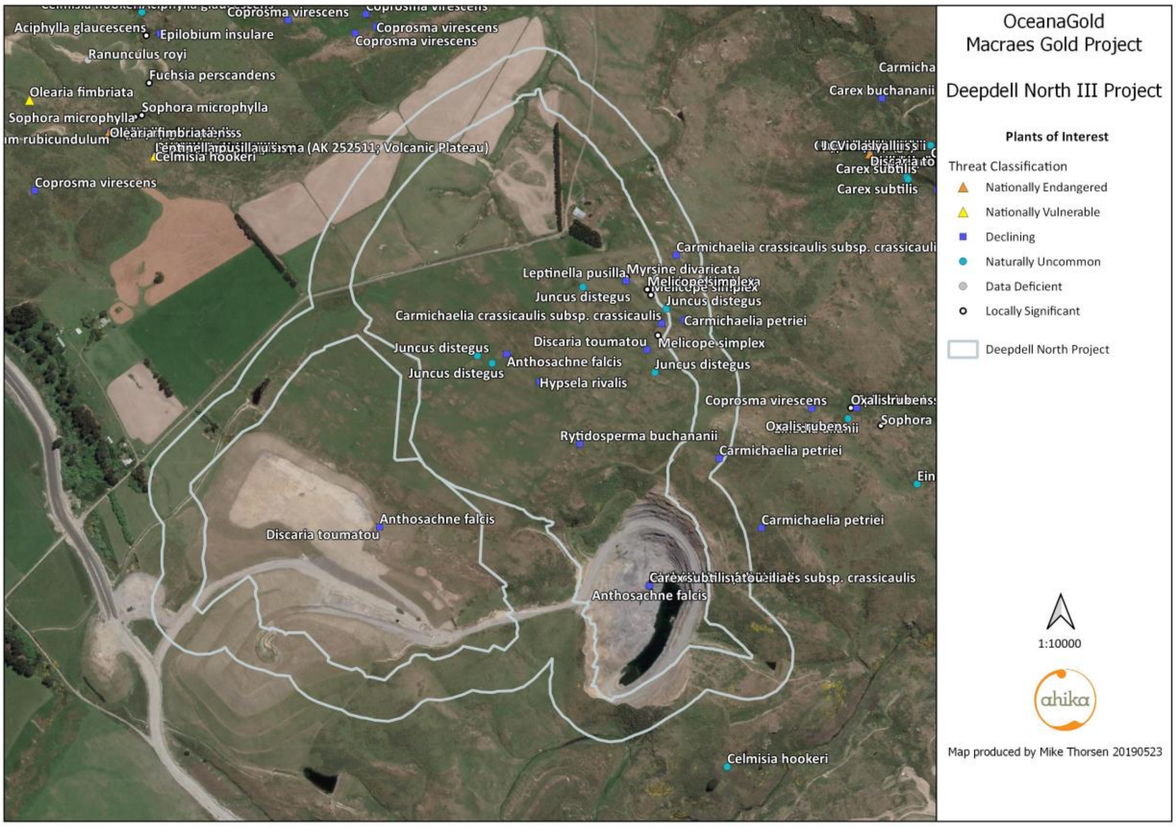

Figure 3. Locations where Threatened, At Risk and other plant species of interest (Data Deficient, rare plants) have been recorded within the PIA.

4.6.1.1 *Anthosachne falcis (Connor) Barkworth et S.W.L.Jacobs (dwarf wheatgrass, Poaceae) - Declining.*

This dryland grass was recorded as scattered plants inhabiting shrubland in the Pit and mainly in the WRS zones and it is estimated that approximately 100 plants could occur in the PIA.

The result of project effects will be the loss of the species from the PIA and some potential impact on plants in the buffer area. As this species is widely and patchily distributed within natural sites in the Macraes area, and is known to occur at multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

4.6.1.2 *Carmichaelia crassicaulis Hook.f. subsp. crassicaulis (coral broom, Fabaceae) - Declining.*

Three plants of this thick-stemmed broom were recorded at one site in the Pit (one grazed plant) and at one site in the WRS (2 heavily grazed plants). A group of 15 heavily grazed plants and a single nearby plant are present in the Buffer area.

The result of project effects will be the loss of 2 individuals of the species from one site. This would have very little impact on local population dynamics by removing most of the plants in an area where there are few other nearby plants. The impact on the species at a national scale is estimated to result in a negligible reduction in the total population.

4.6.1.3 *Carmichaelia petriei Petrie (desert broom, Fabaceae) - Declining.*

This leafless broom was recorded at several sites in both the Pit and WRS zones where several plants are present.

The result of project effects will be the loss of 2 individuals of this species from within the project area. As this species is widely and patchily distributed within natural sites in the Macraes area, and is known to occur at multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

4.6.1.4 *Discaria toumatou Petrie (matagouri, Rhamnaceae) - Declining.*

Matagouri was recorded at multiple sites and in considerable numbers in the Pit and WRS zones. Matagouri is a new addition to the threatened plant list and is classified as Declining, with no qualifiers, on the basis that the total population is estimated to exceed 100,000 mature individuals with a predicted decline of 10–70% (Townsend et al. 2007, de Lange et al. 2018). In this assessment, the panel did not consider that the species is known to rapidly expand its range in many parts of the South Island unless physically prevented from doing so. Previously it was not assessed as of conservation significance in 1976 or to 2013 (Given 1976, Given 1986, de Lange et al. 1999, de Lange et al. 2004, de Lange et al. 2009, de Lange et al. 2013).

The result of project effects will be the loss of the species from within the project area. As this species is abundant and widely distributed within natural sites in the Macraes area, and is known to occur over very large areas at multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the PIA is unlikely to impact the longer-term security of the species locally or nationally.

4.6.1.5 *Leptinella pusilla Hook.f. (a button daisy, Asteraceae) - Declining.*

This creeping button daisy was recorded at one site in the WRS where one patch is present.

The result of project effects will be the loss of the species from one site within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. It is widely but sparsely distributed and the mechanism of interbreeding between such widely spaced populations is not known. It appears to flourish in grazed situations. Overall, the loss of the one site in the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

4.6.1.6 *Lobelia ionantha Heenan (a wetland herb, Campanulaceae) - Declining.*

This creeping wetland herb was recorded at one site in the ephemeral wetland G in the WRS where several patches totalling an estimated $0.56m^2$ are present.

The result of project effects will be the loss of the species from one site within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. It is widely but sparsely distributed. It appears to flourish in grazed wetland situations. Overall, the loss of the one site in the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

4.6.1.7 *Rytidosperma buchananii (Hook.f.) Connor & Edgar (a dryland bristlegrass, Poaceae) - Declining.*

This grass was recorded at one site in the WRS where one plant is present on a rock stack in the WRS.

The result of project effects will be the loss of one individual of the species from one site within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. Overall, the loss of the one site in the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

4.6.1.8 *Carex subtilis K.A.Ford (elegant hookgrass, Cyperaceae) – Naturally Uncommon.*

This small sedge was recorded at one site in the WRS zone.

The result of project effects will be the loss of the species from one site. There is some risk of a reduction in the longer-term viability of the species in a local context as this species occurs as widely separated groups.

4.6.1.9 *Juncus distegus Edgar (Two-storey rush, Juncaceae) – Naturally Uncommon.*

This rush was recorded in various numbers bordering the ephemeral wetlands and is the dominant larger plant species in the seepage wetland in the WRS where there are patches covering an estimated 369 m^2 with an additional scattered 56 individuals.

The result of project effects will be the loss of the species from within the WRS. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. It is widely but sparsely distributed. It is considered that the loss will have some impact on local population dynamics, but this is very unlikely to majorly impact the longer-term security of the species locally or nationally.

4.6.1.10 *Juncus pusillus Buchenau (dwarf rush, Juncaceae) – Naturally Uncommon.*

This tiny rush was recorded as two 5 x 5 cm patches in ephemeral wetland A.

The result of project effects will be the loss of the species from within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. It is widely but sparsely distributed. It is considered that the loss is very unlikely to majorly impact the longer-term security of the species locally or nationally.

4.6.1.11 *Carex resectans Cheeseman (desert sedge, Cyperaceae) – Naturally Uncommon.*

This small creeping sedge was recorded as three patches totalling 40 x 40 cm in ephemeral wetland G.

The result of project effects will be the loss of the species from within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. It is widely but sparsely distributed. It is considered that the loss may have some impact on local plant population dynamics by reducing the number of populations in the area, but the effect is very unlikely to majorly impact the longer-term security of the species nationally.

4.6.1.12 *Melicope simplex A.Cunn. (poataniwha, Rutaceae) – Naturally Uncommon.*

This shrub was recorded as 11 individuals in one group of rock outcrops in the WRS.

The result of project effects will be the loss of the species from within the PIA. This will cause some loss from the local area. As this species is widespread outside of Central Otago and there are very large populations at some sites, the loss of these individuals is very unlikely to majorly impact the longer-term security of the species nationally.

4.6.1.13 *Myrsine divaricata A.Cunn. (weeping matipo/mapou, Primulaceae) – Naturally Uncommon.*

This shrub was recorded as 2 individuals in one group of rock outcrops in the WRS.

The result of project effects will be the loss of the species from within the PIA. This will cause some loss from the local area. As this species is widespread outside of Central Otago and there are very large populations at some sites, the loss of these individuals is very unlikely to majorly impact the longer-term security of the species nationally.

4.6.2 *Birds*

One of the nine indigenous bird species is classified as At Risk.

4.6.2.1 *Anthus novaeseelandiae Gmelin subsp. novaeseelandiae (pipit, Motacillidae) - Declining.*

Pipits are present within the Pit zone, where it is estimated that there a single pair of birds. Their presence in an artificially created habitat may be an indication of this species' adaptability to novel environments.

The result of project effects will be the loss of the species from the site. This may cause some negligible effect on the Macraes pipit population as the relocating birds may interact with resident birds with the most likely outcome being that the newcomers will be excluded from the resident bird's area. The fate of the displaced pair is unknowable, but it is thought that the project effects are unlikely to cause mortality of the pair as they have shown an ability to utilise an artificial habitat (grassed rock mounds) of which there is plenty in the surrounding area. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of a breeding season for a single pair is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as it is widely (though sparsely) distributed through rough grasslands of Central Otago and beyond.

4.6.3 *Reptiles*

Three of the reptile species are currently classified as At Risk: the skinks *Oligosoma polychroma* (clade 5 genotype) and *Oligosoma inconspicuum* and the gecko *Woodworthia* "Otago/Southland large".

4.6.3.1 ***Oligosoma polychroma (Patterson & Daugherty 1990) (clade 5 genotype) (southern grass skink, Scincidae) - Declining.***

Within the PIA this species has a local distribution mainly in well-vegetated sites and it is estimated based on encounter rate that there are 5 individuals within the PIA.

The result of project effects will be the loss of the species from the site and displacement of some individuals into surround areas in the buffer. This may cause some negligible effect on the Macraes population as the displaced animals will cause some short-term disruption to reptile populations in the buffer area resulting in mortality of the displaced or resident animals equivalent to the number of displaced animals. As the populations within the PIA of this species are relatively small (for the area), it is assessed that the project will have a moderate effect on the local populations.

4.6.3.2 ***Oligosoma inconspicuum (Patterson & Daugherty 1990) (cryptic skink, Scincidae) - Declining.***

Within the PIA this species has a very local distribution and was possibly seen at one site and it is estimated that there are very few individuals (if any).

The result of project effects will be the possible loss of a very small number of individuals of this species from the site and possible displacement of some individuals into surround areas in the buffer. This may cause some negligible effect on the Macraes population as the displaced animals may cause some short-term disruption to reptile populations in the buffer area resulting in mortality of the displaced or resident animals equivalent to the number of displaced animals. However, populations of this species are often widely separated, and it is unlikely that the displaced animals will encounter a resident population. As the populations within the PIA of this species are relatively small (for the area), it is assessed that the project will have a minor effect on the local populations.

4.6.3.3 *Woodworthia "Otago/Southland large" (korero gecko, Gekkonidae) - Declining.*

Within the PIA this species has a local distribution mainly in near larger rock outcrops and are also likely to be present in some of the smaller rock outcrops that are scattered through the steeper areas of the PIA. The total population within the PIA is estimated at 30 individuals based on encounter rate and quantity of habitat present.

The result of project effects will be the loss of an estimated 30 individuals of this species from the site and displacement of some individuals into surround areas in the buffer. This may cause some negligible effect on the Macraes population as the displaced animals may cause some short-term disruption to reptile populations in the buffer area resulting in mortality of the displaced or resident animals equivalent to the number of displaced animals. As the populations within the PIA of this species are relatively small (for the area), it is assessed that the project will have a moderate effect on the local populations.

4.7 Summary of Project Impacts

Ecological Feature Class	Ecological Feature Type	Ecological Feature	Classification of Feature	Buffer	Pit	WRS	PIA	Unit of Measurement	Accuracy of measurement	Ecological Importance of Feature	Magnitude of Project Impact on Feature		Overall Project Effect	Assessment Confidence
											Local Scale	National Scale		
Bird	Community	Ecological function								Moderate	Moderate	Negligible	Very Low	Moderate-Low
Bird	Species	Pipit	Declining				2	individuals	Counted	Moderate	Low	Negligible	Very Low	Moderate-Low
Bird	Species	Black-backed gull					45	individuals	Counted	Low	Moderate	Negligible	Very Low	
Bird	Species	Grey teal					6	individuals	Counted	Low	Moderate	Negligible	Very Low	
Bird	Species	Grey warbler					10	individuals	Estimated	Low	Moderate	Negligible	Very Low	
Bird	Species	Harrier hawk					1	individuals	Counted	Low	Moderate	Negligible	Very Low	
Bird	Species	Paradise shelduck					6	individuals	Counted	Low	Moderate	Negligible	Very Low	
Bird	Species	Spur-winged plover					8	individuals	Estimated	Low	Moderate	Negligible	Very Low	
Bird	Species	Welcome swallow					5	individuals	Estimated	Low	Moderate	Negligible	Very Low	
Environment	LENZ	< 10% indigenous cover left	Cultivated Pasture	26.39	29.16	24.93	80.49	Hectares	Measured					
Environment	LENZ	< 10% indigenous cover left	Ephemeral Wetland	0.02		0.3	0.31	Hectares	Measured					
Environment	LENZ	< 10% indigenous cover left	Low producing grassland	13.24	7.8	29.11	50.15	Hectares	Measured					
Environment	LENZ	< 10% indigenous cover left	Seasonal gully drainage	1.79	0.5	1.91	4.2	Hectares	Measured					
Environment	LENZ	< 10% indigenous cover left	Seepage			0.07	0.07	Hectares	Measured					
Environment	LENZ	< 10% indigenous cover left	Shelterbelts & Exotic Trees	0.08		0.53	0.61	Hectares	Measured					
Environment	LENZ	< 10% indigenous cover left	Shrublands	3.17	0.08	2.79	6.04	Hectares	Measured					
Flora	Community	Ephemeral Wetland	Critically Endangered Historically Uncommon ecosystem type	0.02		0.3	0.31	Hectares	Measured	High	High	Medium	High	Low-Moderate
Flora	Community	Seepage	Endangered Historically Uncommon ecosystem type			0.07	0.07	Hectares	Measured	High	Moderate	Low	Low	Low-Moderate

[Type text]

Flora	Community	Cultivated Pasture		26.39	29.16	24.93	80.49	Hectares	Measured	Negligible	Low	Negligible	Very Low	
Flora	Community	Low producing grassland		24.82	8.76	39.47	73.04	Hectares	Measured	Moderate	Moderate	Low	Low	Moderate-Low
Flora	Community	Seasonal gully drainage		1.79	0.5	1.91	4.2	Hectares	Measured	Low	Moderate	Low	Very Low	Low
Flora	Community	Shelterbelts & Exotic Trees		0.08		0.53	0.61	Hectares	Measured	Negligible	Low	Negligible	Very Low	Moderate-High
Flora	Community	Shrublands		7.36	0.08	3.65	11.09	Hectares	Measured	Moderate	Low	Negligible	Very Low	Moderate
Flora	Community	Ecosystem services								Minor				
Flora	Community	Historically Rare or Threatened Ecosystems				2	2	Communities		See Ephemeral Wetland and Seepage Wetland Flora Communities				
Flora	Community	Integrity								Moderate				
Flora	Community	National Priorities for Protection				2	2	Communities		See Ephemeral Wetland and Seepage Wetland Flora Communities				
Flora	Community	Rarity								High	Moderate	Medium	Medium	
Flora	Community	Representativeness								Moderate	Moderate	Medium	Medium	
Flora	Community	Sites recommended for protection					0	Sites		Nil				
Flora	Community	Wetlands of National Importance or Ramsar sites					0	Sites		Nil				
Flora	Species	Carmichaelia crassicaulis Hook.f. subsp. crassicaulis	Declining	15		2	17	individuals	Counted	High	Very Low	Negligible	Very Low	Moderate
Flora	Species	Carmichaelia petriei Kirk	Declining	10		7	17	individuals	Counted	High	Low	Negligible	Very Low	Moderate
Flora	Species	Discaria toumatou Raoul	Declining	7.36	0.08	3.65	3.73	Hectares	Estimated	High	Negligible	Negligible	Very Low	Moderate-High
Flora	Species	Leptinella pusilla Hook.f.	Declining			1	1	m^2	Estimated	High	Low	Negligible	Very Low	Moderate-Low
Flora	Species	Lobelia ionantha Heenan	Declining			0.561	0.561	m^2	Estimated	High	Moderate	Low	Low	Moderate-Low
Flora	Species	Rytidosperma buchananii (Hook.f.) Connor & Edgar	Declining			1	1	individuals	Counted	Low	Very Low	Negligible	Very Low	Moderate-Low
Flora	Species	Carex resectans Cheeseman	Locally Uncommon			1.6	1.6	m^2	Estimated	Moderate	Moderate	Low	Low	Moderate-Low
Flora	Species	Melicope simplex A.Cunn.	Locally Uncommon			11	11	individuals	Counted	Moderate	Moderate	Negligible	Very Low	Moderate
Flora	Species	Myrsine divaricata A.Cunn.	Locally Uncommon			2	2	individuals	Counted	Moderate	Moderate	Negligible	Very Low	Moderate

Flora	Species	Anthosachne falcis (Connor) Barkworth & S.W.L.Jacobs	Naturally Uncommon				100	individuals	Estimated	High	Moderate	Low	Low	Moderate
Flora	Species	Carex subtilis K.A.Ford	Naturally Uncommon			1	1	individuals	Counted	Moderate	Moderate	Negligible	Very Low	Moderate
Flora	Species	Juncus distegus Edgar	Naturally Uncommon			369	369	m^2	Estimated	Moderate	Moderate	Low	Low	Moderate-Low
Flora	Species	Juncus distegus Edgar	Naturally Uncommon			56	56	individuals	Estimated	Moderate	Moderate	Low	Low	Moderate-Low
Flora	Species	Juncus pusillus Buchenau	Naturally Uncommon			1	1	m^2	Estimated	Moderate	Moderate	Low	Very Low	Moderate-Low
Flora	Species	Diversity								Moderate	Moderate	Medium	Medium	
Invertebrates	Community	Overall importance								Moderate	Moderate	Low	Low	Low
Reptiles	Community	Overall importance								Moderate	Moderate	Low	Low	Moderate
Reptiles	Species	*Oligosoma inconspicuum*	Declining		1			individuals	Counted	High	Moderate	Negligible	Very Low	Moderate-Low
Reptiles	Species	*Oligosoma polychroma* (clade 5 genotype)	Declining				5	individuals	Estimated	High	Moderate	Negligible	Very Low	Moderate-Low
Reptiles	Species	*Woodworthia* “Otago/Southland large”	Declining				30	individuals	Estimated	High	Moderate	Low	Low	Moderate
Reptiles	Species	*Oligosoma maccanni* (clade 4 genotype)					150	individuals	Estimated	Moderate	Moderate	Low	Low	

Table 4. Summary table of project impacts on terrestrial ecological features assessed using the Environment Institute of Australia and New Zealand’s 2018 Ecological Impact Assessment Guidelines. Rows shaded pink are effects that are significant under regional or district plan criteria.

5 Impact Management

5.1 Approach

The approach to impact management follow a Mitigation Hierarchy of first seek to avoid the impact, then remediate residual ecological effects[8], then mitigate residual ecological effects, then employ an offset to address as much of the remaining residual ecological effects as practicable, and finally compensate for the outstanding balance of the ecological effects. Moving to the next step in the hierarchy is only possible once the possibility of employing the higher-order option has been fully explored and documented and the residual ecological effects calculated. This approach is consistent with Policies 5.4.6 *Offsetting for indigenous biological diversity* and 5.4.8 *Adverse effects from mineral and petroleum exploration, extraction and processing* of the pORPS (and including Environment Court decision NZEnvC41 of 15 March 2019). For the purposes of giving effect to these policies "significant adverse effects" are considered those where the overall project effect is moderate or greater.

5.2 Summary of Impact Management Activities

OceanaGold's preferred approach to addressing the Deepdell North III project's impact on ecological features is to adopt a hierarchical management approach, as outlined below:

- avoid effects through siting of the WRS and isolating important areas;
- remedy effects through creation of new lizard habitat and a new pit lake;
- mitigate effects by employing Standard Operating Procedures and relocation of two plant species; and to (mainly)
- offset impacts through funded actions at two offset locations, one for ephemeral wetlands and supported by a research programme and the other in a high value mixed shrubland and tussockland area.

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[8] Residual adverse ecological effects, are the remainder of a project's predicted impact on all of the ecological features within the PIA that would not be addressed once the actions under consideration for that mitigation option have been employed as designed.

5.2.1 *Avoidance of effects*

Four options for siting of the WRS were evaluated, and the option with the least impact over ecological, environmental and social considerations became the preferred option. WRS construction will be staged with initial deposition into the existing Deepdell Pit. This action avoids impacts on significant ecological features if the project is halted before completion.

Areas in the buffer area with higher ecological values will be isolated from unintended effects (such as vehicle movements) by clearly delineating in maps provided to mine operations staff and on the ground by using well-maintained flagging tape, temporary fencing and signage.

5.2.2 *Remediation of effects*

Constructing areas of the margins of the final WRS to provide habitat for lizards. This will provide benefit in 1) creating habitat that will be occupied by populations of the skinks *Oligosoma maccanni* (clade 4 genotype), *Oligosoma polychroma* (clade 5 genotype), and the Declining gecko *Woodworthia* “Otago large”, 2) create a safer refuge for these lizard populations by decreasing the hunting efficiency of cats in these areas.

The rehabilitated Deepdell North III WRS is expected to produce replacement habitat of very similar nature to the impacted existing Deepdell WRS which is utilised by one pair of Declining pipits and Not Threatened spur-winged plover.

Likewise, the new pit lake in the Deepdell North III pit will produce replacement habitat similar to that occupied by the breeding colony of black-backed gulls in the existing Deepdell South pit.

5.2.3 *Mitigate effects*

Potential effects associated with dust, noise, disturbance, sediment runoff, weeds and fire risk will be appropriately minimised via the adherence to best practice and Standard Operating Procedures throughout the mining activities.

Relocating certain plant species that are of ecological importance to safe site(s) in an Ecological Enhancement Areas (EEA) (such as the nearby OceanaGold covenants) is also a key mitigation feature. This will be undertaken by a suitably experienced operator removing them (or propagating parts of them such as seeds or cuttings) following OceanaGold’s Plant Propagation, Translocation and Management Procedure (updated to include the species listed below) and establishing them at EEA sites with existing suitable habitat. The plants will receive post-introduction care where necessary including watering and suppression of competing vegetation for two years. The success of moving these species will be monitored by counting number of plants at the recipient site on an annual basis for three years. Relocation is proposed for the following species:

1. The Locally Uncommon shrub *Melicope simplex* from the eleven trees in the WRS to result in twenty individuals at one site in the nearby OceanaGold Highlay Creek Shrubland Covenant to create a new population there.
2. The Naturally Uncommon shrub *Myrsine divaricata* from the two individuals in the WRS to result in 10 individuals at one site in the nearby OceanaGold Highlay Creek Shrubland Covenant to create a new population adjacent to an existing population.

As there are forecast to be residual adverse effects of the project on the site's biodiversity after implementation of the Avoid, Remedy and Mitigate, an offset will be provided to address remaining significant residual adverse effects.

5.2.4 *Offset residual effects*

Creating a multi-outcome offset Ecological Enhancement Area (EEA) at a nearby site with similar or better ecological values and provide funds for the ecological management of this area is recommended. This offset will have several components: an averted loss multiuse offset in an EEA on Redbank Station (Redbank EEA) to address the project's impact on shrublands, low producing grasslands and the seepage wetland, and an ephemeral wetland enhancement offset and supporting research project at sites in another EEA in the south of the Ecological District (Ephemeral Wetland EEA) to address the impact on ephemeral wetlands. There are local constraints on how an offset can be realised in the Macraes situation and these have been considered in the design of the offset package. The disaggregated accounting model[9] was used to calculate the extent of works required within the EAAs to achieve a state of No Net Loss of biodiversity (NNL). The implementation and management of the EEA sites will be documented in an EEA Management Plan. The EEA's will also contain ecological features that are additional to those needed for addressing project effects. These additional features are considered to be a biobank.

[9] Maseyk, F.J.F; Barea, L.T; Stephens, R.T.T; Possingham, H.P; Dutson, G; Maron, M. 2016. A disaggregated biodiversity accounting model to improve estimation of ecological equivalency and no net loss. Biological Conservation 204: 322-332.

5.2.4.1 *Redbank EEA*

The Redbank EEA in the upper Waikouaiti River North Branch offset site (Figure 4) has been chosen on the basis of discussions with both landowners who identify it as a site of low farming usefulness and a site examination that shows the site has considerable ecological value in terms of fauna, vegetation communities and as habitat for rare species. This site is currently part of a farming environment and has no protections beyond that afforded by regional and district plans and therefore ongoing damage to some ecological features is expected and the site could be subject to extensive livestock grazing. Some of the ecological features in the EEA are restricted to areas where stock are not able to access.

Figure 4. Location of Redbank EEA.

A covenant of at least 126 ha will be established under the Conservation Act which contains biodiversity that is of similar character to that being lost, but of better quality and with other inherent ecological values. Sensitive parts of this covenanted area will be fenced to exclude stock and limits will be placed on the type of stocking that can occur in the covenanted area and on any activities that could result in damage to the soils or to vegetation of high ecological importance. This land will be managed using the income from a fund held by OceanaGold until cessation of mining when the fund will be ceded to another authority.

Important components of this component of the offset are:

- Have a legal protection.
- Will be farmed as appropriate with the objective of protecting the important biodiversity features.
- Be of sufficient size to compensate for uncertainties in ecological outcomes associated with retaining farming in the covenant.
- Satisfy the offset criteria detailed in the pORPS.
- Will have a fund to support the management of the covenant on an ongoing basis.
- Will involve the farming community together with DOC and Councils in the offset design and placement.
- Will incorporate the Science and Traditional Knowledge offset principle by including farming community knowledge of biodiversity management in the Macraes Area.
- Will incorporate the Equity offset principle by sharing the risks and benefits between the farming community, DOC and Councils.
- Be managed with ecological oversight.
- Will result in a Biobank of additional ecological gains that will be used to address a future project's ecological impact.

This offset is currently under investigation to investigate its feasibility. This offset will also address the project's impact on the shrubland, seepage wetlands and low-producing grassland plant communities, as well as the Declining matagouri, desert broom *Carmichaelia petriei*, skinks *Oligosoma inconspicuum* and *Oligosoma polychroma*, gecko *Woodworthia* "Otago/Southland large", Naturally Uncommon grass *Anthosachne falcis*, some components of the invertebrate and bird communities and on McCann's skink through protecting areas inhabited by these species.

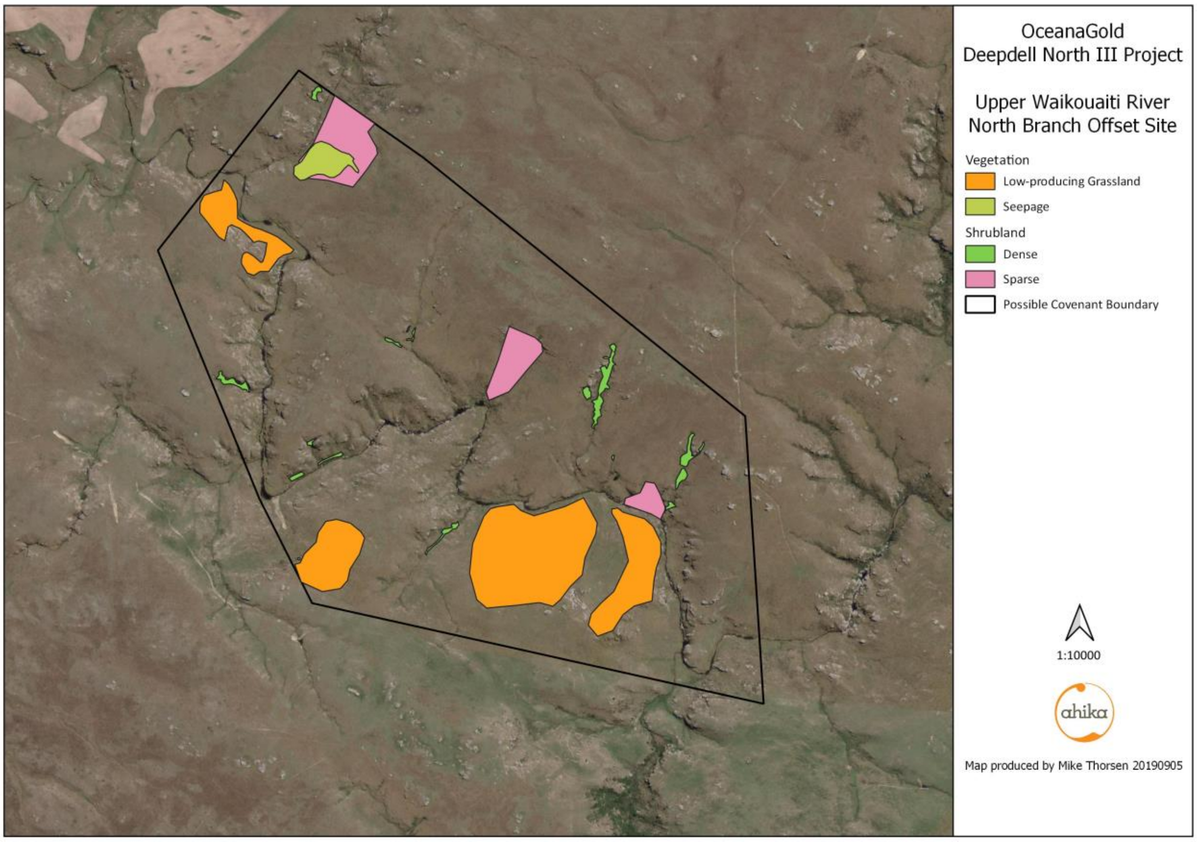

Figure 5. Location off plant community offset sites in Redbank EEA. Remainder of the area is narrow-leaved tussock grassland.

Shrubland Component

Offsetting the loss of an estimated 3.73 ha of shrubland from the Deepdell North III site will be through including 4.23 ha of an equivalent plant community of better ecological integrity. The offset site has a higher diversity of shrub species (22 species), than in the impacted shrubland (15 species), is ecologically more intact with fewer exotic species and a denser canopy, and is of a similar nature (though with some species that reflect a higher elevation and damper area). This component of the offset will involve planting of 5 ha of new shrubland in the EEA that is comprised of at least 18 shrub species and reaching 2 m in height and 75% canopy cover within 10 to 20 years, respectively, and keeping these free of exotic shrub species for 10 years. This produces a Net Present Biodiversity Value of 0.29 and should achieve NNL 20 years after implementation. This offset should also address impacts on the Declining matagouri, desert broom *Carmichaelia petriei*, skinks *Oligosoma inconspicuum* and *Oligosoma polychroma*, gecko *Woodworthia* "Otago/Southland large", Naturally Uncommon grass *Anthosachne falcis*, some components of the invertebrate and bird communities and on McCann's skink through improving habitat for these species.

Seepage Wetland Component

Offsetting the impact resulting in the loss of 0.07 ha of seepage wetland will be through including the 0.82 ha of an equivalent plant community and managing this to better ecological integrity. This offset is considered to have the elements of both an averted loss offset and an improved condition offset. The averted loss component of the offset is difficult to calculate as there is no available data on loss of these ecosystems in the area, but there have been high reported loss of wetlands from Southland and they are classified as Endangered based on their estimated rate of decline caused by weed invasion over ≥70% of their extent nationally. This offset component will involve using weed control to achieve a 20% improvement in indigenous species dominance within the 0.82 ha seepage wetland at the offset site by 10 years. This produces a Net Present Biodiversity Value of 0.01, but additional to NNL are the gains considered to have been achieved through the averted loss portion of the offset. Protecting this seepage wetland against the background of 70% loss (over an estimated 30 years) would increase the Present Biodiversity Value by c. 70% to 0.017. The impact on the Naturally Uncommon rush *Juncus distegus* will also be addressed through this offset by creating conditions in which this species can flourish, supplemented by planting of 50 individuals.

Low-producing grassland Component

Offsetting the impact resulting in the loss of an estimated 49.47 ha of low producing grassland will be through including 24.55 ha of an equivalent plant community and managing this to better ecological integrity. This offset is considered to be an averted loss offset as this vegetation community decreased in the Macraes E.D. by 79.3% between 2008 and 2012[10]. It is likely this rate of loss is continuing. Based on this rate of loss, NNL will have been achieved within 5 years of protection of the habitat. This offset would be realised on establishment of the covenant with appropriate safeguards against invasion of the habitat by woody weed species and changes to land management (particularly guarding against soil disturbance). The impact on the Declining grass *Anthosachne falcis* (will also be addressed through this offset by creating conditions in which this species can flourish.

[10] Based on change in the NZ Land Cover Database

5.2.5 *Ephemeral wetland EEA*

Offsetting the impact resulting in the loss of 0.81 ha of ephemeral wetlands will be an improved-condition offset with the improvement work informed by a research project investigating ephemeral wetland form, function and threats. This offset will involve using weed control to produce a 25% improvement in indigenous vegetation cover at ephemeral wetlands at 5-7 sites totalling at least 2 ha and an improvement in indigenous plant indigenous plant diversity to at least 11 indigenous plant species characteristic of Macraes ephemeral wetlands by 10 years. This produces a Net Present Biodiversity Value of 0.31 and NNL is achieved by year 10. The 2 ha target of managed ephemeral wetland is double the 1 ha required to reach NNL, but compensates for current uncertainties in ecological state of these systems and lack of proven management tools. These figures are also based on the associated research project addressing deficiencies in knowledge on the form, function, threats and management of ephemeral wetlands. This research project will establish the physical profiles and subsurface nature of 10 selected ephemeral wetlands, documenting their hydrological profile over time and measuring changes in their plant communities 3-4 times a year over 5 years. The threat that ephemeral wetlands face will be established by revisiting 20 previously surveyed sites and documenting their current condition, quantifying surrounding land use of all mapped ephemeral wetlands and visiting a random selection of 50 ephemeral wetlands to describe their current condition. The impact on the Declining wetland herb *Lobelia ionantha* and Locally Uncommon sedge *Carex resectans* will also be addressed through including these species as two of the 11 species.

5.2.6 *EEA Management Plans*

The implementation and management of each of the EEA's will be documented in a management plan (EEAMP). The EEAMP will form a part of a broader project Ecological Management Plan (which will include on-site works to avoid, remedy, and mitigate adverse effects).

The EEAMP will include:

- a description of the offset, the calculation basis, locations and management activities at which enhancements will be generated;
- securing the ability to undertake enhancement works within management sites by way of landowner agreements (e.g. covenants) or acquisitions;
- the technical detail of the offset works;
- the financial costs of site management into bond calculations or other similar instruments as required by Council that secure financial delivery of biodiversity enhancements;

- a monitoring programme to assess the degree to which enhancement targets are being achieved and the ability to adjust biodiversity management to ensure that gains are achieved and maintained for the long term;
- the roles and responsibilities of those carrying out the work, and the governance and management structures relating to the operation of the enhancement site(s); and
- reporting the results of monitoring results and a process for undertaking actions if enhancement targets are not being achieved as anticipated.

5.2.7 *Biobanking*

The proposed Redbank EEA includes 73 ha of narrow-leaved tussock grassland that is additional to that required under this Impact Mitigation Plan. This narrow-leaved tussock grassland is considered a biobank for use when appropriate to address the impact of a future OceanaGold project. The baseline ecological condition and change in condition over time will be measured using vegetation plots. The proposed EEA also provides habitat to an additional 17 plant species of conservation concern which are also considered biobanked (together with any additional species found during future surveys) and their population status will be monitored over time. The reptile, bird and invertebrate communities that inhabit the additional areas are also considered biobanked and their baseline and condition over time.

The ecological condition of these additional communities will be measured as for the offset areas and the biobank will be adjusted to reflect any changes (beneficial or detrimental) in ecological condition.

5.2.8 *Ecological compensation*

As there are expected to be no significant residual adverse effects following implementation of the Avoid, Remedy, Mitigate and Offset options, no activities are proposed as ecological compensation.

5.2.9 *Nil actions*

No mitigatory or compensatory activities are proposed for the two individuals of Declining coral broom, 1 m^2 of Declining rush *Juncus pusillus*, one individual of the Declining grass *Rytidosperma buchananii*, one patch of the Naturally Uncommon hookgrass *Carex subtilis,* Not Threatened grey teal, Not Threatened welcome swallow, or the seasonal gully drainage plant community, as the impact of the project on these ecological features is predicted to be Very Low.

5.2.10 *Adequacy of Impact Management Activities*

These actions will, if implemented correctly, fully address all non-minor project effects excepting some minor impacts on individuals of some rare plants and common indigenous bird species, or mostly exotic plant-dominated plant communities noted above. It is also considered that benefit of the offset covenant containing a higher quantity of the Macraes biodiversity more than compensates for the impact of the Deepdell North III project on these features.

OceanaGold has overall responsibility for undertaking this work as described in the Impact Management Plan.

6 Site photographs

Figure 6. View of shrublands in Deepdell South pit backfill area of WRS looking east from 1398138 4975528. Old Deepdell South pit in right midground. Photo taken 16 January 2018.

Figure 7. View of Deepdell North III pit eastern boundary looking north towards Horse Flat from 1398028 4975609. Photo taken 16 January 2018.

Figure 8. Ephemeral wetland F near Deepdell North III pit on Horse Flat at 1398013 4975714. Photo taken 16 January 2018.

Figure 9. Seasonal gully drainage at 1397550 4976002. Photo taken 16 January 2018.

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Deepdell North III Project

Impact of Project on Vegetation, Avifauna, Herpetofauna and Invertebrates

December 2019

Report prepared for Oceana Gold (New Zealand) Ltd by Dr M. J. Thorsen,

5 December 2019

Report number: 0219-19

2 Dowling Street
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New Zealand

1 Contents

2 Executive Summary

This report evaluates the potential impact of the proposed Deepdell North III project on the area's vegetation, avifauna, herpetofauna and invertebrates. The Deepdell North III project will remove 54.79 ha of indigenous vegetation comprising of low producing grassland, shrubland, seasonal gully drainages, ephemeral wetlands and a seepage wetland and inhabited by 71 indigenous plants (including 13 rare species), twenty bird species (nine indigenous and one rare species), four reptile species (three rare species) and an invertebrate community. The vegetation communities are underlain by 3 Threatened LENZ. The ephemeral wetland vegetation community is recorded as being Historically Rare and Critically Endangered and the seepage wetland is recorded as being Historically Rare and Endangered. Both types of ecosystem are priorities for protection. The indigenous vegetation communities are generally of low species diversity and most are characterised by high weed representation. The populations of the 17 At Risk or Rare species are mostly small, except for the Declining Matagouri which is dominant in the shrubland vegetation community and frequent in the low producing grassland plant community. Given its prevalence throughout much of the South Island there is doubt concerning the national conservation assessment for this species.The project will also impact on 54.09 ha of cultivated pasture and shelterbelts.

If appropriate controls are employed during the mining activity, there is anticipated to limited impact on the surrounding pastoral and indigenous ecosystems.

Overall the Deepdell North III project is assessed as having low to very low effect on most of the terrestrial ecological features. Exceptions to this are a moderate impact on some indigenous plant communities and a high impact on the seven Historically Uncommon Nationally Critical ephemeral wetlands. These effects will be addressed through an Impact Management Plan.

3 Quality Assurance

The practices and methods set out in this Ecological Impact Assessment are those considered appropriate for delivering accurate information and would withstand scrutiny from a majority of competent ecologists.

No survey can guarantee to detect every species present in an area, and non-detection is likely to be more of a factor in cryptic or rare species, invertebrates, or plant species with no flowering material at the time of survey. All reasonable effort was made in the detection of these species during survey. There is also an element of uncertainty in the distribution of some species that are difficult to identify, or smaller herbs and grasses as these are frequently overlooked during informal surveys. There is approximately 20% of the flora that lacks a formal name and there is limited information available both on how to identify these entities and where they are found. There is limited information on invertebrates.

Due to the limited period of survey the results in this document will not reflect: 1) seasonal variation in abundance or site usage by some species, or 2) inter-annual variation in abundance or site usage by any species.

The identity and boundary of vegetation communities have been determined from interpretation of aerial photographs together with ground-truthing and oblique photography. The map may not accurately represent the correct vegetation community or current border of some vegetation communities, particularly those with a dispersed character or where bordered by similar communities. Smaller occurrences (<1 ha) of some vegetation communities are generally not represented in this document's reports and maps.

This document uses information drawn from previous reports by other organisations and no guarantee can be made on the quality, comprehensiveness or accuracy of that information.

4 Project Overview

4.1 The Deepdell North III Project

The 105 ha Deepdell North III Project (Figure 1) is an extension to the existing consented Deepdell North project at OceanaGold's Macraes Gold Project (MGP). The main elements of the Project are:

1. Open Pit Excavation
    a. Current footprint 38ha, 18.7ha of disturbing previously mined areas and 19.6 ha of new disturbance. Potential to expand if upcoming exploration is successful.
    b. Quantities: Ore 3.5Mt, Backfill waste 9.4Mt, in-situ oxide waste (brown rock) 2.4Mt, in-situ fresh waste 41.5Mt. Total movement 57Mt
    c. Haul roads 30m wide. Roads within pit footprint only.
    d. The top of the pit excavation is at about 520mRL and the base of the pit is at 370mRL, making the total pit depth 150m.
    e. Water management during operations would require pumping of stormwater runoff (primarily) out of the pit and into the existing drain that drains to the Deepdell North Silt Pond
    f. At closure, the pit lake will form slowly through passive ground and surface water inputs and is not expected to overflow to deepdell catchment for approximately 100 years
    g. Ancillary infrastructure associated with the open pit (park-up areas, smoko and ablutions, portable fuel tank etc.) would be located immediately west of the pit in the same areas previously used for these purposes.
2. Waste rock disposal – Deepdell South Backfill
    a. Total backfill footprint 16.4 ha, most (13.2 ha) is filling in a previously disturbed open pit and 3.2ha is new disturbance.
    b. Storage quantities 13Mt
    c. No new access roads required as access via existing Deepdell South haul road. Internal roads will be constructed to access top levels.
    d. Base of waste backfill is the base of the existing open pit at 360mRL, top of design backfill is at 500mRL, thus making the total depth stacked 140 m.
    e. Waste backfill runoff and long term seepage will drain to the existing Deepdell South silt pond
    f. No additional infrastructure will be required.
3. Waste rock disposal – Horse Flat Waste Rock Stack
    a. Total stack footprint 60ha, all of which is new disturbance.
    b. Storage quantities 45Mt
    c. A small access road will need to be constructed off the existing Coronation haul road. Internal roads will be constructed to access top levels.
    d. Base of waste stack is at 485mRL, top of design stack is at 640mRL, thus making the total depth stacked 155m.
    e. Waste stack runoff and long term seepage drainage will enter Highlay Creek and Deepdell Creek via existing and proposed silt ponds.

f. No additional infrastructure will be required.

Mining Method & Equipment

Same as existing operations. Up to two dig fleets may be engaged in the excavation operations.

Project Closure

1. Pit: Not backfilled. Where possible (i.e. rock is soft or within existing backfill) the excavation levels above the final lake level will be shaped to provide aesthetically pleasing and suitable areas for vegetation establishment.

   Surface water from the waste rock stack to be directed to the pit and clean water to be will continue to be diverted to Camp Creek. This lake to drain as per notes above.
2. Waste disposal
   a. Deepdell South backfill is backfilling a previously mined pit (c. 2001), slopes to be dozed down to a 3H : 1V slope and rehabilitated back into pasture using standard site techniques. Note that this will substantially soften the visual amenity from the Golden Point historic reserve.
   b. Horse Flat Waste Rock Stack slopes will be designed to blend into the surrounding topography as far as possible but the slopes will frequently be shallower than some of the surrounding natural slopes in order to establish stable vegetation growth and minimise erosion damage.
3. Site establishment areas and haul roads will be rehabilitated using standard site techniques.

Project Timeline

The Round 2 LOMP17 schedule sees these major project milestones:

- Site establishment and first overburden mining: October 2020
- First ore: December 2020
- Mining finished: July 2022

4.2 Land Tenure

This project is entirely on Oceana Gold New Zealand Limited freehold land.

4.3 Regulatory Authorities

This project is situated within the Waitaki District Council (WDC) territorial boundary. It is also within the jurisdictional boundaries of the Otago Regional Council and Department of Conservation's Kā Moana Haehae/Alexandra Office.

4.4 OceanaGold Environmental Standards

OceanaGold's environmental management programme is based on the complete mine life cycle, from exploration through development and operation, to eventual decommissioning, closure and site rehabilitation. The company seeks to not only meet, but consistently exceed regulatory requirements in place, to protect the environment for future generations and safeguard the sustainability of nearby communities.

OceanaGold is committed to continued improvement in the identification, assessment, mitigation, and monitoring of the environmental effects of its operations. The company works hard to plan and implement environmental projects that protect and support the natural environments associated with its operations, and that demonstrate its focus on international best practice environmental stewardship. Clearly, the company's activities can impact the environment and in some cases, create lasting effects. Wherever possible, OceanaGold seeks to ensure a net environmental gain from its activities, and is diligent in its adherence to all applicable laws and standards in New Zealand and offshore.

The Company aims to be an industry leader in the identification, assessment, mitigation and monitoring of its environmental impacts. Specifically, OceanaGold commits to:

- Identify and mitigate all environmental and human health impacts associated with its activities. In undertaking mitigation measures, the company will aim for a net environmental gain.
- Comply with all applicable laws and standards, and apply company-wide standards, based on international best practice, that minimise adverse environmental impacts arising from its operations.
- Rehabilitate all mine sites to a stable landscape and land use which does not pose any unacceptable risk to the environment.

• Develop an end-of-mine-life land use, in consultation with stakeholders, which will leave a positive legacy.

The aim of this policy is to provide direction to OceanaGold's employees, and contractors undertaking activities on the Company's behalf. The policy aims to place OceanaGold at the forefront of environmental impact identification and mitigation within the mining industry.

The purpose of ecological work at OceanaGold's Macraes mine site is to:

1. Ensure monitoring, management and reporting of flora, fauna and habitat meets relevant legislation, permits or licenses and community consultation outcomes.
2. Pursue a practice of minimum disturbance for the flora, fauna and habitat in the areas the site operates.
3. Ensure that the conservation status of flora and fauna species is not threatened.

These works will be undertaken to <u>at least</u> the Minimum Standard where:

- Sites will develop an Environmental Impact Assessment or Management Plan which will address management of land, flora, fauna and habitat, taking into account relevant legislation, permits or licenses, and community consultation.
- The Environmental Impact Assessment is to be updated where there are changes to any part of the operation (either man-made or natural) that significantly impact on it.
- The minimum area of vegetation required for exploration, construction and operation will be cleared.
- Where practicable, topsoil to a depth of 15 cm will be stockpiled prior, for use in rehabilitation.
- Sites will develop a programme to monitor and evaluate the health of flora and fauna affected by the location, and take steps to mitigate any adverse effects revealed.
- The monitoring programme will include weed and pest species, and appropriate management practices will be used to mitigate adverse effects.
- All employees are prohibited from capturing, purchasing or acquiring native wildlife for any purpose.

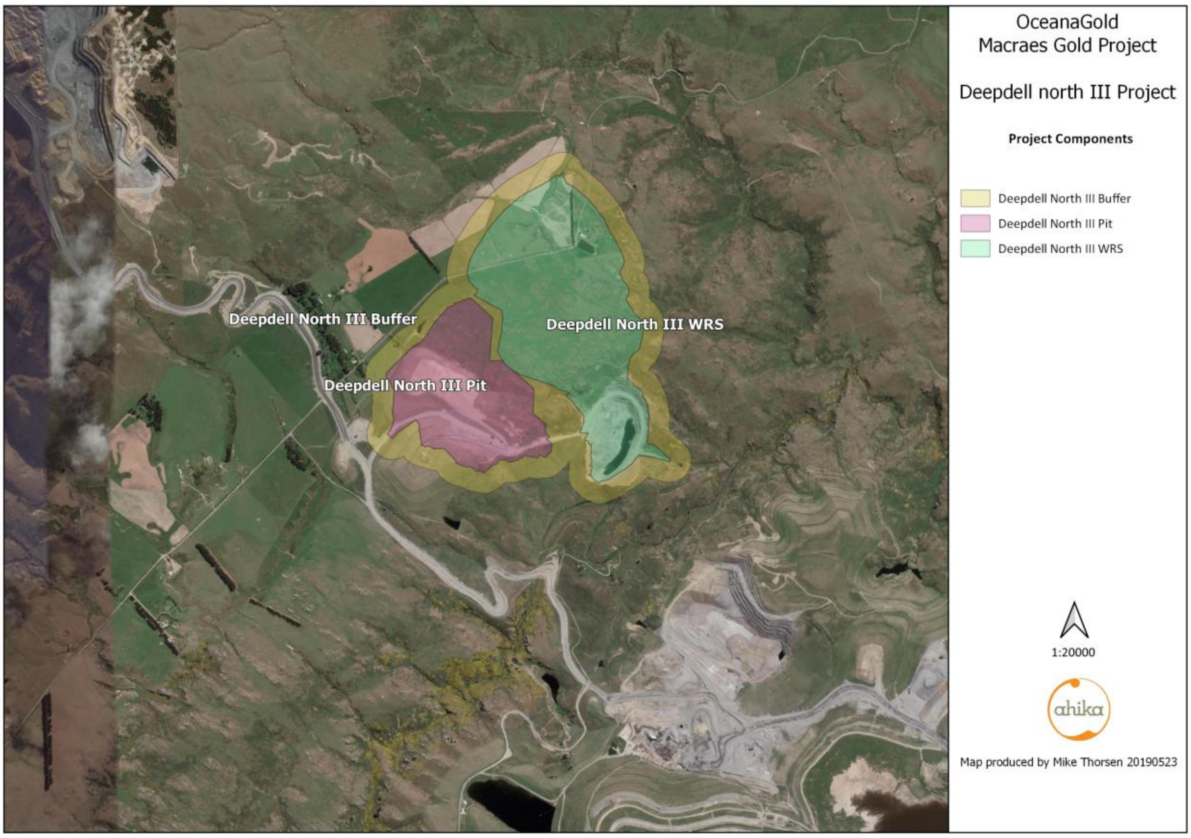

Figure 1. Location of Deepdell North III project area.

5 Assessing Ecological Importance

5.1 The Permitted Baseline

This impact assessment is in consideration to the permitted baseline and current ecological condition of the area. The activities that are permitted in regional and district plants to occur within the project area and that are likely to be having some influence on the site's ecological condition are: farming activities such as grazing of stock, topdressing, pasture grass establishment and maintenance and vegetation clearance (up to extent specified in plans).

5.2 Assessment criteria

The information that was gathered during the inventory surveys was used to evaluate the ecological importance of the vegetation, birds and reptiles and their habitats within and surrounding the Project Impact Area (PIA), against the following criteria (based on those recommended in the Environment Institute of Australia and New Zealand's 2018 Ecological Impact Assessment Guidelines available at http://www.eianz.org/resources/publications):

- Representativeness of communities.
- Distinctiveness of communities.
- Ecological functionality of communities (intactness, connectivity, buffering).
- Rarity of communities.
- Community diversity.
- Role in ecosystem servicing.
- Sites or communities of significance at
  - National (Threatened Land Environments, National Priorities for Conservation, Historically Rare or Threatened Ecosystems, Wetlands of National Importance, Ramsar Sites).
  - Regional (as identified in the Regional Plan), or
  - Local (as identified in District Plans) scales.
- Sites identified as worthy of protection.
- Presence of rare, At Risk or Threatened species.
- Presence of species of biogeographical interest.
- Presence of genetically or morphologically distinct forms.

The results of this assessment of ecological importance, based on Table 3, Table 5, Table 6 and supporting text of the Environment Institute of Australia and New Zealand (EIANZ) guidelines, is provided in Section 6, and summarised in Section 6.10.

5.3 Determining the boundary of ecological impact of project.

The ecological impact that arises from a project's activities includes the footprint of the planned project (the footprint area) but may extend beyond the area where that activity occurs. How far this effect may extend depends primarily on the nature of the activity, the mechanism of the impact, and the sensitivity of the ecological features in the surrounding area. In this instance a

100 m buffer has been selected on the basis of the impact of project activities (Section 7.3), and the sensitivities of the ecological features to these activities (Sections 6.2, 7.4, 7.6, 0 and 7.8). Together, the footprint area and the buffer area comprise the Project Impact Area (PIA) within which some impact on ecological features might be expected.

The PIA for the Deepdell North project in total covers 169.9 ha, of which 109.4 ha is within project activities that will eventually result in the loss of all vegetation and fauna within the identified boundary (footprint areas: the 38.5 ha Pit and 70.9 ha WRS[1]), and 60.5 ha is in the 100 m wide buffer area surrounding the footprint area (Figure 1).

5.4 Assessment Methodology

5.4.1 *Literature review*

All available literature on the natural history of the Macraes area was reviewed as part of the assessment process. Unpublished databases were also utilised: plant location records maintained by the New Zealand Plant Conservation Network (www.nzpcn.org.nz), NatureWatch (www.naturewatch.org.nz) and the author's unpublished database of plants observed in the Macraes area; invertebrate records on NatureWatch (including the author's records); reptile location records maintained by the Department of Conservation (DOC) in their Amphibian and Reptile Distribution Scheme (ARDS), bird location records maintained by eBird (www.ebird.org) and Nature Watch, and for invertebrates involved online searches for the phrase "Macraes Invertebrate/Insect" in Google (www.google.co.nz), Google Scholar (https://scholar.google.co.nz/), ResearchGate (www.researchgate.net) and Bugz (www.bugz.org.nz) and utilising the NZ Arthropod Collection for records of species.

[1] There is a small overlap between the map of the Pit and WRS. This overlap has been removed from my area calculations.

5.4.2 *On-site inventory survey methodology*

The flora, reptiles, birdlife and invertebrates of the Project Impact Area (PIA, see Section 5.3) were assessed using expert walk-through surveys, as it is considered that these are better at finding rare features compared to plot-based assessments, complemented with light-trapping for nocturnal Lepidoptera and night searches for nocturnal invertebrates.

5.4.2.1 *Flora survey*

The flora survey was undertaken by Mike Thorsen on 14 January 2016 and multiple dates in 2019 and Alex Ghaemaghamy on 16, 17 & 31 January and 14 February 2018. During the flora survey all plant species (indigenous and exotic) were recorded during a walk-through survey of the PIA and adjacent area. The survey path traversed the most botanically interesting areas, and an estimate of each plant's abundance both within the WRS and Pit areas of the PIA and in the surrounding area was made using the following criteria:

- Previously Present (recorded by previous visitors, but not recorded during this survey);
- Rare (infrequently seen during survey and in very low numbers covering <1% of area);
- Local (only seen at few areas during survey, but could be quite common within these areas and covering <5% of total area);
- Occasional (individuals were scattered throughout site or were in widely scattered clumps and covering 5-20% of area);
- Common (frequently encountered during survey, but not a dominant part of the flora and covering 20-60% of area);
- Abundant (a dominant part of the flora and covering >60% of area).

The locations of plant species or vegetation communities of interest were recorded using a hand-held GPS unit.

Photographs of general vegetation patterns and sites of interest were taken. The results of this flora survey are provided in Section 6.2.

To provide an estimate of percentage vegetation cover by indigenous species, a Naturalness Index was calculated. This Index is calculated by first assigning each plant species an abundance value assigned during the site inspection. The abundance values used are: Rare = 2, Local = 3, Occasional = 5, Common = 7, Abundant = 10. The abundance values of all indigenous and exotic species encountered during this survey are then summed, and the Naturalness Index is calculated by dividing the summed abundance values for indigenous species divided by the sum of all abundance values of indigenous and exotic species combined. This Naturalness Index was then compared with results from nearby comparison sites.

5.4.2.2 *Avifauna survey*

Bird species diversity and abundance, particularly of indigenous species, is already low in the Macraes area, and this makes more intensive survey efforts such as distance-sampling or 5-minute bird counts of limited utility. For the survey of the PIA, a record was made of all birds seen or heard during the walkthrough surveys conducted by Sven Stadtmann on 16 & 17 January and 7 February 2018. The locations of species of interest were recorded using a hand-held GPS unit. Overall, 17 km was traversed in 12 hours over the two days of the survey. The results of this survey are provided in Section 6.4.

5.4.2.3 *Herpetofauna survey*

The herpetofauna survey of the PIA was undertaken by Luke Bovill on 16 & 17 February 2018 and of the final WRS position by Mike Thorsen during several visits in 2019. During the surveys, a path was followed that traversed areas considered the most likely to harbour reptiles or amphibians. Overall, 20.5 km was traversed in 10 hours over the two days of the 16 & 17 February survey. At likely sites (and over the space travelled between sites) the area was scanned for visible animals, crevices were inspected (using a torch) for signs of animals or shed skins, and potential retreats (rocks and overhanging vines) were physically searched. The surveys were conducted during reasonably warm and sunny weather. All species seen were identified to species when possible (some sightings were too brief to allow a positive identification of species). A record of the time spent searching and the number of animals was recorded for calculating Catch Per Unit Effort (CPUE). All locations will be recorded onto ARDS cards and submitted to DOC. The results of this herpetofauna survey are provided in Section 6.5.

5.4.2.4 *Invertebrate survey*

The invertebrate survey of the PIA was undertaken by Ian Millar and Fran Thorsen on 12-14 January 2018. It did not include the eastern or northern area of the final WRS as this was a latter change to the project design and it was considered that the information already obtained was sufficient to also assess impact in the final WRS location. Several methodologies were employed targeting larger terrestrial invertebrates, caddis flies and nocturnal Lepidoptera. To sample nocturnal Lepidoptera, two or three 12v battery visible light traps were deployed over two nights (5 light trap nights in total). To sample nocturnal larger terrestrial invertebrates, areas of promising habitat were searched visually at night on two nights. Time was spent during two days sweep-netting day-flying invertebrates and searching under likely retreats (rocks). The surveys were conducted during reasonably warm and sunny weather. Super-abundant specimens were counted and the bulk discarded except a representative sample. The specimens were prepared post-collection and sorted into taxonomic group which were sent to an expert for identification to lowest possible taxonomic unit (the taxonomy of many invertebrate groups is complex or unclear and it is often difficult to assign a specimen to a species). Coleoptera were identified by Ian Millar, some Lepidoptera were identified by Ian Millar and the others sent to Robert Hoare (Manaaki Whenua, Lincoln), and a leaf-veined slug to Gary Barker (Manaaki Whenua, Hamilton). The results of this invertebrate survey are provided in Section 6.6.

6 Deepdell North III Project Assessment of Ecological Importance

6.1 General Ecological Setting

The Deepdell North III project (Figure 1), located 4 km north of Macraes Flat township, is situated on the northern end of the Taieri Ridge in the Macraes Ecological District (E.D.), being one of two Ecological Districts that make up the Lammerlaw Ecological Region of Otago (Bibby 1997). The climate is moderate, with periodic snow-lie during winter and occasional summer drought. The topography of the area consists of rolling hill country with rounded ridge crests and shallowly to deeply incised drainage associated with the Otago peneplain of the Rakaia Terrane, which has probably been exposed since the late Miocene (Forsyth 2001). Rock outcropping is predominantly associated with drainage systems, with some tor formation on ridge crests. Underlying lithology is well foliated quartzo-feldspathic biotite greenschist and lesser chlorite schist, with occasional auriferous quartz reefs of Chlorite Subzone 3 and 4, Haast Schist Group, and areas of overlying Miocene to Quaternary sediments (Mutch 1963, McKellar 1966, Forsyth 2001). Soils are loess-derived hygrous Wehenga upland and high country yellow-brown earths.

Past vegetation cover of the Macraes ED is thought to have comprised montane short tussockland grading into subalpine tall tussockland, with areas of mixed hardwood and podocarp forest, kanuka forest and *Coprosma*-flax scrub (Bibby 1997). In Otago, much of the original vegetation cover has been dramatically altered as a result of anthropogenic factors (particularly repeated burning by Maori) (McGlone et al. 1995), and this massive vegetation change also occurred at Macraes (Whitaker 1996). Since European settlement in the 1850's (Thompson 1949), areas have been burnt (sometimes repeatedly) and exotic grasslands induced by ploughing, oversowing, and applying fertiliser (Whitaker 1996). The present vegetation of the Macraes ED is of a highly modified nature, with approximately 75% of the district dominated by exotic vegetation types (mainly improved pastureland) and the remainder of the vegetation types being indigenous and comprised of varying density narrow-leaved tussockland, copper tussock-based wetlands and grey shrubland interspersed with remnants of original forest cover and scattered ephemeral wetlands (Bibby 1997, Thorsen pers. obs.). The remaining native vegetation communities currently present within the Macraes area are botanically diverse (Thorsen 2008) and is comprised of 589 indigenous (including 15 Data Deficient, 61 At Risk and 27 Threatened species) and 226 exotic species. The vegetation communities present are likely to be derived from the original vegetation communities that existed prior to human colonisation of the region, but many are likely to be considerably reduced in extent and species diversity. Invasion by exotic shrub and tree species, particularly gorse and broom, is an increasing problem in the area.

Of the fauna, fifty-four species of birds have been recorded from the Macraes E.D., of which thirty-four are indigenous and twenty are introduced. The area's indigenous avifauna are likely being predated by exotic mammals, though the impact of this predation pressure on population dynamics is not known. They are also being impacted by changes to their habitats, however the nature of these changes and their impacts on the species is again not known.

The area is noted for its high diversity of seven lizard species, including the last known wild populations of grand skink *Oligosoma grande* and Otago skink *Oligosoma otagense* (Whitaker et al. 2002), which are a focus of a Department of Conservation managed Ecological Management Unit. The lizard species is being similarly impacted as birds by exotic mammals and habitat change, though the severity of predation is somewhat moderated by the abundance of rocky habitats offering safer retreat sites. This is thought to be at least part of the reason why Central Otago retains a high density and diversity of lizard species.

The invertebrate communities are diverse (for a region at moderate altitude) and contains some species that are rare or of biogeographic interest (Patrick 1997).

Some catchments provide habitat for populations of non-migratory galaxiids, freshwater crayfish and longfin eel, which are being affected through predation by trout and changes to their habitats, particularly in the lower reaches of watercourses.

6.2 Deepdell North PIA Flora Ecological Features

6.2.1 *Vegetation communities*

Seven vegetation communities are present within the PIA (Figure 2): seasonal gully wetlands, ephemeral wetlands, seepages, low-producing grassland, cultivated pasture, shelterbelts and shrubland (Table 1). There are also small areas of shelter belt amenity plantings.

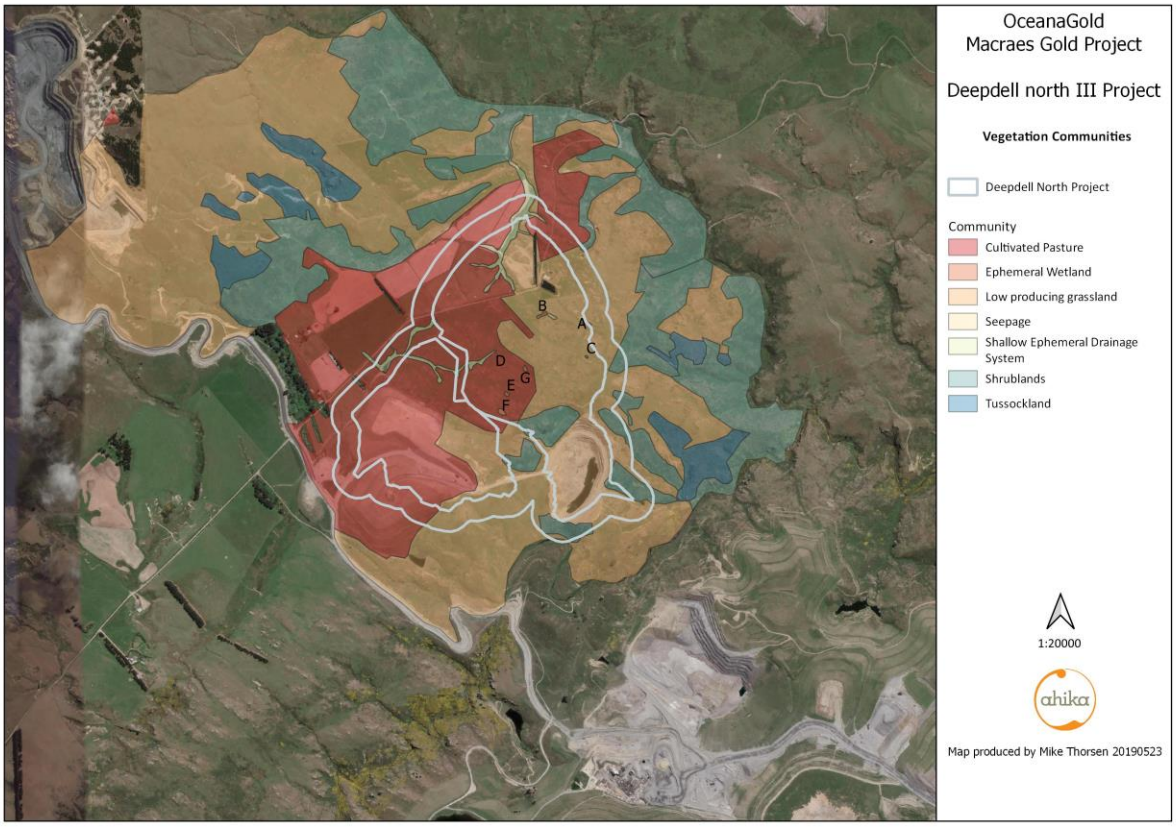

Figure 2. Vegetation communities within the PIA. The seven ephemeral wetlands are labelled A-G.

Vegetation Community	Pit	WRS	Buffer	Total
Exotic vegetation communities				
Cultivated Pasture	29.16	24.93	26.39	80.49
Shelterbelts & Exotic Trees		0.53	0.08	0.61
Semi-natural vegetation communities				
Ephemeral Wetland		0.30	0.02	0.31
Low producing grassland	8.76	39.47	24.82	73.04
Seepage		0.07		0.07
Shallow Ephemeral Drainage System	0.50	1.91	1.79	4.20
Shrublands	0.08	3.65	7.36	11.09
Total	**38.49**	**70.85**	**60.46**	**169.81**

Table 1. Areas of vegetation communities within PIA

6.2.1.1 *Seasonal gully drainage*

The shallowly-incised, flat-bottomed gullies on the road-side terrace are not ephemeral wetlands in the normal sense in that they are connected to the normal gully drainage system, but as they are shallow and of limited water catchment they frequently dry over much of the summer. They cover 4.20 ha within the PIA, and are dominated by exotic grasses, rushes and sedges, and have frequent pukio *Carex secta* pedestals.

This mostly exotic vegetation community is not classified by Singers and Rogers (2014). It is likely to occur in other lowland flat areas in the Macraes E.D.

This vegetation community is of **low** representativeness due to the predominance of exotic species, of **moderate** rarity/distinctiveness value as it is a landform that is rare in the E.D., of **low** diversity and pattern value and **low** ecological context value. Overall this vegetation community is assessed as having **low** ecological importance.

6.2.1.2 *Ephemeral wetlands*

The seven ephemeral wetlands cover 0.02 ha within the buffer zone and 0.30 ha within the WRS zone of the PIA. All are of the type which forms on schist pans in some areas of Central Otago. Six of the examples within the PIA are short-inundation pans that completely dry in summer. Site B is fed by a seepage and does not dry to the same extent. Sites A and F are particularly deep example of pans. All are dominated by exotic grasses, mainly kneed foxtail *Alopecurus geniculatus*, and have scattered representation by indigenous species including scattered clumps of the indigenous rushes *Juncus edgariae* and *Juncus distegus*, the herbs *Galium* aff. *perpusillum*, *Callitriche petriei*, *Limosella lineata*, *Myriophyllum propinquum* and the fern relative *Azolla rubra*. The Declining *Lobelia ionantha* and Locally Uncommon *Carex resectans* are present at Site G. The coverage and diversity of indigenous species in the sites varies from 1-5 species and at least two sites are thought to be functionally almost completely transformed into an exotic species based wetland.

This vegetation community is classified by Singers and Rogers (2014) as WL14: Herbfield [Ephemeral wetland], though the Deepdell North III examples are more grassland than herbfield. Various forms of ephemeral wetlands are found throughout New Zealand, though those formed in depressions in schist bedrock are restricted to Central Otago (Johnson and Rogers 2003). Schist-based ephemeral wetlands are most common in the Strath Taieri area and are particularly grouped in the Redbank Scenic Reserve, Paddy's Rock, Cranky Jims, Sutton and Styx areas. The examples in the Deepdell North III area are considered short-inundation subtype in that their profile is so shallow that water is not retained during the driest periods of the year.

Ephemeral wetlands are mainly under threat from invasion by weeds and cattle pugging. It is thought that sheep grazing is beneficial to this vegetation type by reducing competition from taller plants that tend to also be exotic species.

This vegetation community is of **moderate** representativeness due to the predominance of exotic species, of **high** rarity/distinctiveness value as it is a landform that is rare in NZ, of **moderate** diversity and pattern value and **moderate** ecological context value. Overall this vegetation community is assessed as having **high** ecological importance.

6.2.1.3 *Seepage wetlands*

A seepage wetland occurs over 0.07 ha at one site within the WRS zone. This community is visually dominated by the Declining indigenous rush *Juncus distegus* and lower-growing exotic grasses and rushes.

This vegetation community is probably classified by Singers and Rogers (2014) as WL22: *Carex, Shoenus pauciflorus* sedgeland, though the Deepdell North III examples are a rushland.

Seepage wetlands occur at several sites throughout Macraes E.D. where subterranean water is forced to the surface by geological features. They are mainly under threat from invasion by weeds and cattle pugging.

This vegetation community is of **moderate** representativeness due to the predominance of exotic species and low indigenous diversity, of **high** rarity/distinctiveness value as it is a landform that is rare in NZ, of **low** diversity and pattern value and **low** ecological context value. Overall this vegetation community is assessed as having **high** ecological importance.

6.2.1.4 *Low-producing grassland*

This predominantly exotic vegetation community, produced by oversowing and top-dressing recently burnt tussockland, covers 73.04 ha over much of the PIA. The main species present are exotic grasses and herbs such as browntop *Agrostis capillaris*, sweet vernal *Anthoxanthum odoratum, Rytidosperma penicellatum*, sheep's sorrel *Rumex acetosella* and hawkweed *Pilosella officinarum* with scattered individuals and areas of hard tussock *Festuca novae-zelandiae*, blue tussock *Poa colensoi*, scattered individuals and patches of low matagouri and *Coprosma propinqua* bushes and scattered indigenous herbs and grasses.

This induced vegetation community or what it is analogous to is not classified by Singers and Rogers (2014). Fire- and grazing-induced short tussock grassland is widespread on hillslopes in montane pastoral areas of the eastern South Island.

This vegetation community is of **low** representativeness due to the prevalence of exotic species, recent history of burning and oversowing, of **moderate** rarity/distinctiveness value as it hosts lizard and plant species that are At Risk, of **low** diversity and pattern value and **moderate** ecological context value. Overall this vegetation community is assessed as having **moderate** ecological importance.

6.2.1.5 *Shrubland*

Areas of shrubland occur as scattered patches over 11.09 ha of the PIA, mainly in the WRS and Buffer areas. The main species present are abundant matagouri, *Coprosma propinqua,* with scattered *Rubus schmidelioides* subsp. *subpauperatus* and *Muehlenbeckia complexa* and a few individuals of the Declining grass *Anthosachne falcis*, coral broom and desert broom, and the Locally Uncommon *Melicope simplex* and *Myrsine divaricata*. Much of the shrublands are of very short stature (to 1.5 m canopy height) with low shrub species diversity interspersed with low-producing exotic grassland tending towards scattered narrow-leaved tussock *Chionochloa rigida* subsp. *rigida* on slopes above Deepdell Creek.

This semi-natural vegetation community is not classified by Singers and Rogers (2014). It may be a fire- and grazing-induced community derived from assemblages that would have naturally occurred on cooler semi-arid slopes such as CDF2: *Dracophyllum*, mountain celery pine, *Olearia*, *Hebe* scrub [subalpine scrub], T12: Kanuka, *Olearia* scrub/treeland, or AL1: Narrow-leaved and slim snow tussockland/shrubland. The shrubland at Deepdell North III is probably anthropogenic, being created following early Maori burning of eastern South Island dryland forest (McGlone 1989) followed by repeated burning and fertiliser application to narrow-leaved tussock grassland, and is well represented on lower-elevation hillslopes of Central Otago, though its extent is being reduced by conversion to pasture, invasion by exotic shrubs (particularly broom) and, in places, repeated burning.

This vegetation community is of **low** representativeness due to the prevalence of exotic species, recent history of burning and oversowing and low species diversity, of **high** rarity/distinctiveness value as it hosts plant and lizard species that are At Risk or rare, of **low** diversity and pattern value and **moderate** ecological context value. Overall this vegetation community is assessed as having **moderate** ecological importance.

6.2.1.6 *Cultivated pasture and shelter belts*

Exotic pasture (including shelter belts) has been induced over 86.5 ha throughout much of the PIA either through ploughing and oversowing on the flatter areas. Exotic pastures are comprised mainly of browntop, *Bromus hordaceus, Lolium perenne, Erodium cicutarium, Rumex acetosella, Cerastium semidecandrum, Dactylis glomerata* and *Leontodon autumnalis*. Shelter belts, comprised of macrocarpa and pines cover 0.61 ha mainly within the WRS area. These vegetation communities are not known to harbour any indigenous plant species but do provide habitat for some common exotic bird species and the cultivated pasture may be used for foraging by harrier hawks, paradise shelduck, black-backed gull and spur-winged plover.

These exotic vegetation communities are widespread over lower-relief areas and lower hill slopes of Central Otago.

This vegetation community is of **very low** representativeness due to it being a human-induced exotic vegetation type, of **very low** rarity/distinctiveness value, of **very low** diversity and pattern value and **very low** ecological context value as it may provide some habitat for common indigenous bird species. Overall this vegetation community is assessed as having **negligible** ecological importance.

6.2.2 *Vegetation representativeness & pattern*

The PIA is representative of the current general vegetation patterns in this area of the Macraes E.D. The community patterning of shrubland on slopes and gullies with the flatter areas being cultivated for exotic pasture is common in the area.

Of the indigenous vegetation types, the short-inundation ephemeral wetlands are also known at several sites throughout the Macraes area, particularly on Red Bank Ridge, the OceanaGold Protected Wetlands along the Macraes road, and in Cranky Jims Wetland Covenant. An incomplete project mapping the ephemeral wetlands in the Macraes E.D. has located 310 ephemeral wetlands in the upper area of the District and a further 172 potential sites. The shrublands are very typical of that which occur throughout the area. The seasonal water course is of more restricted distribution in the Macraes area in that these only occur on larger areas with gentle slope. The seepages are also of restricted distribution, but expressions of this wetland type in the area are mostly too small and appear similar to ponded wetlands making them difficult to identify from aerial images. Because of this their representativeness is difficult to assess.

Overall, the PIA is assessed as of **moderate** representativeness importance of the current vegetation, **low** representativeness of the pre-European vegetation patterns and **very low** representativeness of the pre-human vegetation patterns.

6.2.3 *Ecological integrity*

The PIA is part of a mosaic of natural and exotic vegetation communities that are found throughout the wider Macraes area. Several of the natural vegetation communities in the Macraes E.D. are decreasing in extent due to conversion to pasture through land conversion and, to a lesser extent, irrigation. They are also being degraded through weed invasion, which is being facilitated by repeated burning, changes in stocking, and fertiliser application. However, some vegetation communities such as low-producing grasslands and shrublands may be increasing in areas within the District as a result of lessened farm attention. Exotic mammals and invertebrates are likely to be having both a negative (through browsing of plants and preventing regeneration) and positive effect (through maintaining some plant communities by suppressing competing weed species). In areas where sheep grazing and land management practices has been continued in a similar fashion for many years, the vegetation appears to reach a semi-stable state with a high diversity of both indigenous and exotic species.

Areas mapped as semi-natural or natural vegetation communities cover 88.7 ha (52% of PIA) and exotic plant communities cover 81.1 ha (48% of PIA). Overall, the PIA has a Naturalness Index of 0.46 (i.e. approximately 50% of the area is covered by indigenous species). No areas within the PIA are reasonably ecologically intact, and there is some impact in all areas from ongoing grazing by sheep and cattle. Some extensive areas of cultivated plant communities are present. The only ecological value of these is that they may occasionally be used as foraging areas for some bird species. The PIA is likely to be playing some role in supporting a metapopulation of some plant species, but the extent and type of this role is unknown and likely to vary between species. To some extent the outer margin of the PIA buffers the surrounding vegetation from mine effects.

Overall, the PIA is assessed as of **moderate** ecological integrity importance.

6.2.4 *Vegetation rarity*

Within the PIA, the ephemeral wetlands, seepage and seasonal gully drainage could be considered as vegetation communities that are rare in the Macraes E.D., mainly due to their limited extent and infrequent representation. These communities have however been altered through surrounding land use practices and are now largely or almost completely comprised of exotic plant species.

Overall, the ephemeral wetland, seepage and seasonal gully drainage vegetation communities within the PIA are assessed[2] as of **high** rarity importance.

[2] The use of the Land Environment New Zealand (LENZ) model for assessing vegetation rarity, as proposed by some organisations (e.g., Ecan), is evaluated separately in this document. This assessment of the rarity of vegetation communities is based on estimated representation within the Ecological District of vegetation communities.

6.2.5 *Botanical diversity*

The total botanical diversity of the PIA is moderate, with 71 indigenous species and 78 exotic species being recorded within 109.4 ha (Table 2). This botanical diversity is due to the large area of pastoral land in the PIA, as the number of species hectare^{-1} is lower than within the OceanaGold covenants (Table 2). The total botanical diversity of the PIA represents 19% of the 815 indigenous and exotic species known for the Macraes E.D. The 71 indigenous species component represents 12% of the 589 indigenous species known by the author from the Macraes area.

Site	**Area (hectares)**	**# indigenous species**	**# exotic species**	**Indigenous species hectare^{-1}**	**Naturalness Index**
Deepdell North	109.4	71	78	0.6	0.40
Coronation North PIA	494	175	78	0.4	0.62
Cranky Jims Shrubland Covenant	47.1	98	39	2.1	0.65
Cranky Jims Wetland Covenant	97.3	92	40	0.9	-
Deepdell Tussock Covenant	109.8	108	37	1.0	0.72
Highlay Creek Covenant	16.9	52	47	3.1	0.55

Table 2. Comparison of botanical diversity and naturalness at sites within the Macraes area

Overall, the PIA is assessed as of **moderate** botanical diversity importance.

6.2.6 *Ecosystem services*

6.2.6.1 *Linkages and networks*

The PIA probably plays a **moderate** role in providing a patchwork of natural ecological areas assisting the local persistence of some species. There are no ecological sequences in evidence.

6.2.6.2 *Buffering*

The PIA probably plays a **moderate** role in buffering natural areas (including the nearby Golden Point Historic Reserve, Deepdell Creek Conservation Area and Marginal Strip) and waterways from weed incursion and increased sedimentation arising from nearby cultivated areas and would also play a role in buffering the surrounding vegetation from mine activities.

6.2.6.3 *Support services*

The PIA has a **minor** ecosystem support services role by protecting genetic diversity.

6.2.6.4 *Regulating services*

The PIA has a **minor** ecosystem regulating services role in reducing erosion of underlying soils and regulating flood flows in the area.

6.2.6.5 *Cultural services*

The PIA currently has a **negligible** ecosystem cultural services role.

6.2.6.6 *Provisioning services*

The PIA has a **minor** ecosystem provisioning services role in providing stock water to downstream areas.

Overall, the PIA is assessed as providing a **minor** ecosystem service.

6.2.7 *Notable vegetation communities or sites*

6.2.7.1 ***Indigenous vegetation associated with Threatened land environments (defined by Land Environments of New Zealand at Level IV) that have ≤20% remaining in indigenous cover (Ministry for Environment and Department of Conservation 2007, Walker et al. 2007, 2008).***

Three Level IV LENZ categories are present in the PIA (Table 3, Figure 3), all of which are currently classified as Threatened Land Environments: the Acutely Threatened L1.3a and N3.1e, and the Chronically Threatened Q4.3b.

L1.3a covers the north-western part of the PIA and is covered by exotic pasture, low-producing pasture and seasonal gully drainage and the rehabilitated WRS of the Deepdell North project.

N3.1e occurs along the south-eastern part of the PIA and is primarily exotic pasture, shrubland and low-producing grassland and the rehabilitated WRS of the Deepdell North project.

Q4.3b covers the slopes of Deepdell Stream gully and is covered by shrubland, low-producing grassland, and the Deepdell North pit.

LENZ	Deepdell North III Buffer	Deepdell North III Pit	Deepdell North III WRS	Total
Acutely Threatened	**44.7**	**37.5**	**59.6**	**141.9**
L1.3a	28.6	24.4	35.3	88.3
N3.1e	16.1	13.1	24.3	53.5
Chronically Threatened	**15.8**	**1.0**	**11.2**	**28.0**
Q4.3b	15.8	1.0	11.2	28.0
Total	**60.5**	**38.5**	**70.9**	**169.9**

Table 3. Areas of Level IV LENZ categories within the PIA.

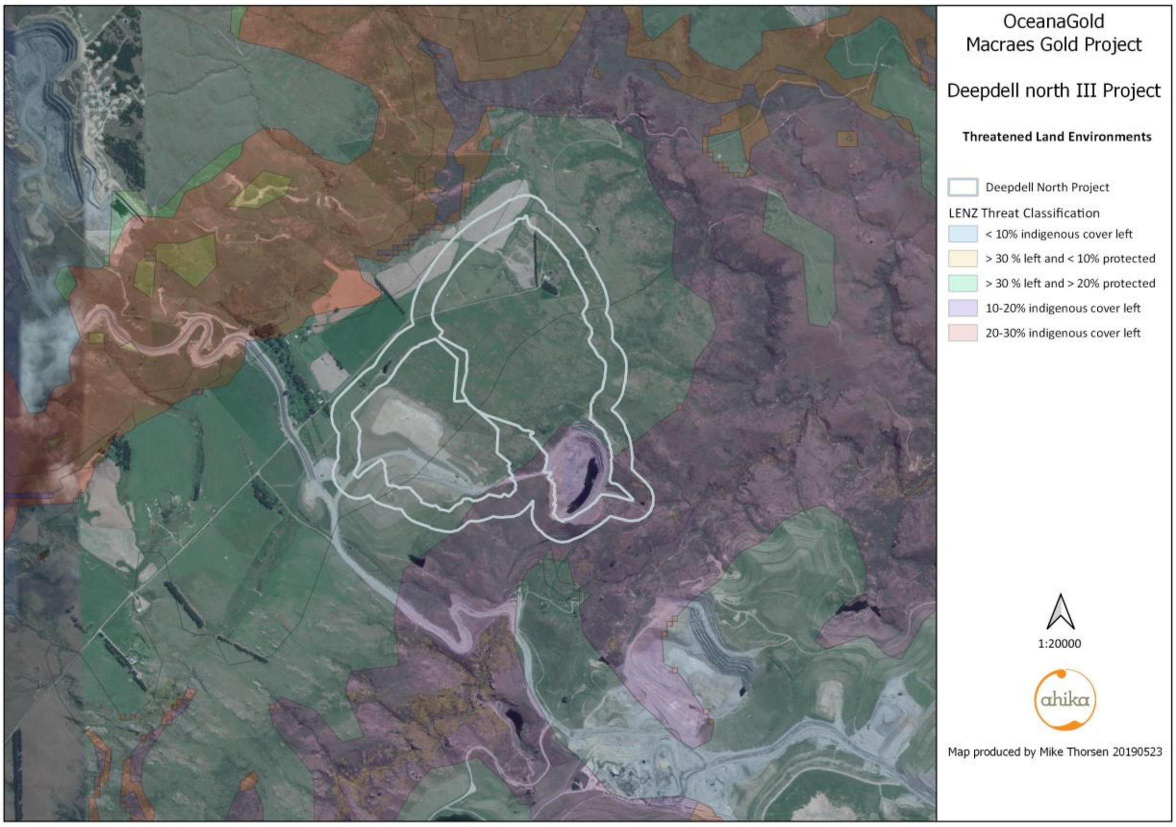

Figure 3. LENZ classification of the PIA at Level IV.

6.2.7.2 *Indigenous vegetation associated with sand dunes and wetlands, ecosystem types that have become uncommon due to human activity and are a National Priority for Protection (Ministry for Environment and Department of Conservation 2007).*

The PIA includes two vegetation communities that are a National Priority for Protection: the ephemeral wetland and the seepage wetland.

6.2.7.3 *Indigenous vegetation associated with 'Historically Rare' or 'Threatened' terrestrial ecosystem types (Ministry for Environment and Department of Conservation 2007, Williams et al. 2007, Holdaway et al. 2012).*

The PIA includes two wetland vegetation communities that are Naturally Uncommon (= Historically Rare): the ephemeral wetlands and the seepage wetland. Both are Threatened ecosystems: the ephemeral wetlands are Critically Endangered and the seepage wetland is Endangered.

6.2.7.4 *Wetlands of National Importance or Ramsar sites.*

The PIA includes no Wetlands of National Importance or Ramsar sites.

6.2.7.5 *Sites previously identified as recommended for protection*

No sites identified by Bibby (1997) as a Recommended Area for Protection (RAP) are situated within the PIA.

6.2.8 *Importance overall of vegetation communities*

Overall, the indigenous vegetation communities present within the PIA are assessed as being of **high** ecological importance, though the importance of each vegetation community varies between **negligible** for cultivated pasture and shelterbelts, **moderate** for the low producing grasslands and shrublands and **high** for the ephemeral wetlands and seepage wetland. Though the indigenous plant communities are of moderate to low representation and ecosystem service importance, and moderate diversity and moderate integrity, there are remnants of rare vegetation communities present, the ephemeral wetland vegetation communities and seepage wetland are a national priority for protection, are Naturally Uncommon and classified as Threatened, there are three Threatened Level IV land environments that are overlain by some natural vegetation and it provides habitat for At Risk, or rare plant and animal species.

All the indigenous vegetation communities (ie all except cultivated pasture and shelterbelts) are **significant** under the Proposed ORPS (Appeals Version) and the WDC District Plan, and the ephemeral wetland, seepage and shrubland vegetation communities are **significant** under the Operative Otago RPS.

6.3 Threatened, At Risk, or rare plant species

Thirteen plant species that occur within the PIA are either currently classified as At Risk or Data Deficient (Townsend et al. 2007, de Lange et al. 2018), or are thought to be rare in the Otago region or Macraes E.D. based on the author's observations (Figure 4).

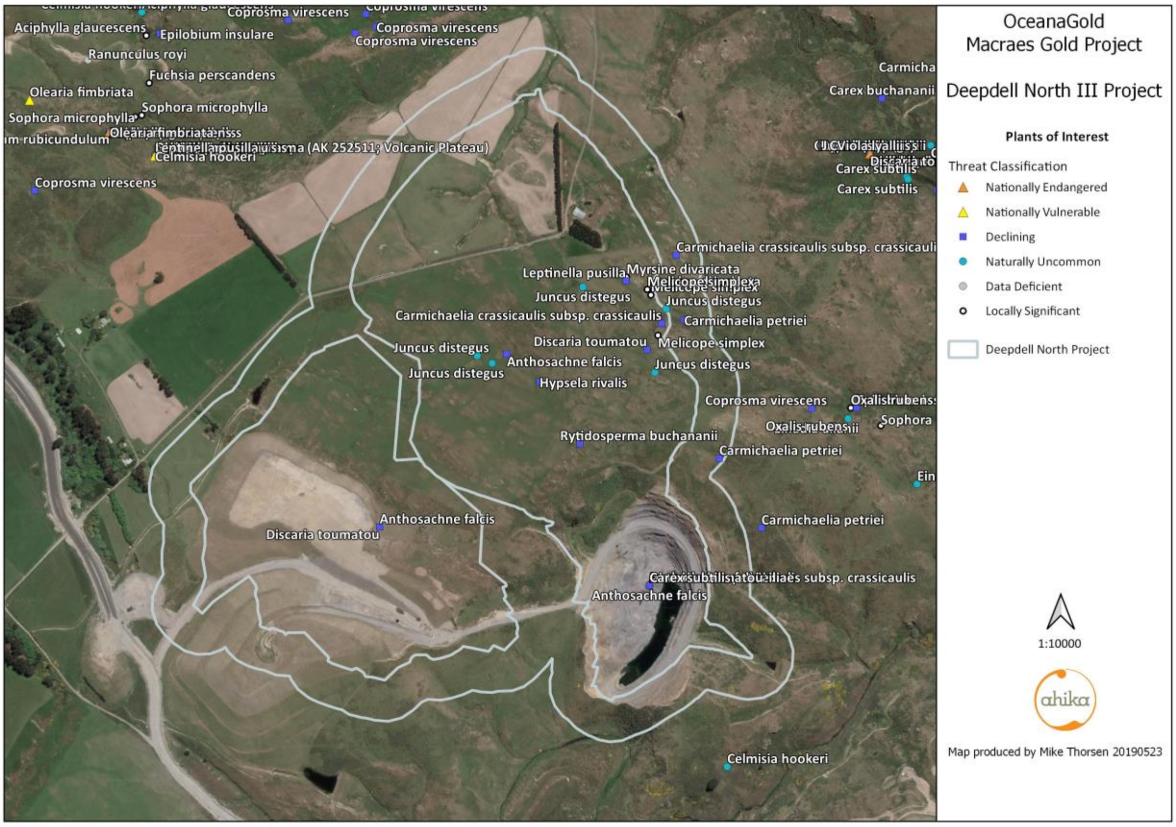

Figure 4. Locations of Threatened, At Risk and other plant species of interest (Data Deficient, rare plants) within the PIA.

6.3.1 *Threatened species*

No Threatened plant species occur within the PIA.

6.3.2 *At Risk species*

10 At Risk plant species are known to occur within the PIA: seven species that are classified as Declining and three species classified as Naturally Uncommon.

6.3.2.1 *Declining Species*

Seven species classified as Declining are known to occur within the PIA: the wheatgrass *Anthosachne falcis,* coral broom *Carmichaelia crassicaulis* subsp. *crassicaulis,* desert broom *Carmichaelia petriei*, matagouri *Discaria toumatou*, the creeping button daisy *Leptinella pusilla,* the wetland herb *Lobelia ioantha* and the dryland grass *Rytidosperma buchananii*.

1. *Anthosachne falcis* (Connor) Barkworth et S.W.L.Jacobs (dwarf wheatgrass, Poaceae).

Distribution within project

This dryland grass was recorded as scattered plants inhabiting shrubland in the Pit and mainly in the WRS zones.

Summary of existing information

Anthosachne falcis was recently reclassified as Declining, with the qualifiers Data Poor and Sparse, on the basis of a predicted decline of 10-50% in total population or area of occupancy over 3 generations and its range being estimated at less than 10,000 ha (Townsend et al. 2007, de Lange et al. 2018). Previously it was not assessed as Rare and Endangered in 1976 or 1986, as Insufficiently Known in 1999, as Range Restricted in 2004, and Naturally Uncommon in 2009 and 2013 (Given 1976, Given 1986, de Lange et al. 1999, de Lange et al. 2004, de Lange et al. 2009, de Lange et al. 2013).

This species occurs in the dry inland basins of the Waimakariri, Ashburton Lakes, Mackenzie, Waitaki and Central Otago. In Otago it had previously been misidentified as *Anthosachne solandri* “channel” in some botanical surveys, and it was only recently that the correct identity of these plants was realised. Subsequent to this discovery it has been found to be widely but sparsely scattered in semi-natural grasslands in the Macraes area, including in OceanaGold covenants and the Deighton Creek Nature Reserve. It inhabits dry, short tussock grassland and open areas in shrubland.

This species is considered to be at risk due to of conversion of its dryland habitat. No conservation programmes are known for this species, but it flourishes in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

1) Declining conservation status.

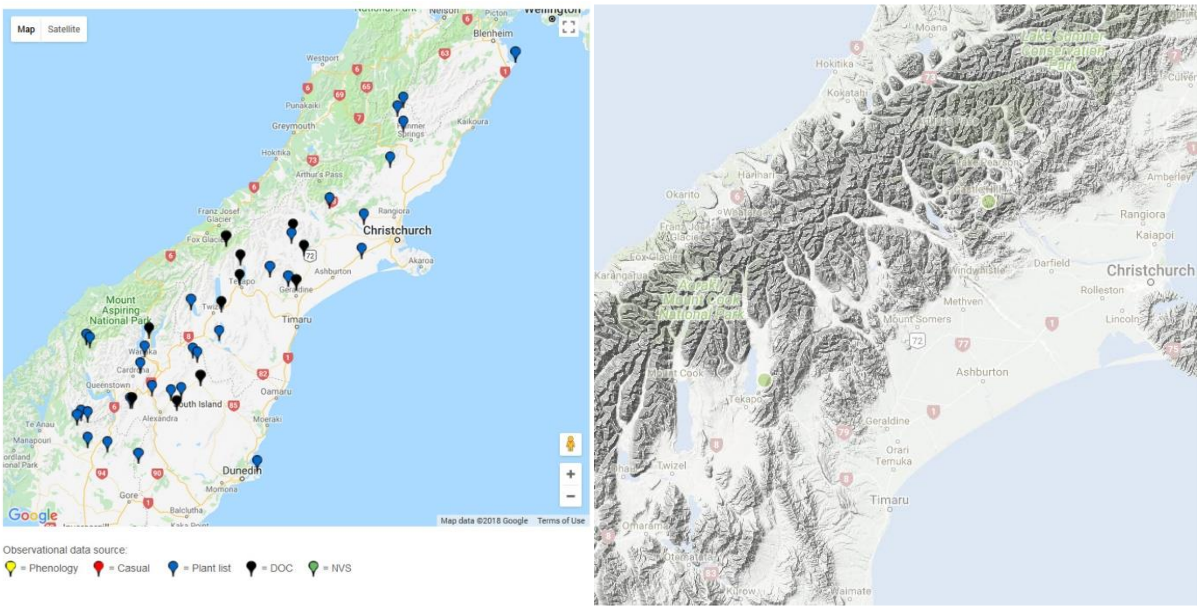

Figure A. Distribution of *Anthosachne falcis* in New Zealand from the NZ Plant Conservation Network (left) and NatureWatch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

Edgar, E; Connor, H.E. 2010. Flora of New Zealand Vol. 5: Gramineae, 2nd Ed. Manaaki Whenua Press, Lincoln.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=478 accessed 15 February 2018.

NatureWatch http://naturewatch.org.nz/taxa/470787 accessed 15 February 2018.

Dr M. Thorsen unpub. file notes.

2. *Carmichaelia crassicaulis* Hook.f. subsp. *crassicaulis* (coral broom, Fabaceae).

Distribution within project

Three plants of this thick-stemmed broom were recorded at one site in the Pit (one grazed plant) and at one site in the WRS (2 heavily grazed plants). A group of 15 heavily grazed plants and a single nearby plant are present in the Buffer area.

Summary of existing information

Carmichaelia crassicaulis subsp. *crassicaulis* is currently classified as Declining, with the qualifier Recruitment Failure, on the basis that the total population is estimated to number 20,000–100,000 mature individuals with a predicted decline of 10–50%, and there is little evidence of young plants in the populations (Townsend et al. 2007, de Lange et al. 2018). Previously it was not assessed as Rare and Endangered in 1976 or 1986, as Declining in 1999, as Gradual Decline in 2004, and as Declining in 2009 (Given 1976, Given 1986, de Lange et al. 1999, de Lange et al. 2004, de Lange et al. 2009, de Lange et al. 2013).

This species is distributed through the eastern South Island from Marlborough to Otago, with the majority of the populations in Otago. In the wider Macraes area it occurs on OceanaGold tenure land adjacent to the PIA in Coal Creek and Trimbells Gully and is known from 41 sites between Red Bank and Ramrock Roads. It inhabits a variety of dry, usually rocky, sites.

This species is considered to be in decline primarily through loss of its dryland habitat and lack of recruitment of young individuals into populations. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats (but even at these sites recruitment appears to be rare). A nearby population at Nenthorn has many young seedlings that have germinated after stock were fenced from the area.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

1) Presence of only three individuals;
2) Number of nearby populations;
3) Declining conservation status;
4) The reduction in extent of its dryland habitat;
5) the lack of young plants within populations.

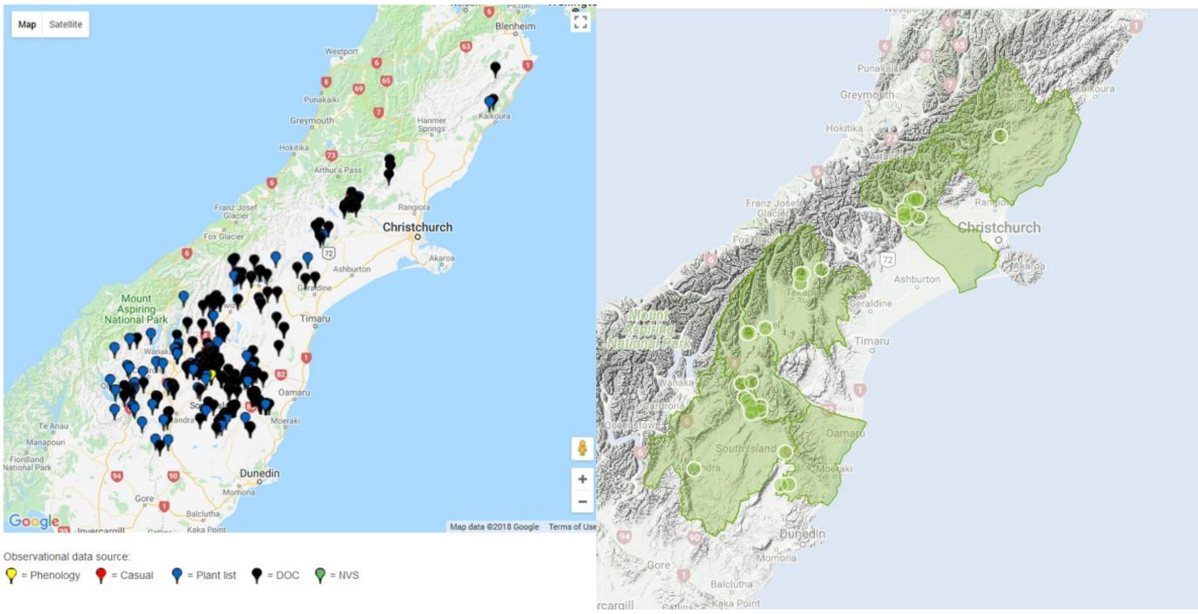

Figure A. Distribution of *Carmichaelia crassicaulis* subsp. *crassicaulis* in New Zealand from the NZ Plant Conservation Network (left) and NatureWatch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

Heenan, P.B. 1998. An emended circumscription of *Carmichaelia*, with new combination, a key, and notes on hybrids. New Zealand Journal of Botany 36: 53-63.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=152 accessed 15 February 2018.

NatureWatch http://naturewatch.org.nz/taxa/412101 accessed 15 February 2018.

Dr M. Thorsen unpub. file notes.

3. *Carmichaelia petriei* Petrie (desert broom, Fabaceae).

Distribution within project

This leafless broom was recorded at several sites in both the Pit and WRS zones where several plants are present.

Summary of existing information

Carmichaelia petriei is a new addition to the threatened plant list and is classified as Declining, with the qualifiers Data Poor and Recruitment Failure, on the basis that the total population is estimated to number 20,000–100,000 mature individuals with a predicted decline of 10–50%, and there is little evidence of young plants in the populations (Townsend et al. 2007, de Lange et al. 2018). Previously it was not assessed as of conservation significance in 1976 or to 2013 (Given 1976, Given 1986, de Lange et al. 1999, de Lange et al. 2004, de Lange et al. 2009, de Lange et al. 2013).

This species is distributed through the eastern South Island from the Mackenzie Basin to Southland and on Stewart Island, with the majority of the populations in Otago. In the wider Macraes area it occurs in most areas of indigenous shrubland and grasslands, including those that are highly degraded, though numbers vary between sites. Plants are often heavily grazed when smaller, but this does not seem to cause mortality of the plants.

This species is considered to be in decline primarily through loss of its dryland habitat and lack of recruitment of young individuals into populations. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats (but even at these sites recruitment appears to be rare).

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

1) Declining conservation status;
2) The reduction in extent of its dryland habitat;
3) Number and size of nearby populations;
4) The lack of young plants within populations.

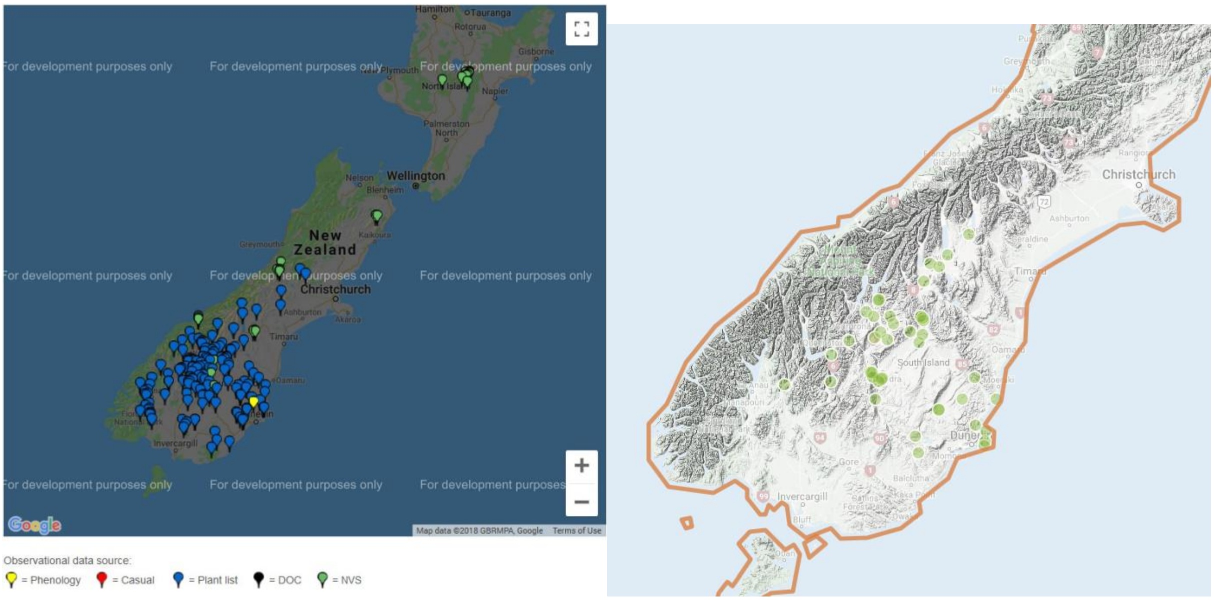

Figure A. Distribution of *Carmichaelia petriei* in New Zealand from the NZ Plant Conservation Network (left) and NatureWatch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

Heenan, P.B. 1996. A taxonomic revision of *Carmichaelia* (Fabaceae-Galegeae) in New Zealand (part II). New Zealand Journal of Botany 34: 157-177.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1602 accessed 8 November 2018.

NatureWatch https://inaturalist.nz/observations?place_id=6803&taxon_id=52110 accessed 8 November 2018.

Dr M. Thorsen unpub. file notes.

4. *Discaria toumatou* Petrie (matagouri, Rhamnaceae).

Distribution within project

Matagouri was recorded at multiple sites and in considerable numbers in the Pit and WRS zones.

Summary of existing information

Matagouri is a new addition to the threatened plant list and is classified as Declining, with no qualifiers, on the basis that the total population is estimated to exceed 100,000 mature individuals with a predicted decline of 10–70% (Townsend et al. 2007, de Lange et al. 2018). In this assessment, the panel did not consider that the species is known to rapidly expand its range in many parts of the South Island unless physically prevented from doing so. Previously it was not assessed as of conservation significance in 1976 or to 2013 (Given 1976, Given 1986, de Lange et al. 1999, de Lange et al. 2004, de Lange et al. 2009, de Lange et al. 2013).

This species is distributed patchily through the North Island to Auckland and is widespread and common in montane areas of the South Island, particularly in the east. In the wider Macraes area it occurs in most (all?) areas of indigenous shrubland and grasslands, including those that are highly degraded. Plants are not grazed and it is well known to South Island farmers as a colonist of grazed and fertilised hillslopes.

This species is considered to be in decline primarily through loss of its dryland habitat, particularly in the Mackenzie Basin and intermontane basins of Central Otago. No conservation programmes are known for this species, but it occurs in a multitude of protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

1) Declining conservation status;
2) The reduction in extent of its dryland habitat;
3) Number and size of nearby populations;
4) Vigorous spread at many sites
5) Uncertainty over the validity of the threat assessment.

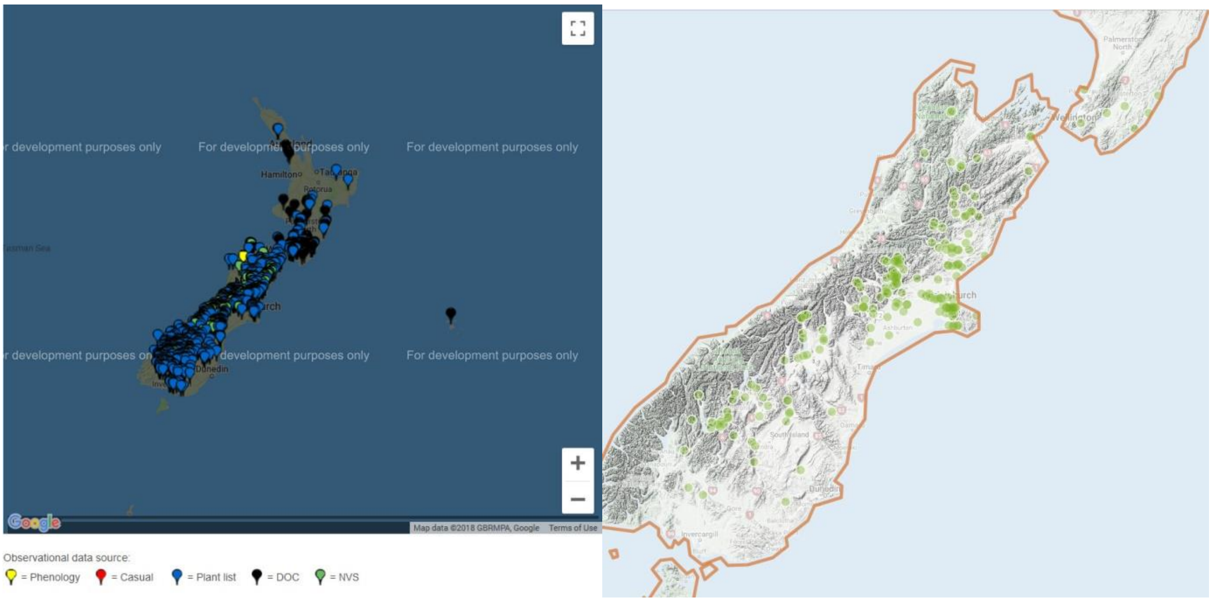

Figure A. Distribution of *Discaria toumatou* in New Zealand from the NZ Plant Conservation Network and NatureWatch (right) databases (see data sources). No guarantee is given as to the accuracy of the map or the identification of the species.

Data sources used in this assessment:

de Lange, P.J; Rolfe, J.R; Barkla, J.W; Courtney, S.P; Champion P.D; Courtney, S.P; Perrie, L.R; Beadel, S.M; Ford, K.A; Breitwieser, I; Schönberger, I; Hindmarsh-Walls, R; Heenan, Ladley, K. 2018. Conservation status of New Zealand indigenous vascular plants, 2017. New Zealand Threat Classification Series 22. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1795 accessed 8 November 2018.

NatureWatch https://inaturalist.nz/observations?place_id=6803&taxon_id=333825 accessed 8 November 2018.

Dr M. Thorsen unpub. file notes.

5. *Leptinella pusilla* Hook.f. (a button daisy, Asteraceae).

Distribution within project

This creeping button daisy was recorded at one site in the WRS where one patch is present on the margin of ephemeral wetland C.

Summary of existing information

Leptinella pusilla is a new addition to the threatened plant list and is classified as Declining, with no qualifiers, on the basis that the species is estimated to occupy less than 1,000 ha and is predicted to decline at 10-30% (Townsend et al. 2007, de Lange et al. 2018). Previously it was not assessed as of conservation significance in 1976 or to 2013 (Given 1976, Given 1986, de Lange et al. 1999, de Lange et al. 2004, de Lange et al. 2009, de Lange et al. 2013).

This species is distributed through the south-eastern North Island and much of the eastern South Island. Exact distribution is not clear as the species is often misidentified for the commoner *Leptinella squalida* (or in some cases *Leptinella serrulata*). In the wider Macraes area it is patchily distributed and has been recorded from 47 sites. It often occurs within small groves of shrubs, often in heavily grazed areas.

This species is considered to be in decline primarily through loss of its dryland habitat. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

1) Single patch present within PIA;
2) Declining conservation status;
3) The reduction in extent of its dryland habitat.

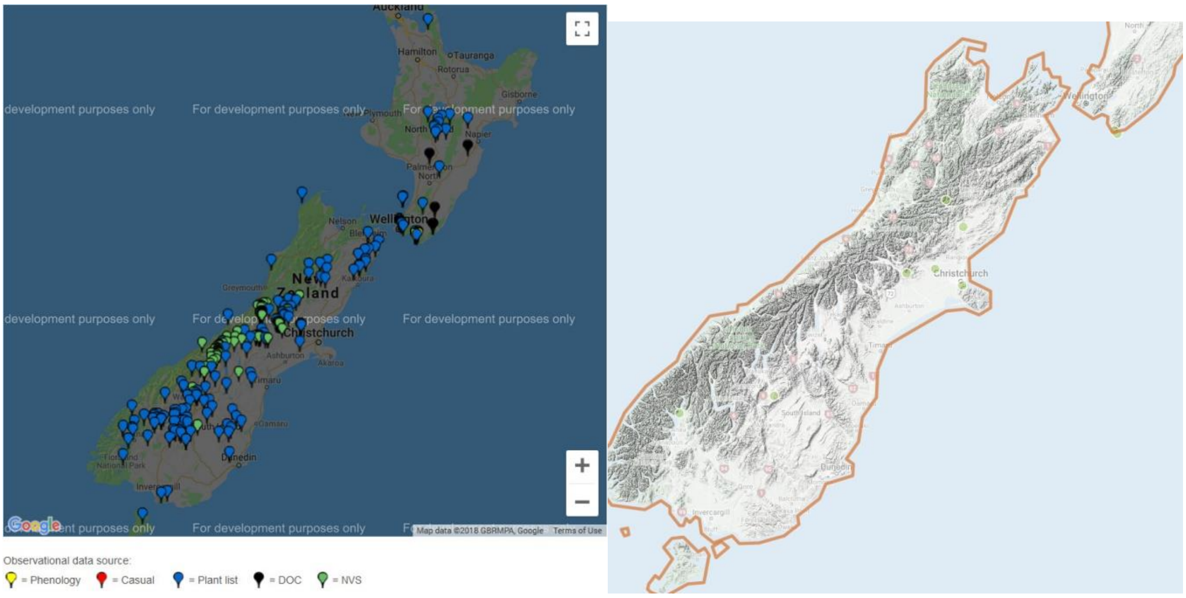

Figure A. Distribution of *Leptinella pusilla* in New Zealand from the NZ Plant Conservation Network (left) and NatureWatch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

Lloyd, D.G. 1972. A revision of the New Zealand, Subantarctic, and South American species of Cotula, Section Leptinella, New Zealand Journal of Botany, 10: 277-372.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=917 accessed 9 November 2018.

NatureWatch https://inaturalist.nz/observations?place_id=6803&taxon_id=52110 accessed 8 November 2018.

Dr M. Thorsen unpub. file notes.

6. *Lobelia ionantha* Heenan (a wetland herb, Campanulaceae).

Distribution within project

This creeping wetland herb was recorded at one site in the ephemeral wetland G in the WRS where several patches totalling an estimated $0.56m^2$ are present.

Summary of existing information

Lobelia ioantha is currently classified as Declining, with the qualifier Data Poor, on the basis that the total area of occupancy Is estimated to exceed > 10,000ha with a predicted decline of 10–70% (Townsend et al. 2007, de Lange et al. 2018). It was first included in the Threatened plant list in 2013 and was assessed as Declining in 2012 and 2017 (de Lange et al. 2013, de Lange et al. 2018).

This species is distributed through the eastern and southern South Island in wetland margins, tarns, river terraces and damp tussock grasslands. Exact distribution is not clear as this species previously included other species of what are now *Lobelia* in *Hypsela rivalis*. In the wider Macraes area it is patchily distributed and has been recorded from 13 sites, mostly in ephemeral wetlands. At Macraes it is most often found within low herbfield in ephemeral wetlands. Its annual lifecycle in these habitats is unknown, particularly when the site is inundated. It is not known to be browsed by mammals, but plants can be damaged through pugging of wetlands.

This species is considered to be in decline primarily through loss of its wetland habitats. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

1) Single site present within PIA;
2) Declining conservation status;
3) The reduction in extent of its wetland habitats.

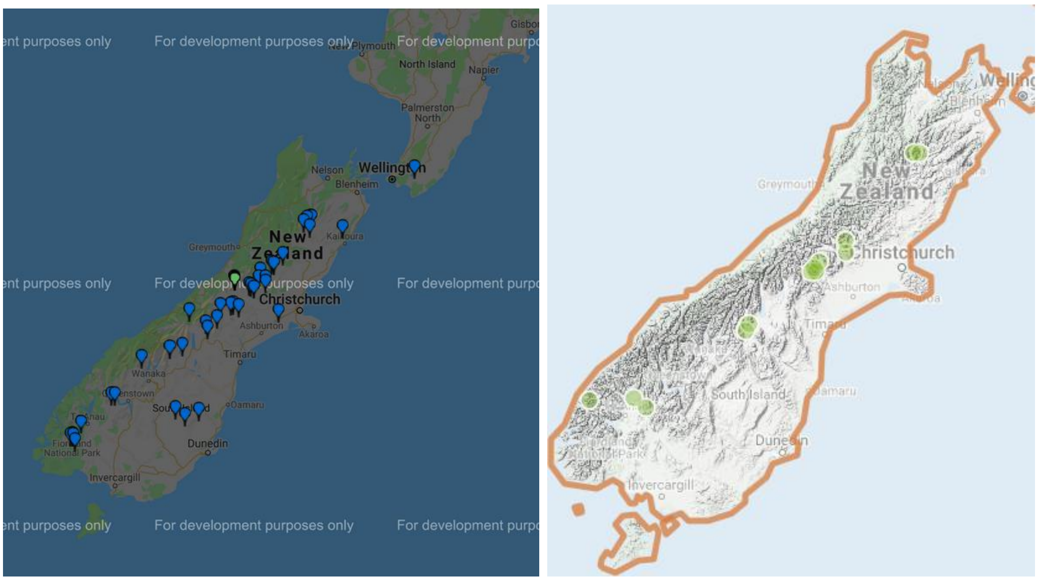

Figure A. Distribution of *Lobelia ionantha* in New Zealand from the New Zealand Plant Conservation Network and NatureWatch databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

Heenan, P.B; Knox, E.B; Courtney, S.P; Johnson, P.N; Dawson, M.I. 2008. Generic placement in *Lobelia* and revised taxonomy for New Zealand species previously in *Hypsela* and *Isotoma* (Lobeliaceae). New Zealand Journal of Botany 46: 87-100.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=857 accessed 31 May 2019.

NatureWatch https://inaturalist.nz/observations?place_id=6803&taxon_id=428642 accessed 31 May 2019.

Dr M. Thorsen unpub. file notes.

7. *Rytidosperma buchananii* (Hook.f.) Connor & Edgar (a dryland bristlegrass, Poaceae).

Distribution within project

This grass was recorded at one site in the WRS where one plant is present on a rock stack in the WRS.

Summary of existing information

Rytidosperma buchananii is a new addition to the threatened plant list and is classified as Declining, with the qualifier Data Poor, on the basis that the total area of occupancy Is estimated to exceed > 10,000ha with a predicted decline of 10–70% (Townsend et al. 2007, de Lange et al. 2018).

This species is distributed through the central North Island and much of the South Island. In the wider Macraes area it is very patchily distributed and has been recorded from 4 sites, usually in low numbers. It is most often found on rocky sites but is also occasionally present in depleted grassland.

It is not known why this species is considered to be in decline. Its rocky habitats appear secure, but it may be lost from some dryland grass habitats. No conservation programmes are known for this species, but it occurs in many protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **low**[3] on the basis of its:

1) Single plant present within PIA;
2) Declining conservation status;
3) Uncertainty around justification for Declining status.

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[3] While the AIANZ guidelines recommend 'high' a value of low is used here on the basis that only one plant is present.

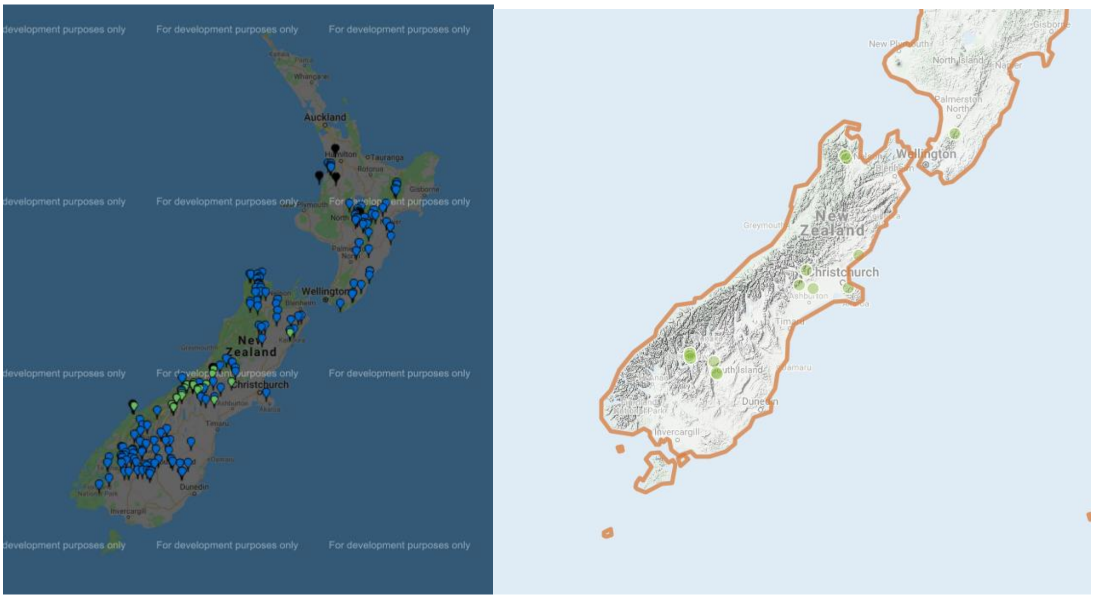

Figure A. Distribution of *Rytidosperma buchananii* in New Zealand from the NZ Plant Conservation Network (left) and NatureWatch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

Connor, H.E; Edgar, E. 1979. *Rytidosperma* Steudel (*Notodanthonia* Zotov) in New Zealand. New Zealand Journal of Botany 17: 311-337.

Edgar, E; Connor, H.E. 2010. Flora of New Zealand, Vol. V: Grasses (2nd Ed.). Manaaki Whenua Press, Lincoln.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=917 accessed 31 May 2019.

NatureWatch https://inaturalist.nz/observations?place_id=6803&taxon_id=405802 accessed 31 May 2019.

Dr M. Thorsen unpub. file notes.

6.3.2.2 *Naturally Uncommon*

Three species classified as Naturally Uncommon are known to occur within the PIA: the hookgrass *Carex subtilis*, the wetland rush *Juncus distegus* and the dwarf rush *Juncus pusillus.*

8. *Carex subtilis* K.A.Ford (elegant hookgrass, Cyperaceae).

Distribution within project

This small sedge was recorded at one site in the WRS zone.

Summary of existing information

Carex subtilis (previously *Uncinia elegans*) is currently classified as Naturally Uncommon, with the qualifiers Data Poor, Secure Overseas and Sparse because of the widely spaced populations, its inconspicuous nature and its abundance in Tasmania (Townsend et al. 2007, de Lange et al. 2018). Previously it was not assessed as Rare and Endangered in 1976, 1986, or 1999, assessed as Sparse in 2004, Data Deficient in 2009 and Naturally Uncommon in 2013 (Given 1976, Given 1986, de Lange et al. 1999, de Lange et al. 2004, de Lange et al. 2009, de Lange et al. 2013).

This species occurs in shady sites at the base of rock outcrops or under shrubs in the eastern South Island. In the wider Macraes area it is very patchily distributed and has been recorded from 8 sites, usually as single patches under shrubs or at the base of shaded rock outcrops. Plants appear to be restricted to these sites either as they provide a suitable shaded environment, or browsers are preventing them expanding outside of these sites. No conservation programmes are known for this species and its presence within the national protected areas network is unknown.

The ecological importance of the population of this species within the PIA is categorised as **moderate** on the basis of its:

1) Naturally Uncommon conservation status;
2) Susceptibility to browsers.

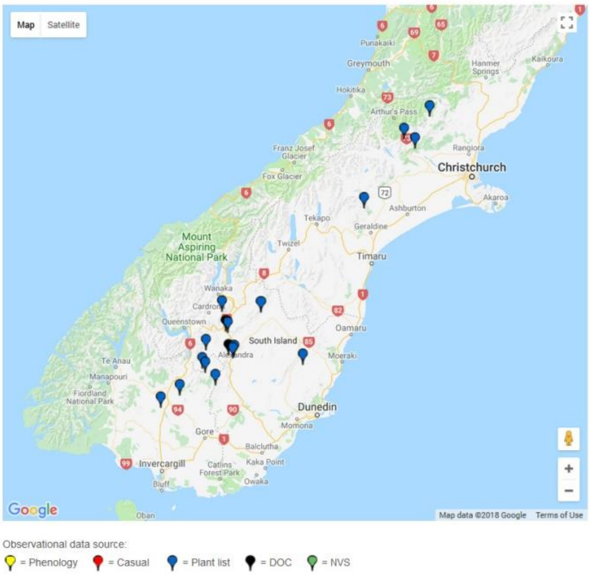

Figure A. Distribution of *Carex subtilis* in New Zealand from the NZ Plant Conservation Network database (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=334 accessed 15 February 2018.

Dr M. Thorsen unpub. file notes.

9. *Juncus distegus* Edgar (Two-storey rush, Juncaceae).

This rush was recorded in various numbers bordering the ephemeral wetlands and is the dominant larger plant species in the seepage wetland in the WRS where there are patches covering an estimated 369 m^2 with an additional scattered 56 individuals.

Summary of existing information

Juncus distegus is a new addition to the threatened plant list and is currently classified as Naturally Uncommon, with the qualifiers Data Poor and Sparse, on the basis that it occurs within naturally small and widely scattered populations with less than 20,000 individuals or occupies less than 100,000 ha and with no evidence of declining numbers (Townsend et al. 2007, de Lange et al. 2018).

This species is patchily distributed through the North, South and Chatham Islands. In the wider Macraes area it is patchily distributed and has been recorded from 20 damp areas. No conservation programmes are known for this species, but it probably occurs in many protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **moderate** on the basis of its:

1) Healthy population present within PIA;
2) Naturally Uncommon conservation status.

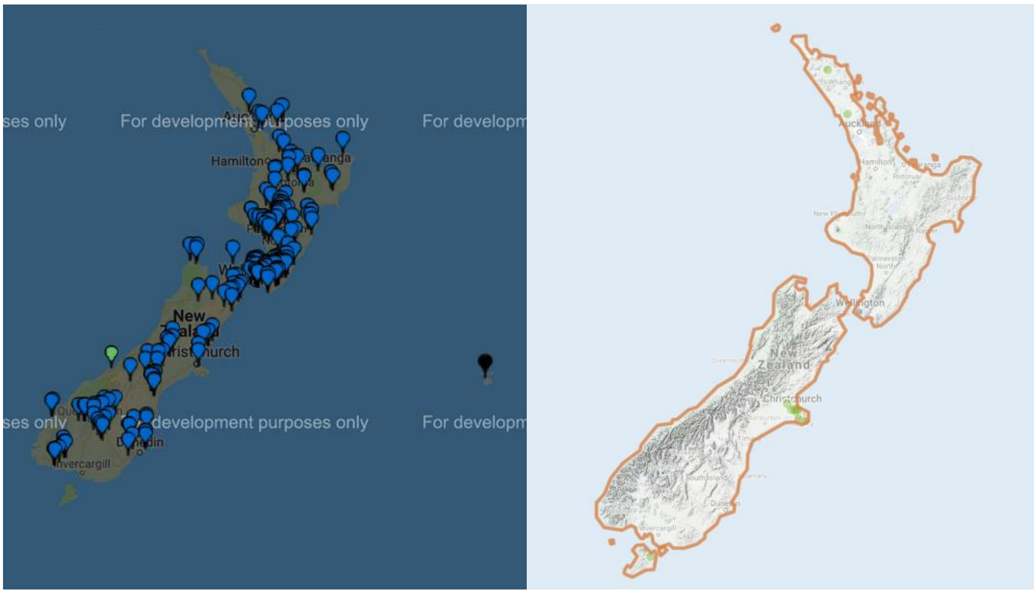

Figure A. Distribution of *Juncus distegus* in New Zealand from the NZ Plant Conservation Network (left) and NatureWatch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

Bodmin, K; Champion, P; James, T; Burton, T. 2015. New Zealand rushes: *Juncus* factsheets. NIWA, Hamilton.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=868 accessed 31 May 2019.

NatureWatch https://inaturalist.nz/observations?place_id=6803&taxon_id=402872 accessed 31 May 2019.

Dr M. Thorsen unpub. file notes.

10. *Juncus pusillus* Buchenau (dwarf rush, Juncaceae).

This tiny rush was recorded as two 5 x 5 cm patches in ephemeral wetland A.

Summary of existing information

Juncus pusillus is currently classified as Naturally Uncommon, with the qualifiers Data Poor, Secure Overseas and Sparse because of the widely spaced populations, its inconspicuous nature and its presence in Tasmania (Townsend et al. 2007, de Lange et al. 2018), though the Tasmanian records are better referred to *Juncus sandwithii* and *Juncus pusillus* being a New Zealand endemic. Previously it was not assessed as Rare and Endangered in 1976, 1986, 1999, 2004, Naturally Uncommon in 2009 and Not Threatened in 2013 (Given 1976, Given 1986, de Lange et al. 1999, de Lange et al. 2004, de Lange et al. 2009, de Lange et al. 2013).

This species is distributed through much of the North Island and throughout the South, Stewart and Auckland Islands. In the wider Macraes area it is patchily distributed and has been recorded from 10 damp sites some of which are human created. No conservation programmes are known for this species, but it probably occurs in many protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **low** on the basis of its:

1) Small population present within PIA;
2) Naturally Uncommon conservation status;

Figure A. Distribution of *Juncus pusillus* in New Zealand from the NZ Plant Conservation Network database (see data sources). No guarantee is given as to the accuracy of the map or the identification of the species.

Data sources used in this assessment:

Johnson, L.A.S. 1991. New Australia taxa in *Juncus* (Juncaceae). Pp. 34-46 in: Banks, M.R. et al. (Eds). Aspects of Tasmanian botany – a tribute to Winifred Curtis. Royal Society of Tasmania, Hobart.

Bodmin, K; Champion, P; James, T; Burton, T. 2015. New Zealand rushes: *Juncus* factsheets. NIWA, Hamilton.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=871 accessed 31 May 2019.

Dr M. Thorsen unpub. file notes.

6.3.3 *Data Deficient species*

No species classified as Data Deficient are known to occur within the PIA.

6.3.4 *Rare species*

Three species that are considered rare are known to be present within the PIA:

6.3.4.1 ***Species uncommon in region***

No species that are considered uncommon in the Otago region are known within the PIA.

6.3.4.2 ***Species uncommon in Ecological District***

Three species that are uncommon within the Macraes Ecological District are known to be present within the PIA: the small sedge *Carex resectans* and the shrubs *Melicope simplex* and *Myrsine divaricata*.

11. *Carex resectans* Cheeseman (desert sedge, Cyperaceae).

Distribution within project

This small creeping sedge was recorded as three patches totalling 40 x 40 cm in ephemeral wetland G.

Summary of existing information

Carex resectans is distributed in the east of the North and South Islands and is a species rarely recorded within the Macraes E.D. where it has been recorded at one other site. It inhabits short grasslands.

The ecological importance of the population of this species within the PIA is categorised as **moderate** on the basis of its:

1) Rarity within the Ecological District.

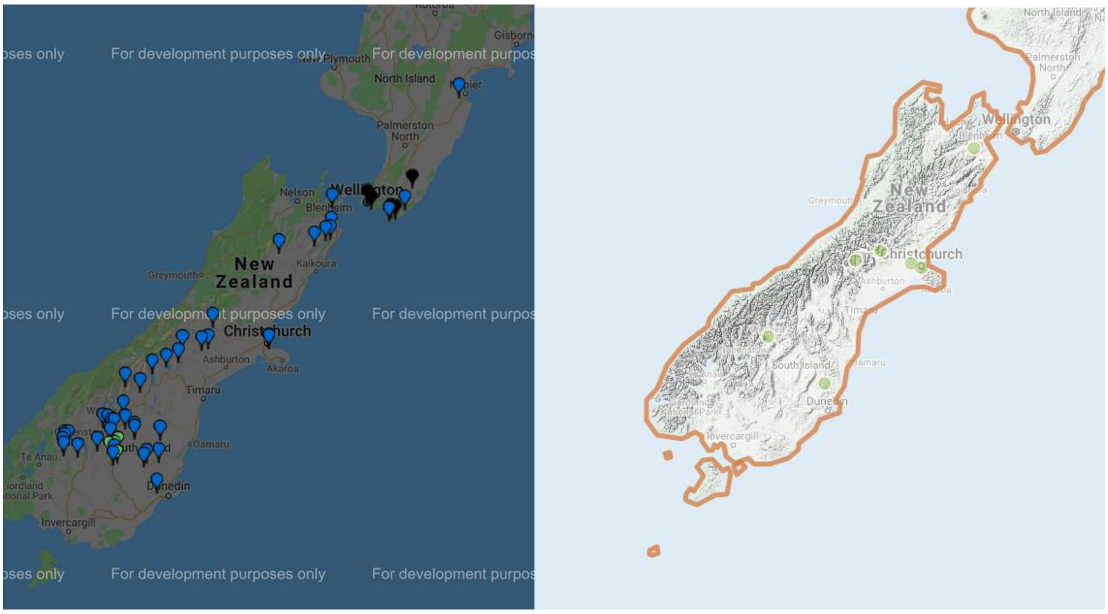

Figure A. Distribution of *Carex resectans* in New Zealand from the NZ Plant Conservation Network (left) and NatureWatch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1417 accessed 31 May 2019.

NatureWatch https://inaturalist.nz/observations?place_id=6803&taxon_id=400461 accessed 31 May 2019.

Dr M. Thorsen unpub. file notes.

12. *Melicope simplex* A.Cunn. (poataniwha, Rutaceae).

Distribution within project

This shrub was recorded as 11 individuals in one group of rock outcrops in the WRS.

Summary of existing information

Melicope simplex is distributed throughout the North and South Islands but is rare in within the Macraes E.D. where it has been recorded at four other sites. At Macraes it inhabits shrublands around rock outcrops and is thought to be a relict species from previous woody vegetation.

The ecological importance of the population of this species within the PIA is categorised as **moderate** on the basis of its:

1) Rarity within the Ecological District.

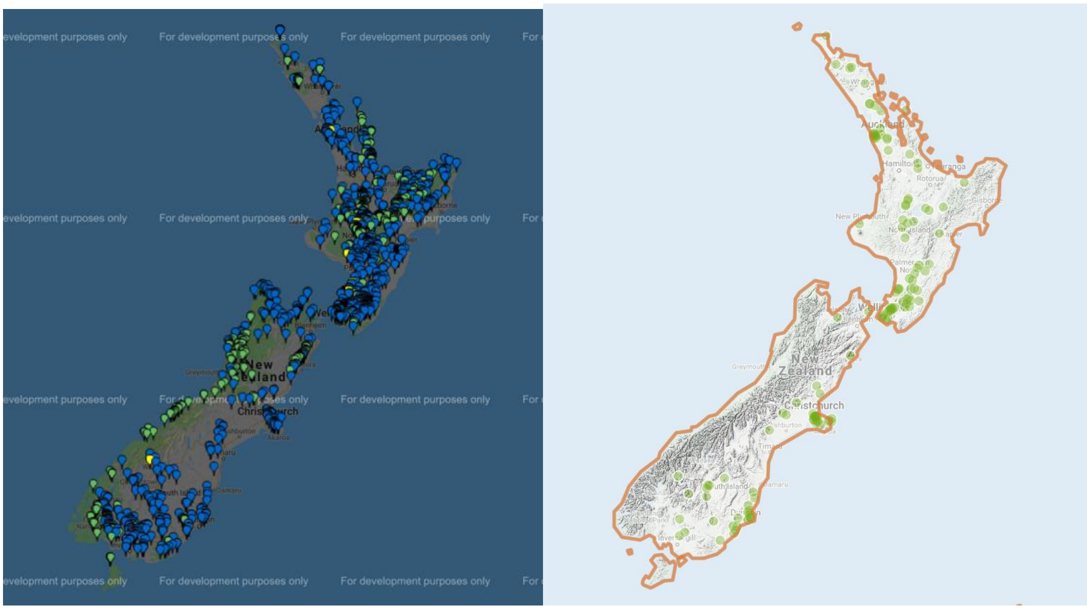

Figure A. Distribution of *Melicope simplex* in New Zealand from the NZ Plant Conservation Network (left) and NatureWatch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=966 accessed 31 May 2019.

NatureWatch https://inaturalist.nz/observations?place_id=6803&taxon_id=366690 accessed 31 May 2019.

Dr M. Thorsen unpub. file notes.

13. *Myrsine divaricata* A.Cunn. (weeping matipo/mapou, Primulaceae).

Distribution within project

This shrub was recorded as 2 individuals in one group of rock outcrops in the WRS.

Summary of existing information

Myrsine divaricata is distributed throughout the North and South Islands but is rare in within the Macraes E.D. where it has been recorded at five other sites. At Macraes it inhabits shrublands around rock outcrops and is thought to be a relict species from previous woody vegetation.

The ecological importance of the population of this species within the PIA is categorised as **moderate** on the basis of its:

1) Rarity within the Ecological District.

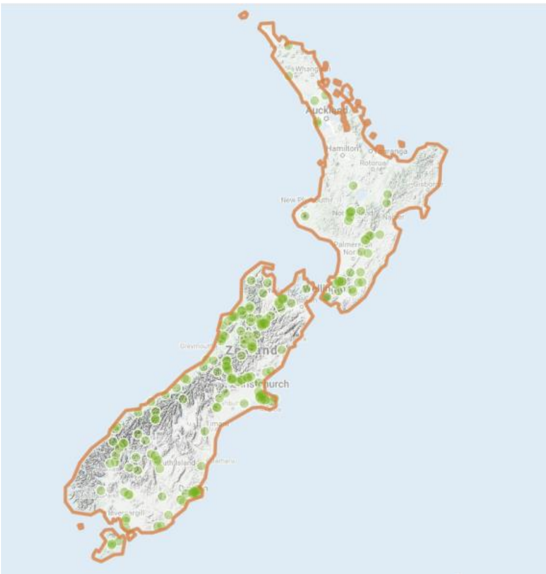

Figure A. Distribution of *Myrsine divaricata* in New Zealand from the NatureWatch database (see data sources). No guarantee is given as to the accuracy of the map or the identification of the species.

Data sources used in this assessment:

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1009 accessed 31 May 2019.

NatureWatch https://inaturalist.nz/observations?place_id=6803&taxon_id=70240 accessed 31 May 2019

Dr M. Thorsen unpub. file notes.

6.3.5 *Species of biogeographic interest*

No plant species of biogeographic interest occur within the PIA.

6.3.6 *Genetically or morphologically distinct forms*

No morphologically distinct plant forms are present within the PIA.

6.4 Avifauna Ecological Features

6.4.1 *Avifauna communities*

Twenty bird species were recorded from within the PIA, nine of which are indigenous: grey teal, black-backed gull, pipit, harrier hawk, grey warbler, paradise shelduck, welcome swallow, kereru, and spur-winged plover, and eleven of which are exotic: blackbird, skylark, goldfinch, starling, yellowhammer, chaffinch, redpoll, house sparrow, magpie, mallard, and song thrush. Several birds were not able to be identified, including one sighting of what may have been a flock of three brown creeper in shrubland on the margin of the WRS.

A pair of pipit was observed on the existing recently revegetated Deepdell WRS and are assumed to be breeding there. One harrier hawk was seen on most visits to the site. It is assumed that they regularly use the area for hunting and feeding but are unlikely to be breeding there. A pair of grey warbler was seen in the WRS zone near the existing Deepdell North pit. It is assumed that there are likely to be other birds present and they are breeding in some of the more intact shrubland areas. Six paradise shelduck were observed in the WRS zone. A flock of 6 grey teal were observed on the farm pond in the Pit zone and it is assumed they are using this site for feeding, though they may be nesting in the willows outside of the PIA. A group of welcome swallow were also observed feeding over this pond and may be nesting in nearby buildings or rock overhangs. Welcome swallows are probably migrant into the area for breeding over the summer months. Spur-winged plover were vocally conspicuous in the Pit and WRS zones (particularly in the latter). It is estimated that several pairs were present, and it is likely that they breed there. A colony of black-backed gulls is breeding adjacent to the existing Deepdell South pit lake: 45 adults and 15 juveniles were present on the 7 April visit and they are foraging in the surrounding farmland. A single kereru was seen flying 150 m overhead. It is not thought that this species is using this area and is excluded from further consideration. No falcon have been seen or heard during the Deepdell North III or Coronation surveys, though they are known from further afield in this area. It is possible the species uses this area occasionally for hunting.

Of the exotic birds, blackbird, song thrush and house sparrow are present in gullies in the shrubland and are nesting in these areas or the nearby derelict buildings. Skylark, goldfinch, yellowhammer, starling magpie and redpoll are scattered throughout the PIA in areas of open vegetation. Mallards are using the farm pond for feeding and probably nesting.

6.4.2 *Ecological function*

Of the twenty bird species recorded from within the PIA, eleven are exotic species. Six of these: skylark, goldfinch, yellowhammers, starlings, redpoll and house sparrow are considered of minor ecological importance, being insectivores or seed eaters and as such competing with few native species. The song thrush and blackbird have some ecological importance due to their role in dispersing fruit of native shrubs. The magpies are likely to be predators of indigenous lizards, and the mallards may be competing with the indigenous grey teal for food.

Eight of the indigenous species: grey teal, black-backed gull, pipit, harrier hawk, grey warbler, paradise shelduck, welcome swallow and spur-winged plover, are all likely to be playing some ecological role within the PIA. Pipits are mainly insectivores, but also disperse fruit of native plants (Thorsen et al. 2011). Harrier hawks play a role in regulating rabbit density and behaviour in the area. Grey warblers are predominantly insectivorous and play a role in regulating tree-dwelling invertebrate numbers. Paradise shelduck and grey teal (and other waterfowl) influence the stature and composition of wetland plant communities. Spur-winged plovers are omnivorous, mainly feeding on plant material but also some animal material (Heather and Robertson 2000). They are a recent natural arrival to New Zealand, and their ecological function here is not known. Black-backed gulls are mainly scavengers in this area and are most likely feeding on dead (or dying) farmland animals. Their breeding colonies are fiercely defended, and this could be displacing harrier from the area around the pit lake. The ecological function of welcome swallows is not well known, but they may regulate aquatic invertebrate numbers.

Overall the site is assessed as having **moderate** importance in ecological function of bird species.

6.4.3 *Species diversity*

Dryland Central Otago is depauperate in bird species due to its aridity and lack of forest and wetland habitats. The nine indigenous and eleven exotic bird species observed within the PIA is the normal diversity expected for this site. The eight Non-Threatened indigenous bird species that occur within the PIA are of **low** ecological importance.

6.4.4 *Threatened, At Risk, or rare species*

One of the nine indigenous bird species is classified as At Risk: pipit.

1. *Anthus novaeseelandiae* Gmelin subsp*. novaeseelandiae* (pipit, Motacillidae).

Pipits are currently classified as Declining on the basis of a >100,000 population that is predicted to decline by 10-70% (Robertson et al. 2017). They also held this classification in the assessment in 2012 (Robertson et al. 2012) and were assessed as Not Threatened in 2005 (Hitchmough et al. 2007). This decline is mainly attributed to conversion of rough grasslands (particularly short tussock grassland) to pasture, predation and possibly changes to habitat caused by drought (Heather and Robertson 2000, http://nzbirdsonline.org.nz/species/new-zealand-pipit accessed 19/2/18). Pipit are distributed throughout the North, South and Stewart Islands, with subspecies on the offshore islands (Figure 6b). Macraes is one of the highest densities of sightings of pipits in New Zealand, being recorded in 25-40% of the reports in this area (http://nzbirdsonline.org.nz/species/new-zealand-pipit accessed 19/2/18) and within the Macraes area pipit are widespread, particularly in rough low grassland, although population density varies greatly from site to site. Pipits are present within the Pit zone, where it is estimated, based on encounter rate, that there a single pair of birds. Their presence in an artificially created habitat may be an indication of this species' adaptability to novel environments.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

1) Declining conservation status.
2) Very small population size in PIA.
3) Human-created habitat.

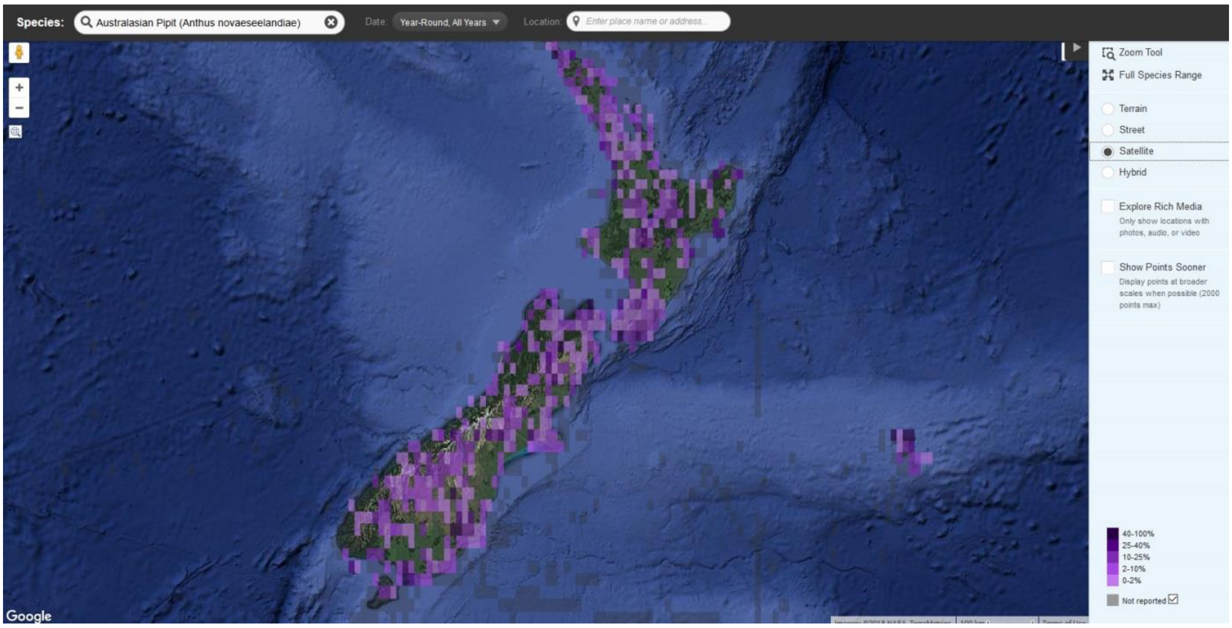

Figure 6b. National distribution of pipit and density of sightings, from:

http://ebird.org/ebird/newzealand/map/auspip1?neg=true&env.minX=156.24755859375&env.minY=-47.82790816919327&env.maxX=-166.83837890625&env.maxY=-33.99802726234875&zh=true&gp=false&ev=Z&mr=1-12&bmo=1&emo=12&yr=all&byr=1900&eyr=2016 accessed 17 February 2018.

Data sources used in this assessment:

Birds Online http://nzbirdsonline.org.nz/species/new-zealand-pipit accessed 13 November 2018.

Dr M. Thorsen unpub. file notes.

6.4.5 *Species of biogeographic interest*

No bird species that are at their distribution limits or of other biogeographic interest were found within the PIA.

6.4.6 *Genetically or morphologically distinct forms*

No bird species within the PIA are thought to be of genetically or morphologically distinct forms.

6.4.7 *Importance overall of avifauna*

The ecological importance of the birds within the PIA is categorised as **moderate-low** on the basis of:

1) The presence of one At Risk species;
2) Bird species role in ecosystem function;
3) Low species diversity and abundance.

6.5 Herpetofauna Ecological Features

6.5.1 *Herpetofauna communities*

Four reptile species were recorded in the PIA: the skinks *Oligosoma maccanni* (clade 4 genotype), *Oligosoma polychroma* (clade 5 genotype) and *Oligosoma inconspicuum* and the gecko *Woodworthia* “Otago/Southland large”. Densities of all these species are low with 0.6 individuals sighted per kilometre/1.2 individuals sighted per hour of search effort.

The McCann’s skink *O. maccanni* (clade 4 genotype) is present in low to moderate numbers throughout the shrubland vegetation community and is absent from the majority of the exotic grassland. It is commoner in rocky sites and areas with good cover in the WRS zone. The total population within the PIA is estimate at 150 individuals based on encounter rate and quantity of habitat present

The southern grass skink *Oligosoma polychroma* (clade 5 form) is present infrequently in areas with denser vegetation or rock piles. The total population of this species within the PIA is estimated at 5 individuals based on encounter rate and quantity of habitat present.

The cryptic skink *Oligosoma inconspicuum* is rare in this area due to a shortage of suitable habitat. It was sighted in one area of rocks of the existing waste rock stack beside the road. This is anomalous habitat for this species as they are more typically an inhabitant of gully bottoms in the Macraes area. The possibility exists that this was a misidentification of a subadult skink of another species (both McCann’s and southern grass skinks are known to occupy this habitat type at Macraes).

The korero gecko *Woodworthia* “Otago/Southland large” was noted in one location in Pit zone though it is likely to also be present on other areas of the PIA, particularly the rocky outcrops in the WRS zone. Only 1-5 individuals are likely to be present where it occurs in the PIA and the total population within the PIA is estimated at 30 individuals based on encounter rate and quantity of habitat present.

It can sometimes be difficult to detect all reptile species during a survey, and other species of reptile are known from the vicinity. Grand skink *Oligosoma grande* were recorded in 1995 2.7

km to the east, and Otago skink *Oligosoma otagense* have been recorded in 1992 from c. 6 km north and in 2003 c. 6 km to the south of the PIA. Neither species were seen in or near the PIA during this survey (the original sites were not resurveyed as they occur outside the PIA). As they have not been detected within the PIA during these surveys, it is considered highly unlikely that these two species are present within the PIA. Green skinks *Oligosoma chloronoton* were present nearby in the 1960's (Whitaker 1986), but there have been no recent records of this species from anywhere within the OceanaGold operational area, including during a ten day species-specific survey of the Macraes area in 2015 which included the valley immediately to the west of the PIA. It is considered unlikely that this species is still present within the PIA.

6.5.2 *Ecological function*

The four reptile species recorded in the PIA: the skinks *Oligosoma maccanni* (clade 4 genotype), *Oligosoma polychroma* (clade 5 genotype) and *Oligosoma inconspicuum* (if present) and gecko *Woodworthia* "Otago/Southland large" play an ecological role in regulating invertebrate numbers and in dispersing the fruit of native plants. They are also prey items of native birds such as falcon (not known from PIA).

6.5.3 *Species diversity*

Four reptile species is a moderate diversity in relation to other sites nearby, where seven species are known to occur in the area (excluding exotic amphibian species). The Not Threatened *Oligosoma maccanni* (clade 4 genotype) is of **moderate**[4] ecological importance.

[4] A value of 'low' is given using the EIANZ guidelines, but a value of 'moderate' is used here to reflect the larger reptile populations that occur in Central Otago relative to that in most of mainland New Zealand.

6.5.4 *Threatened, At Risk, or rare species*

Three of the reptile species are currently classified as At Risk: the skinks *Oligosoma polychroma* (clade 5 genotype) and *Oligosoma inconspicuum* and the gecko *Woodworthia* “Otago/Southland large”.

Overall, these species are considered to be represented by small populations within the PIA when compared with those known at other nearby sites. This appears to be a result of the lack of high-quality habitat: complex rocky sites with a high diversity and dense cover of native shrubs and vines.

1. *Oligosoma polychroma* (Patterson & Daugherty 1990) (clade 5 genotype) (southern grass skink, Scincidae).

Southern grass skinks are currently classified as Declining on the basis of its population estimated to occupy >10,000 (100 km^2) with a predicted decline of 10-70% (Hitchmough et al. 2016). Previously it has been assessed in 2012 as Declining (Hitchmough et al. 2013) and Not Threatened in 2009 and 2005 (Hitchmough et al. 2010, Hitchmough et al. 2007). Within the wider Macraes area this species is frequently encountered at many sites and much of the suitable habitat is occupied. Nearby, a large lizard conservation programme run by DOC is benefitting this species (and others). Within the PIA this species has a local distribution mainly in well-vegetated sites.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

1) Declining conservation status.

2. *Oligosoma inconspicuum* (Patterson & Daugherty 1990) (cryptic skink, Scincidae).

Cryptic skinks are currently classified as Declining on the basis of its population estimated to occupy >10,000 (100 km^2) with a predicted decline of 10-70% (Hitchmough et al. 2016). Previously it has been assessed in 2012 as Declining (Hitchmough et al. 2013), Not Threatened in 2009 (Hitchmough et al. 2010) and Gradual Decline with the qualifiers Data Poor and Human Induced in 2005 (Hitchmough et al. 2007). Within the wider Macraes area this species is infrequently encountered in gully areas with good shrubland density or rock retreat sites. Nearby, a large lizard conservation programme run by DOC is benefitting this species (and others). Within the PIA this species has a very local distribution and was seen at only one site.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

1) Declining conservation status.

3. *Woodworthia* "Otago/Southland large" (korero gecko, Gekkonidae).

Korero geckos are currently classified as Declining with the qualifier Partial Decline on the basis of its population estimated to total >100,000 mature individuals with a predicted decline of 10-70% (Hitchmough et al. 2016). Previously it has had the same assessment in 2012 and 2009 (Hitchmough et al. 2013, Hitchmough et al. 2010) and was assessed as Gradual Decline in 2005 (Hitchmough et al. 2007). Within the wider Macraes area this species is frequently encountered at many sites and most suitable habitat is occupied. Nearby, a large lizard conservation programme run by DOC is benefitting this species (and others). Within the PIA this species has a local distribution mainly in near larger rock outcrops. Korero geckos are also likely to be present in some of the smaller rock outcrops that are scattered through the steeper areas of the PIA.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

1) Declining conservation status.
2) Likely population size within the PIA.

6.5.5 *Species of biogeographic interest*

No reptile species that are at their distribution limits or of other biogeographic interest were recorded within the PIA.

6.5.6 *Genetically or morphologically distinct forms*

Genetically distinct genotypes of three of the reptile species are present in the PIA: skinks *Oligosoma maccanni* (clade 4 genotype) and *Oligosoma polychroma* (clade 5 genotype), and the gecko *Woodworthia* "Otago/Southland large".

Oligosoma polychroma (clade 5 genotype) (Liggins et al. 2008) and *Oligosoma maccanni* (clade 4 genotype) (O'Neill et al. 2008) are members of populations that are genetically distinct from other populations of these species.

The gecko *Woodworthia* "Otago/Southland large" is an unnamed entity within the *Woodworthia* genus that contains several other unnamed entities previously classified as *Woodworthia maculatus* (Hitchmough 1997, Jewell 2008, Nielsen et al. 2011). The population that occurs at Macraes is thought to represent a distinctive eastern form of this unnamed entity (Jewell 2008).

All three of these genetically distinct populations are widespread in the area. The eastern form of *Woodworthia* "Otago/Southland large" occurs at multiples sites between the Waitaki and Clutha Rivers inland to the Rock and Pillar Range (Jewell 2008). The Clade 5 genotype of *Oligosoma polychroma* is known to occur between Banks Peninsula, Mackenzie Basin, Central Otago, Southland and Stewart Island (Liggins et al. 2008). The Clade 4 genotype of *Oligosoma maccanni* is known from south of the Waitaki River through Central Otago east of the Dunstan Mountains to northern Southland (O'Neill et al. 2008).

6.5.7 *Importance overall of herpetofauna*

The ecological importance of the lizard populations within the PIA is categorised as **moderate** on the basis of:

1) The presence of three At Risk species;
2) The presence of genetically distinct lineages (that occur at multiple sites outside the PIA);
3) The role lizards are likely to be playing in ecosystem function;
4) The moderate species diversity and low to moderate abundance.

6.6 Invertebrate Ecological Features

6.6.1 *Invertebrate communities*

Sixty-eight invertebrate species were recorded in the PIA, however the eastern portion of the WRS has not been specifically surveyed and the surveyed area includes the hillslopes of the Taieri Ridge. Some of the specimens collected are awaiting ID. The invertebrate community identified to date is mainly a mix of exotic and indigenous species from the surrounding pasture, shrublands, low producing grassland, gullies and rock outcrops.

Some plant communities such as ephemeral wetlands could harbour distinctive invertebrate communities. However, the invertebrate fauna of New Zealand's ephemeral wetlands is poorly understood. From the literature, ephemeral wetlands in Canterbury typically have similar species richness to permanent wetlands and contain no unique aquatic invertebrate species (Burns *et al*., 1984; Wissenger *et al*., 2009) and are dominated by species with high-dispersal capabilities or species that can tolerate desiccation. This lack of uniqueness differs to similar ecosystems overseas which typically have a diverse array of temporary habitat specialists (Wellborn *et al.*, 1996; Urban, 2004). This discrepancy could either be a result of incomplete studies, or that New Zealand's erratic climate causes an irregular cycle of wetland wetting and drying, preventing the evolution of temporary habitat specialists.

A species of particular interest to ephemeral wetlands in the Macraes E.D. is the clam shrimp *Eulimnadia marplesi* (Timms and McLay, 2005). This species is known from ephemeral wetlands near Sutton and is classified as 'Nationally Critical' by the Department of Conservation (Grainger *et al*., 2018). Recent efforts have failed to relocate this species. Other rare wetland species are known to occur in the Macraes E.D., but it is not known if they occur within ephemeral wetlands.

Significant gaps exist within the knowledge of New Zealand's ephemeral wetland invertebrate fauna, particularly around their use of these habitats during their 'dry phase', and for non-aquatic species such as the Diptera and Lepidoptera that have been observed in ephemeral wetlands at Macraes.

6.6.2 *Ecological function*

The invertebrate communities (both exotic and indigenous) are likely to be playing a very important role in their ecosystems through pollination, as disease vectors, competition, herbivory, predation, litter decomposition, soil formation, and as a food source for fish, birds and reptiles. Some species (both exotic and indigenous) are likely to be serious pasture pests.

6.6.3 *Species diversity*

The invertebrate diversity in the groups sampled appeared to be moderate as the 68 species recorded is 84% of the 81 species recorded in Patrick (1997) or on NatureWatch for the Taieri Ridge area. However, only 7 species are shared between these lists.

6.6.4 *Threatened, At Risk, or rare species*

None of the invertebrate species identified to date from within the PIA is currently classified as Threatened, At Risk or rare.

6.6.5 *Species of biogeographic interest*

No invertebrate species that are known as at their distribution limits or of other biogeographic interest were recorded within the PIA, however the distribution of many of New Zealand's invertebrates are poorly known and the species present in the PIA that may be of biogeographic interest.

6.6.6 *Genetically or morphologically distinct forms*

No distinct morphotypes or genotypes are present in the invertebrate species identified to date, however many invertebrate groups are known for variation in their appearance and some are postulated as distinct, unnamed taxa. Three examples of this are present in the invertebrate species in the PIA: *Harmologa* sp. A, *Orocrambus* sp. B of NZAC, *Tingena* sp. cf. *siderodeta*. All are widespread Lepidoptera. The specimen of *Apoctena* cf. *conditana* differs in colouration from most of the specimens of this species in the NZ Arthropod Collection, but its genitalia are similar.

6.6.7 *Importance overall of invertebrate fauna*

The ecological importance of the invertebrate communities within the PIA is categorised as **moderate** on the basis of:

1) Moderate diversity and mostly low to moderate density of indigenous species;
2) The importance of invertebrates in ecosystems.
3) The lack of information on invertebrate distribution and ecology.

6.7 Sites or communities identified as significant in regional planning documents

6.7.1 *Otago Regional Council Regional Policy Statement*

Using the criteria within Policy 10.5.2 of the 1998 Otago Regional Policy Statement 10: Biota, the low-producing grassland, seepages, ephemeral wetlands and shrubland vegetation type within the Deepdell North III impact area is considered **significant** as they are, or contain, species or vegetation that meet the criteria specified in Policy 10.5.2(b) "*habitat or vegetation that support the maintenance or recovery of indigenous species that are uncommon or threatened with extinction (rare, vulnerable or endangered) regionally or nationally"*, these being the 17 species listed in Sections 6.3, 6.4.4 and 6.5.4.

6.7.2 *Otago Regional Council Proposed Regional Policy Statement*

Using the criteria in Schedule 4 of Policy 3.2.1, and with regards to Policies 5.3.5 and 5.4.8, of the Partially Operative Otago Regional Policy Statement 2019:

<u>Criteria 1. Representativeness</u>

The seasonal gully drainage, ephemeral wetland, seepages, low-producing grassland and shrubland vegetation types described in 5.2.1 are **significant** under Criteria 1 in that they are "*an example of an indigenous vegetation type or habitat that is typical or characteristic of the natural diversity of the relevant ecological district. This may include degraded examples of their type or represent all that remains of indigenous vegetation and habitats of indigenous fauna in some areas*."

<u>Criteria 2. Rarity</u>

The 17 species listed in Sections 6.3, 6.4.4 and 6.5.4 are **significant** under a. of Criteria 2 in that they are "a*n indigenous species that is threatened, at risk, or uncommon, nationally or within an ecological district*".

The areas of indigenous vegetation that occur on the mapped areas of LENZ categories L1.3a and N3.1e (both classified as having 10% of their natural vegetation remaining nationally) and Q4.3b (classified as having 10-20% of their natural vegetation remaining nationally) (see Section 6.2.7.1) are **significant** under b of Criteria 2 in that they have been mapped as "*Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent nationally, regionally or within a relevant land environment, ecological district, or freshwater environment including wetlands*". The natural vegetation communities at these sites are areas of low-producing grassland, shrublands, seepage, ephemeral wetland and seasonal gully drainages totalling 88.7 ha (Table 4).

The ephemeral wetlands and seepage wetland that occur in the PIA are considered **significant** under c. of Criteria 2 "*indigenous vegetation and habitats within originally rare ecosystems*".

Plant community	L1.3a	N3.1e	Q4.3b	Total
Ephemeral Wetland	0.1	0.2		0.3
Low producing grassland	17.7	32.5	22.9	73.0
Seepage	0.1			0.1
Shallow Ephemeral Drainage System	4.2			4.2
Shrublands	0.0	6.0	5.1	11.1
Total	22.1	38.7	27.9	88.7

Table 4. Extent of natural vegetation in the PIA occurring on mapped extent of LENZ classified as having less than 20% of their national area being covered by indigenous vegetation.

Criteria 3. Diversity

The vegetation communities are considered **not significant** under Criteria 3 "*an area that supports a high diversity of indigenous vegetation and habitats of indigenous fauna or consists of a diverse range or sequence of interrelated vegetation and habitat types*" as 1) the number of species that occurs in each community is not diverse relative to other examples of that vegetation community in the area; 2) the diversity of habitats of indigenous fauna is lower than the diversity of habitats that occur in the surrounding area; 3) none contain a diverse range or sequence of vegetation types.

Criteria 4. Distinctiveness.

The terrestrial ecological features are considered **not significant** under a. of Criteria 4 "*indigenous species at their distributional limit within Otago or nationally*" as none of the species recorded is at its distributional limit either nationally or within the Otago Regional Council territorial area.

The terrestrial ecological features are considered **not significant** under b. of Criteria 4 "*indigenous species that are endemic to the Otago region*" as none of the species is known to be endemic to the Otago Regional Council territorial area.

The seasonal gully drainage and ephemeral wetlands within the PIA are considered **significant** under c. of Criteria 4 "*indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, or has developed as a result of an unusual environmental factor or combinations of factors*" as the ephemeral wetland is a distinctive vegetation community within Otago Regional Council territorial area, both the ephemeral wetland and seasonal gully drainage vegetation communities are of restricted occurrence within the Otago Regional Council territorial area and both have developed as a result of unusual environmental factors (low rainfall, and flat or gently sloping terrain).

Criteria 5. Ecological Context.

The terrestrial ecological features are considered **not significant** under a. of Criteria 5 "*an area that has important connectivity value allowing dispersal of indigenous vegetation and fauna between different areas*" as though there is some connectivity between this site and adjoining sites, this connectivity is not considered important in a regional context.

The terrestrial ecological features are considered **not significant** under b. of Criteria 5 "*an important buffering function that helps to protect the values of an adjacent area or feature*" as though there is some buffering between this site that may help protect the values of the adjacent areas, this buffering is not considered important in a regional context.

The terrestrial ecological features are considered **not significant** under c. of Criteria 5 "*an area that is important for indigenous fauna during some part of their life cycle, either regularly or on an irregular basis, e.g. for feeding, nesting, breeding, or refuges from predation*" as though there is some use of this site for breeding, feeding, as a refuge and for other purposes, this usage is not considered important in a regional context for the species.

6.7.3 *Otago Regional Council Regional Plan: Water for Otago*

The PIA contains no Regionally Significant Wetlands or Wetland Management Areas listed in Schedule 9 of the Regional Plan: Water for Otago.

6.8 Sites or communities identified as significant in district planning documents

6.8.1 *Waitaki District Council District Plan*

The indigenous vegetation communities within the PIA were assessed using the criteria within Policy 16.9.3 of the 2010 Waitaki District Council District Plan, and the ephemeral wetlands, seepage wetland, low-producing grassland, seasonal gully drainage and shrubland vegetation types within the Deepdell North III impact area is considered **significant** as they are, or contain, species or vegetation that meet criteria:

i) *Representativeness*

The area supports an example of a particular vegetation type, habitat or ecological process that is typical of the ecological district relative to the pre-European baseline and contributes to maintaining the appropriate proportional representation of that feature;

In addition, the ephemeral wetlands, seepage wetland, low-producing grassland and shrubland vegetation communities are **significant** as they contain rare species that meet criteria:

ii) *Rarity and distinctiveness*

The area supports an indigenous species, habitat or community, which is rare and vulnerable within the ecological district or threatened nationally;

None of the exotic vegetation types are considered significant using the criteria outlined above.

6.9 Summary of ecological features identified as significant in district or regional planning documents

Vegetation Community	Significant Under operative RPS?	Significant under OPRPS?	Significant under WDC District Plan?
Cultivated Pasture			
Ephemeral Wetland	✓ (habitat of rare species)	✓ (representativeness, distinctiveness, rarity)	✓ (representativeness, rarity)
Low-producing grassland	✓ (habitat of rare species)	✓ (rarity)	✓ (representativeness, rarity)
Seasonal gully drainage		✓ (representativeness, rarity, distinctiveness)	
Shrublands	✓ (habitat of rare species)	✓ (representativeness, rarity)	✓ (representativeness, rarity)
Seepage	✓ (habitat of rare species)	✓ (representativeness, rarity)	✓ (representativeness, rarity)
Plant species		✓ (rarity)	✓ (rarity)
Avifauna		✓ (rarity)	✓ (rarity)
Herpetofauna		✓ (rarity)	✓ (rarity)
Invertebrates			

6.10 Summary Table of Ecological Features

Ecological Feature Class	Ecological Feature Type	Ecological Feature	Classification of Feature	Buffer	Pit	WRS	PIA	Unit of Measurement	Accuracy of measurement	Ecological Importance of Feature
Bird	Community	Ecological function								Moderate
Bird	Species	Pipit	Declining				2	individuals	Counted	Moderate
Bird	Species	Black-backed gull					45	individuals	Counted	Low
Bird	Species	Grey teal					6	individuals	Counted	Low
Bird	Species	Grey warbler					10	individuals	Estimated	Low
Bird	Species	Harrier hawk					1	individuals	Counted	Low
Bird	Species	Paradise shelduck					6	individuals	Counted	Low
Bird	Species	Spur-winged plover					8	individuals	Estimated	Low
Bird	Species	Welcome swallow					5	individuals	Estimated	Low
Environment	LENZ	Cultivated Pasture	< 10% indigenous cover left	26.39	29.16	24.93	80.49	Hectares	Measured	
Environment	LENZ	Ephemeral Wetland	< 10% indigenous cover left	0.02		0.3	0.31	Hectares	Measured	
Environment	LENZ	Low producing grassland	< 10% indigenous cover left	13.24	7.8	29.11	50.15	Hectares	Measured	
Environment	LENZ	Seasonal gully drainage	< 10% indigenous cover left	1.79	0.5	1.91	4.2	Hectares	Measured	
Environment	LENZ	Seepage	< 10% indigenous cover left			0.07	0.07	Hectares	Measured	

Environment	LENZ	Shelterbelts & Exotic Trees	< 10% indigenous cover left	0.08		0.53	0.61	Hectares	Measured	
Environment	LENZ	Shrublands	< 10% indigenous cover left	3.17	0.08	2.79	6.04	Hectares	Measured	
Environment	LENZ	Threatened LENZ with indigenous vegetation	< 10% indigenous cover left	5.26	1.7	15.14	22.09	Hectares	Measured	
Environment	LENZ	Threatened LENZ with indigenous vegetation	< 10% indigenous cover left	12.95	6.68	19.04	38.67	Hectares	Measured	
Environment	LENZ	Low producing grassland	10-20% indigenous cover left	11.58	0.96	10.36	22.89	Hectares	Measured	
Environment	LENZ	Shrublands	10-20% indigenous cover left	4.2		0.86	5.05	Hectares	Measured	
Environment	LENZ	Threatened LENZ with indigenous vegetation	10-20% indigenous cover left	15.77	0.96	11.21	27.94	Hectares	Measured	
Flora	Community	Ephemeral Wetland	Critically Endangered Historically Uncommon ecosystem type	0.02		0.3	0.31	Hectares	Measured	High
Flora	Community	Seepage	Endangered Historically Uncommon ecosystem type			0.07	0.07	Hectares	Measured	High
Flora	Community	Cultivated Pasture		26.39	29.16	24.93	80.49	Hectares	Measured	Negligible
Flora	Community	Low producing grassland		24.82	8.76	39.47	73.04	Hectares	Measured	Moderate
Flora	Community	Seasonal gully drainage		1.79	0.5	1.91	4.2	Hectares	Measured	Low
Flora	Community	Shelterbelts & Exotic Trees		0.08		0.53	0.61	Hectares	Measured	Negligible
Flora	Community	Shrublands		7.36	0.08	3.65	11.09	Hectares	Measured	Moderate
Flora	Community	Ecosystem services								Minor
Flora	Community	Historically Rare or Threatened Ecosystems				2	2	Communities		

Flora	Community	Integrity								Moderate
Flora	Community	National Priorities for Protection				2	2	Communiti es		
Flora	Community	Rarity								High
Flora	Community	Representativeness								Moderate
Flora	Community	Sites recommended for protection					0	Sites		Nil
Flora	Community	Wetlands of National Importance or Ramsar sites					0	Sites		Nil
Flora	Species	Carmichaelia crassicaulis Hook.f. subsp. crassicaulis	Declining	15		2	17	individuals	Counted	High
Flora	Species	Carmichaelia petriei Kirk	Declining	10		7	17	individuals	Counted	High
Flora	Species	Discaria toumatou Raoul	Declining	7.36	0.08	3.65	3.73	Hectares	Estimated	High
Flora	Species	Juncus pusillus Buchenau	Declining			1	1	m^2	Estimated	Moderate
Flora	Species	Leptinella pusilla Hook.f.	Declining			1	1	m^2	Estimated	High
Flora	Species	Lobelia ionantha Heenan	Declining			0.561	0.561	m^2	Estimated	High
Flora	Species	Rytidosperma buchananii (Hook.f.) Connor & Edgar	Declining			1	1	individuals	Counted	Low
Flora	Species	Carex resectans Cheeseman	Locally Uncommon			1.6	1.6	m^2	Estimated	Moderate
Flora	Species	Melicope simplex A.Cunn.	Locally Uncommon			11	11	individuals	Counted	Moderate
Flora	Species	Myrsine divaricata A.Cunn.	Locally Uncommon			2	2	individuals	Counted	Moderate
Flora	Species	Anthosachne falcis (Connor) Barkworth & S.W.L.Jacobs	Naturally Uncommon				100	individuals	Estimated	High
Flora	Species	Carex subtilis K.A.Ford	Naturally Uncommon			1	1	individuals	Counted	Moderate

Flora	Species	Juncus distegus Edgar	Naturally Uncommon			369	369	m^2	Estimated	Moderate
Flora	Species	Juncus distegus Edgar	Naturally Uncommon			56	56	individuals	Estimated	Moderate
Flora	Species	Diversity								Moderate
Invertebrates	Community	Overall importance								Moderate
Reptiles	Community	Overall importance								Moderate
Reptiles	Species	*Oligosoma inconspicuum*	Declining		1			individuals	Counted	High
Reptiles	Species	*Oligosoma polychroma* (clade 5 genotype)	Declining				5	individuals	Estimated	High
Reptiles	Species	*Woodworthia* “Otago/Southland large”	Declining				30	individuals	Estimated	High
Reptiles	Species	*Oligosoma maccanni* (clade 4 genotype)					150	individuals	Estimated	Moderate

7 Project Impact on Ecological Features

7.1 Assessing Project Impact

The impact of the project on the ecological features, at both a local and national scale, is assessed by considering the effects of the project activities (Section 7.3) identified as having a potential to impact on the ecological features (Section 6, summarised in Section 6.10), within the area identified as the PIA (Section 5.3) against the current ecological condition and permitted baseline/existing environment (Section 5.1). The magnitude of the effect on the ecological feature is assessed at both a local (within approximately 10 km of the site) and national scale based on Table 8 of the 2018 EIANZ guidelines. An overall effect of the project on the ecological feature at a national scale is based on Table 10 of the EIANZ guidelines. An indication of the confidence in the assessment is provided.

The assessment of effect on the vegetation is in Sections 7.3, 7.4, 0, avifauna in Section 7.6, herpetofauna in Section 7.7 and invertebrates in Section 7.8.

A summary of the project impacts is provided in Section 7.9.

7.2 Cumulative effects

Some projects that have staged implementations, such as OceanaGold's Macraes mine, can have effects from previous projects that accumulate over time and act in conjunction to produce an overall effect greater than envisioned at the project stage. These cumulative effects can be difficult to discern. The Macraes gold project has now impacted 1,250 ha, an unknown proportion of which was previously indigenous vegetation. Each project has implemented an impact management procedure to address project effects, and these are considered to be achieving their objectives of minimising the environmental impact of the mine's operations. Currently there are no cumulative effects known beyond the impact on the ecological features of each project.

There may be other cumulative effects arising from surrounding land use by pastoral activities and the spread of pests, weeds and diseases. These effects are very hard to measure, and beyond the scope of this assessment.

Any cumulative effects that are occurring are likely to show in reduced extent in quality and quantity of the current indigenous vegetation communities and fauna populations. It is against this benchmark, which includes unknown cumulative effects, that this project's effects are evaluated.

7.3 Project activities likely to affect ecological features

The following have been identified as project activities which are likely to result in an effect on the PIA's ecological features. Ecological feature-specific impacts are assessed in Section 7.3 to 7.8, but general effects are discussed here.

7.3.1 *Excavation of Pit*

Removal of overburden and ore material from the pit will be through bed-rock blasting and removal of material using heavy machinery moving along a haul road graded into the ground surface. This activity will result in the removal of all vegetation from the Pit zone.

7.3.2 *Deposition of rock material in the Waste Rock Stack*

The overburden and rock remnants of the processed ore will be deposited by heavy machinery in a Waste Rock Stacks (WRS). This activity will bury all vegetation within the WRS zone.

7.3.3 *Sediment run-off*

The unconsolidated fine rock and dust that will be deposited with the rock material into the WRS will, if uncontained, be washed into the waterways that lead from the WRS. This could, if unmanaged, inundate areas of streambed vegetation under a layer of sediment that could extend for 100m or more downstream.

7.3.4 *Effect of changes in weed populations*

Importation of weed species, either directly through seed contamination of equipment or material, or indirectly by creating favourable establishment sites, could, if unchecked, transform habitats in the surrounding area, making them unsuitable for some species. The severity of this effect depends on the nature of the weed species and the ability to detect and manage an emerging weed problem.

7.3.5 *Displacement of pests into surrounding area*

Project activities are likely to cause resident pests such as pigs, rabbits, hares, mustelids and rodents to move into the surrounding area, where they will increase browsing and predation on the surrounding areas' fauna and flora. This effect is likely to be temporary.

7.3.6 *Displacement of resident animals*

Some animal species, particularly birds, will be displaced from the PIA as a result of project activities. These displaced individuals will compete with individuals from the surrounding area. As the surrounding area is assumed to be at carrying capacity, this competition will eventually result in the mortality of either the displaced or resident individuals.

7.3.7 *Noise*

Blasting and operating heavy machinery creates considerable noise. Any adverse effects due to noise are likely to be species specific depending in part on the auditory ability of the species and the frequency and proximity of the noise. Previous exposure to such noise is also likely to be important. Plants are not susceptible to noise impacts.

7.3.8 *Wind-blown dust*

Dust could be generated from exposed surfaces (such as roads or deposition areas) at higher wind speeds and at lower speeds from such surfaces disturbed by machinery and vehicle movements. Dust is actively managed within existing Macraes mine operations, and as a result the activities onsite produce very little wind-blown dust. Noticeable dust accumulation only occurs within the immediate vicinity (<100m) of mine works. Within this zone there is likely to be some reduction in a plant's photosynthetic capacity, potentially resulting in a loss of growth and reproductive output.

7.3.9 *Artificial lighting*

The project may use artificial lighting during night operations. Strong artificial lighting can cause either a negative or positive reaction in animals, depending on species. Moths in particular are drawn to these lights and this can disrupt their foraging and mating. Insect accumulations around lights could also attract nocturnal predators such as little owl, which are not known in area, but are possibly present. No seabirds are known to fly near the PIA, and therefore there is no risk of artificial lighting disorienting overflying seabirds. Other nocturnal species are likely to avoid brightly lit areas. The intensity of project lighting is not of a level that it would affect plant growth.

7.3.10 *Accidental fire*

The Macraes environment is often dry, and accidental fires, if unmanaged, have the potential to burn large areas.

7.3.11 *Changed hydrological regimes*

Excavation of the pit may result in decreased surface and subsurface flow of water into some water courses.

7.4 Impact on Vegetation Communities

The proposal involves the clearance of approximately 54.74 ha of indigenous vegetation, and 54.62 ha of exotic vegetation (Table 5. Extent of vegetation types in area where loss is expected to be total (within the pit and WRS boundaries) and area where there may be some impact from project activities (area within 100 m buffer).).

In addition, there may be some effect on the surrounding vegetation resulting from project activities extending to 100 m beyond the project area (the Buffer in Table 5) of 33.99 ha of indigenous vegetation and 26.47 ha of exotic vegetation.

The extent of each vegetation type in each of these areas is provided in Table 5.

Vegetation Community	Pit	WRS	Buffer	PIA	Area within Macraes E.D.[5]	Estimated % loss resulting from project
Exotic vegetation communities	*29.16*	*25.46*	*26.47*	*81.1*		
Cultivated Pasture	29.16	24.93	26.39	80.49	79635.17	0.10
Shelterbelts & Exotic Trees		0.53	0.08	0.61	4607.59	0.01
Semi-natural vegetation communities	*9.34*	*45.4*	*33.99*	*88.71*		
Ephemeral Wetland		0.30	0.02	0.31	30.73[6]	<1.01
Low producing grassland	8.76	39.47	24.82	73.04	11957.08	0.61
Seepage		0.07		0.07	43.23[7]	0.16
Shallow Ephemeral Drainage System	0.50	1.91	1.79	4.20	?	?
Shrublands	0.08	3.65	7.36	11.09	3547.15	0.31
Total	**38.49**	**70.85**	**60.46**	**169.81**	**99820.95**	**0.17**

Table 5. Extent of vegetation types in area where loss is expected to be total (within the pit and WRS boundaries) and area where there may be some impact from project activities (area within 100 m buffer).

Effect of sediment run-off

Moderate effect on gully-side vegetation only as stream bed sedimentation, if uncontrolled, could cause an increase in wet, bare ground which is usually colonised by weed species. This is expected to be more of a risk in the gullies exiting the Deepdell South pit backfill WRS area.

Effect of changes in weed populations

Minor to major effect, if uncontrolled, on all vegetation communities, depending on weed species involved.

Effects of displacement of pest animals

Minor effect on many communities as most pest species will already also be present in the surrounding area. Effect is expected to be temporary as pest species leave the area.

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[5] As mapped in Landcover Database 4.1 from 2012 satellite imagery,

[6] Based from incomplete mapping

[7] Based on results from Landcare map of vegetation of Macraes E.D.

Effects of dust

Minor to moderate effect, if uncontrolled, on vegetation communities immediately adjacent to project boundaries. Most lowland to montane plant communities do not seem to be dramatically affected by dust at the sites where they occur close to gravel roads. The effect of dust on vegetation surrounding existing mine operations appears to be confined to less than 10 m where dust coating can be obvious, but no obvious effects have been observed on plant health or mortality. Beyond 10 m the dust coasting is lessened and is regularly removed by rainfall. This is the effect that is expected in the Deepdell North III project.

Effects of accidental fire

Minor to major effect, if uncontrolled, depending on moisture content of vegetation community and whether it occurs in natural fire refugia where it is unlikely that heat levels would reach a level sufficient to effect plant health.

Changed hydrological regimes

Nil to minor effect depending on vegetation community and location. Water draw-down and altered subsurface flow is expected to result in a limited degree of drying of the unimpacted downstream areas of the seasonal gully waterways. This is unlikely to substantially alter the remaining indigenous character of this vegetation type as it is currently already subjected to summer-drying.

Changes in vegetation extent in the Macraes E.D. between 2008 and 2012.

The extent of the vegetation communities in the Macraes E.D. is changing over time. Table 6 gives the estimated change in extent for the plant communities present in the PIA. The plant communities showing the largest changes in extent over that time period are cultivate pasture which has more than doubled in extent and the loss of nearly half of the low producing grasslands. In the Otago area (for where analysis is available) the increase in extent of cultivated pasture has been a result of conversion of low producing grassland and clearance of exotic gorse and broom shrubland. The loss of low producing grassland has been through conversion to cultivated pasture, succession into fernland and invasion by exotic gorse and broom shrubland. Information is not available to assess changes in the other vegetation communities.

Vegetation Community	Area within Macraes E.D. in 2008	Area within Macraes E.D. in 2012	% change in extent 2008 to 2012
Exotic vegetation communities			
Cultivated Pasture	29872.15	79635.17	166.6
Shelterbelts & Exotic Trees	4514.2	4607.59	2.1
Semi-natural vegetation communities			
Ephemeral Wetland	?	162.39[8]	?
Low producing grassland	57760.15	11957.08	-79.3
Seepage	?	43.23[9]	?
Shallow Ephemeral Drainage System	?	?	?
Shrublands	3522.7	3547.15	0.7

Table 6. Changes in vegetation community extent in the Macraes E.D. between 2008 and 2012

Overall effect on the seasonal gully drainage vegetation community

The result of these project effects will be a reduction by 2.41 ha of this vegetation community in the extent of this community and minor changes to the 1.79 ha in the buffer area. The extent of this community locally or nationally is not known, and therefore the consequence of this reduction in area is difficult to assess. However, this vegetation community in the PIA is heavily modified by exotic species.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the vegetation community.

This vegetation community is assessed as having **low** ecological importance.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this vegetation community is **very low**.

The confidence of this assessment is **low** as this vegetation community is of uncertain distinctiveness and its distribution in the wider area is unknown.

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[8] Based on mapping in 2019

[9] Based on results from 2018 Landcare map of vegetation of Macraes E.D.

Overall effect on the ephemeral wetland vegetation community

The result of these project effects will be a loss of 0.32 ha of this vegetation community from 7 sites. The extent of this vegetation community in the Otago region is unknown, but mapping of this community in the Macraes E.D. (Figure 5) identified at least 1,360 ephemeral wetlands covering 162.39 ha (and at least a further 218 possible examples) mostly in the southern and western parts of the ecological district. The ecological integrity of the ephemeral wetlands in this area is unknown, but nearly all are dominated by exotic grasses and the majority have only 1-4 indigenous species present (Author pers. obs.). Ephemeral wetlands are known habitat for a number of rare plants (Johnson and Rogers, 2003), but these are present only in a few of the sites that are inspected and seem to be lost from sites following invasion by sward farming grasses. They may be particularly at risk of this if grazing is removed (Author pers. obs.). The ephemeral wetlands in the PIA are all dominated by exotic species, and all but 4 (ephemeral wetlands A [10 indigenous species], B, C [both with 5 indigenous species], G [4 indigenous species]) have a low diversity of indigenous plant species. Ephemeral wetlands F and A are particularly deep examples for their type and size. Therefore, it is considered that the impact of this project on ephemeral wetlands of this type will result in an approximately 0.2% reduction in extent of the vegetation community in the Macraes E.D. and about a 0.5% reduction in the number of sites within the Macraes E.D. The loss in the PIA being represented by sites with mostly moderate indigenous plant component and including some rare plant species (see also Section 6.6.1 for consideration of invertebrate communities inhabiting this habitat). This vegetation community is a Historically Rare and Threatened plant community.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the vegetation community.

This vegetation community is assessed as having **high** ecological importance.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **high**, and at a national level as **moderate**.

The overall degree of the project's effect on this vegetation community is **high**.

The confidence of this assessment is **low**-**moderate** as though this vegetation community is distinctive, it is difficult to map using available aerial imagery and therefore its extent in the Macraes E.D. or in Otago is largely unknown. The ecological integrity of these sites is mostly unknown.

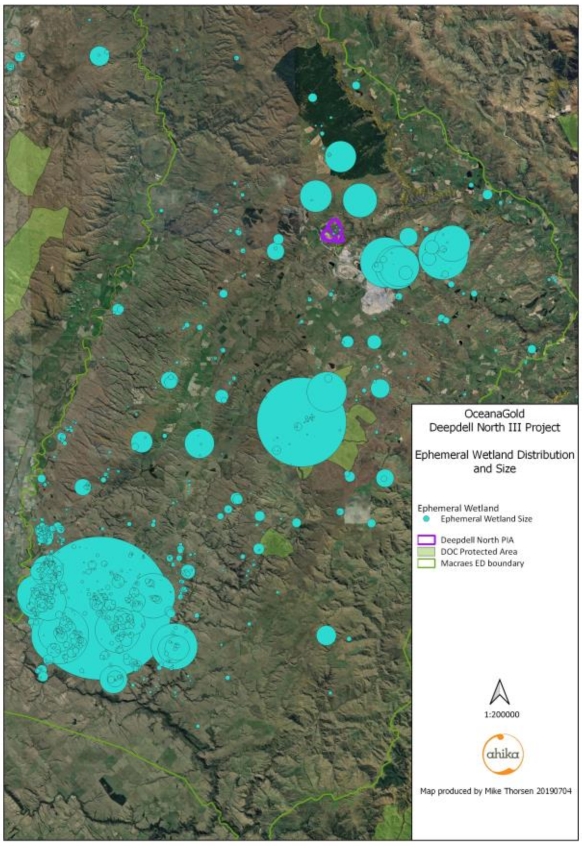

Figure 5. Mapped locations and size of ephemeral wetlands in the vicinity of Macraes E.D. Symbol size based on mapped area of the wetland and is centred on wetland location.

Overall effect on the seepage wetland vegetation community

The result of these project effects will be a loss of 0.07 ha of this vegetation community at 1 site. The extent of this vegetation community in the Otago region is unknown. Wetlands (of which seepage wetlands are a subclass) are mapped by Manaaki Whenua as covering 43.23 ha in the Macraes E.D., though the accuracy of this map is yet to be evaluated. The extent of the seepage wetland in the PIA represents 0.16% of the mapped wetlands in the Macraes E.D. The example in the PIA is highly degraded but is dominated by one rare indigenous rush. This vegetation community is a Historically Rare and Threatened plant community.

Therefore, the impact of this project is assessed as having an **adverse**, **indirect**, **temporary**, **reversible**, **local impact** on the vegetation community.

This vegetation community is assessed as having **high** ecological importance.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this vegetation community is **low**.

The confidence of this assessment is **low**-**moderate** as though this vegetation community is distinctive, it is difficult to map using available aerial imagery and therefore its extent in the Macraes E.D. or nationally is largely unknown. The ecological integrity of these sites is mostly unknown.

Overall effect on the low-producing grassland vegetation community

The result of these project effects will be a reduction by 48.23 ha of this vegetation community in the extent of this community and minor changes to the 24.82 ha in the buffer area. This vegetation community has been mapped from satellite photography as covering 11,957 ha in the Macraes E.D. (Figure 6), and the area within the PIA represents 0.6% of this extent. Between 2008 and 2012, low-producing grassland coverage decreased by 80% in the Macraes E.D. and this loss appears to be continuing with ongoing conversion to high-producing exotic pasture and reversion to exotic or indigenous shrubland.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the vegetation community.

This vegetation community is assessed as having **moderate** ecological importance.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this vegetation community is **low**.

The confidence of this assessment is **moderate-low** as this vegetation community can be very difficult to map accurately from satellite images, particularly when it is of a fragmented nature or been oversown and grazed such as which occurs over much of the Macraes E.D.

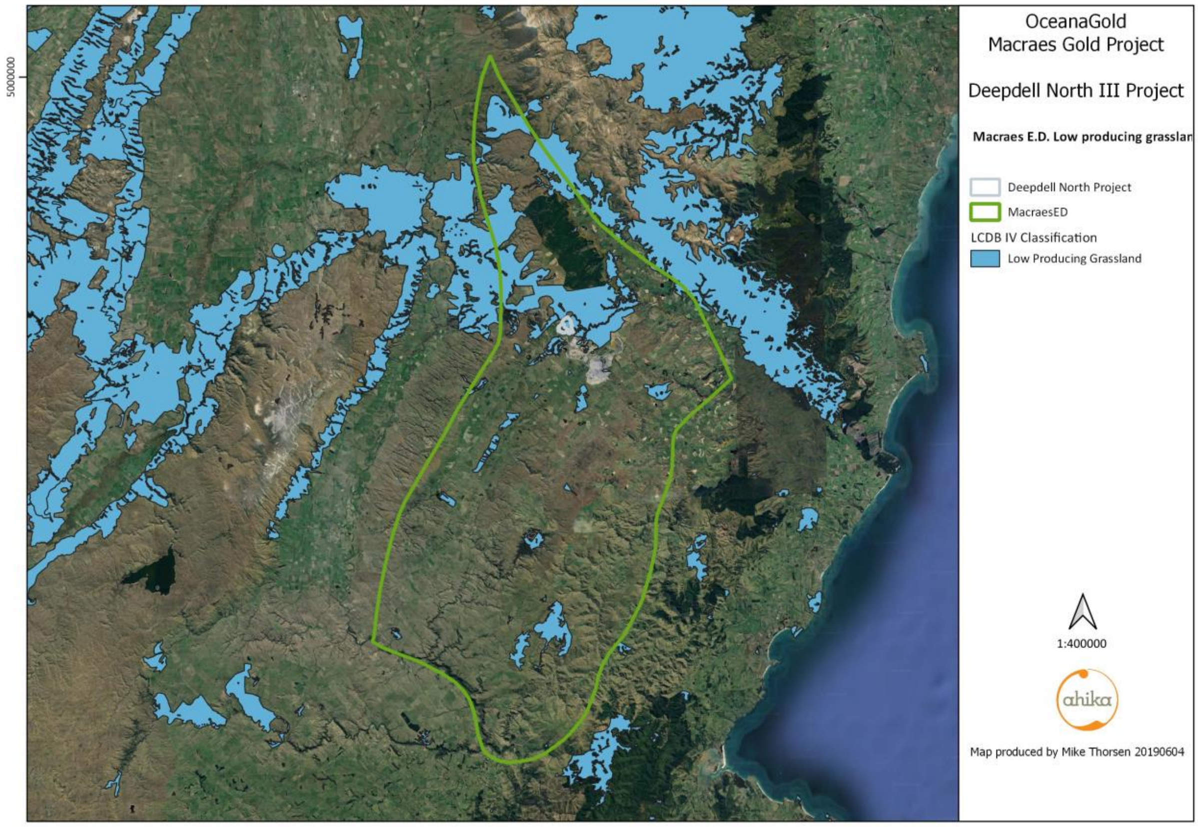

Figure 6. Distribution of low producing grassland vegetation community in the vicinity of Macraes E.D.

Overall effect on the shrubland vegetation community

The result of these project effects will be a reduction by 3.73 ha of this vegetation community in the extent of this community and minor changes to the 7.36 ha in the buffer area. This vegetation community has been mapped from satellite photography as covering 3,547 ha in the Macraes E.D. (Figure 7), and the area within the PIA represents 0.3% of this extent. Between 2008 and 2012, shrubland coverage increased by 0.7% in the Macraes E.D. This vegetation community is well-known as being seral and quickly invading farmland in the Macraes E.D., unless prevented from doing so. The extent of this type of vegetation community is probably greatly affected by farming profitability (especially funds available for vegetation control) and extent decreases when farm profitability is high and large areas of low-diversity and low stature shrublands develop when farm profitability is low.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the vegetation community.

This vegetation community is assessed as having **moderate** ecological importance.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **low**, and at a national level as **negligible**.

The overall degree of the project's effect on this vegetation community is **very low**.

The confidence of this assessment is **moderate** as this vegetation community can be very difficult to map accurately from satellite images, particularly when it is of a fragmented nature as which occurs over much of the Macraes E.D.

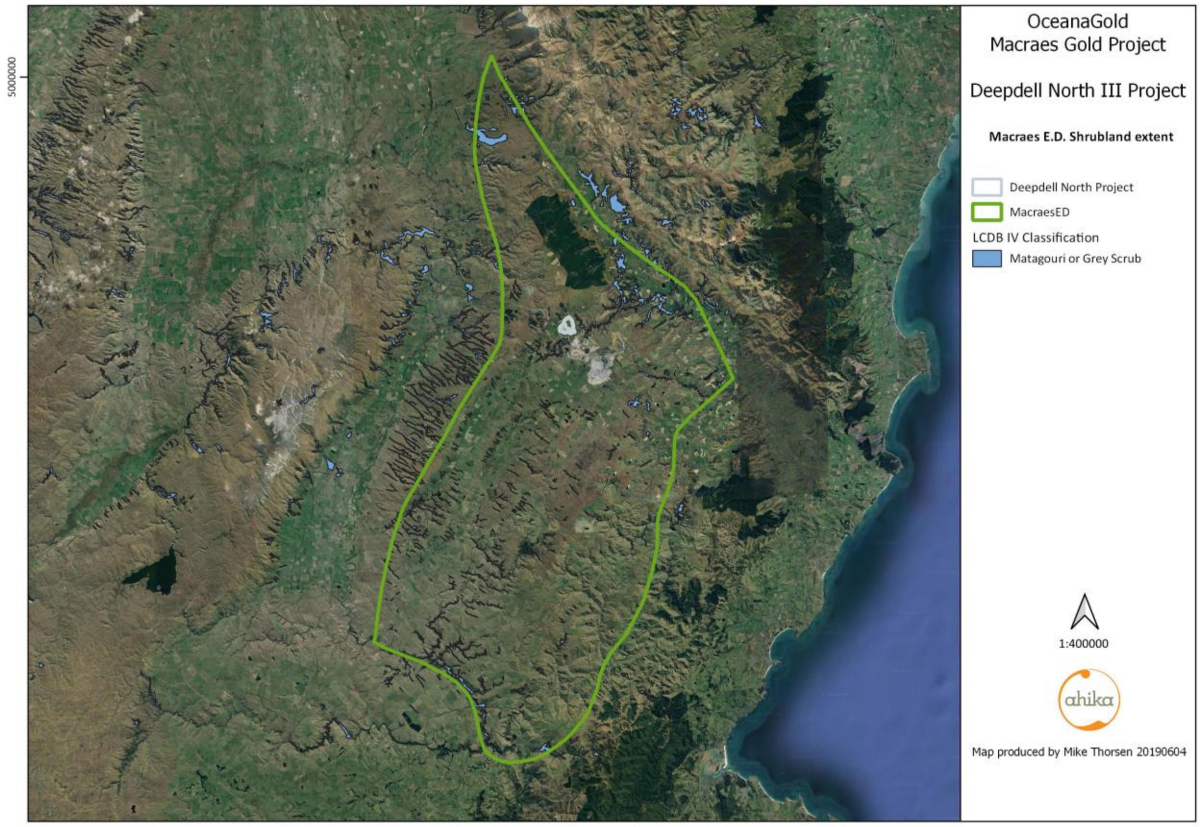

Figure 7. Distribution of shrubland vegetation community in the vicinity of Macraes E.D.

Overall effect on the cultivated pasture vegetation community

The result of these project effects will be a reduction by 54.09 ha in the extent of this exotic vegetation community and minor changes to the 26.39 ha in the buffer area. This vegetation community provides habitat for some common exotic bird species and may be used for foraging by indigenous harrier hawks, paradise shelduck, black-backed gull and spur-winged plover. This vegetation community has been mapped from satellite photography as covering 79,635 ha in the Macraes E.D. (Figure 8), and the area within the PIA represents 0.1% of this extent. Between 2008 and 2012, cultivated pasture coverage increased by 166% in the Macraes E.D.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the vegetation community.

This vegetation community is assessed as having **negligible** ecological importance.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **low**, and at a national level as **negligible**.

The overall degree of the project's effect on this vegetation community is **very low**.

The confidence of this assessment is **moderate-high** as this vegetation community is readily discernible in satellite images, except when it is reverting to low-producing grassland, shrublands or weed communities.

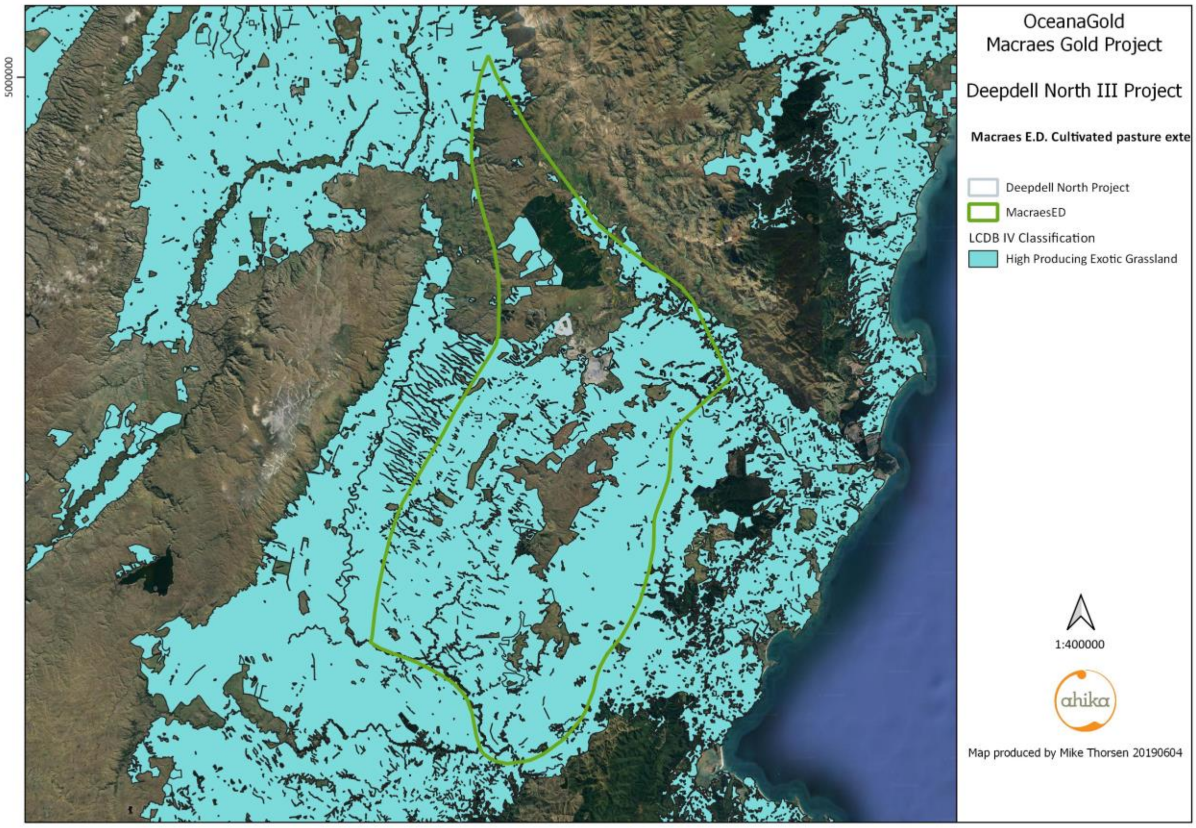

Figure 8. Distribution of cultivated pasture vegetation community in the vicinity of Macraes E.D.

Overall effect on the shelterbelt and exotic trees vegetation community

The result of these project effects will be a reduction by 0.53 ha in the extent of this exotic vegetation community and minor changes to the 0.08 ha in the buffer area. This vegetation community in the PIA is not known to harbour any indigenous species but does provide habitat for some common exotic birds. This vegetation community has been mapped (as exotic forestry) from satellite photography as covering 4,607 ha in the Macraes E.D. (Figure 9), and the area within the PIA represents 0.01% of this extent. Between 2008 and 2012, exotic forestry coverage increased by 2.1% in the Macraes E.D.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the vegetation community.

This vegetation community is assessed as having **negligible** ecological importance.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **low**, and at a national level as **negligible**.

The overall degree of the project's effect on this vegetation community is **very low**.

The confidence of this assessment is **moderate-high** as this vegetation community is readily discernible in satellite images, except when it is reverting to low-producing grassland, shrublands or weed communities.

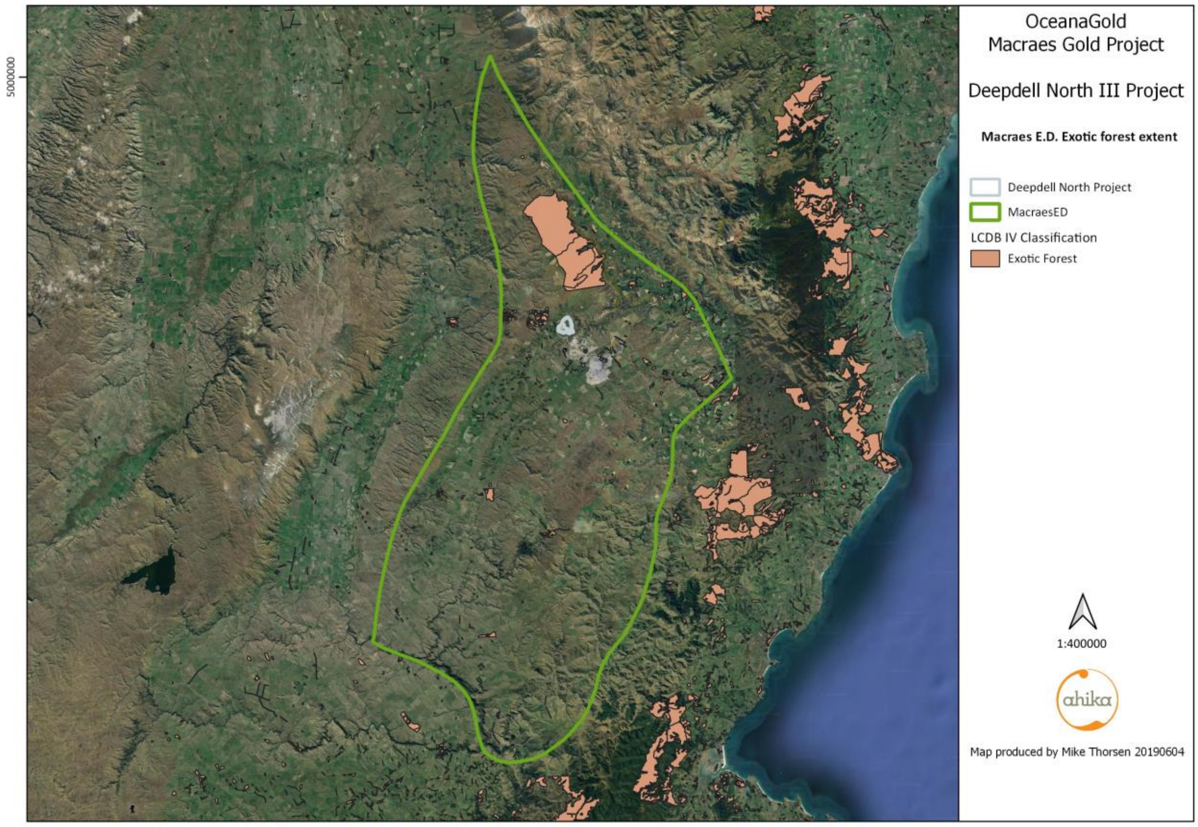

Figure 9. Distribution of exotic forest vegetation community in the vicinity of Macraes E.D.

Summary of effects on vegetation communities

Five indigenous vegetation communities are identified within the PIA. Overall, the indigenous vegetation communities present within the PIA are assessed as being of **high** ecological importance. The communities are of moderate representation, diversity, integrity and ecosystems service importance. There are two Naturally Uncommon vegetation communities present (although degraded by exotic plant invasion), both are national priorities for protection and one is classified as Nationally Critical and the other as Endangered. There are three Threatened Level IV land environments that are overlain to some extent by natural vegetation. The natural vegetation types are significant under the Operative ORPS, new partially operative ORPS and WDC District Plan.

The effects of the project will result in the loss of all vegetation within the Pit and WRS and totals 54.7 ha of indigenous vegetation and 54.6 ha of exotic vegetation. In addition, there may be some effect of the project activities on the vegetation within the buffer zone of the PIA totalling 33.9 ha of indigenous vegetation and 26.5 ha of exotic vegetation, but this effect is expected to be minor if appropriate mitigation approaches are employed.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the vegetation communities.

The magnitude of the project's impact on the area's vegetation communities at a local scale is assessed as **moderate**, and at a national level as **moderate**.

The overall degree of the project's effect on these communities is conservatively assessed as **moderate**, as although many of the ecological features are highly degraded, the remnants of some have high importance.

The confidence of this assessment is **moderate**, as much of the area surrounding the PIA has not been closely explored. Further, it is difficult to discriminate between vegetation communities using aerial photography, which makes it difficult to assess their distribution at a local scale. Lastly, vegetation communities in this area often interdigitate and intergrade, making it difficult to accurately determine their classification and extent.

7.5 Impact on Threatened, At Risk, or Rare Plant Species

Thirteen plant species that occur within the PIA are either currently classified as Threatened, At Risk or Data Deficient (Townsend et al. 2007, de Lange et al. 2013), or are thought to be rare in the Macraes E.D. based on the author's observations.

7.5.1 *At Risk species*

7.5.1.1 *Declining Species*

1. *Anthosachne falcis* (Connor) Barkworth et S.W.L.Jacobs (dwarf wheatgrass, Poaceae).

This dryland grass was recorded as scattered plants totalling c. 100 individuals mainly in the WRS zone.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

Depositing WRS material will destroy an unknown number of this species in the PIA.

Effect of changes in weed populations

Negligible to major effect on this species in the buffer area depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species in the buffer area as it is browsed by animals, particularly hares and pigs. Resident pest animals are likely to be a bigger problem for this species.

Effects of dust

Minor effect as this species in the buffer area as this species is known to occur in dry sites with naturally higher dust loadings.

Effects of accidental fire

Negligible to moderate effect on plants in the buffer area depending on timing of fire and growth of surrounding vegetation.

The result of these project effects will be the loss of the species from the PIA and some potential impact on plants in the buffer area. As this species is widely and patchily distributed within natural sites in the Macraes area, and is known to occur at multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **high**. The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **low**.

The confidence of this assessment is **moderate**, as this species was only discovered to occur in the area in 2016. Much of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. This species is easily confused with other *Anthosachne* grasses, is relatively inconspicuous, and many New Zealand botanists are unfamiliar with grasses.

2. *Carmichaelia crassicaulis* Hook.f. subsp. *crassicaulis* (coral broom, Fabaceae).

This thick-stemmed broom was recorded as 2 individuals at one site in the WRS zone, 1 plant in the Pit Zone and as 15 individuals in the Buffer Zone.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

Depositing WRS material will destroy 2 individuals of this species.

The result of these project effects will be the loss of 3 individuals of the species from one site. This would have very little impact on local population dynamics by removing most of the plants in an area where there are few other nearby plants. The impact on the species at a national scale is estimated to result in a negligible reduction in the total population.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **high**. The magnitude of the project's impact on this species at a local scale is assessed as **very low**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate** as much of the area surrounding the PIA has not been closely explored, and all available records of this species from the area are the result of opportunistic or limited-scale (rather than structured) surveys, therefore the distribution described here is likely to be a subset of a wider distribution.

3. *Carmichaelia petriei* Petrie (desert broom, Fabaceae).

This leafless broom was recorded at several sites in WRS zone where seven plants are present.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

> Depositing WRS material will destroy seven individuals within the PIA.

Effect of changes in weed populations

> Negligible to major effect on individuals in the buffer zone depending on species of weed.

Effects of displacement of pest animals

> Temporary minor effect for this species in the buffer zone as it is browsed by animals, particularly hares. Resident pest animals are likely to be a bigger problem for this species.

Effects of dust

> Minor effect as this species in the buffer area as this species is known to occur in dry sites with naturally higher dust loadings.

Effects of accidental fire

> Negligible to moderate effect depending on timing of fire and growth of surrounding vegetation.

The result of these project effects will be the loss of 2 individuals of this species from within the project area. As this species is widely and patchily distributed within natural sites in the Macraes area, and is known to occur at multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **high**.

The magnitude of the project's impact on this species at a local scale is assessed as **low**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate**, as much of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore the distribution described here is likely to be a subset of a wider distribution.

4. *Discaria toumatou* Petrie (matagouri, Rhamnaceae).

Matagouri was recorded at multiple sites and in considerable numbers in the Deepdell III pit site, Horse Flat WRS and Deepdell South pit backfill WRS zone.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

> Depositing WRS material will destroy an unknown number of individuals of this species in the PIA.

Effect of removing rock material when excavating pit

> Excavating the pit and associated processes will cause the mortality of an unknown number of individuals in the Deepdell North III pit zone.

Effects of accidental fire

> Negligible to moderate effect depending on timing of fire and growth of surrounding vegetation.

The result of these project effects will be the loss of the species from within the project area. As this species is abundant and widely distributed within natural sites in the Macraes area, and is known to occur over very large areas at multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **high**. The magnitude of the project's impact on this species at a local scale is assessed as **negligible**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate-high** as this is a well-marked species whose current distribution is reasonably well known. However, its main habitat (grey scrub) is thought to be in decline nationally, but the speed of this loss is not known. Determining speed of loss of this species is partly complicated by its propensity to establish itself in pasture areas in montane South Island unless actively prevented from doing so.

***5. Leptinella pusilla* Hook.f. (a button daisy, Asteraceae).**

This creeping button daisy was recorded at one site in the WRS where one patch measuring 1 m^2 is present.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

Depositing WRS material will destroy one patch of this species in the PIA.

The result of these project effects will be the loss of the species from one site within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. It is widely but sparsely distributed and the mechanism of interbreeding between such widely spaced populations is not known. It appears to flourish in grazed situations. Overall, the loss of the one site in the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **high**. The magnitude of the project's impact on this species at a local scale is assessed as **low**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate-low**. The distribution of this species is poorly known and it is difficult to distinguish from similar *Leptinella* species (see NatureWatch identifications of this species, some of which are of other species).

6. *Lobelia ionantha* Heenan (a wetland herb, Campanulaceae).

This creeping wetland herb was recorded at one site in the ephemeral wetland G in the WRS where several patches totalling an estimated 0.56m^2 are present.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

Depositing WRS material will destroy the one site of this species in the PIA.

The result of these project effects will be the loss of the species from one site within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. It is widely but sparsely distributed. It appears to flourish in grazed wetland situations. Overall, the loss of the one site in the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **high**. The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **low**.

The confidence of this assessment is **moderate-low**. The distribution of this species is poorly known and the vulnerability of its wetland habitats is also unknown.

7. *Rytidosperma buchananii* (Hook.f.) Connor & Edgar (a dryland bristlegrass, Poaceae).

This grass was recorded at one site in the WRS where one plant is present on a rock stack in the WRS.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

> Depositing WRS material will destroy the one individual at one site of this species in the PIA.

The result of these project effects will be the loss of one individual of the species from one site within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. Overall, the loss of the one site in the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **low**. The magnitude of the project's impact on this species at a local scale is assessed as **very low**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate-low**, as much of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. This species is easily confused with other *Rytidosperma* grasses, is relatively inconspicuous, and many New Zealand botanists are unfamiliar with grasses.

7.5.1.2 *Naturally Uncommon Species*

8. *Carex subtilis* K.A.Ford (elegant hookgrass, Cyperaceae).

This small sedge was recorded as one individual at one site in the Pit zone.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

Deposition of rock will destroy the only site of this species in one site in the Deepdell South pit backfill WRS zone.

The result of these project effects will be the loss of the species from one site. There is some risk of a reduction in the longer-term viability of the species in a local context as this species occurs as widely separated groups. The impact on the species at a national scale is negligible.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **moderate**.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate**, as the majority of the area surrounding the PIA has not been closely explored, and all available records from the area are the result of opportunistic or limited-scale (rather than structured) surveys, therefore the distribution described here is likely to be a subset of a wider distribution. This species when not in flower can be confused with other *Carex* species that occur in the area, particularly *Carex wakatipu* and *Carex breviculmis*. It is a small inconspicuous plant that mostly occurs under vegetation or beside rock outcrops and is likely to be under-recorded.

9. *Juncus distegus* Edgar (Two-storey rush, Juncaceae).

This rush was recorded in various numbers bordering the ephemeral wetlands and is the dominant larger plant species in the seepage wetland in the WRS where there are patches covering an estimated 369 m^2 with an additional scattered 56 individuals.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

> Depositing WRS material will destroy an estimated 369 m^2 and an additional scattered 56 individuals in the PIA.

The result of these project effects will be the loss of the species from within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. It is widely but sparsely distributed. It is considered that the loss will have some impact on local population dynamics, but this is very unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **moderate**.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **low**.

The confidence of this assessment is **moderate-low**. The distribution of this species is poorly known and it is difficult to distinguish from similar *Juncus* species.

10. *Juncus pusillus* Buchenau (dwarf rush, Juncaceae).

This tiny rush was recorded as two 5 x 5 cm patches in ephemeral wetland A.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

Depositing WRS material will destroy an estimated 1 m^2 of this species in the PIA.

The result of these project effects will be the loss of the species from within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. It is widely but sparsely distributed. It is considered that the loss is very unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **low**.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate-low**. The distribution of this species is poorly known and it is difficult to distinguish from similar *Juncus* species.

7.5.2 *Rare species*

7.5.2.1 *Species uncommon in Ecological District*

11. *Carex resectans* Cheeseman (desert sedge, Cyperaceae).

This small creeping sedge was recorded as three patches totalling 40 x 40 cm in ephemeral wetland G.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

Depositing WRS material will destroy an estimated 1.6 m^2 of this species in the PIA.

The result of these project effects will be the loss of the species from within the PIA. This will cause some loss from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. It is widely but sparsely distributed. It is considered that the loss may have some impact on local plant population dynamics by reducing the number of populations in the area, but the effect is very unlikely to majorly impact the longer-term security of the species nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **moderate**.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **low**.

The confidence of this assessment is **moderate-low**. The distribution of this species is poorly known as it is a small inconspicuous species.

12. *Melicope simplex* A.Cunn. (poataniwha, Rutaceae).

This shrub was recorded as 11 individuals in one group of rock outcrops in the WRS.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

Depositing WRS material will destroy 11 individuals of this species in the PIA.

The result of these project effects will be the loss of the species from within the PIA. This will cause some loss from the local area. As this species is widespread outside of Central Otago and there are very large populations at some sites, the loss of these individuals is very unlikely to majorly impact the longer-term security of the species nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **moderate**.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate**, as much of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore the distribution described here is likely to be a subset of a wider distribution.

13. *Myrsine divaricata* A.Cunn. (weeping matipo/mapou, Primulaceae).

This shrub was recorded as 2 individuals in one group of rock outcrops in the WRS.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

Depositing WRS material will destroy 2 individuals of this species in the PIA.

The result of these project effects will be the loss of the species from within the PIA. This will cause some loss from the local area. As this species is widespread outside of Central Otago and there are very large populations at some sites, the loss of these individuals is very unlikely to majorly impact the longer-term security of the species nationally.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **moderate**.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate**, as much of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore, the distribution described here is likely to be a subset of a wider distribution.

7.6 Impact on Avifauna Ecological Features

Twenty bird species were recorded from within the PIA, nine of which are indigenous. The ecological importance of the birds within the PIA is categorised as **moderate** on the basis of the presence of one At Risk species, the avifauna's role in ecosystem function and the low species diversity and abundance within the PIA.

7.6.1 *Impact on Bird Communities*

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of bird species, including the nesting area of a colony of black-backed gulls, and cause the displacement of all individuals from the WRS zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will destroy some known habitat of bird species and cause the displacement of all individuals from the Pit zone.

Effect of sediment run-off

Nil effect as none of the bird species occur in watercourses in the PIA.

Effect of changes in weed populations

Negligible to major effect as importation of weed species, either directly through seed contamination of equipment or material, or indirectly by creating favourable establishment sites, could, if unchecked, transform habitat for bird species in the surrounding area, making the area unsuitable.

Effects of displacement of pest animals

Mustelids and rodents, displaced by the commencement of mining activities, will have a temporary minor effect on populations of surrounding birds, particularly ground-nesting birds such as pipits.

Effects of displacement of resident animals

This will be a temporary moderate effect, as birds resident within the PIA are likely to move into the surrounding area where they will compete for space and food with that area's residents. As the areas around the PIA are assumed to be at carrying capacity, this competition is likely to result in the mortality of either resident birds or displaced birds, with the total mortality approaching the number of individuals that are displaced from the PIA.

Effects of noise & disturbance

This will have a negligible effect on the bird populations surrounding the PIA, as most of the species appear to acclimate to regular disturbance. It is likely that harrier hawks will avoid hunting the nearby surrounding area, and that paradise shelducks will not nest within sight of the project.

Effects of dust

Negligible effect as dust-fall, when managed, is minimal at distance. There may be some avoidance of dusty fruit by frugivorous species.

Effects of light

Minor effect as project lighting will attract insects which could attract birds, particularly little owls if they are in the area.

Effects of accidental fire

Minor to moderate effect depending on the timing of fire. If a fire was to occur during the nesting season then bird's nests would be at risk, particularly those of ground-nesting pipit.

Changed hydrological regimes

Nil effect as no species occurs in this zone.

The result of these project effects will be the displacement of bird individuals from within the PIA, with a temporary increase in competition with neighbouring resident birds leading to the mortality of some individuals. Longer term there is likely to be avoidance of the area by harrier hawks and paradise shelduck. Disruption to the black-billed gull colony is thought to be temporary as they are nesting in an artificial habitat, which will be re-created in the Deepdell

North III pit. The possible presence of brown creeper is not considered significant as they are a common bird in many areas of the South Island and are likely to be either using this site as part of a wider feeding range or transiting through. There are extensive areas of similar shrubland habitat in the surrounding area and so the loss of any feeding habitat is likely to be inconsequential. The overall result of these effects is some disruption of local bird populations, most of which are common on a national scale, and the displacement of a pair of At Risk pipit which are inhabiting an artificial habitat.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on these species.

The ecological importance of the bird communities is **moderate**.

The magnitude of the project's impact on bird species at a local scale is assessed as **moderate**, and at a national level as **negligible**.

The overall degree of the project's effect on these species is **very low**.

The confidence of this assessment is **moderate-low**, as the distribution and density of birds within the wider Macraes area is largely unknown.

7.6.2 *Impact on Threatened, At Risk, or Rare Bird Species*

One species that occur within the PIA is classified as At Risk: the pipit.

1. *Anthus novaeseelandiae* Gmelin subsp*. novaeseelandiae* (pipit, Motacillidae).

Pipits are present within the Pit zone in an artificially created habitat, where it is estimated, based on encounter rate, that there is a single pair of birds.

The following project activities are likely to impact on this species:

Effect of excavation of pit

> The earth-moving activities involved in excavating the pit will cause the single pair of pipits to relocate to another area.

The result of these project effects will be the loss of the species from the site. This may cause some negligible effect on the Macraes pipit population as the relocating birds may interact with resident birds with the most likely outcome being that the newcomers will be excluded from the resident bird's area. The fate of the displaced pair is unknowable, but it is thought that the project effects are unlikely to cause mortality of the pair as they have shown an ability to utilise an artificial habitat (grassed rock mounds) of which there is plenty in the surrounding area. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of a breeding season for a single pair is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as it is widely (though sparsely) distributed through rough grasslands of Central Otago and beyond.

Therefore, the impact of this project is assessed as having both an **adverse**, **direct**, **temporary**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **high**. The magnitude of the project's impact on this species at a local scale is assessed as **low**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the PIA has not been surveyed for this species and its population density and population trajectory in the area are unknown.

7.7 Impact on Herpetofauna Ecological Features

Four reptile species were recorded in the PIA. In addition, there are records in the nearby area of a further three Threatened or At Risk reptile species held in the Herpetofauna Database (Figure 10). The ecological importance of the lizard populations within the PIA is categorised as **moderate** on the basis of the presence of three At Risk species, the presence of genetically distinct lineages (that also occur at multiple sites outside the PIA), the role the herpetofauna is likely to be playing in ecosystem function, and the low species diversity and abundance within the PIA.

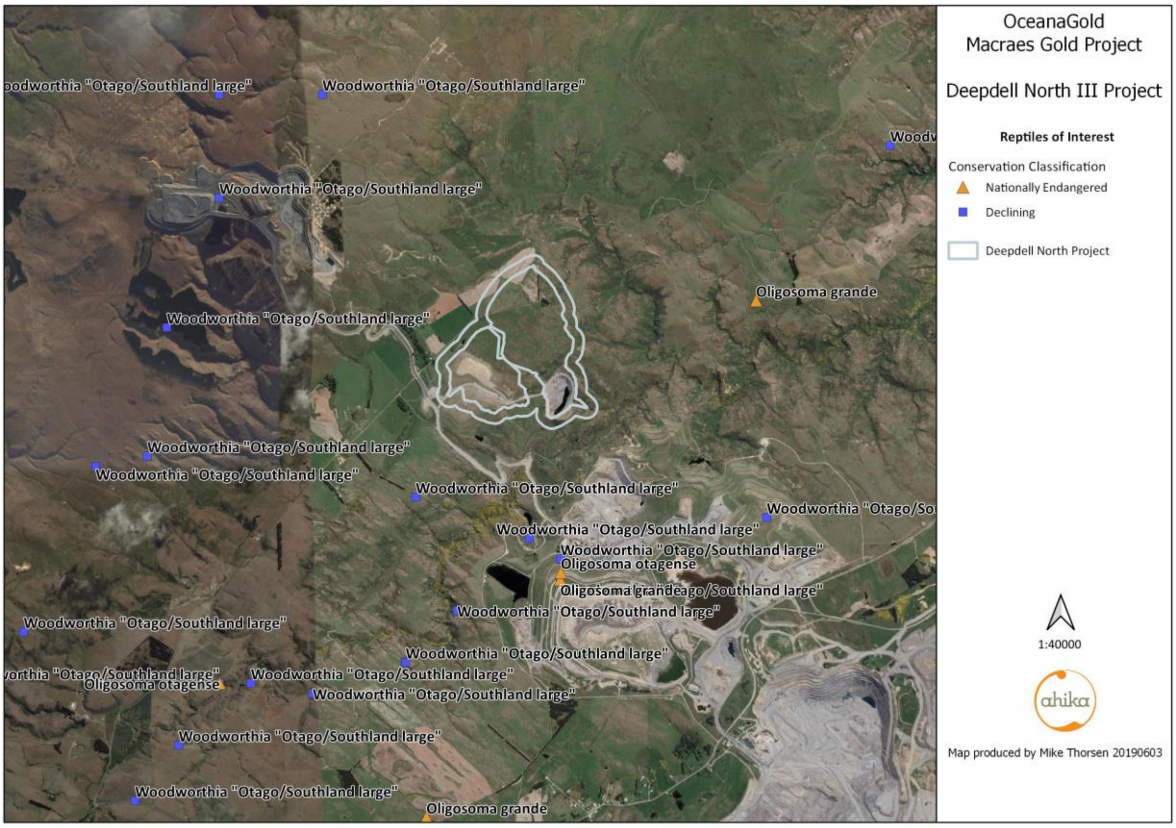

Figure 10. Records of Threatened or At Risk reptiles in the vicinity of the Deepdell North III project. Data from DOC Herpetofauna Database.

7.7.1 *Impact on Reptile Communities*

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of reptile species and cause the mortality of most of the approximately 185 individuals thought to occur in the PIA.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will destroy some known habitat of reptile species and cause the mortality of some of the approximately 185 individuals thought to occur in the PIA.

Effect of sediment run-off

Negligible effect as sediment accumulation is unlikely to affect either the habitat or food supply of any lizards inhabiting gullies.

Effect of changes in weed populations

Negligible to major effect as importation of weed species, either directly through seed contamination of equipment or material, or indirectly by creating favourable establishment sites, could, if unchecked, transform habitat for reptile species in the surrounding area, making the area unsuitable.

Effects of displacement of resident animals

Displacement of individuals is only likely to occur along the fringes of the project area. Most individuals within the project area are likely to be killed outright as a result of earth-moving activities. Displaced individuals will likely compete with surrounding residents, resulting in the death of one of the individuals as the surrounding area is assumed to be at carrying capacity and incapable of supporting additional individuals over the medium-term.

Effects of noise & vibration

Negligible effect of noise on the reptile populations. There may be some effect of the vibrations caused by heavy machinery and earth moving. But the presence of reptiles very close to existing mine activities indicates that any effect is short-range and minor.

Effects of dust

Negligible effect as dust-fall is minimal at distance.

Effects of light

Negligible effect. There is a chance that project lighting will attract insects which could attract *Woodworthia* “Otago/Southland large” into the area, although this is considered unlikely given the types of habitat and disturbance that surround lights.

Effects of accidental fire

Minor to moderate effect, depending on timing of fire and habitat burnt. Most of the larger reptile populations in this area occur at sites that are considered natural fire refuges because of their rocky nature.

Changed hydrological regimes

Minor effect as there may be some changes to the habitat of the skinks *Oligosoma polychroma* and *Oligosoma inconspicuum* but it is unclear whether these changes will adversely affect these species.

The result of these project effects will be the death of an estimated 185 reptile individuals from within the project area and some short-term disruption to reptile populations in the area immediately surrounding the project. As the populations within the PIA of these lizards are relatively small (for the area), it is assessed that the project will have a moderate effect on local lizard populations. As the lizard species concerned are widespread and often numerous, the project is considered to have a minor impact on lizard populations at a national scale.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the species.

The ecological importance of the reptile communities is **moderate**.

The magnitude of the project’s impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project’s effect on these species is **low**.

The confidence of this assessment is **moderate** as, although the distribution and density of reptiles to the south of the project area are among the best known in New Zealand, the areas to the west and east of the project area are poorly known in regard to reptiles.

7.7.1 *Impact on Threatened, At Risk, or Rare Reptile Species*

Three of the reptile species considered to be present in the PIA are currently classified as At Risk: the skinks *Oligosoma polychroma* (clade 5 genotype) and *Oligosoma inconspicuum* and the gecko *Woodworthia* "Otago/Southland large".

1. *Oligosoma polychroma* (Patterson & Daugherty 1990) (clade 5 genotype) (southern grass skink, Scincidae).

The southern grass skink *Oligosoma polychroma* (clade 5 form) is present infrequently in areas with denser vegetation or rock piles. The total population of this species within the PIA is estimated at 5 individuals based on encounter rate and quantity of habitat present.

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

> Depositing WRS material will destroy an estimated 5 individuals of this species in the PIA.

Effects of displacement of pest animals

> Temporary minor effect for this species in the buffer area.

Effects of noise

> Minor effect on individuals in the PIA as reptile populations near existing mine workings appear to acclimate to mine noise.

Effects of dust

> Minor effect as this species in the buffer area as this species is known to occur in dry sites with naturally higher dust loadings.

Effects of accidental fire

> Negligible to moderate effect on individuals in the buffer area depending on timing of fire and growth of surrounding vegetation.

The result of these project effects will be the loss of the species from the site and displacement of some individuals into surround areas in the buffer. This may cause some negligible effect on the Macraes population as the displaced animals will cause some short-term disruption to reptile populations in the buffer area resulting in mortality of the displaced or resident animals equivalent to the number of displaced animals. As the populations within the PIA of this species are relatively small (for the area), it is assessed that the project will have a moderate effect on the local populations.

Therefore, the impact of this project is assessed as having both an **adverse**, **direct**, **permanent**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **high**. The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the PIA has not been surveyed for this species and its population density and population trajectory in the area are unknown.

2. *Oligosoma inconspicuum* (Patterson & Daugherty 1990) (cryptic skink, Scincidae).

The cryptic skink *Oligosoma inconspicuum* is rare in this area due to a shortage of suitable habitat. It was potentially sighted in one area of rocks of the existing waste rock stack beside the road.

The following project activities are likely to impact on this species:

Effect of excavation of Pit

> Excavating the pit and associated earthworks will destroy a very small number of individuals of this species in the PIA.

Effects of displacement of pest animals

> Temporary minor effect for this species in the buffer area.

Effects of noise

> Minor effect on individuals in the PIA as reptile populations near existing mine workings appear to acclimate to mine noise.

Effects of dust

Minor effect as this species in the buffer area as this species is known to occur in sites with naturally higher dust loadings.

Effects of accidental fire

Negligible to moderate effect on individuals in the buffer area depending on timing of fire and growth of surrounding vegetation.

The result of these project effects will be the loss of a small number of individuals of this species from the site and displacement of some individuals into surround areas in the buffer. This may cause some negligible effect on the Macraes population as the displaced animals may cause some short-term disruption to reptile populations in the buffer area resulting in mortality of the displaced or resident animals equivalent to the number of displaced animals. However, populations of this species are often widely separated, and it is unlikely that the displaced animals will encounter a resident population. As the populations within the PIA of this species are relatively small (for the area), it is assessed that the project will have a minor effect on the local populations.

Therefore, the impact of this project is assessed as having both an **adverse**, **direct**, **permanent**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **high**. The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the PIA has not been surveyed for this species and its population density and population trajectory in the area are unknown.

3. *Woodworthia* "Otago/Southland large" (korero gecko, Gekkonidae).

The korero gecko *Woodworthia* "Otago/Southland large" was noted in one location in Pit zone though it is likely to also be present on other areas of the PIA, particularly the rocky outcrops in the WRS zone. Only 1-5 individuals are likely to be present where it occurs in the PIA and the total population within the PIA is estimated at 30 individuals based on encounter rate and quantity of habitat present. Korero geckos have been recorded form scattered sites throughout the surrounding area (Figure 10).

The following project activities are likely to impact on this species:

Effect of construction of waste rock stack

Depositing WRS material will destroy an estimated 30 individuals of this species in the PIA.

Effects of displacement of pest animals

Temporary minor effect for this species in the buffer area.

Effects of noise

Minor effect on individuals in the PIA as reptile populations near existing mine workings appear to acclimate to mine noise.

Effects of dust

Minor effect as this species in the buffer area as this species is known to occur in dry sites with naturally higher dust loadings.

Effects of artificial light

As this species is nocturnal, there is a possibility that artificial lighting, especially flood lighting, used in the project for various purposes at night may impact on this species by either repelling or attracting korero gecko, or its prey (particularly nocturnal moths). This effect is difficult to assess as the impact of artificial lighting on New Zealand's herpetofauna has not been investigated.

Effects of accidental fire

Negligible to moderate effect on individuals in the buffer area depending on timing of fire and growth of surrounding vegetation.

The result of these project effects will be the loss of an estimated 30 individuals of this species from the site and displacement of some individuals into surround areas in the buffer. This may cause some negligible effect on the Macraes population as the displaced animals may cause some short-term disruption to reptile populations in the buffer area resulting in mortality of the displaced or resident animals equivalent to the number of displaced animals. As the populations within the PIA of this species are relatively small (for the area), it is assessed that the project will have a moderate effect on the local populations.

Therefore, the impact of this project is assessed as having both an **adverse**, **direct**, **permanent**, **local impact** on the species.

The ecological importance of the population of this species within the PIA is categorised as **high**. The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **low**.

The confidence of this assessment is **moderate** as large parts of the area surrounding the PIA has not been surveyed for this species and its population density and population trajectory in the area are unknown.

7.8 Impact on Invertebrate Ecological Features

Mostly common indigenous invertebrate species were recorded in the PIA. The ecological importance of the invertebrate communities within the PIA is categorised as **moderate** on the basis of the role invertebrates are likely to be playing in ecosystem function, and the moderate species diversity and abundance within the PIA.

7.8.1 *Impact on Invertebrate Communities*

The invertebrate communities of the PIA are poorly known but appear to be a mix of indigenous and exotic species. It is generally assumed that invertebrate community diversity and integrity mirror the diversity and integrity of the plant communities of an area. It is possible that some of the rare plant communities such as ephemeral wetlands harbour rare or unusual species, but this habitat type in Otago does not appear to have been sampled for invertebrates.

Effect of construction of waste rock stack

Depositing WRS material will destroy some habitat of invertebrate communities in the WRS zones.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will destroy some habitat of invertebrate communities.

Effect of sediment run-off

Negligible to minor effect as sediment accumulation, additional to that which already occurs, is unlikely to greatly affect the habitat of terrestrial invertebrate communities.

Effect of changes in weed populations

Negligible to major effect as importation of weed species, either directly through seed contamination of equipment or material, or indirectly by creating favourable establishment sites, could, if unchecked, transform habitat for invertebrate communities in the surrounding area, making the area unsuitable or causing influxes of exotic species.

Effects of displacement of resident animals

Invertebrate species are unlikely to be displaced, with the possible exception of some species with flighted life stages.

Effects of noise & vibration

Invertebrates are unlikely to be susceptible to noise, but ground vibrations may make hunting temporarily difficult for some fossorial carnivorous species such as carabids.

Effects of dust

Negligible effect as dust-fall is minimal at distance.

Effects of light

Negligible to major effect, depending on species. Some species, particularly nocturnal Lepidoptera and Trichoptera will be attracted to project lighting when it is in use. This could have the effect of disrupting feeding and mating of these individuals. This effect is poorly understood in New Zealand invertebrates, but there are concerns overseas that this could be a factor causing the rarity of some species.

Effects of accidental fire

Minor to major effect, depending on timing of fire and habitat burnt.

Changed hydrological regimes

Minor effect as there may be some changes to the habitat of invertebrate communities inhabiting ephemeral waterways.

The result of these project effects will be the loss of invertebrate communities within the project area and some disruption to some species in the wider PIA. As most the invertebrate species concerned are widespread and often numerous, the project is considered to have a minor impact on invertebrate communities at a national scale.

Therefore, the impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the invertebrate communities.

The ecological importance of the reptile communities is **moderate**.

The magnitude of the project's impact on the invertebrate communities at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on these species is **low**.

The confidence of this assessment is **low** as the distribution of many of New Zealand's invertebrate species is poorly known at local and national scales. Invertebrates are also difficult to identify and there are few experts in this field. The taxonomy of many invertebrate groups is uncertain or dated and this makes considerations of impacts difficult. Our knowledge of invertebrate community function is also patchy, as is information on their conservation requirements.

7.9 Summary of Project Impacts

The Deepdell North III project will remove 54.79 ha of indigenous vegetation comprising of low producing grassland, shrubland, seasonal gully drainages, ephemeral wetlands and a seepage wetland and inhabited by 71 indigenous plants (including 13 rare species), twenty bird species (nine indigenous and one rare species), four reptile species (three rare species) and a largely unknown invertebrate community. The project will also impact on 54.09 ha of cultivated pasture and shelterbelts. There may be some effect on a further 88.71 ha of indigenous vegetation and 26.47 ha of cultivated pastures in the surrounding area, but these effects are expected to be minimal if appropriate controls are employed. All of the indigenous vegetation communities are significant under the representativeness, rarity or distinctiveness criteria of the partially operative Otago Regional Policy Statement, and all but the seasonal gully drainage are significant under representativeness or rarity criteria of the Waitaki District Plan. The vegetation communities are habitat for 13 At Risk or Rare plant, bird or lizard or species and are underlain by 3 Threatened LENZ. The ephemeral wetland vegetation community is Historically Rare and Critically Endangered and the seepage wetland is Historically Rare and Endangered. Both are national priorities for protection. The indigenous vegetation communities are generally of low species diversity and most are characterised by high weed representation. The populations of the At Risk or Rare species are mostly small, except for the Declining Matagouri which is dominant in the shrubland vegetation community and frequent in the low producing grassland plant community. There is doubt concerning the national conservation assessment for this species.

Mostly the Deepdell North III project is assessed to having low to very low effect on most of the terrestrial ecological features examined in this document (Table 7). Exceptions to this are an overall moderate impact on the plant communities together (mainly a result of the presence of the LENZ, rare species, and the Nationally Critical ephemeral wetland) and a high impact on the seven Historically Uncommon Nationally Critical ephemeral wetlands. These effects will be addressed through an Impact Management Plan.

Ecological Feature Class	**Ecological Feature Type**	**Ecological Feature**	**Classification of Feature**	**Buffer**	**Pit**	**WRS**	**PIA**	**Unit of Measurement**	**Accuracy of measurement**	**Ecological Importance of Feature**	**Magnitude of Project Impact on Feature**		**Overall Project Effect**
											Local Scale	National Scale	
Bird	Community	Ecological function								Moderate	Moderate	Negligible	Very Low
Bird	Species	Pipit	Declining				2	individuals	Counted	Moderate	Low	Negligible	Very Low
Bird	Species	Black-backed gull					45	individuals	Counted	Low	Moderate	Negligible	Very Low
Bird	Species	Grey teal					6	individuals	Counted	Low	Moderate	Negligible	Very Low
Bird	Species	Grey warbler					10	individuals	Estimated	Low	Moderate	Negligible	Very Low
Bird	Species	Harrier hawk					1	individuals	Counted	Low	Moderate	Negligible	Very Low
Bird	Species	Paradise shelduck					6	individuals	Counted	Low	Moderate	Negligible	Very Low
Bird	Species	Spur-winged plover					8	individuals	Estimated	Low	Moderate	Negligible	Very Low
Bird	Species	Welcome swallow					5	individuals	Estimated	Low	Moderate	Negligible	Very Low
Environment	LENZ	< 10% indigenous cover left	Cultivated Pasture	26.39	29.16	24.93	80.49	Hectares	Measured				
Environment	LENZ	< 10% indigenous cover left	Ephemeral Wetland	0.02		0.3	0.31	Hectares	Measured				
Environment	LENZ	< 10% indigenous cover left	Low producing grassland	13.24	7.8	29.11	50.15	Hectares	Measured				
Environment	LENZ	< 10% indigenous cover left	Seasonal gully drainage	1.79	0.5	1.91	4.2	Hectares	Measured				
Environment	LENZ	< 10% indigenous cover left	Seepage			0.07	0.07	Hectares	Measured				
Environment	LENZ	< 10% indigenous cover left	Shelterbelts & Exotic Trees	0.08		0.53	0.61	Hectares	Measured				

Environment	LENZ	< 10% indigenous cover left	Shrublands	3.17	0.08	2.79	6.04	Hectares	Measured				
Environment	LENZ	< 10% indigenous cover left	Threatened LENZ with indigenous vegetation	5.26	1.7	15.14	22.09	Hectares	Measured				
Environment	LENZ	< 10% indigenous cover left	Threatened LENZ with indigenous vegetation	12.95	6.68	19.04	38.67	Hectares	Measured				
Environment	LENZ	10-20% indigenous cover left	Low producing grassland	11.58	0.96	10.36	22.89	Hectares	Measured				
Environment	LENZ	10-20% indigenous cover left	Shrublands	4.2		0.86	5.05	Hectares	Measured				
Environment	LENZ	Threatened LENZ with indigenous vegetation	10-20% indigenous cover left	15.77	0.96	11.21	27.94	Hectares	Measured				
Flora	Community	Ephemeral Wetland	Critically Endangered Historically Uncommon ecosystem type	0.02		0.3	0.31	Hectares	Measured	High	High	Medium	High
Flora	Community	Seepage	Endangered Historically Uncommon ecosystem type			0.07	0.07	Hectares	Measured	High	Medium	Low	Low
Flora	Community	Cultivated Pasture		26.39	29.16	24.93	80.49	Hectares	Measured	Negligible	Low	Negligible	Very Low
Flora	Community	Low producing grassland		24.82	8.76	39.47	73.04	Hectares	Measured	Moderate	Medium	Low	Low
Flora	Community	Seasonal gully drainage		1.79	0.5	1.91	4.2	Hectares	Measured	Low	Medium	Low	Very Low
Flora	Community	Shelterbelts & Exotic Trees		0.08		0.53	0.61	Hectares	Measured	Negligible	Low	Negligible	Very Low
Flora	Community	Shrublands		7.36	0.08	3.65	11.09	Hectares	Measured	Moderate	Low	Negligible	Very Low
Flora	Community	Ecosystem services								Minor			
Flora	Community	Historically Rare or Threatened Ecosystems				2	2	Communities		See Ephemeral Wetland and Seepage Wetland Flora Communities			
Flora	Community	Integrity								Moderate			

Flora	Community	National Priorities for Protection				2	2	Communities		See Ephemeral Wetland and Seepage Wetland Flora Communities			
Flora	Community	Rarity								High	Medium	Medium	Medium
Flora	Community	Representativeness								Moderate	Medium	Medium	Medium
Flora	Community	Sites recommended for protection					0	Sites		Nil			
Flora	Community	Wetlands of National Importance or Ramsar sites					0	Sites		Nil			
Flora	Species	Carmichaelia crassicaulis Hook.f. subsp. crassicaulis	Declining	15		2	17	individuals	Counted	High	Very Low	Negligible	Very Low
Flora	Species	Carmichaelia petriei Kirk	Declining	10		7	17	individuals	Counted	High	Low	Negligible	Very Low
Flora	Species	Discaria toumatou Raoul	Declining	7.36	0.08	3.65	3.73	Hectares	Estimated	High	Negligible	Negligible	Very Low
Flora	Species	Juncus pusillus Buchenau	Declining			1	1	m^2	Estimated	Moderate	Medium	Low	Very Low
Flora	Species	Leptinella pusilla Hook.f.	Declining			1	1	m^2	Estimated	High	Low	Negligible	Very Low
Flora	Species	Lobelia ionantha Heenan	Declining			0.561	0.561	m^2	Estimated	High	Medium	Low	Low
Flora	Species	Rytidosperma buchananii (Hook.f.) Connor & Edgar	Declining			1	1	individuals	Counted	Low	Very Low	Negligible	Very Low
Flora	Species	Carex resectans Cheeseman	Locally Uncommon			1.6	1.6	m^2	Estimated	Moderate	Medium	Low	Low
Flora	Species	Melicope simplex A.Cunn.	Locally Uncommon			11	11	individuals	Counted	Moderate	Medium	Negligible	Very Low
Flora	Species	Myrsine divaricata A.Cunn.	Locally Uncommon			2	2	individuals	Counted	Moderate	Medium	Negligible	Very Low
Flora	Species	Anthosachne falcis (Connor) Barkworth & S.W.L.Jacobs	Naturally Uncommon				100	individuals	Estimated	High	Medium	Low	Low
Flora	Species	Carex subtilis K.A.Ford	Naturally Uncommon			1	1	individuals	Counted	Moderate	Medium	Negligible	Very Low
Flora	Species	Juncus distegus Edgar	Naturally Uncommon			369	369	m^2	Estimated	Moderate	Medium	Low	Low
Flora	Species	Juncus distegus Edgar	Naturally Uncommon			56	56	individuals	Estimated	Moderate	Medium	Low	Low

Flora	Species	Diversity								Moderate	Medium	Medium	Medium
Invertebrates	Community	Overall importance								Moderate	Medium	Low	Low
Reptiles	Community	Overall importance								Moderate	Medium	Low	Low
Reptiles	Species	*Oligosoma inconspicuum*	Declining		1			individuals	Counted	High	Medium	Negligible	Very Low
Reptiles	Species	*Oligosoma polychroma* (clade 5 genotype)	Declining				5	individuals	Estimated	High	Medium	Negligible	Very Low
Reptiles	Species	*Woodworthia* "Otago/Southland large"	Declining				30	individuals	Estimated	High	Medium	Low	Low
Reptiles	Species	*Oligosoma maccanni* (clade 4 genotype)					150	individuals	Estimated	Moderate	Medium	Low	Low

Table 7. Summary table of project impacts on terrestrial ecological features assessed using the Environment Institute of Australia and New Zealand's 2018 Ecological Impact Assessment Guidelines.

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9 Appendices

9.1 Appendix 1. Biodiversity recorded during site inventory

9.1.1 *Flora*

Current Name + Authority	Common name	Group 1	Group 2	Family (Tribe)	Threat ranking (2017)	Abundance Class
Achillea millefolium L.	yarrow	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Anaphalioides bellidioides (G.Forst.) Glenny	Hells Bells	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Not Threatened	l
Arctium minus subsp. minus	burdock	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	l
Artemisia absinthium	wormwood	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	r
Carduus nutans	nodding thistle	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Cirsium arvense	Californian thistle	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Cirsium vulgare	Scotch thistle	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Crepis capillaris	hawksbeard	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Hypochaeris radicata	catsear	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Leptinella pusilla Hook.f.	0	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Declining	o
Pilosella officinarum F.Schultz & Sch.Bip.	hawkweed, mouse-ear hawkweed	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	c
Senecio glomeratus Poir. subsp. glomeratus	fireweed	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Not Threatened	r
Senecio quadridentatus Labill.	cotton fireweed, white fireweed, pahokoraka	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Not Threatened	r
Taraxacum officinale agg.	dandelion	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	r
Acaena agnipila var. aequispina	sheeps bur	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rosaceae	Exotic	o
Acaena anserinifolia (J.R.Forst. & G.Forst.) J.B.Armstr.	Bidibid, hutiwai, piripiri	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rosaceae	Not Threatened	o
Acaena caesiiglauca (Bitter) Bergmans	Glaucus bidibid, piripiri	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rosaceae	Not Threatened	l

Acaena inermis Hook.f.	Blue mountain bidibid, spineless bidibid	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rosaceae	Not Threatened	l
Acaena juvenca B.H.Macmill. x Acaena novae-zelandiae Kirk	0	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rosaceae	Hybrid	r
Acaena novae-zelandiae Kirk	red bidibid	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rosaceae	Not Threatened	r
Aciphylla aurea W.R.B.Oliv.	Golden spaniard, golden speargrass	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Apiaceae	Not Threatened	o
Anthriscus caucalis	beaked parsley	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Apiaceae	Exotic	l
Aphanes inexspectata	piert parsley	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rosaceae	Exotic	r
Arenaria serpyllifolia L.	sandwort	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	r
Callitriche petriei R.Mason subsp. petriei	Petrie's starwort	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Plantaginaceae	Not Threatened	l
Capsella bursa-pastoris	shepherd's purse	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Brassicaceae	Exotic	o
Cardamine forsteri Govaerts	0	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Brassicaceae	Not Threatened	r
Cerastium fontanum subsp. vulgare (Hartm.) Greuter & Burdet	0	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	c
Cerastium semidecandrum L.	little mouse ear chickweed	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	o
Chaerophyllum ramosum (Hook.f.) K.F.Chung	0	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Apiaceae	Not Threatened	l
Crassula sieberiana (Schult. & Schult.f.) Druce	0	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Crassulaceae	Not Threatened	l
Dichondra repens J.R.Forst. & G.Forst.	Mercury Bay weed, Dichondra	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Convolvulaceae	Not Threatened	l
Digitalis purpurea L.	foxglove	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Plantaginaceae	Exotic	o

Dysphania pumilio (R.Br.) Mosyakin & Clemants	clammy goosefoot	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Amaranthaceae	Exotic	r
Epilobium pubens A.Rich.	Willowherb	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Onagraceae	Not Threatened	o
Erodium cicutarium (L.) L''Hér.	storksbill	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Geraniaceae	Exotic	c
Erythranthe moschata (Lindl.) G.L.Nesom	musk	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Phrymaceae	Exotic	l
Galium (b) (CHR 469914; aff. G. perpusillum; "lacustrine")	0	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rubiaceae	Not Assessed	l
Galium aparine	cleavers	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rubiaceae	Exotic	l
Geranium (d) (; aff. G. microphyllum; "mainland")	0	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Geraniaceae	Not Assessed	r
Geranium molle L.	doves foot cranesbill	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Geraniaceae	Exotic	l
Hydrocotyle heteromeria A.Rich.	waxweed, waxweed pennywort	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Araliaceae	Not Threatened	l
Hydrocotyle novae-zeelandiae var. montana Kirk	0	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Araliaceae	Not Threatened	l
Limosella lineata Glück	mudwort	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Plantaginaceae	Not Threatened	l
Lobelia ionantha Heenan	Hypsela	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Campanulaceae	Declining	r
Lotus pedunculatus Cav.	lotus	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Fabaceae	Exotic	l
Marrubium vulgare	horehound	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Lamiaceae	Exotic	o
Myosotis laxa Lehm. subsp. caespitosa (CF Schultz)	water forget-me-not	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Boraginaceae	Exotic	l
Myriophyllum propinquum A.Cunn.	Common water milfoil	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Haloragaceae	Not Threatened	l

Nasturtium microphyllum Boenn. ex Rchb.	one-rowed watercress	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Brassicaceae	Exotic	r
Oxalis exilis A.Cunn.	creeping oxalis, yellow oxalis	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Oxalidaceae	Not Threatened	r
Plantago major	broad-leaved plantain	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Plantaginaceae	Exotic	r
Ranunculus foliosus Kirk	Grassland buttercup	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Ranunculaceae	Not Threatened	l
Reseda luteola	wild mignonette	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Resedaceae	Exotic	l
Rumex acetosa	sorrel	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Polygonaceae	Exotic	c
Rumex acetosella	sheep's sorrel	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Polygonaceae	Exotic	o
Rumex crispus	curled dock	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Polygonaceae	Exotic	o
Sagina procumbens L.	procumbent pearlwort	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	r
Scleranthus uniflorus P.A.Will.	0	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Not Threatened	l
Sherardia arvensis	field madder	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rubiaceae	Exotic	l
Solanum dulcamara L.	bittersweet	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Solanaceae	Exotic	r
Spergularia rubra (L.) J.Presl & C.Presl	sand spurrey	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	r
Stellaria alsine Grimm	bog stichwort	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	l
Stellaria media (L.) Vill. subsp. media	chickweed	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	l
Trifolium arvense	haresfoot trefoil	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Fabaceae	Exotic	o

Trifolium dubium	suckling clover	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Fabaceae	Exotic	o
Trifolium repens	white clover	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Fabaceae	Exotic	c
Urtica urens	nettle, stinging nettle	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Urticaceae	Exotic	l
Verbascum thapsus L.	woolly mullein, common mullein	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Scrophulariaceae	Exotic	c
Veronica arvensis	field speedwell, corn speedwell	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Plantaginaceae	Exotic	l
Veronica serpyllifolia	turf speedwell, thyme-leaved speedwell	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Plantaginaceae	Exotic	r
Vicia hirsuta	hairy vetch, tiny vetch	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Fabaceae	Exotic	r
Vicia sativa	vetch	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Fabaceae	Exotic	r
Wahlenbergia albomarginata subsp. albomarginata Hook.	New Zealand harebell, harebell	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Campanulaceae	Not Threatened	r
Clematis marata J.B.Armstr.	0	DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS	0	Ranunculaceae	Not Threatened	l
Muehlenbeckia australis (G.Forst.) Meisn.	Pohuehue, large-leaved muehlenbeckia	DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS	0	Polygonaceae	Not Threatened	l
Muehlenbeckia complexa (A.Cunn.) Meisn. var. complexa	Small-leaved pohuehue, scrub pohuehue, wire vine	DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS	0	Polygonaceae	Not Threatened	o
Rubus schmidelioides var. subpauperatus (Cockayne) Allan	Tataramoa, bush lawyer, white-leaved lawyer	DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS	0	Rosaceae	Not Threatened	o
Carmichaelia crassicaulis Hook.f. subsp. crassicaulis	coral broom	DICOTYLEDONOUS TREES AND SHRUBS	0	Fabaceae	Declining	l
Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS	0	Fabaceae	Declining	o

Coprosma crassifolia Colenso	0	DICOTYLEDONOUS TREES AND SHRUBS	0	Rubiaceae	Not Threatened	l
Coprosma dumosa (Cheeseman) G.T.Jane	0	DICOTYLEDONOUS TREES AND SHRUBS	0	Rubiaceae	Not Threatened	r
Coprosma propinqua var. propinqua A.Cunn.	mingimingi	DICOTYLEDONOUS TREES AND SHRUBS	0	Rubiaceae	Not Threatened	l
Coprosma propinqua var. propinqua X Coprosma crassifolia	0	DICOTYLEDONOUS TREES AND SHRUBS	0	Rubiaceae	Hybrid	r
Cytisus scoparius	wild broom	DICOTYLEDONOUS TREES AND SHRUBS	0	Fabaceae	Exotic	l
Discaria toumatou Raoul	matagouri, wild Irishman	DICOTYLEDONOUS TREES AND SHRUBS	0	Rhamnaceae	Declining	c
Melicope simplex A.Cunn.	Poataniwha	DICOTYLEDONOUS TREES AND SHRUBS	0	Rutaceae	Locally Significant	r
Melicytus alpinus (Kirk) Garn.-Jones	Porcupine shrub	DICOTYLEDONOUS TREES AND SHRUBS	0	Violaceae	Not Threatened	l
Myrsine divaricata A.Cunn.	Weeping matipo, weeping mapou	DICOTYLEDONOUS TREES AND SHRUBS	0	Primulaceae	Locally Significant	r
Olearia bullata H.D.Wilson & Garn.-Jones	0	DICOTYLEDONOUS TREES AND SHRUBS	0	Asteraceae	Not Threatened	o
Olearia lineata (Kirk) Cockayne x Olearia bullata H.D.Wilson & Garn.-Jones	0	DICOTYLEDONOUS TREES AND SHRUBS	0	Asteraceae	Hybrid	r
Ribes uva-crispa	Gooseberry	DICOTYLEDONOUS TREES AND SHRUBS	0	Grossulariaceae	Exotic	l
Rosa rubiginosa	briar	DICOTYLEDONOUS TREES AND SHRUBS	0	Rosaceae	Exotic	l
Sambucus nigra	elder, elderflower, elderberry	DICOTYLEDONOUS TREES AND SHRUBS	0	Adoxaceae	Exotic	o
Sorbus aucuparia subsp. aucuparia	rowan	DICOTYLEDONOUS TREES AND SHRUBS	0	Rosaceae	Exotic	o
Ulex europaeus	gorse	DICOTYLEDONOUS TREES AND SHRUBS	0	Fabaceae	Exotic	r

Asplenium flabellifolium Cav.	butterfly fern, walking fern, necklace fern	FERNS	0	Aspleniaceae	Not Threatened	l
Asplenium richardii (Hook.f.) Hook.f.	Richards spleenwort	FERNS	0	Aspleniaceae	Not Threatened	r
Azolla rubra R.Br.	Pacific azolla, azolla, red azolla	FERNS	0	Salviniaceae	Not Threatened	l
Cranfillia fluviatilis (R.Br.) Gasper & V.A.O.Dittrich	kiwikiwi, kiwakiwa, creek ferm	FERNS	0	Blechnaceae	Not Threatened	r
Hypolepis millefolium Hook.	Thousand leaved fern	FERNS	0	Dennstaedtiaceae	Not Threatened	l
Microsorum pustulatum subsp. pustulatum (G.Forst.) Copel.	hounds tongue, kowaowao, paraharaha	FERNS	0	Polypodiaceae	Not Threatened	r
Polystichum vestitum (G.Forst.) C.Presl	punui, prickly shield fern	FERNS	0	Dryopteridaceae	Not Threatened	l
Pteridium esculentum (G.Forst.) Cockayne	bracken, rarauhe, bracken fern	FERNS	0	Dennstaedtiaceae	Not Threatened	l
Agrostis capillaris L.	browntop	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	a
Agrostis stolonifera L.	creeping bent	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Aira caryophyllea L. subsp. caryophyllea	silvery hair grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Alopecurus geniculatus L.	kneed foxtail	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	r
Anthosachne falcis (Connor) Barkworth & S.W.L.Jacobs	0	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Declining	o
Anthoxanthum odoratum L.	sweet vernal	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	a
Bromus hordeaceus L.	soft brome	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	c
Chionochloa rigida (Raoul) Zotov subsp. rigida	narrow-leaved snow tussock	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	l
Critesion murinum subsp. murinum	barley grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	c

Cynosurus cristatus L.	crested dogstail	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	o
Dactylis glomerata L.	cocksfoot	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	a
Dichelachne crinita (L.f.) Hook.f.	long-hair plume grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	o
Festuca novae-zelandiae (Hack.) Cockayne	Fescue tussock, hard tussock	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	l
Festuca rubra L. subsp. rubra	red fescue	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Festuca rubra subsp. commutata	Chewings fescue	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	c
Glyceria declinata Bréb.	blue sweet grass, glaucous sweet grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Holcus lanatus L.	Yorkshire fog	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	o
Lachnagrostis striata (Colenso) Zotov	Purple wind grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	r
Lolium perenne L.	perennial rye grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	c
Phleum pratense L.	timothy	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Poa annua L.	annual poa	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Poa cita Edgar	Silver tussock	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	o
Poa colensoi Hook.f.	Blue tussock	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	l
Poa infirma Kunth	annual poa	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Poa pratensis L.	Kentucky bluegrass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	o

Rytidosperma buchananii (Hook.f.) Connor & Edgar	slender danthonia, bristle grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Declining	l
Rytidosperma clavatum (Zotov) Connor & Edgar	Bristle grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	l
Rytidosperma penicillatum (Labill.) Connor & Edgar	danthonia	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	o
Vulpia bromoides (L.) Gray	Vulpia hair grass, brome fescue, squirrel-tailed fescue	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	o
Bulbinella angustifolia (Cockayne & Laing) L.B.Moore	0	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Asphodelaceae	Not Threatened	l
Juncus articulatus L.	jointed rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Exotic	l
Juncus bufonius var. bufonius	toad rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Exotic	l
Juncus distegus Edgar	two storey rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Naturally Uncommon	l
Juncus edgariae L.A.S.Johnson & K.L.Wilson	Wiwi, Edgars rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Not Threatened	l
Juncus effusus L. var. effusus	leafless rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Exotic	l
Juncus filicaulis	leafless rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Exotic	l
Juncus pusillus Buchenau	Dwarf rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Naturally Uncommon	r
Carex colensoi Boott	Colensos sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	l
Carex flagellifera Colenso	Glen Murray tussock, Trip Me Up	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	r
Carex leporina L.	oval sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Exotic	l
Carex resectans Cheeseman	Desert Sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Locally Significant	r

Carex secta Boott	Purei, Pukio, Niggerhead	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	I
Carex subtilis K.A.Ford	Handsome Bastard Grass, Handsome Hook Sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Naturally Uncommon	I
Carex testacea Sol. ex Boott	Speckled Sedge, Trip Me Up	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	I
Carex wakatipu Petrie	Sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	I
Eleocharis acuta R.Br.	sharp spike sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	I

9.1.2 *Avifauna*

Name	Common Name	Status	Family	Number of observations
Alauda arvensis	skylark, kaireka, common skylark	Exotic	Alaudidae	58
Anas gracilis Buller, 1869	tētē moroiti, tētē, tete moroiti, tete, gray teal	Not Threatened	Anatidae	6
Anas platyrhynchos Linnaeus, 1758	mallard duck, wild duck, northern mallard, greenhead	Exotic	Anatidae	6
Anthus novaeseelandiae Gmelin subsp. *novaeseelandiae*	New Zealand pipit, pipit, pīhoihoi, pihoihoi, Richard's pipit	Declining	Motacillidae	2
Carduelis carduelis L	goldfinch	Exotic	Fringillidae	29
Carduelis flammea subsp. *cabaret*	redpoll	Exotic	Fringillidae	63
Circus approximans Peale	Australasian harrier, harrier hawk, hawk, kāhu, kahu, swamp harrier	Not Threatened	Accipitridae	14
Emberiza citrinella subsp. *caliginosa*	yellow bunting, yellowhammer	Exotic	Emberizidae	66
Gerygone igata Quoy & Gaimard	grey warbler, riroriro, rainbird, teetotum, gray warbler, New Zealand gerygone, grey gerygone	Not Threatened	Acanthizidae	2
Gymnorhina tibicen subsp.	Australian magpie, magpie, white-backed magpie, black-backed magpie, makipae	Exotic	Artamidae	9
Hemiphaga novaeseelandiae (Gmelin, 1789)	kererū, kereru, kukupa, kuku, wood pigeon, native pigeon, kokopa	Not Threatened	Columbidae	1
Hirundo neoxena Gould, 1842	Welcome swallow, warou, house swallow	Not Threatened	Hirundinidae	19
Larus dominicanus Lichtenstein, 1823	southern black backed gull, karoro, kelp gull, dominican gull, black-backed gull, mollyhawk, seagull, blackbacked gull	Not Threatened	Laridae	5
Passer domesticus Linnaeus, 1758 subsp. *domesticus*	House sparrow, tiu, English sparrow	Exotic	Passeridae	44
Sturnus vulgaris L. subsp. *vulgaris*	common starling, starling, European starling	Exotic	Sturnidae	140
Tadorna variegata Gmelin	paradise shelduck, paradise duck, pūtangitangi, putangitangi, pari, parry, parrie	Not Threatened	Anatidae	6

Turdus merula L	Eurasian blackbird, blackbird, manu pango	Exotic	Turdidae	14
Turdus philomelos subsp. *clarkei*	song thrush, thrush	Exotic	Turdidae	3
Vanellus miles (Boddaert, 1783)	spur winged plover, masked lapwing, masked plover, spur-wing, spurwinged plover	Not Threatened	Charadriidae	14

9.1.3 *Herpetofauna*

Oligosoma maccanni (Patterson & Daugherty, 1990) (clade 4 genotype)	McCann's skink	Not Threatened	Scinicidae	Occasional
Oligosoma inconspicuum (Patterson & Daugherty, 1990)	cryptic skink	Declining	Scinicidae	Rare
Oligosoma polychroma (Patterson & Daugherty, 1990) (clade 5 genotype)	southern grass skink	Declining	Scinicidae	Local
Woodworthia “Otago Large”	korero gecko	Declining	Gekkonidae	Local

9.1.5 *Invertebrates*

Note: this list includes species recorded from nearby on the Taieri Ridge slopes

Current name	Common name	Threat ranking (2012)	Group 2	Family (Tribe)	Notes
Costelytra? *Odontria*? small, shiny scarab	Scarab beetle	Not Threatened	Coleoptera (beetles)	Scarabaeidae - Melolonthinae	This small beetle (c.9mm long) keyed out uncertainly to genus *Costelytra* and could not be successfully keyed to a species of either genus. Taken at night in the Horse Flat Dump site.
Mecodema sculpturatum	carabid beetle	Not Threatened	Coleoptera (beetles)	Carabidae - Trechinae	This ground beetle is a southern South Island species, known predominantly from Southland and Otago, but found as far north as Otira Gorge. Two dead specimens, one only recently dead, were found in the Horse Flat Dump site.
Mimopeus sp.	Darkling beetle	Not Threatened	Coleoptera (beetles)	Tenebrionidae	Moderately large beetle, possibly a small *M. opaculus*, from the Horse Flat Dump site.
Neocicindela sp.	tiger beetle	Not Threatened	Coleoptera (beetles)	Carabidae - Cicindelinae	Tiger beetle larvae holes were visible in some clay banks at the Horse Flat Dump site, usually along road cuttings. A single adult beetle was seen at one site but eluded capture. The beetle was quite light-coloured, suggesting that it may have been a teneral (i.e., a recently emerged adult), which in turn suggests that it was early in the season for the adults to be present. The beetle appeared to have quite a wide marginal line (the whitish band around the edges of the elytra) which may indicate either *Neocicindela latecincta* or *N. parryi*, both of which are known from the Otago area.
Odontria sp.1 “medium brown, mottled, velvety”	Scarab beetle	Not Threatened	Coleoptera (beetles)	Scarabaeidae - Melolonthinae	Four males and a female in the light traps, Horse Flat Dump site.
Odontria sp.2 “darker, grey, mottled”	Scarab beetle	Not Threatened	Coleoptera (beetles)	Scarabaeidae - Melolonthinae	Two apparent males and a female from the Horse Flat Dump site, one male and the female taken in a light trap.
Odontria sp.3 “dark brown, darker & more extensive mottling”	Scarab beetle	Not Threatened	Coleoptera (beetles)	Scarabaeidae - Melolonthinae	Likely male from the Deepdell South site, taken at night
Odontria sp.4 “red-brown” (some similarities to the description of O. smithii)	Scarab beetle	Not Threatened	Coleoptera (beetles)	Scarabaeidae - Melolonthinae	In light trap, Horse Flat Dump site.
Oregus aereus	carabid beetle	Not Threatened	Coleoptera (beetles)	Carabidae - Trechinae	Widespread in Central Otago; previously known from the Deepdell Stream area.
Forficula auricularia	earwig	Exotic	Dermaptera (earwigs)	Forficulidae	The only earwig collected (from Deepdell South) keyed to this widespread introduced species

Anabarhynchus sp.; provisionally keyed to *A. triangularis*	stilleto fly	Not Threatened	Diptera (flies)	Therevidae	A single male, taken from a speargrass at the Deepdell South site. *A. triangularis* was described from two males and two females, taken from the Cromwell Gorge and Kawerau Gorge areas. Previous experience with this group indicates that inland Otago has a number of undescribed species.
Species undertermined	robber fly	Not Threatened	Diptera (flies)	Asilidae	A large male robber fly was seen in the Horse Flat Dump site but not collected due to the lack of an up-to-date taxonomy.
Kikihia sp., possibly *K. angusta*	cicada	Not Threatened	Hemiptera (true bugs)	Cicadidae	On Horse Flat Dump site. *K. angusta* is a widespread species in the South Island, but this identification is very tentative.
Pentatomidae sp.	shieldbug	Not Threatened	Hemiptera (true bugs)	Pentatomidae	A shield bug nymph was collected in the Horse Flat Dump site. There are several reasonably widespread native species known from this group.
Rhodopsalta sp., presumed to be either *Rhodopsalta cruentata* or *R. microdora*	cicada	Not Threatened	Hemiptera (true bugs)	Cicadidae	On Horse Flat Dump site; widespread species in the South Island
Huberia brounii	ant	Not Threatened	Hymenoptera (wasps and ants)	Formicidae	Widespread endemic species.
'Aletia' moderata		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A common species from about Rotorua south in open habitats, larvae on *Raoulia*.
'Chloroclystis' filata		Exotic	Lepidoptera (butterflies & moths)	Geometridae	Naturalised from Australia. Abdunant throughout New Zealand, larvae on flowers of gorse and other plants.
'Hydriomena' deltoidata		Not Threatened	Lepidoptera (butterflies & moths)	Geometridae	Common almost throughout New Zealand, but scarcer in the far North. Larvae on plantains.
'Hydriomena' rixata		Not Threatened	Lepidoptera (butterflies & moths)	Geometridae	Common throughout New Zealand. Larvae on plantains and willowherbs.
Apoctena cf. *conditana*		Not Threatened	Lepidoptera (butterflies & moths)	Tortricidae	*Apoctena conditana* is a widespread tortricid that is supposedly polyphagous, but I believe that more than one species may be confused under this name (hence the 'cf.'). In Auckland I have only reared it from *Lycopodium deuterodensum*, but according to John Dugdale's notes, based on rearings by Brian Patrick in the southern South Island it is polyphagous on various trees, shrubs and herbs. The genitalia of the Macraes specimen show minor differences from those illustrated by John Dudgale (NZ J Zool 1990), which were from a specimen from Opouri (SD) and the whole issue of the taxonomy needs further investigation. We don't have many similar looking specimens under *conditana* in NZAC, and it looks utterly different from Auckland specimens attributed to this species
Argyrophenga antipodum	Tussock ringlet butterfly	Not Threatened	Lepidoptera (butterflies & moths)	Nymphalidae	Tussock ringlet butterflies were common at both sites. A single specimen collected was identified as *A. antipodum*; the study site is probably also within the known range of *A. janitae*.

Asaphodes chlamydota		Not Threatened	Lepidoptera (butterflies & moths)	Geometridae	A fairly common and widespread species throughout New Zealand, larvae on *Clematis* spp.
Asaphodes clarata		Not Threatened	Lepidoptera (butterflies & moths)	Geometridae	A locally common species from the central North Island south.
Austrocidaria similata		Not Threatened	Lepidoptera (butterflies & moths)	Geometridae	A common and widespread species throughout New Zealand, larvae on *Coprosma* spp.
Bityla defigurata		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	Fairly common throughout New Zealand, larvae on *Muehlenbeckia.*
Epiphryne undosata		Not Threatened	Lepidoptera (butterflies & moths)	Geometridae	Locally common throughout New Zealand, larvae on *Hoheria*.
Eudonia (?)oculata		Locally Notable	Lepidoptera (butterflies & moths)	Crambidae	A little-known South Island species, larvae presumed to be on moss or in herbaceous swards. Apparently very local and only recent material in NZAC is from Tiwai Point, Southland. Populations on the Chatham Islands may not be conspecific.
Eudonia rakaiensis		Not Threatened	Lepidoptera (butterflies & moths)	Crambidae	A usually rather uncommon but widespread species throughout the country. Larva unknown, probably in moss or herbaceous swards.
Eudonia submarginalis		Not Threatened	Lepidoptera (butterflies & moths)	Crambidae	Abundant throughout New Zealand, larvae in herbaceous swards.
Gadira acerella		Not Threatened	Lepidoptera (butterflies & moths)	Crambidae	Fairly common throughout the country. Larvae presumed to be on lichens.
Graphania lignana		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species throughout New Zealand, larvae on grasses.
Graphania morosa		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species from the central North Island south, larvae on grasses.
Graphania mutans		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A very common and widespread species throughout New Zealand, larvae polyphagous, mainly on herbaceous plants.
Graphania omoplaca		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species from the central North Island south, larvae on grasses, plantain and probably other herbs.
Graphania plena		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A very common and widespread species throughout New Zealand, larvae polyphagous, mainly on herbaceous plants.
Graphania rubescens		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A fairly common and widespread species from the southern North Island south, larvae on herbaceous plants including *Gunnera*.
Harmologa oblongana		Not Threatened	Lepidoptera (butterflies & moths)	Tortricidae	Common and widespread species, larvae polyphagous in shrublands.
Harmologa scoliastis		Not Threatened	Lepidoptera (butterflies & moths)	Tortricidae	Widespread and fairly common species, larvae on *Muehlenbeckia*.

Harmologa sp. A.		Not Threatened	Lepidoptera (butterflies & moths)	Tortricidae	Local but widespread South Island species associated with small-leaved *Melicytus*.
Helastia corcularia		Not Threatened	Lepidoptera (butterflies & moths)	Geometridae	Common throughout the South Island.
Helastia triphragma		Locally Notable	Lepidoptera (butterflies & moths)	Geometridae	Local and usually uncommon species of the southern South Island.
Hierodoris s-fractum		Not Threatened	Lepidoptera (butterflies & moths)	Xyloryctidae	Very local, endemic to the southern South Island (Hoare 2005). Larvae in leaf-litter in shrubland.
Lycaena feredayi	glade copper butterfly	Not Threatened	Lepidoptera (butterflies & moths)	Lycaenidae	A female was taken in the Horse Flat Dump site.
Lycaena salustius	Common copper butterfly	Not Threatened	Lepidoptera (butterflies & moths)	Lycaenidae	This species was present in large numbers throughout the sites investigated
Mnesictena flavidalis		Not Threatened	Lepidoptera (butterflies & moths)	Crambidae	Larvae on various herbaceous plants including *Hydrocotyle*. Common throughout New Zealand.
Monopis ethelella		Exotic	Lepidoptera (butterflies & moths)	Tineidae	Very common and widespread birds' nest species.
Musotima nitidalis		Not Threatened	Lepidoptera (butterflies & moths)	Crambidae	Larvae on various ferns. Common throughout New Zealand, also in Australia.
Opogona comptella		Exotic	Lepidoptera (butterflies & moths)	Tineidae	Fairly common and widespread species in drier parts of the country; larvae in dead wood.
Orocrambus flexuosellus		Not Threatened	Lepidoptera (butterflies & moths)	Crambidae	larvae on native and exotic grasses. Extremely common throughout New Zealand.
Orocrambus sp. B of NZAC		Not Threatened	Lepidoptera (butterflies & moths)	Crambidae	Larvae presumed to be on tussock grasses. A local species of Central Otago and Otago Lakes that has been confused with *O. crenaeus* in collections and was therefore overlooked by Gaskin (1975) in his revision of *Orocrambus*. It needs to be critically compared with the very similar and poorly known *O. dicrenellus*, but genitalia seem to be distinct.
Orocrambus vittellus		Not Threatened	Lepidoptera (butterflies & moths)	Crambidae	larvae on grasses. Common throughout New Zealand.
Pasiphila (?)cotinaea		Not Threatened	Lepidoptera (butterflies & moths)	Geometridae	Very local species occurring from the central North Island south. A worn specimen, identification is doubtful as this genus is unrevised and can be very tricky.
Persectania aversa		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species throughout New Zealand except the northern North Island, larvae on grasses.
Physetica phricias		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A locally common South Island species, larvae on matagouri (*Discaria*).

Tingena sp. cf. *siderodeta*		Not Threatened	Lepidoptera (butterflies & moths)	Oecophoridae	*Tingena* spp. are associated with leaf-litter. an unrevised and very challenging genus; it is not possible to identify the specimen confidently to species without substantial further research.
Tmetolophota atristriga		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A common to abundant and widespread species throughout New Zealand, larvae on grasses.
Tmetolophota propria		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species in the South Island (and central plateau of the North Island), larvae on grasses.
Tmetolophota semivittata		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species throughout New Zealand, larvae on sedges (*Carex* spp.), rushes (*Juncus* spp.) and probably also grasses.
Tmetolophota steropastis (2)		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species throughout New Zealand, larvae mainly on flax (*Phormium*) toetoe (*Austroderia* spp.) and pampas grass (*Cortaderia*)., occasionally on other monocots.
Wiseana (?)copularis		Not Threatened	Lepidoptera (butterflies & moths)	Hepialidae	Endemic. A very common and widespread grassland and pasture species.
Wiseana (?)umbraculata		Not Threatened	Lepidoptera (butterflies & moths)	Hepialidae	Endemic. A common and widespread grassland / wetland species.
Xanthorhoe semifissata		Not Threatened	Lepidoptera (butterflies & moths)	Geometridae	Fairly common from the central North Island south.
Zizina oxleyi	little blue butterfly	Not Threatened	Lepidoptera (butterflies & moths)	Lycaenidae	Presumed to be much declined in range and abundance since European arrival in New Zealand, but still locally common where found, and classified as 'Not Threatened' (Hoare *et al.* 2017). Larvae on *Carmichaelia* and introduced clover.
Pseudaneitea sp.	leaf-veined slug	Not Threatened	Mollusca (snails, slugs, etc.)	Athoracophoridae	*Pseudaneita* sp. A single leaf-veined slug was collected at night in the Horse Flat Dump site.
Anisoptera sp.	dragonfly	Not Threatened	Odonata (damselflies & dragonflies)		Several specimens of at least one species of medium-sized dragonfly (not a *Uropetala*) were seen but not captured. These were especially prevalent at the Deepdell South Backfill site. Any of three species – *Aeshna brevistyla* and the two species of *Procordulia* – could potentially account for these sightings. All three are widespread in New Zealand.
Austrolestes colensonis	Blue Damselfly	Not Threatened	Odonata (damselflies & dragonflies)	Lestidae	Damselflies were common throughout both sites investigated.
Xanthocnemis zealandica	common redcoat damselfly	Not Threatened	Odonata (damselflies & dragonflies)	Coenagrionidae	Damselflies were common throughout both sites investigated.

9.2 Appendix 2. Abbreviations used in text

DOC	Department of Conservation
E.D.	Ecological District
EMP	Ecological Management Plan
OceanaGold	Oceana Gold (New Zealand) Ltd
ORC	Otago Regional Council
PIA	Project Impact Area
WDC	Waitaki District Council
WRS	Waste Rock Stack

9.3 Appendix 3. Site photographs

Figure 11. View of shrublands in Deepdell South pit backfill area of WRS looking east from 1398138 4975528. Old Deepdell South pit in right midground. Photo taken 16 January 2018.

Figure 12. View of Deepdell North III pit eastern boundary looking north towards Horse Flat WRS location (on far hill slope) from 1398028 4975609. Photo taken 16 January 2018.

Figure 13. Ephemeral wetland F near Deepdell North III pit on Horse Flat at 1398013 4975714. Photo taken 16 January 2018.

Figure 14. Seasonal gully drainage at 1397550 4976002. Photo taken 16 January 2018.

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Deepdell North III Project

Impact Management Plan

December 2019

Report prepared for Oceana Gold (New Zealand) Ltd by Dr M. J. Thorsen,

5 December 2019

Report number: 0219-20

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New Zealand

Ahika Consulting Ltd guarantees its work as free of political bias and as grounded in sound ecological principles based on quality knowledge.

1 Contents

1 Document Summary

The Deepdell North III project will remove 54.79 ha of indigenous vegetation comprising of low producing grassland, shrubland, seasonal gully drainages, ephemeral wetlands and a seepage wetland and inhabited by 71 indigenous plants (including 13 rare species), twenty bird species (nine indigenous and one rare species), four reptile species (three rare species) and a largely unknown invertebrate community. The vegetation communities are underlain by 3 Threatened LENZ. The ephemeral wetland vegetation community is Historically Rare and Critically Endangered and the seepage wetland is Historically Rare and Endangered. Both are priorities for protection. The indigenous vegetation communities are generally of low species diversity and most are characterised by high weed representation. The populations of the 17 At Risk or Rare species are mostly small, except for the Declining Matagouri which is dominant in the shrubland vegetation community and frequent in the low producing grassland plant community.

The project will also impact on 54.09 ha of cultivated pasture and shelterbelts. There may be some effect on a further 88.71 ha of indigenous vegetation and 26.47 ha of cultivated pastures, but these effects are expected to be minimal if appropriate controls are employed.

Mostly the Deepdell North III project is assessed to having low to very low effect on most of the terrestrial ecological features. Exceptions to this are a moderate impact on the plant communities together (mainly a result of the presence of the LENZ, rare species, and the Nationally Critical ephemeral wetland) and a high impact on the seven Historically Uncommon Nationally Critical ephemeral wetlands. These effects will be addressed through an Impact Management Plan.

To address these impacts OceanaGold (New Zealand) Limited (OceanaGold) proposes to support the activities within this Impact Management Plan. These activities include avoiding effects by evaluating siting of infrastructure and by isolating higher-value ecological areas in the buffer zone, mitigating general environmental effects such as dust, noise and weeds, and implementing an ecological management programme under an offset design at two sites. Once implemented, this Impact Management Plan will result in avoiding, minimising and rehabilitating all significant adverse ecological effects arising from the Deepdell North III Project.

This document is laid out so that the general condition and threats to biodiversity in the Macraes Ecological District are described (Sections 2 and 3), the predicted impact of the project (Section 4) are summarised from the project Ecological Impact Assessment, the regulatory framework within which the Impact Management Plan must fit (Section 5), a general evaluation of impact management options in Section 6 and how to quantify these (Section 7), the preferred mitigation options selected for this project in Section 8 and the Impact Management Plan (Section 9) that will give effect to the preferred mitigation options.

2 General Ecological Setting

The general ecological setting of the Deepdell North III project is described in the Ecological Impact Assessment and is summarised here as it provides important context for the Impact Management Plan.

Past vegetation cover of the Macraes ED is thought to have comprised montane short tussockland grading into subalpine tall tussockland, with areas of mixed hardwood and podocarp forest, kanuka forest and *Coprosma*-flax scrub (Bibby 1997). In Otago, much of the original vegetation cover has been dramatically altered as a result of anthropogenic factors (McGlone et al. 1995), and this massive vegetation change has also occurred at Macraes (Whitaker 1996). Since European settlement in the 1850's (Thompson 1949), areas have been burnt (sometimes repeatedly) and exotic grasslands induced by ploughing, oversowing, and applying fertiliser (Whitaker 1996). The present vegetation of the Macraes ED is of a highly modified nature, with approximately 75% of the district dominated by exotic vegetation types (mainly improved pastureland) and the remainder of the vegetation types being indigenous and comprised of varying density narrow-leaved tussockland, copper tussock-based wetlands and grey shrubland interspersed with remnants of original forest cover and scattered ephemeral wetlands (Bibby 1997, Thorsen pers. obs.). The remaining native vegetation communities currently present within the Macraes area are botanically diverse (Thorsen 2008) and is comprised of 592 indigenous (including 15 Data Deficient, 61 At Risk and 27 Threatened species) and 216 exotic species. The remaining vegetation communities are likely to be derived from the original vegetation communities that existed before human colonisation of the region, but many are likely to be considerably reduced in extent and species diversity. Invasion by exotic shrub and tree species, particularly gorse and broom, is an increasing problem in the area.

Of the fauna, fifty-four species of birds have been recorded from the Macraes E.D., of which thirty four are indigenous and twenty are introduced. The area's indigenous avifauna are likely being predated by exotic mammals, though the impact of this predation pressure on population dynamics is not known. They are also being impacted by changes to their habitats, however the nature of these changes and their impacts on the species is again not known. The area is noted for its high diversity of seven lizard species (Whitaker et al. 2002) and the invertebrate communities are diverse (for a region at moderate altitude) and contains some species that are rare or of biogeographic interest (Patrick 1997). The lizard species is being similarly impacted as birds by exotic mammals and habitat change, though the severity of predation is somewhat moderated by the abundance of rocky habitats offering safer retreat sites. This is thought to be at least part of the reason why Central Otago retains a high density and diversity of lizard species. Some catchments provide habitat for populations of non-migratory galaxiids, freshwater crayfish and longfin eel, which are being affected through predation by trout and changes to their habitats, particularly in the lower reaches of watercourses.

3 Threats to biodiversity

Many of the species of conservation concern in the Macraes E.D. retain good population sizes probably at least in part because of past farming practices, but current conversion of narrow-leaved tussockland and dryland herbfield by discing or spraying are reducing the extent of some plant communities. Oversowing and topdressing of areas of indigenous vegetation also alters the species composition, usually at the expense of the indigenous species (matagouri being a notable exception to this). Burning of indigenous grasslands is not now commonly practiced in the area, but escaped fires are very detrimental to grasslands and shrublands. Predation by introduced mammals and invasion by exotic herb, grass, shrub and tree species, (particularly gorse and broom and weed invasion of wetlands) is insidious but difficult to quantify and likely impacts species differently and some “pest” species may be beneficial to some species in some situations.

Efforts to protect the biodiversity in the Macraes E.D. include a DOC skink protection programme in the Redbank-Nenthorn area and conservation activities associated with past OceanaGold projects including the creation of six covenants between 16 and 290 ha in size. The Department of Conservation (DOC) has undergone a process of identifying Ecological Management Units (EMU)[1]: the sites where conservation management would provide the most conservation gain. The Macraes DOC reserves and Mt Watkins are two EMU that are close to the PIA.

The current protected area network protects a full range of the habitat types present in the Macraes E.D., but much of the biodiversity inhabiting these habitat types is of restricted occurrence so a focus needs to be on protecting the under-represented habitat types reflective of this biogeographic pattern.

There are large outstanding conservation needs in the Macraes E.D., particularly for in the conservation of plants, fish and invertebrates.

[1] See http://www.doc.govt.nz/about-us/our-role/managing-conservation/natural-heritage-management/identifying-conservation-priorities/

4 Project Impacts on Ecological Features

The ecological assessments of the Deepdell North III project (Ahika Consulting Ltd 2019, Ryder Consulting Ltd 2019) identified the following ecological features within the Project Impact Area (PIA) will be impacted by project activities:

Ecological Feature Class	Ecological Feature Type	Ecological Feature	Classification of Feature	Buffer	Pit	WRS	PIA	Unit of Measurement	Accuracy of measurement	Ecological Importance of Feature	Magnitude of Project Impact on Feature		Overall Project Effect
											Local Scale	National Scale	
Bird	Community	Ecological function								Moderate	Moderate	Negligible	Very Low
Bird	Species	Pipit	Declining				2	individuals	Counted	Moderate	Low	Negligible	Very Low
Bird	Species	Black-backed gull					45	individuals	Counted	Low	Moderate	Negligible	Very Low
Bird	Species	Grey teal					6	individuals	Counted	Low	Moderate	Negligible	Very Low
Bird	Species	Grey warbler					10	individuals	Estimated	Low	Moderate	Negligible	Very Low
Bird	Species	Harrier hawk					1	individuals	Counted	Low	Moderate	Negligible	Very Low
Bird	Species	Paradise shelduck					6	individuals	Counted	Low	Moderate	Negligible	Very Low
Bird	Species	Spur-winged plover					8	individuals	Estimated	Low	Moderate	Negligible	Very Low
Bird	Species	Welcome swallow					5	individuals	Estimated	Low	Moderate	Negligible	Very Low
Environment	LENZ	Cultivated Pasture	< 10% indigenous cover left	26.39	29.16	24.93	80.49	Hectares	Measured				
Environment	LENZ	Ephemeral Wetland	< 10% indigenous cover left	0.02		0.3	0.31	Hectares	Measured				

Environment	LENZ	Low producing grassland	< 10% indigenous cover left	13.24	7.8	29.11	50.15	Hectares	Measured				
Environment	LENZ	Seasonal gully drainage	< 10% indigenous cover left	1.79	0.5	1.91	4.2	Hectares	Measured				
Environment	LENZ	Seepage	< 10% indigenous cover left			0.07	0.07	Hectares	Measured				
Environment	LENZ	Shelterbelts & Exotic Trees	< 10% indigenous cover left	0.08		0.53	0.61	Hectares	Measured				
Environment	LENZ	Shrublands	< 10% indigenous cover left	3.17	0.08	2.79	6.04	Hectares	Measured				
Environment	LENZ	Threatened LENZ with indigenous vegetation	< 10% indigenous cover left	5.26	1.7	15.14	22.09	Hectares	Measured				
Environment	LENZ	Threatened LENZ with indigenous vegetation	< 10% indigenous cover left	12.95	6.68	19.04	38.67	Hectares	Measured				
Environment	LENZ	Low producing grassland	10-20% indigenous cover left	11.58	0.96	10.36	22.89	Hectares	Measured				
Environment	LENZ	Shrublands	10-20% indigenous cover left	4.2		0.86	5.05	Hectares	Measured				
Environment	LENZ	Threatened LENZ with indigenous vegetation	10-20% indigenous cover left	15.77	0.96	11.21	27.94	Hectares	Measured				
Flora	Community	Ephemeral Wetland	Critically Endangered Historically Uncommon ecosystem type	0.02		0.3	0.31	Hectares	Measured	High	High	Moderate	High
Flora	Community	Seepage	Endangered Historically Uncommon ecosystem type			0.07	0.07	Hectares	Measured	High	Moderate	Low	Low
Flora	Community	Cultivated Pasture		26.39	29.16	24.93	80.49	Hectares	Measured	Negligible	Low	Negligible	Very Low
Flora	Community	Low producing grassland		24.82	8.76	39.47	73.04	Hectares	Measured	Moderate	Moderate	Low	Low
Flora	Community	Seasonal gully drainage		1.79	0.5	1.91	4.2	Hectares	Measured	Low	Moderate	Low	Very Low
Flora	Community	Shelterbelts & Exotic Trees		0.08		0.53	0.61	Hectares	Measured	Negligible	Low	Negligible	Very Low

Flora	Community	Shrublands		7.36	0.08	3.65	11.09	Hectares	Measured	Moderate	Low	Negligible	Very Low
Flora	Community	Ecosystem services								Minor			
Flora	Community	Historically Rare or Threatened Ecosystems				2	2	Communiti es					
Flora	Community	Integrity								Moderate			
Flora	Community	National Priorities for Protection				2	2	Communiti es					
Flora	Community	Rarity								High	Moderate	Moderate	Moderate
Flora	Community	Representativeness								Moderate	Moderate	Moderate	Moderate
Flora	Community	Sites recommended for protection					0	Sites		Nil			
Flora	Community	Wetlands of National Importance or Ramsar sites					0	Sites		Nil			
Flora	Species	Carmichaelia crassicaulis Hook.f. subsp. crassicaulis	Declining	15		2	17	individuals	Counted	High	Very Low	Negligible	Very Low
Flora	Species	Carmichaelia petriei Kirk	Declining	10		7	17	individuals	Counted	High	Low	Negligible	Very Low
Flora	Species	Discaria toumatou Raoul	Declining	7.36	0.08	3.65	3.73	Hectares	Estimated	High	Negligible	Negligible	Very Low
Flora	Species	Juncus pusillus Buchenau	Declining			1	1	m^2	Estimated	Moderate	Moderate	Low	Very Low
Flora	Species	Leptinella pusilla Hook.f.	Declining			1	1	m^2	Estimated	High	Low	Negligible	Very Low
Flora	Species	Lobelia ionantha Heenan	Declining			0.561	0.561	m^2	Estimated	High	Moderate	Low	Low
Flora	Species	Rytidosperma buchananii (Hook.f.) Connor & Edgar	Declining			1	1	individuals	Counted	Low	Very Low	Negligible	Very Low

Flora	Species	Carex resectans Cheeseman	Locally Uncommon			1.6	1.6	m^2	Estimated	Moderate	Moderate	Low	Low
Flora	Species	Melicope simplex A.Cunn.	Locally Uncommon			11	11	individuals	Counted	Moderate	Moderate	Negligible	Very Low
Flora	Species	Myrsine divaricata A.Cunn.	Locally Uncommon			2	2	individuals	Counted	Moderate	Moderate	Negligible	Very Low
Flora	Species	Anthosachne falcis (Connor) Barkworth & S.W.L.Jacobs	Naturally Uncommon				100	individuals	Estimated	High	Moderate	Low	Low
Flora	Species	Carex subtilis K.A.Ford	Naturally Uncommon			1	1	individuals	Counted	Moderate	Moderate	Negligible	Very Low
Flora	Species	Juncus distegus Edgar	Naturally Uncommon			369	369	m^2	Estimated	Moderate	Moderate	Low	Low
Flora	Species	Juncus distegus Edgar	Naturally Uncommon			56	56	individuals	Estimated	Moderate	Moderate	Low	Low
Flora	Species	Diversity								Moderate	Moderate	Moderate	Moderate
Invertebrates	Community	Overall importance								Moderate	Moderate	Low	Low
Reptiles	Community	Overall importance								Moderate	Moderate	Low	Low
Reptiles	Species	*Oligosoma inconspicuum*	Declining		1			individuals	Counted	High	Moderate	Negligible	Very Low
Reptiles	Species	*Oligosoma polychroma* (clade 5 genotype)	Declining				5	individuals	Estimated	High	Moderate	Negligible	Very Low
Reptiles	Species	*Woodworthia* “Otago/Southland large”	Declining				30	individuals	Estimated	High	Moderate	Low	Low
Reptiles	Species	*Oligosoma maccanni* (clade 4 genotype)					150	individuals	Estimated	Moderate	Moderate	Low	Low
Freshwater	Community	Watercourse length					480	Metres	Measured				
Freshwater	Species	Potential *Paranephrops zealandicus* habitat	Declining				120	Metres	Measured				

Other matters requiring consideration are:

- A proportion of the PIA has been classified as a Threatened LENZ environment.
- The ephemeral wetlands are a Critically Endangered Naturally Uncommon ecosystem.
- The shrubland and ephemeral wetland vegetation communities present in the PIA are considered significant under proposed Otago Regional Policy Statement and the Waitaki District Plan.

5 Impact Management Approach

The following impact management approach has been followed for managing the effects of the GPUG Infrastructure project on biological diversity. This approach is consistent with Policies 5.4.6 *Offsetting for indigenous biological diversity* and 5.4.8 *Adverse effects from mineral and petroleum exploration, extraction and processing* of the partially operative ORPS (pORPS) (and including Environment Court decision NZEnvC41 of 15 March 2019). For the purposes of giving effect to these policies "significant adverse effects" are considered those where the overall project effect (last column in **Error! Reference source not found.**) is moderate or greater.

These options follow a Mitigation Hierarchy of first seek to avoid the impact, then remediate residual ecological effects[2], then mitigate residual ecological effects, then employ an offset to address as much of the remaining residual ecological effects as practicable, and finally compensate for the outstanding balance of the ecological effects. Moving to the next step in the hierarchy is only possible once the possibility of employing the higher-order option has been fully explored and documented and the residual ecological effects calculated.

The relevant wording in pORPS (and including Environment Court decision NZEnvC41 of 15 March 2019), and which this Impact Management Plan has been formulated, is:

For project impacts on areas of significant indigenous vegetation and significant habitats of indigenous fauna, or where there are significant adverse effects:

- Avoid where practicable locating activities in areas of significant indigenous vegetation and significant habitats of indigenous fauna;
- Where it is not practicable to avoid locating in areas of significant indigenous vegetation and significant habitats of indigenous fauna avoid, remedy or mitigate, as necessary, adverse effects on values in order to maintain the outstanding or significant nature of the significant indigenous vegetation or habitat of indigenous fauna;
- Consider first biological diversity offsetting, and then biological diversity compensation if significant adverse effects on indigenous biological diversity cannot be practicably remedied or mitigated.

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[2] Residual adverse ecological effects, are the remainder of a project's predicted impact on all of the ecological features within the PIA that would not be addressed once the actions under consideration for that mitigation option have been employed as designed.

Consider the offsetting of indigenous biological diversity offsetting, when:

- Adverse effects of activities cannot be avoided, remedied or mitigated;
- The offset achieves no net loss and preferably a net gain in indigenous biological diversity;
- The offset ensures there is no loss of individuals of rare or vulnerable species as defined in reports published prior to 14 January 2019 under the New Zealand Threat Classification System ("NZTCS");
- The offset is undertaken where it will result in the best ecological outcome, preferably:
    - Close to the location of development; or
    - Within the same ecological district or coastal marine biogeographic region;
- The offset is applied so that the ecological values being achieved are the same or similar to those being lost;
- The positive ecological outcomes of the offset last at least as long as the impact of the activity, preferably in perpetuity;
- The offset will achieve biological diversity outcomes beyond results that would have occurred if the offset was not proposed; and
- The delay between the loss of biological diversity through the proposal and the gain or maturation of the offset's biological diversity outcomes is minimised

Consider the use of biological diversity compensation when:

- Adverse effects of activities cannot practicably be avoided, remedied, mitigated or offset;
- The residual adverse effects will not result in:
    - The loss of an indigenous taxon (excluding freshwater flora and flora) or of any ecosystem type from an ecological district or coastal marine biogeographic region;
    - Removal or modification of habitat of a threatened or at risk indigenous species of fauna or flora under the New Zealand Threat Classification System ("NZTCS");
    - Removal or loss of viability of an originally rare uncommon ecosystem type that is associated with indigenous vegetation or habitat of indigenous fauna;
    - Worsening of the NZTCS conservation status of any threatened or at risk indigenous freshwater fauna.
- By applying the following criteria:
    - The compensation is proportionate to the adverse effect;
    - The compensation is undertaken where it will result in the best practicable ecological outcome, preferably;
        - Close to the location of development;
        - Within the same ecological district or coastal marine biogeographic region;
    - The compensation will achieve positive biological diversity outcomes that would not have occurred without that compensation;
    - The positive ecological outcomes of the compensation last for at least as long as the adverse effects of the activity; and

- The delay between the loss of biological diversity through the proposal and the gain or maturation of the compensation's biological diversity outcomes is minimised.

In considering the above approaches, the following assumptions have been made:

Avoidance refers to changing a project's activity so that it no longer impacts on an ecological feature. Mining, by its very nature, makes it difficult to avoid an ecological feature where it overlays the targeted resource, but there are opportunities to avoid impacts arising from some mine activities, such as placement of road and building infrastructure, but this needs to be balanced against other values (including economics, heritage, cultural and other stakeholder concerns). Avoidance can also include staging of project activities – for example by depositing WRS material into lower-value areas first – where there is some uncertainty in the extent of the Project Design.

Remedying refers to undertaking activities, following cessation of the impact, that rehabilitate or restore the site back to an acceptable ecological state. The opportunities to restoring a mining project's impact are limited by the technical challenges associated with rehabilitating mine workings in this location to a functioning natural ecological state, and the previously-expressed wish of the local community that the mine is rehabilitated to farming pasture.

Mitigating (or minimising) refers to adopting a practice that reduces a project's impact on an ecological feature. Minimisation includes salvaging of species from the Project footprint and either translocating directly to a new site, or cultivating for later planting at an appropriate site. It also includes Standard Operating Procedures adopted to reduce the effects of dust, noise, weeds, fire, etc.

Biological Diversity Offsetting refers to measurable conservation outcomes resulting from actions designed to address residual adverse biodiversity impacts arising from project development after appropriate avoidance, minimisation and remediation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground. The ability to utilise an offset is included in the pORPS as part of a mitigation hierarchy and the pORPS includes guidance on the necessary features of an offset. There are a number of guiding documents available to guide the design of an offset in NZ including the approaches adopted internationally by Business & Biodiversity Offsets Programme (BBOP), and nationally by DOC and the Biodiversity Working Group's (BWG) guidance to Councils. For this project the BWG guidance to Councils[3] is used as the guiding document for the design and evaluation of the offset with the offset calculations following a disaggregated biodiversity offset accounting model[4,5] as this is considered the current best practice for the use of offsets in NZ.

Compensation involves undertaking activities that will result in a gain in ecological value outside the project footprint or off-site. Compensation differs from Offsetting in that the biodiversity outcomes are 'like for unlike'. A number of compensatory activities can be undertaken, either separately or in combination, to address a project's impacts, ranging from legal covenanting, enhancing habitat of plants or wildlife, through weed or pest control, research to better understand how to manage ecological features, habitat creation, education and interpretation, supporting community-led biodiversity projects, and undertaking activities that protect rare species.

Biobanking is the undertaking of conservation actions now, that are then used to address the effects of a future project.

The following evaluation considerations are also used to help select the most appropriate activities:

- Where possible align compensatory activities with the greatest conservation need.
- The ecological gain that could be achieved, including gains in knowledge that increase ability to effectively manage conservation issues here or elsewhere.
- That the ecological gain is sufficiently worthwhile.
- That the compensatory activities are technically feasible with an acceptable chance of achieving their desired outcome.
- That the compensatory activity is affordable and delivers benefits appropriate to the cost.
- That ecological resilience is considered when selecting a site for an activity, to ensure that gains are not eroded over time due to ecological processes that are difficult to manage (e.g. lost ecosystem function).
- That land tenure allows certainty of access to undertake the activity over time.
- The ability to maintain the gain achieved by the activity over the term of the project impact.
- That the ecological gain can be monitored to ensure that the compensatory activity is achieving its planned outcome.

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[3] Maseyk, F; Ussher, G; Kessels, G; Christensen, M; Brown, M. 2018. Biodiversity Offsetting under the Resource Management Act: A guidance document. BioManagers Group for the Biodiversity Working Group.

[4] Maseyk, F.J.F; Barea, L.P; Stephens, R.T.T; Possingham, H.P; Dutson, G; Maron, M. 2016. A disaggregated biodiversity offset accounting model to improve estimation of ecological equivalency and no net loss. Biological Conservation 204: 322-332.

[5] Maseyk, F; Maron, M; Seaton, R; Dutso, G. 2015. A Biodiversity Offsets Accounting Model for New Zealand: User Manual. Department of Conservation, Hamilton.

- There is an ability to add additional mitigation measures in response to additional OceanaGold projects.
- That the process of evaluation and implementation is transparent and of high quality.
- That the outcomes of compensatory activities do not unnecessarily constrain future commercial endeavours of either OceanaGold and/or the local community, particularly farming.

6 Options for Impact Management in a Macraes Context

The options available to address a project's impacts in the Macraes context are described here in the order of the Mitigation Hierarchy.

6.1 Avoidance options

The opportunity to avoid ecological features includes siting of all, or part, project infrastructure, staging construction, and excluding (by using temporary fencing) areas in buffer areas, depending on the operational and financial constraints of the sites.

6.2 Remedial options

Remediating an area back to its pre-impact ecological condition is possible in some situations, but is limited by the technical challenges associated with rehabilitating mine workings in this location to a functioning natural ecological state, the timescale to replicate some ecological features (such as old-growth shrubland), the paucity of examples of successful site rehabilitation, and the previously-expressed wish of the local community that the mine is rehabilitated to farming pasture.

6.3 Mitigation options

The opportunities to minimise the impact of this project includes measures to reduce dust, noise, disturbance, and sediment, contaminant suppression, weed surveillance, fire response and rescue (removal to a safe site) of ecological features. These are discussed further here.

6.3.1 *Dust suppression*

Dust-fall can be a problem for plants as it inhibits their photosynthetic capacity. Supressing dust that is created during construction activities is a standard mine operating procedure and will minimise this effect.

6.3.2 *Noise and minimising disturbance*

Operating heavy machinery and construction activities creates considerable noise and disturbance which is likely to create a negative reaction in animal species, though this reaction will vary depending on species. Minimising noise is a standard mine operating procedure and will minimise this effect, though there is likely to be displacement of some animal species from the vicinity of the mine site.

6.3.3 *Weed surveillance*

Importation of new weed species into the area during construction and operations could, depending on the species, have a huge impact on the area's biodiversity. Regular inspection of the area for new weed species can alleviate this risk. Areas of OceanaGold land are regularly inspected for new weed incursions and new environmental weeds that are found are subject to OceanaGold's annual environmental weed control operation.

6.3.4 *Fire response*

The Macraes area is often very dry and any fires that do start have the potential to cover large areas and harm large areas of natural vegetation, as well as farm assets. A site fire avoidance protocol and rapid response to any suspected fires is a standard operating procedure and will minimise this effect.

6.3.5 *Sediment Control*

Ground works associated with buildings and roadway construction disturbs land, removes vegetation and soil cover and so increases the risk of fine sediment discharges to watercourses. Sediment control measures are routinely employed by OceanaGold at Macraes Mine and will continue to be applied to minimise this effect.

6.3.6 *Manage accidental contaminants spills*

The presence of construction machinery in and around waterways presents a risk of contaminants entering watercourses with potential to harm aquatic life. OceanaGold will continue to address this effect by operating an appropriate on-site contaminant management plan.

6.3.7 *Protect against nuisance weed/algae introduction into waterways*

Machinery and personnel involved in construction can potentially transfer nuisance weeds/algae to local watercourses. OceanaGold complies with notices and guidelines issued by Biosecurity New Zealand regarding nuisance weeds/algae and will continue this practice.

6.3.8 *Rescue of ecological features*

Some of the higher-importance ecological features such as some plant species can be rescued by removing them (or propagating parts of them such as seeds or cuttings) following OceanaGold's Plant Propagation, Translocation and Management Procedure and establishing them at suitable areas within existing habitat (for instance nearby DOC and OceanaGold protected areas) (Figure 1. Location of OceanaGold (blue) and DOC (green) protected areas relative to the Deepdell III project (purple).).

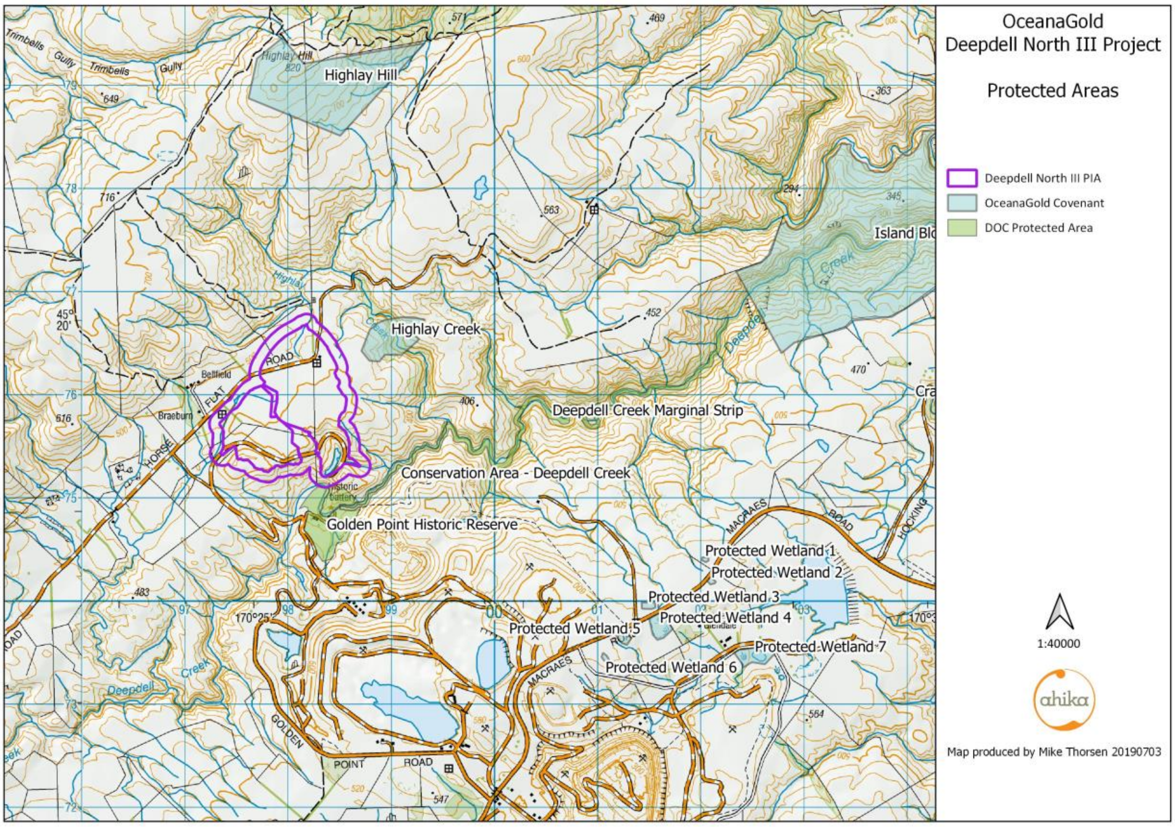

Figure 1. Location of OceanaGold (blue) and DOC (green) protected areas relative to the Deepdell III project (purple).

6.4 Offsetting and Compensation options

Offsetting and compensation can employ the same mechanisms, and these mechanisms are described here. The main difference between Offsetting and Compensation under the pORPS is that that there is less focus on the 'like-for-like' component in a compensation scenario. Both offsetting and compensation, either in full or partially, of residual adverse effects may be a useful tool to address impacts of a project. The opportunity to employ an offset is determined by the availability of comparable sites in which to undertake the offset, the technical challenges of employing the offset, the ability to set a reference baseline and to measure progress towards a No Net Loss situation, and the cost of these activities. There are some local constraints on establishing protected areas as an 'averted loss' offset (see 6.4.1), which is a commonly applied offsetting approach. Compensation has limitations in that there is reduced certainty in the ecological gain under this approach. Preference is given to adopting an offset over utilising a compensation approach to address the projects residual ecological effects unaddressed following implementation of the Avoid, Remediate and Mitigate Hierarchy.

6.4.1 *Land protection*

Protecting areas of high conservation value, which may have different ecological values to those being impacted, via a legal covenant has been used in previous OceanaGold projects. While land protection is a valuable tool to remediate a project's impacts, and their benefits are long-lasting, care needs to be taken when pursuing a covenant as they can unintentionally constrain land use if they are sited on an area of land that has commercial value (for instance for mining or farming). There is also a need for on-going management to maintain the covenant's biodiversity features, which requires landowner support and both funds and labour over the life of the covenant (usually in-perpetuity) otherwise the covenant's 'degrade' in value over time and become reservoirs for pests. OceanaGold manages the covenants on its land to appropriate standards, but when that land changes ownership (the intention of OceanaGold) then management of the covenant becomes the responsibility of the new landowner. There has been concern expressed in the local farming community about this as in their view a covenant decreases the area of land available to farming and causes impediments to farming operations in adjacent areas. This is of concern as there is increasing evidence that social support is critical in achieving the objectives of establishing a protected area[6].

OceanaGold currently manages six ecological covenants covering a total of 655 ha. Other protected lands in the vicinity include the 590 ha Deighton Creek Nature Reserve, the 1,452 ha Redbank Scenic Reserve and the 332 ha Manuka Stream Conservation Area (**Error! Reference source not found.**), giving a total of 3,029 ha of legally protected land in the Macraes Ecological District. This equates to 2.4% of the Ecological District's land area and is similar to the proportion protected of the ecologically similar nearby Manorburn Ecological District (Ahika Consulting Ltd unpub. data).

6.4.2 *Habitat enhancement*

Enhancing the habitat of indigenous plants or wildlife (usually through enrichment planting, pest control or weed control) as a compensatory measure can provide benefit to both a habitat and its inhabitants by removing predators that are limiting populations, removing weed species that are displacing plants or animals from their preferred habitat, or by creating barriers to movement of trout into high-value aquatic environments.

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[6] See for example Oldekop, J.A; Holmes, G; Harris, W.E; Evans, K.L. 2015. A global assessment of the social and conservation outcomes of protected areas. Conservation Biology 30: 133-141.

Protecting or enhancing rare habitats can provide high ecological benefit. A number of New Zealand's habitats are considered rare, either because they were always of very limited distribution (see Williams et al. 2007) or because human activity has reduced their extent and/or intactness. Also, some habitats are now considered Threatened (Holdaway et al. 2012). Several examples of these rare and threatened habitats are present in Otago, and in the Macraes E.D. there are Critically Endangered saline sites and ephemeral wetlands as well as Endangered seepages and flushes. Other important communities are the schist bluff communities, dryland shrubland (grey scrub) and riparian margin vegetation as these are of limited extent and host a number of rare species. Without conservation attention many of these habitats and communities will be lost.

6.4.3 *Invasive weed and animal pest control*

Removing or controlling aggressive environmental weeds or animal pests can be a compensatory measure. The NZ Biodiversity Strategy regards invasive introduced species which have become animal pests and weeds as a more serious threat to biodiversity than ongoing habitat loss and modification. Some weeds that have the potential to transform local wetlands are known from just one locality within the Macraes E.D. and are of very limited occurrence in Otago. There are other species that have recently arrived in the Macraes E.D. and which could become a nuisance to agriculture and biodiversity. Eradicating these species will save a large amount of biodiversity protection work into the future. Instigating a weed surveillance programme together with the capacity to remove newly arrived weed species would have benefit to protecting both biodiversity areas and agricultural areas.

Invasive animal control in the Macraes E.D. has been shown to benefit local lizard populations and there are opportunities to employ predator control to benefit other lizard populations as well as populations of birds and large invertebrates. The high cost of predator control, uncertainty of level of effectiveness and population responses of the protected fauna, and the rapid loss of benefit when predator control ceases needs to be considered.

6.4.4 *Protecting species of conservation concern*

In New Zealand, a number of plant and animal species are considered at risk of extinction. Of plants, there are 402 species which are considered Threatened (i.e. of high risk of extinction) and a further 885 are considered At Risk (de Lange et al. 2018). Many more are rare in a local context.

The Macraes E.D. is known to contain the highest diversity of rare plants of any site in New Zealand (Bibby 1997, Thorsen 2008, Figure 3). However, the known distributions of the rare species in this area reflects the location of past survey effort, including those conducted by OceanaGold around mine projects. In the Macraes E.D. are populations of 6 Nationally Critical plant species, 10 Nationally Endangered plant species, 12 Nationally Vulnerable plant species, 35 Declining plant species, 26 Naturally Uncommon plant species, and 15 Data Deficient plant species, with populations of some of these being the largest known nationally. Many of the plant species and the rarer plant communities are facing considerable threat from weed competition and exotic animals.

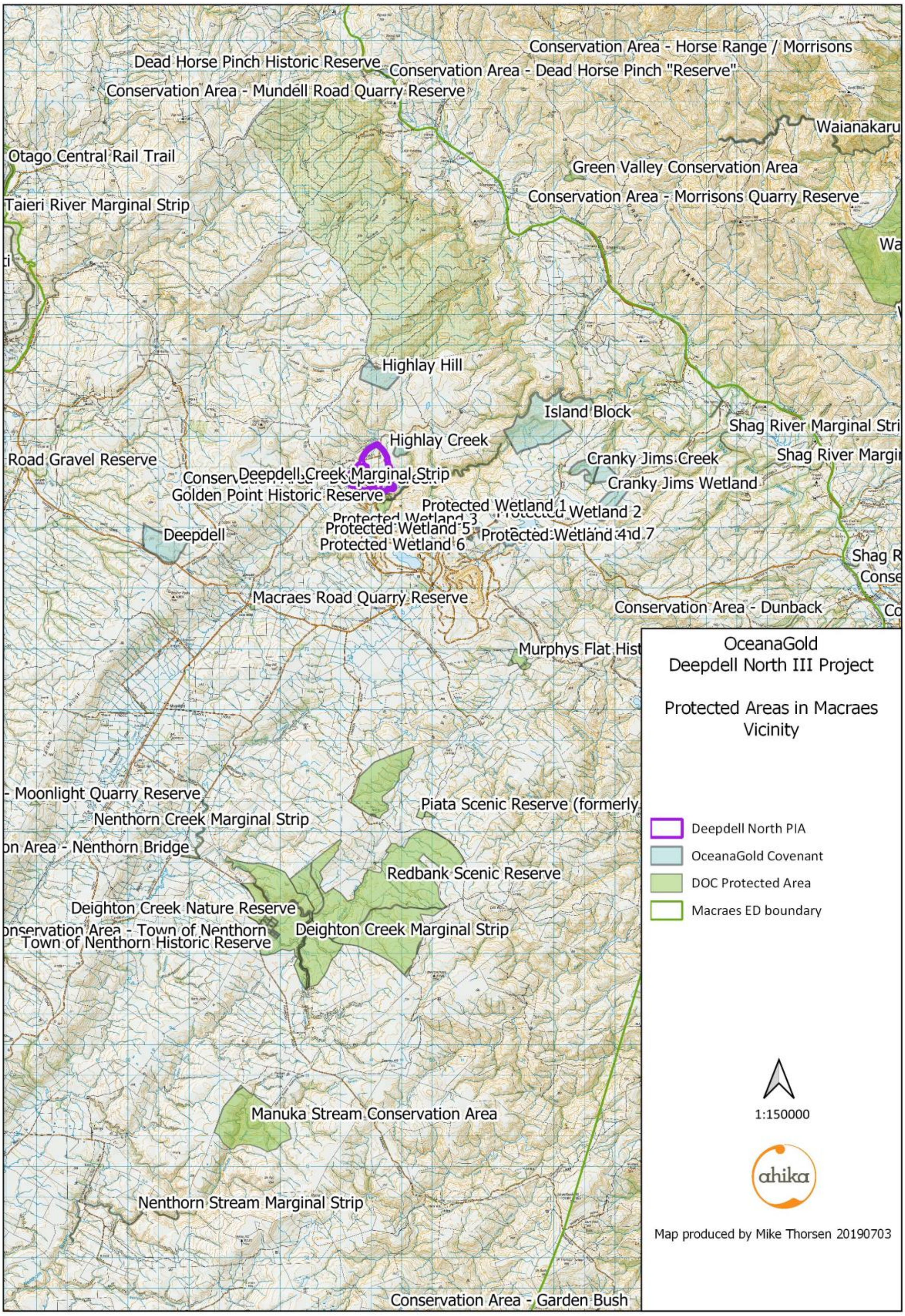

Figure 2. Location of protected areas in the Macraes vicinity.

The Macraes E.D. also contains the last wild populations of Critically Endangered grand and Otago skinks, and important populations of 3 At Risk lizard species. The invertebrate fauna of the Macraes E.D. has been poorly explored, but is known to include at least 412 indigenous species, including 2 Threatened, 6 At Risk, and 7 Data Deficient Species. It is also home to a number of indigenous freshwater fauna that are of conservation concern: the Declining freshwater crayfish *Paranephrops zealandicus* and long-finned eel *Anguilla dieffenbachii*, and the Nationally Vulnerable non-migratory roundhead galaxias *Galaxias anomalus* and Taieri flathead galaxias *Galaxias depressiceps*.

There is a large conservation programme nearby focussed on protecting the grand and Otago skink populations between Redbank and Nenthorn, and this project is also providing benefit to other lizard and bird species. However, there is currently little focus on management of the area's aquatic fauna, invertebrates, rare plants or vegetation communities beyond control of some woody weed species and pests at a few sites. The Macraes E.D. has extensive potential for plant and freshwater species-focussed conservation programmes using specific tools such as translocation, cultivation and replanting in order to enhance populations, and to protect populations through building trout barriers, or controlling weeds, browsing mammals, and pest insects.

6.4.5 *Research*

Research on topics that inform our ability to manage ecosystems or species successfully is a valuable remediation tool. Currently, there is little available research to help guide management of most of New Zealand's rare species or habitats. In the Macraes area there is an opportunity to build on past research projects (e.g. ephemeral wetlands by Johnson and Rogers (2003)), as well as build research into the adaptive management component of other compensatory activities.

6.4.6 *Environmental education and awareness*

Education and awareness on conservation issues, particularly on the importance of biodiversity and its management in a mine environment, is in line with the New Zealand Biodiversity Strategy and Action Plan and can be a valuable compensation activity when well-designed.

6.4.7 *Community conservation*

Local communities undertake a number of important biodiversity projects throughout New Zealand. All of them struggle to be financially sustainable, primarily due to the temporary nature of most funding arrangements, and this factor alone frequently leads to project failure. There are no active biodiversity conservation groups in the Macraes area, but the Landscape Connections Trust[7] is planning pest control activities in the east Otago area and the Central Otago Ecological Trust[8] runs a lizard conservation project centred on the Mokomoko Dryland Sanctuary near Alexandra. Funding of a reputable trust to provide sustainable support for the ongoing efforts of community groups and other conservation organisations in the Macraes region is an option.

6.4.1 *Biobanking*

Biobanking is the undertaking of conservation actions now, that are then used to address the effects of a future project. While there are a number of potential approaches to biobanking, we advocate for adopting an approach that encapsulates the features of a biodiversity offset, as this is conceptually simpler and the measurement metrics can be the same. In the Macraes situation undertaking any project mitigation, offsetting or compensation at a greater scale than required or in anticipation of a future project is considered a biobank. There are advantages to biobanking in that ecological gains are often realised and measurable before a project's impact occurs, giving greater certainty of a positive ecological outcome.

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[7] See http://www.beyondorokonui.org.nz/

[8] See http://www.coet.org.nz/

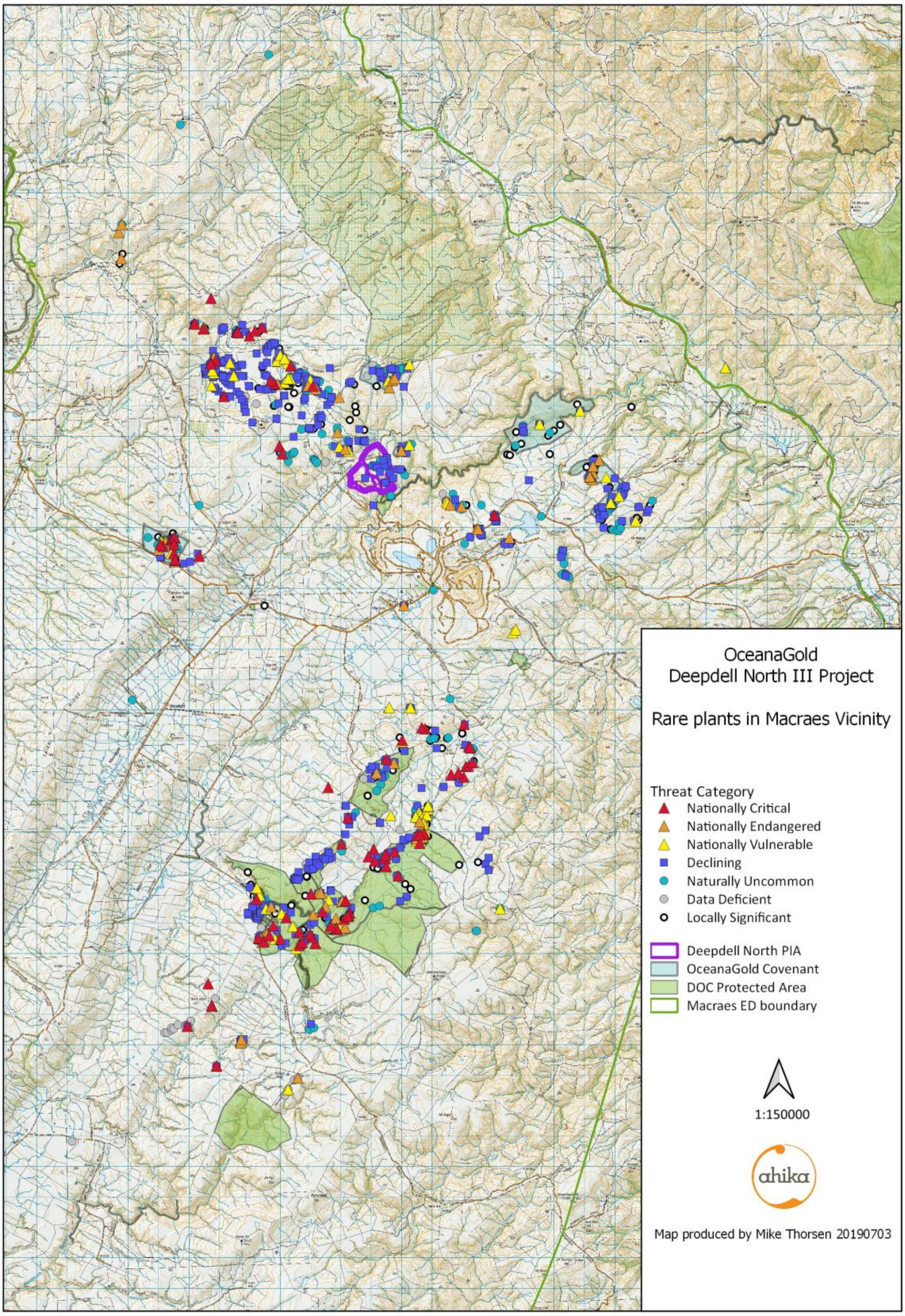

Figure 3. Locations of Threatened, At Risk and rare plant species in the vicinity of the Macraes E.D. Note, clustering of dots reflects survey effort more than actual distribution of rare plant species.

7 Quantifying the loss

Calculating the quantity and 'value' of the biodiversity likely to be lost and therefore replaced under an effects mitigation approach, such as the one used in this Impact Management Plan, is difficult. Measures that are most frequently used are often simplistic: 'like for like' (i.e. 10 *Carex tenuiculmis* plants predicted to be lost from the project site and 10 *Carex tenuiculmis* planned to be planted at a nearby proposed mitigation site), or with additional consideration given to the condition of the feature (i.e. 25 hectares of narrow-leaved tussock grassland of 1m stature and 60% ground cover at both the project site and at a nearby proposed mitigation site). The emergence of disaggregated offset calculations and replacement multipliers is increasing the accuracy of these evaluations. Calculating the value of biodiversity loss when considering a number of features, or features that are 'like for unlike', becomes even more problematic. This approach is best termed 'value for value'. The most frequently used measure (or metric) in these situations consists of combining expert opinions with cross-party negotiation in order to reach a consensus that the projected gain at the mitigation site is appropriate to the value of the ecological loss of the different features in the project site. In these types of calculations, it is important to incorporate consideration of uncertainties and the baseline condition and trend of the feature: for example, halting or slowing a declining trend is a conservation gain.

Another method is to adopt a value of land approach, in which the area of the impact is calculated and then either an equivalent area is protected or payment made at the purchase price of an equivalent area of land in that district. Similar methods have been used in previous OceanaGold projects at Macraes and Reefton.

The impact management plan should adequately address the value of the lost ecological features.

8 Preferred Approach

A range of mitigation and compensatory measures for the project's impacts on ecological features (Section 4) were evaluated against the considerations in Sections 5, 6, 7 (see Appendix 1). For the reasons explained in this evaluation, and the forecast project impacts, OceanaGold's preferred approach to addressing the Deepdell North III project's impact on ecological features is:

Avoid effects by:

1) Siting infrastructure away from areas with high ecological value wherever possible.
2) Staging deposition of rock material into WRS areas.

Remedy effects by:

3) Constructing areas of the margins of the final WRS to provide habitat for lizards.
4) Creating freshwater crayfish habitat in the western clean water drain.

Mitigate impacts by:

5) Minimising project effects of dust, noise, weeds, fire, sediment, contaminants on the surrounding area.
6) Rescuing those plant species that are of moderate or high ecological importance or that are of restricted distribution within the Macraes E.D., to safe site(s) in Ecological Enhancement Areas (EEA) (such as the nearby OceanaGold covenants).

As there are forecast to be residual adverse effects of the project on the site's biodiversity after implementation of the Avoid, Remedy and Mitigate (see Section 9.4), an offset will be provided to address remaining significant residual adverse effects.

Offset all residual effects by:

7) Creating a multi-outcome offset EEA at nearby sites with similar or better ecological values and provide funds for the ecological management of this area.
8)

Compensate for final residual adverse effects by:

9) Planting of freshwater crayfish habitat along the margin of the Camp Creek reservoir.

OceanaGold has overall responsibility for undertaking this work as described in Section 9.

9 Ecology Impact Management Plan

The following are the activities that Oceana Gold (New Zealand) Limited propose to undertake as recompense for the predicted impact on the area's ecological features resulting from implementation of the Deepdell North III project. Task descriptors and responsibilities are provided in Appendix 2. OceanaGold has overall responsibility for undertaking this work as described in this Impact Management Plan.

9.1 Avoiding impact

The opportunity to avoid ecological features in the Deepdell North III project is limited by operational necessities to placement and re-configuring the waste rock stack (WRS) margins and re-routing access routes.

9.1.1 *Siting of WRS and infrastructure*

Three alternative locations for part of the WRS were proposed on 15 November 2017 (Figure 4). None of the options would avoid areas of significant indigenous vegetation and habitats of indigenous fauna. Of these configurations Option A has the least impact on ecological features but is not considered practicable due to other effects on the environment, especially from noise. Options B and C have similar impact on ecological features with higher impact on plants in Option B and higher impact on waterways in Option C. The total area of disturbance is larger in Option C. Because of this a fourth option was developed (the current design) which is sited predominantly on pasture and avoids the effects of the 3 previous options, but has an impact on a Critically Endangered Naturally Uncommon ecosystem, some areas of indigenous vegetation that is habitat to plants and fauna (including some rare species). It is thought that the effects on these ecological features can be managed through implementation of this Impact Management Plan.

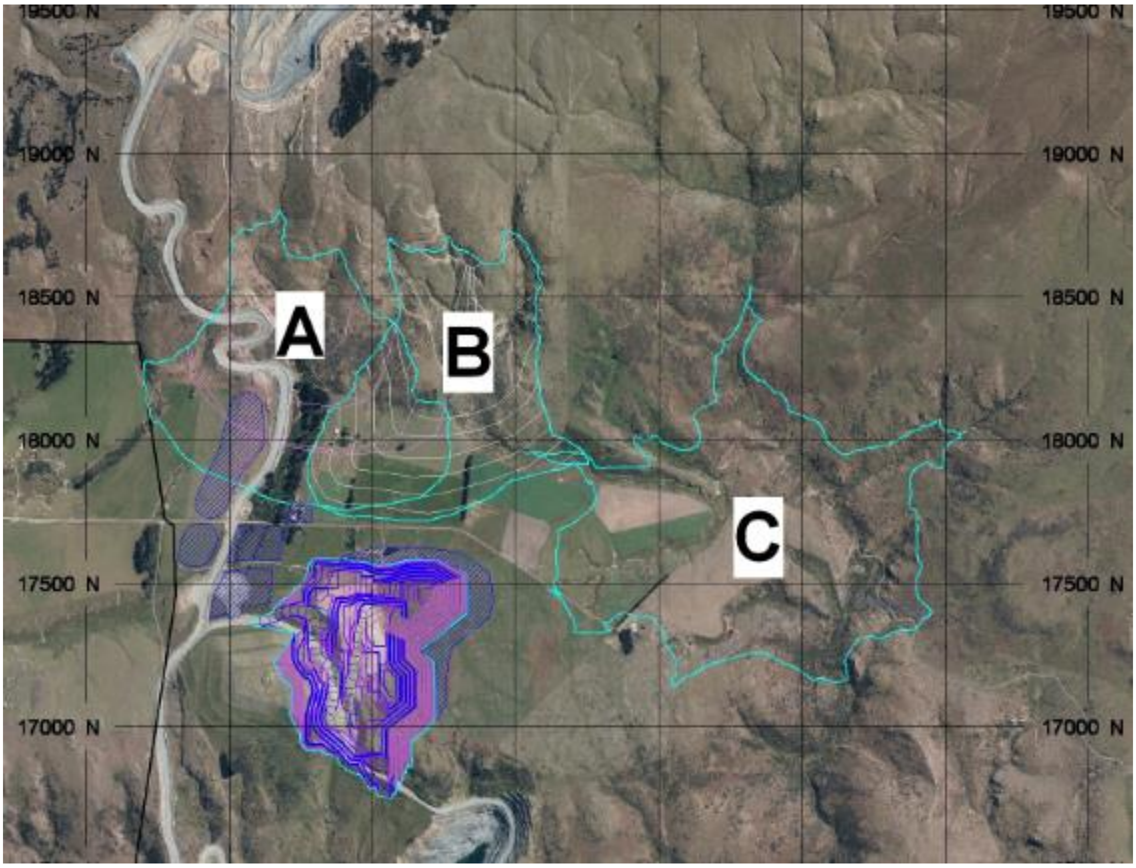

Figure 4. Three original options (A, B, C) considered for siting part of the WRS of the Deepdell North III project.

9.1.2 *Staging WRS construction*

The WRS will be constructed in sequential stages to delay impacts on higher biodiversity areas. The first stage will be infilling of the original Deepdell South pit backfill WRS, the second stage will be deposition of material on the flat areas of the Horse Flat. This action avoids impacts on significant ecological features if the project is halted before completion.

9.1.3 *Isolating high ecological value areas in the Buffer*

Areas in the buffer area with higher ecological values will be isolated from unintended effects (such as vehicle movements) by clearly delineating in maps provided to mine operations staff and on the ground by using well-maintained flagging tape, temporary fencing and signage.

9.2 Remedy impact

The opportunities to remedy this project's impact are limited by the technical challenges associated with rehabilitating mine workings in this location to a functioning natural ecological state, and the wish of the local community that the mine is rehabilitated to farming pasture. However, there is opportunity to undertake some rehabilitation on the WRS margin. Opportunity to utilise the post-excavation Deepdell North III pit lake is limited by the future grazing of this site, and so is not pursued here.

9.2.1 *WRS margin and Pit rehabilitation*

There is some opportunity to rehabilitate the WRS margin and other surfaces such as roadways to provide habitat for lizards by depositing larger aggregate and boulders in identified areas under guidance of the expert working on a similar project in the Coronation North area. These rocky areas will be naturally colonised by lizards from the surrounding area, and the population density at these sites should increase as habitat quality increases with plant growth, particularly if vegetation regrowth includes fruit-bearing plants. It is not planned to monitor lizard colonisation of these sites as previous work has shown that similar created rock habitats such as other waste rock stacks and the lizard rock piles are colonised by lizard species (EcoGecko 2013, OceanaGold unpub. data).

Undertaking this action will provide benefit in 1) creating habitat that will be occupied by populations of the skinks *Oligosoma maccanni* (clade 4 genotype), *Oligosoma polychroma* (clade 5 genotype), and the Declining gecko *Woodworthia* "Otago large", 2) create a safer refuge for these lizard populations by decreasing the hunting efficiency of cats in these areas.

The rehabilitated Deepdell North III WRS is expected to produce replacement habitat of very similar nature to the impacted existing Deepdell WRS which is utilised by one pair of Declining pipits and an estimated six Not Threatened spur-winged plover.

Likewise, the new pit lake in the Deepdell North III pit will produce replacement habitat similar to that occupied by the breeding colony of black-backed gulls in the backfilled existing Deepdell North pit.

9.2.2 *Rehabilitation of the western cleanwater drain*

The western cleanwater drain will be constructed to provide appropriate habitat for freshwater crayfish by including schist flakes on a clay drain bed and with riparian planting of overhanging indigenous plants.

9.3 Mitigate impact

The opportunities to minimise the impact of this project are controls on dust, noise, disturbance, sediment, contaminant suppression, weed surveillance, fire response and rescue (salvage) of ecological features.

9.3.1 *Dust suppression*

Dust-fall can be a problem for plants as it inhibits their photosynthetic capacity. Though none of the species present in the PIA is thought to be particularly susceptible to dust, supressing dust that is created during mine activities is a standard operating procedure and will minimise this effect.

9.3.2 *Noise and minimising disturbance*

Blasting and operating heavy machinery creates considerable noise and disturbance which is likely to create a negative reaction in animal species. Though this reaction will vary, most of the bird species recorded at this site appear to acclimate to regular disturbance. Minimising noise is a standard operating procedure and will minimise this effect, though is likely that harrier hawks will avoid hunting the nearby surrounding area, and that paradise shelducks will not nest within sight of the project.

9.3.3 *Weed surveillance*

Importation of new weed species into the area during mine operations could, depending on the species, have a huge impact on the area's biodiversity. To minimise this risk an inspection of the area around mine operations for new weed species every two years by a qualified ecologist will alleviate this risk. New environmental weeds that are discovered in the area will be subject to OceanaGold's annual environmental weed control operation.

9.3.4 *Fire response*

The Macraes area is usually very dry and any fires that do start have the potential to cover large areas and harm large areas of natural vegetation. A site fire avoidance protocol and rapid response to any suspected fires is a standard operating procedure and will minimise this effect.

9.3.5 *Sediment Control*

Mining disturbs land, removes vegetation and soil cover, and so increases the risk of fine sediment discharges to watercourses. Sediment control measures are routinely employed by OceanaGold at Macraes Mine and will continue to be applied to minimise this effect. Specific efforts on sediment control in the Deepdell North III development are contained in the Erosion and Sediment Control Report (EGL, 2019).

9.3.6 *Manage accidental contaminants spills*

The presence of construction machinery in and around waterways presents a risk of contaminants entering watercourses with potential to harm aquatic life. OceanaGold will continue to address this effect by operating an appropriate on-site contaminant management plan.

9.3.7 *Protect against nuisance weed/algae introduction into waterways*

Machinery and personnel involved in construction can potentially transfer nuisance weeds/algae to local watercourses. OceanaGold complies with notices and guidelines issued by Biosecurity New Zealand regarding nuisance weeds/algae and will continue this practice.

9.3.8 *Rescue of ecological features*

Some of the higher-importance ecological features identified in Section 4 and in Appendix 1 will be rescued by a suitably experienced operator removing them (or propagating parts of them such as seeds or cuttings) following OceanaGold's Plant Propagation, Translocation and Management Procedure (updated to include the species listed below) and establishing them at EEA sites with existing suitable habitat (for instance DOC and OceanaGold protected areas) (Figure 2). The plants will receive post-introduction care where necessary including watering and suppression of competing vegetation for two years. The success of moving these species will be monitored by counting number of plants at the recipient site on an annual basis for three years. Rescue is proposed for the following species:

1) The Locally Uncommon shrub *Melicope simplex* from the eleven trees in the WRS to twenty individuals at one site in the nearby OceanaGold Highlay Creek Shrubland Covenant to create a new population there.

2) The Naturally Uncommon shrub *Myrsine divaricata* from the two individuals in the WRS to 10 individuals at one site in the nearby OceanaGold Highlay Creek Shrubland Covenant to create a new population adjacent to an existing population.

These two species have been selected on the basis of their importance in the local situation, and their probable amenity to being rescued, whilst taking into account the extent of the project impact upon them that was identified in Section 4. The recipient sites have been chosen on the basis of their proximity to the project area and the availability of suitable habitat there. As the overall project impact on these two species is expected to be Very Low, these actions are considered discretionary.

Undertaking this action will provide benefit in 1) preventing a reduction in population density of these two species in this area, and 2) removing these two species to a safer environment within nearby protected areas to create new populations.

9.4 Residual adverse effects subsequent to Avoid, Remedy and Minimise actions

The residual adverse effects remaining subsequent to implementation of Avoid, Remedy and Minimise, are detailed here:

Biodiversity Class	Biodiversity Type	Biodiversity Component	Ecological Importance of Feature	Magnitude of Project Impact on Feature Locally	Magnitude of Project Impact on Feature Nationally	Overall Project Effect on Feature	Overall Loss	Loss Unit
Bird	**Community**	**Ecological function**	Moderate	Moderate	Negligible	Very Low		
Bird	**Species**	**Grey teal**	Low	Moderate	Negligible	Very Low	6	individuals
Bird	**Species**	**Welcome swallow**	Low	Moderate	Negligible	Very Low	5	individuals
Flora	**Community**	**Ephemeral Wetland**	High	High	Medium	High	1.8383	Hectares
Flora	**Community**	**Seepage**	High	Medium	Low	Low	0.0651	Hectares
Flora	**Community**	**Low producing grassland**	Moderate	Medium	Low	Low	49.46519	Hectares
Flora	**Community**	**Seasonal gully drainage**	Low	Medium	Low	Very Low	2.50069	Hectares
Flora	**Community**	**Shrublands**	Moderate	Low	Negligible	Very Low	4.09766	Hectares
Flora	**Species**	**Carmichaelia crassicaulis Hook.f. subsp. crassicaulis**	High	Very Low	Negligible	Very Low	2.75	individuals
Flora	**Species**	**Carmichaelia petriei Kirk**	High	Low	Negligible	Very Low	7.5	individuals
Flora	**Species**	**Discaria toumatou Raoul**	High	Negligible	Negligible	Very Low	3.803212	Hectares
Flora	**Species**	**Juncus pusillus Buchenau**	Moderate	Medium	Low	Very Low	1	m2
Flora	**Species**	**Leptinella pusilla Hook.f.**	High	Low	Negligible	Very Low	1	m2
Flora	**Species**	**Lobelia ionantha Heenan**	High	Medium	Low	Low	0.561	m2
Flora	**Species**	**Rytidosperma buchananii (Hook.f.) Connor & Edgar**	Low	Very Low	Negligible	Very Low	1	individuals
Flora	**Species**	**Carex resectans Cheeseman**	Moderate	Medium	Low	Low	1.6	m2

Flora	**Species**	**Anthosachne falcis (Connor) Barkworth & S.W.L.Jacobs**	High	Medium	Low	Low	55	individuals
Flora	**Species**	**Carex subtilis K.A.Ford**	Moderate	Medium	Negligible	Very Low	1	individuals
Flora	**Species**	**Juncus distegus Edgar**	Moderate	Medium	Low	Low	369	m2
Flora	**Species**	**Juncus distegus Edgar**	Moderate	Medium	Low	Low	56	individuals
Invertebrates	**Community**	**Ecological function**	Moderate	Medium	Low	Low	?	?

9.5 Offsetting

As there are forecast to be residual adverse effects of the project on the sites biodiversity after implementation of the Avoid, Remedy and Mitigate (see Section 9.4), an offset as described under the pORPS will be provided to address remaining significant adverse effects. This offset will have several components: an averted loss multiuse offset in an Ecological Enhancement Area (EEA) on Redbank Station to address the impact on shrublands, low producing grasslands and the seepage wetland, and an ephemeral wetland enhancement offset and supporting research project at sites in another EEA in the south of the Ecological District to address the impact on ephemeral wetlands. There are local constraints on how an offset can be realised in the Macraes situation (see comments in Sections 6.4 and 6.4.1) and these have been considered in the design of the offset package. The implementation and management of the EEA sites will be documented in an EEA Management Plan (sometimes also termed an Offset Plan).

9.5.1 *Offset design*

This offset is designed to fulfil an offset as prescribed in the pORPS (and including Environment Court decision NZEnvC41 of 15 March 2019)[9]: The offset achieves no net loss and preferably a net gain in indigenous biological diversity;

- The offset ensures there is no loss of individuals of rare or vulnerable species as defined in reports published prior to 14 January 2019 under the New Zealand Threat Classification System (“NZTCS”);
- The offset is undertaken where it will result in the best ecological outcome, preferably:
    - Close to the location of development; or
    - Within the same ecological district or coastal marine biogeographic region;
- The offset is applied so that the ecological values being achieved are the same or similar to those being lost;
- The positive ecological outcomes of the offset last at least as long as the impact of the activity, preferably in perpetuity;
- The offset will achieve biological diversity outcomes beyond results that would have occurred if the offset was not proposed; and
- The delay between the loss of biological diversity through the proposal and the gain or maturation of the offset’s biological diversity outcomes is minimised.

[9] Note the offset described in the pORPS does not require use of any offset guidance such as that provided by BBOP, DOC or in recent guidance to Councils.

The disaggregated accounting model[10] was used to calculate the extent of works required within the EAAs to achieve a state of No Net Loss of biodiversity (NNL) using the March 2015 user manual and spreadsheets.

9.5.2 *Site selection*

The upper Waikouaiti River North Branch offset site (Redbank EEA) (Figure 5) has been chosen on the basis of discussions with both landowners who identify it as a site of low farming usefulness and a site examination that shows the site has considerable ecological value in terms of fauna, vegetation communities and as habitat for rare species. This site is part of a farming environment and has no protections beyond that afforded by regional and district plans and therefore ongoing damage to some ecological features is expected and the tussock grassland and shrubland could be actively managed to enhance livestock grazing. Some of the ecological features present are restricted to areas where stock are not able to access.

[10] Maseyk, F.J.F; Barea, L.T; Stephens, R.T.T; Possingham, H.P; Dutson, G; Maron, M. 2016. A disaggregated biodiversity accounting model to improve estimation of ecological equivalency and no net loss. Biological Conservation 204: 322-332.

Figure 5. Location of Redbank EEA.

9.5.3 *Redbank EEA*

A covenant of 126 ha will be established under the Conservation Act in the upper Waikouaiti River North Branch (Figure 1Figure 5) which contains biodiversity that is of similar character to that being lost, but of better quality and with other inherent ecological values. Sensitive parts of this covenanted area will be fenced to exclude stock and limits will be placed on the type of stocking that can occur in the covenanted area and on any activities that could result in damage to the soils or to vegetation of high ecological importance. This land will be managed using the income from a fund held by OceanaGold until cessation of mining when the fund will be ceded to another authority.

Important components of this component of the offset are:

- Have a legal protection.
- Will be farmed as appropriate with the objective of protecting the important biodiversity features.

- Be of sufficient size to compensate for uncertainties in ecological outcomes associated with retaining farming in the covenant.
- Satisfy the offset criteria detailed in the pORPS.
- Will have a fund to support the management of the covenant on an ongoing basis.
- Will involve the farming community together with DOC and Councils in the offset design and placement.
- Will incorporate the Science and Traditional Knowledge offset principle by including farming community knowledge of biodiversity management in the Macraes Area.
- Will incorporate the Equity offset principle by sharing the risks and benefits between the farming community, DOC and Councils.
- Be managed with ecological oversight.
- Will result in a Biobank of additional ecological gains that will be used to address a future project's ecological impact.

This offset will also address the impact on the Declining matagouri, desert broom *Carmichaelia petriei*, skinks *Oligosoma inconspicuum* and *Oligosoma polychroma*, gecko *Woodworthia* "Otago/Southland large", Naturally Uncommon grass *Anthosachne falcis*, some components of the invertebrate and bird communities and on McCann's skink through protecting areas inhabited by these species.

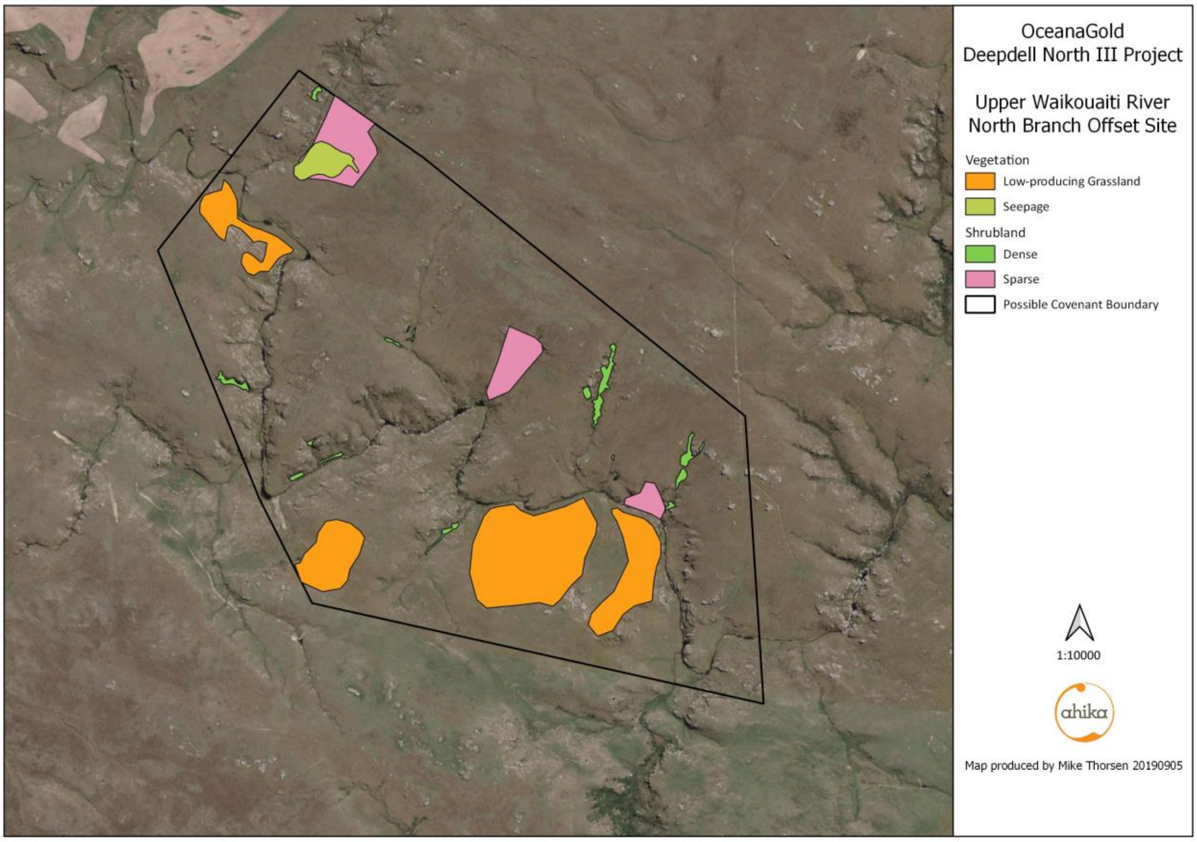

Figure 6. Location off plant community offset sites in Redbank EEA

Shrubland Component

Offsetting the loss of an estimated 3.73 ha of shrubland from the Deepdell North III site will be through including an equivalent plant community of better ecological integrity in the Redbank EEA (Figure 6). The offset site has a higher diversity of shrub species (22 species), than in the impacted shrubland (15 species), is ecologically more intact with fewer exotic species and denser canopy, and is of a similar nature (though with some species that reflect a higher elevation and damper area). Within the offset site there is currently 4.23 ha of equivalent shrubland. This offset will involve planting of 5 ha of new shrubland in the offset area that is comprised of at least 18 different shrub species and reaching 2 m in height and 75% canopy cover within 10 to 20 years, respectively and keeping these free of exotic shrub species for 10 years. This produces a Net Present Biodiversity Value of 0.29.

Seepage Wetland Component

Offsetting the impact resulting in the loss of 0.07 ha of seepage wetland will be through including an equivalent plant community of larger size and managing this to better ecological integrity in the Redbank EEA (Figure 6). This offset is considered to have the elements of both an averted loss offset and an improved condition offset. The averted loss component of the offset is difficult to calculate as there is no available data on loss of these ecosystems in the area, but there have been high reported loss of wetlands from Southland and they are classified as Endangered based on their estimated rate of decline caused by weed invasion of over ≥70% of their extent nationally. This offset will involve using weed control to achieve a 20% improvement in indigenous species dominance within the 0.82 ha seepage wetland at the offset site by 10 years. This produces a Net Present Biodiversity Value of 0.01, but additional to NNL are the gains considered to have been achieved through the averted loss portion of the offset. Protecting this seepage wetland against the background of 70% loss (over an estimated 30 years) would increase the Present Biodiversity Value by c. 70% to 0.017. The impact on the Naturally Uncommon rush *Juncus distegus* will also be addressed through this offset by creating conditions in which this species can flourish, supplemented by planting of 50 individuals.

Low-producing grassland Component

Offsetting the impact resulting in the loss of an estimated 49.47 ha of low producing grassland will be through including 24.55 ha of an equivalent plant community and managing this to better ecological integrity in the Redbank EEA (Figure 6). This offset is considered to be an averted loss offset as this vegetation community decreased in the Macraes E.D. by 79.3% between 2008 and 2012 based on change in the NZ Land Cover Database. It is likely this rate of loss is continuing. Based on this rate of loss, NNL will have been achieved within 5 years of protection of the habitat (

Table 1). This offset would be realised on establishment of the covenant with appropriate safeguards against invasion of the habitat by woody weed species and changes to land management (particularly guarding against soil disturbance). The impact on the Declining grass *Anthosachne falcis* (which is present in the EEA) will also be addressed through this offset by creating conditions in which this species can flourish.

Year	Area of habitat	
0	49.47	Impacted extent
1	39.66	

2	31.80	
3	25.50	NNL achieved
4	20.44	
5	16.39	

Table 1. Predicted extent of unprotected low-producing grassland habitat over time based on a 19.8% annual rate of loss

9.5.4 *Ephemeral wetland EEA*

Offsetting the impact resulting in the loss of 1.84 ha of ephemeral wetlands will be through an improved-condition offset with the improvement work informed by a research project investigating ephemeral wetland form, function and threats. This offset will involve using weed control to produce a 25% improvement in indigenous vegetation cover at ephemeral wetlands at 5-7 sites totalling at least 2 ha and an improvement in indigenous plant diversity at each site to at least 11 indigenous plant species characteristic of Macraes ephemeral wetlands by 10 years. . This produces a Net Present Biodiversity Value of 0.31 and NNL is achieved by year 10. The 2 ha target of managed ephemeral wetland is double the 1 ha required to reach NNL, but compensates for current uncertainties in ecological state of these systems and lack of proven management tools. These figures are based on the research project addressing deficiencies in knowledge on the form, function, threats and management of ephemeral wetlands. This research project will establish the physical profiles and subsurface nature of 10 selected ephemeral wetlands, documenting their hydrological profile over time and measuring changes in their plant communities 3-4 times a year over 5 years. The threat that ephemeral wetlands face will be established by revisiting 20 previously surveyed sites and documenting their current condition, quantifying surrounding land use of all mapped ephemeral wetlands and visiting a random selection of 50 ephemeral wetlands to describe their current condition. The impact on the Declining wetland herb *Lobelia ionantha* and Locally Uncommon sedge *Carex resectans* will also be addressed through including these species as two of the 11 additional species.

9.5.5 *EEA Management Plans*

The implementation and management of each of the EEA's will be documented in a management plan (EEAMP). The EEAMP will form a part of a broader project Ecological Management Plan (which will include on-site works to avoid, remedy, and mitigate adverse effects).

The EEAMP will include:

- a description of the offset, the calculation basis, locations and management activities at which enhancements will be generated;
- securing the ability to undertake enhancement works within management sites by way of landowner agreements (e.g. covenants) or acquisitions;
- the technical detail of the offset works;
- the financial costs of site management into bond calculations or other similar instruments as required by Council that secure financial delivery of biodiversity enhancements;
- a monitoring programme to assess the degree to which enhancement targets are being achieved and the ability to adjust biodiversity management to ensure that gains are achieved and maintained for the long term;
- the roles and responsibilities of those carrying out the work, and the governance and management structures relating to the operation of the enhancement site(s); and
- reporting the results of monitoring results and a process for undertaking actions if enhancement targets are not being achieved as anticipated.

9.6 Biobanking

The proposed covenant in the upper Waikouaiti River North Branch includes 73 ha of narrow-leaved tussock grassland that is additional to that required under this Impact Mitigation Plan. This narrow-leaved tussock grassland is considered a biobank for use when appropriate to address the impact of a future OceanaGold project. The baseline ecological condition and change in condition over time will be measured using vegetation plots. The proposed also provides habitat to an additional 17 plant species of conservation concern which are also considered biobanked (together with any additional species found during future surveys) and their population status will be monitored over time. The reptile, bird and invertebrate communities that inhabit the additional areas are also considered biobanked and their baseline and condition over time.

The ecological condition of these additional communities will be measured as for the offset areas and the biobank will be adjusted to reflect any changes (beneficial or detrimental) in ecological condition.

9.7 Ecological compensation

As there are expected to be no significant residual adverse effects following implementation of the Avoid, Remedy, Mitigate and Offset options, no activities are proposed as ecological compensation.

9.8 Nil actions

No mitigatory or compensatory activities are proposed for the two individuals of Declining coral broom and 1 m^2 of Declining *Juncus pusillus*, one individual of the Declining grass *Rytidosperma buchananii*, one patch of the Naturally Uncommon hookgrass *Carex subtilis,* Not Threatened grey teal, Not Threatened welcome swallow, seasonal gully drainage plant community, as the impact of the project on these ecological features is predicted to be Very Low.

9.8.1 *Adequacy of Impact Management Activities*

10 Evaluation of adequacy of plan

These actions will, if implemented correctly, fully address all non-minor project effects excepting some minor impacts on individuals of some rare plants and common indigenous bird species, or mostly exotic plant-dominated plant communities noted above. It is also considered that benefit of the offset covenant containing a higher quantity of the Macraes biodiversity more than compensates for the impact of the Deepdell North III project on these features. It is considered that overall this Impact Management Plan will maintain the biodiversity in the local area (see Appendix 1). This assessment is based on the actions within the Impact Management Plan (Section 9) being successful.

It is also considered the proposed approach meets the Impact Management principles set out in Section 5, noting in particular that it is not practicable to maintain the significant nature of the biological diversity present at the Deepdell North III project site by avoiding, remedying or mitigating effects, and the proposed offsetting meets the criteria set out in Section 5 for when offsetting can be considered as an appropriate management mechanism.

As a result of the proposed management measures, including the proposed environmental compensation, residual adverse effects on ecological features will be very low, and the affected values will be protected in the local area.

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12 Appendix 1. Impact Management Assessment

See file “DeepdellNorth_AffectedEcolFeatures_20190613.xlsx”

E

APPENDIX E

Water Quality Effects Assessment

Oceana Gold New Zealand Limited

Deepdell North Stage III Project
Receiving Water Quality Analysis

November 2019

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1. Introduction

1.1 Introduction

Oceana Gold New Zealand Limited (OGNZL) are planning to expand the Deepdell North pit and construct a new waste rock stack (WRS) within the Deepdell catchment at the Macraes mine site. Extension of the pit and development of the new WRS is termed the Deepdell North Stage III project.

The Macraes mine site has been operating since 1990 and consists of a number of open pits, the Fraser underground mine, tailings storage facilities (TSF's), ore processing facilities and several WRS's. A plan of the mine site with the new project highlighted, is included as Figure 1.

The proposed Deepdell East WRS is needed for waste rock coming out of the expansion of the Deepdell North pit. The WRS will take an estimated 2 years to construct.

GHD Limited (GHD) was commissioned to assess whether introduction of this new WRS has the potential to cause non-compliance issues with existing downstream water quality resource consent conditions (refer 2.3.1), both during operation and post closure.

GHD developed a site water balance model for OGNZL in 2018 to allow the company to test the impact of future mine development on downstream water quality. This report provides a description of the water balance model and the model results associated with introducing the proposed Deepdell North Stage III Project on downstream receiving water quality.

1.2 Project description

OGNZL provided a project description for the Deepdell North Stage III Project and this is reproduced in the following sections. The project location in relation to the mine site is shown in Figure 1 and a more detailed layout is shown in Figure 2.

1.2.1 Open pit excavation

The planned pit extension is described as follows:

a. Pit footprint 38ha, comprising 18.7ha of disturbed previously mined areas and 19.6ha of proposed new disturbance with potential to expand if upcoming exploration is successful.

b. Quantities: Ore 3.5Mt, Backfill waste 9.4Mt, in-situ oxide waste (brown rock) 2.4Mt, in-situ fresh waste 41.5Mt. Total movement 57Mt.

c. Haul roads 30m wide. Roads within pit footprint only.

d. The top of the pit excavation is at about 520mRL and the base of the pit is at 370mRL, making the total pit depth 150m.

e. Water management during operations will require pumping of stormwater runoff (primarily) out of the pit and into the existing drain to the Deepdell North Silt Pond. This pond overflows to the Deepdell Creek.

f. At closure, the pit lake is expected to flood and eventually drain out of the lowest point to the south.

g. Ancillary infrastructure associated with the open pit (park-up areas, smoko and ablutions, portable fuel tank etc.) will be located immediately west of the pit in the same areas previously used for these purposes.

1.2.2 Waste rock disposal – Deepdell East WRS.

The WRS development includes:

a. Backfill of the existing Deepdell South Pit (13.2 ha)

b. Extending north from Deepdell South Pit to beyond Horse Flat Road covering a total area of 70.8 ha of which 57.6 ha will be new disturbance.

c. Storage quantity 21.6 Mm^3 to 540 mRL (current design height) but has the potential to be constructed to 580 mRL.

d. A short haul road is required between the Deepdell North Pit and the WRS.

e. No additional infrastructure will be required.

1.2.3 Mining method & equipment

It is proposed to use the same methods and equipment that are applied to existing operations. Operations will run 24/7 using two digging units. Peak production will load 67,000t / shift (380 loads / shift & peak of 42 loads /hour).

1.2.4 Stockpiles

Stockpiles for rehabilitation materials are to be formed along the Coronation Haul Road in currently disturbed areas and adjacent to the pit, to the north east.

1.2.5 Roads

Horse Flat Road will be permanently moved to the north due to the construction of the WRS. The realignment of this road will involve the installation of at least one culvert.

1.2.6 Project closure

Closure works will include:

a. Pit: Not backfilled - where possible (i.e. rock is soft or within existing backfill) the excavation levels above the final lake level will be shaped to provide aesthetically pleasing and suitable areas for vegetation establishment.

b. Surface and ground water flow to be directed into the pit void to create a lake. This lake to drain as per notes above.

c. Waste disposal. The final landuse will be pastoral, with slopes to be dozed down to a 3H:1V slope and rehabilitated back into pasture using standard site techniques. Note that this will substantially soften the visual amenity from the Golden Point historic reserve.

d. Site establishment areas and haul roads will be rehabilitated using standard site techniques.

1.2.7 Alternatives considered

Multiple options have been considered by OGNZL for the WRS location. This has included:

a. North west of the proposed pit, against Taieri Ridge and adjacent to the current Coronation Haul Road.

b. Immediately north of the proposed pit, against the Taieri Ridge, also known as the Horse Flat WRS.

1.2.8 Project timeline

The current OGNZL schedule sees these major project milestones:

- Site establishment and first overburden mining: October 2020
- First ore: November 2020
- Mining finished: November 2022

1.3 Limitations

This report: has been prepared by GHD for OGNZL and may only be used and relied on by OGNZL for the purpose agreed between GHD and OGNZL. GHD otherwise disclaims responsibility to any person other than OGNZL arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared. The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report.

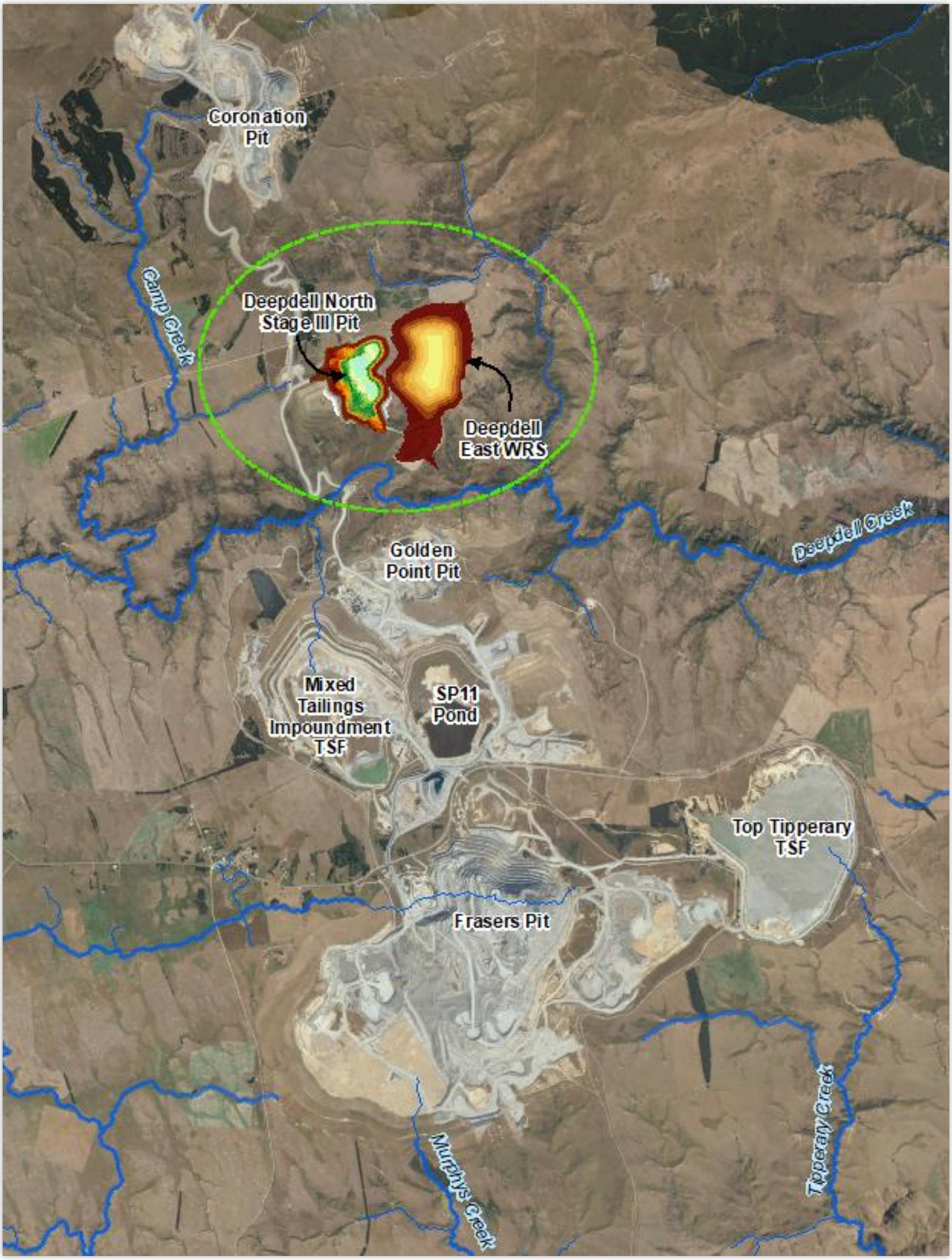


Figure 1 Deepdell North Stage III project location plan

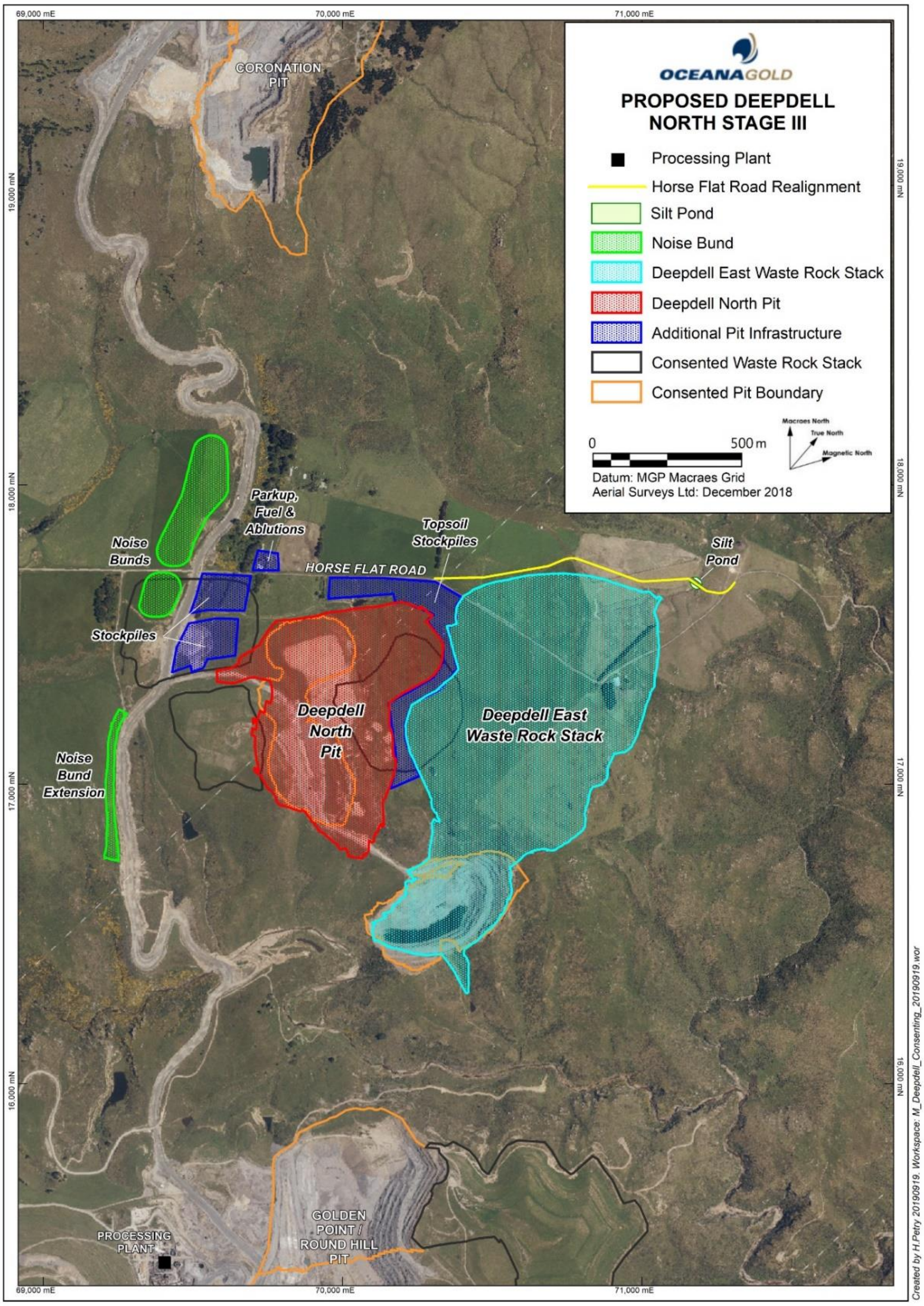


Figure 2 Deepdell North Stage III Project

2. Receiving Waters

2.1 Overview

The Deepdell North Stage III project is located within the Shag River/Waihemo catchment as shown below in Figure 3. The river flows in a south-easterly direction and enters the ocean close to Matakaea. The catchment consists primarily of agriculture and forestry.

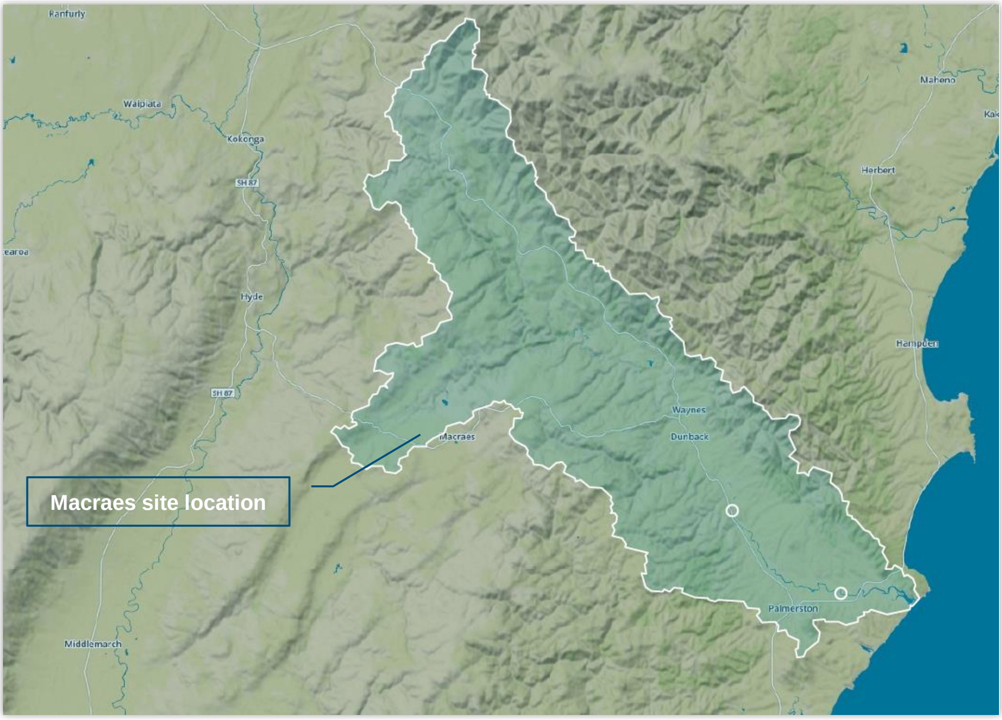


Figure reproduced from LAWA.org.nz

Figure 3 Shag-Waihemo catchment

Discharges from the site ultimately reach the Shag River via a number of tributaries including Deepdell Creek. Figure 4 shows the streams that drain the site and the water quality monitoring sites referenced in this report.

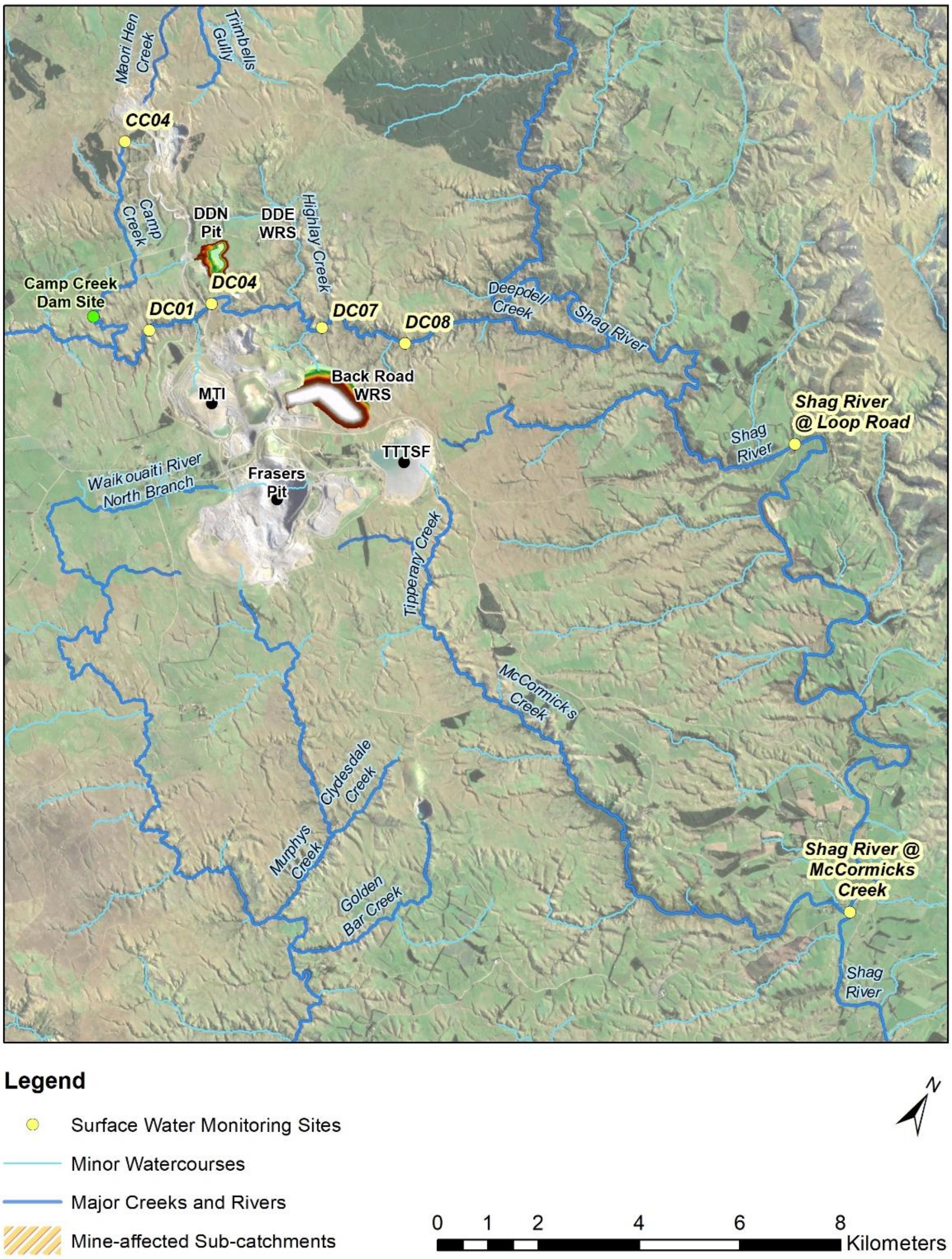


Figure 4 Macraes mine drainage system and monitoring locations

For the Deepdell North III project the relevant tributaries are the Deepdell Creek and its tributary Highlay Creek. The Highlay Creek covers a catchment of approximately 770 ha.

2.2 Hydrology

2.2.1 Deepdell Creek

The Deepdell Creek is characterised by extended periods of low flow, particularly through summer months. Flow records show some occasions of no visible surface flow. Flood events are generally of a short duration. Highlay Creek is also ephemeral with periods through the summer of no visible flow.

2.2.2 Shag River – The Grange

The Shag River drains a catchment of approximately 319 km^2 upstream from the Grange flow monitoring station, which is operated by the Otago Regional Council (ORC). The Grange is located downstream from the water quality compliance monitoring point at Loop Road and upstream from the water quality compliance monitoring point at McCormicks. Unlike Deepdell Creek the Shag River always has flow.

2.2.3 Flow gauges

Synthetic river and stream flow data has been derived for this study using a calibrated Australian Water Balance Model (AWBM) (Boughton 2004[1]). This model determines catchment runoff based on recent daily rainfall and evaporation records. This approach aligns the hydrological behaviour of the model inputs.

The AWBM model was calibrated to Deepdell Creek and Shag River flow data measured at the DC04 and Grange gauges between 31/05/2011 and 30/11/2017; the Shag River gauge and Deepdell Creek gauge has additional coverage extending into 2018 and as far back as October 1989. The coincident flow record is shown in Figure 5 and key metrics for the flow gauges are included in Table 1. Figure 6 shows the specific flow correlation between Deepdell Creek DC04 and Shag River catchments for the available datasets.

There is no flow gauging in the Highlay Creek, hence flow estimates have been derived based on a "pro rata" approach for catchment areas with the flow gauge at DC04.

Table 1 Flow gauge details

Metric	Highlay Creek at Deepdell confluence (Inferred)	Deepdell Creek at DC04	Shag at the Grange
Catchment Area (km^2)	7.7	40.8	319
95th percentile flow (l/s)	0.7	3.5	101
50th percentile flow (l/s)	5.7	30	560
Mean Annual minimum flow (7 day)	0.8	4	164
Minimum Flow	0	0	21

[1] Boughton, W. 2004. The Australian water balance model, *Environmental Modelling & Software*. 19(10), 943-956.

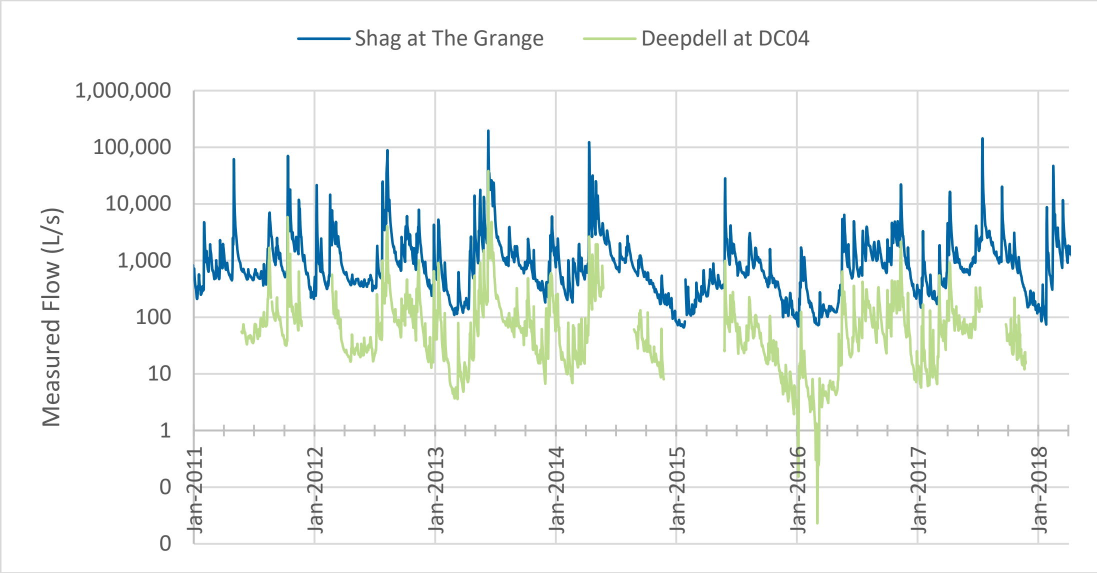


Figure 5 Flow record comparison for Shag River and Deepdell Creek

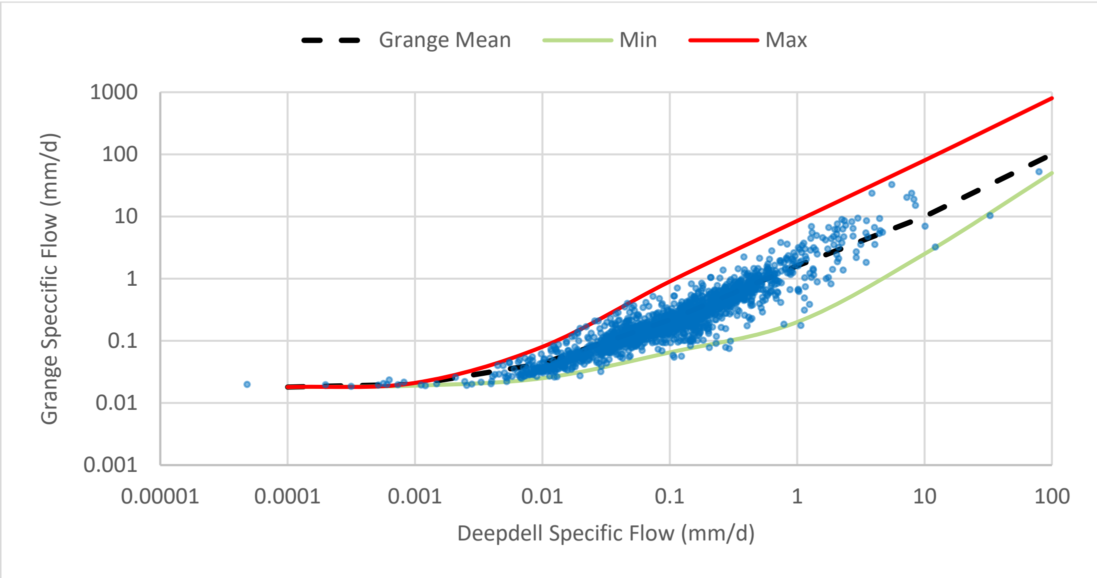


Figure 6 Specific flow correlation between Deepdell Creek and Shag River catchments

2.3 Water quality

2.3.1 Relevant Resource Consent conditions

The key surface water compliance points that are relevant to the Deepdell North Stage III Project are DC08 and Loop Road. The locations of these are shown in Figure 7.

Current water quality compliance values specified in existing resource consents are summarised in Table 2.

OGNZL has advised that the consents which relate to these values include:

- Mixed Tailings Impoundment - 2006.303.V2, 2006.304.V2, 2006.305.V4 and RM10.351.33 and RM10.351.34 (RM10 - both yet to be activated)
- Southern Pit 11A Tailings Storage Facility - 2006.306.V2, 2006.307.V2 and 2006.308.V3
- Southern Pit 10 Tailings Storage Facility - RM10.351.29.V1 and RM10.351.31.V1 (yet to be activated)
- Coronation Project – RM12.378.05, RM12.378.03, RM12.378.04
- Back Road Waste Rock Stack – RM10.351.06.V1, RM10.351.04.V2, RM10.351.05.V2 (yet to be activated)
- Deepdell WRS – 2010.159.V1, Deepdell South Pit Lake – 2003.640.V2, 2005.341.V2, Deepdell North Silt Pond – 2010.158.V1, Deepdell South Silt Pond – 2010.155.V1 05.

Table 2 Relevant water quality compliance criteria (g/m^3)

Compliance Parameter	Deepdell Creek at DC08	Shag River at Loop Road
pH (unitless)	6 – 9.5	7 – 8 .5
Arsenic	0.15	0.01
Cyanide $_{WAD}$	0.1	0.1
Copper (2)	0.009	0.009
Iron	1	0.2
Lead (2)	0.0025	0.0025
Zinc (2)	0.12	0.12
Sulphate	1,000	250

Notes:

1) All units g/m^3 unless otherwise stated.

2) Metal limits hardness adjusted as per equations 1 to 3 below.

1. Copper (g/m^3) = $(0.96\exp^{0.8545[\ln(hardness)]} - 1.702) / 1000$
2. Lead (g/m^3) = $(1.46203 - [\ln(hardness)(0.145712)]\exp^{1.273[\ln(hardness)]} - 4.705) / 1000$
3. Zinc (g/m^3) = $(0.986\exp^{0.8473[\ln(hardness)]} + 0.884) / 1000$

Figure 7 Relevant water quality compliance points

2.3.2 Background studies

A number of studies have been undertaken since mine operation commenced to assess the impacts of mining on downstream water quality and to analyse the potential impacts of various extensions during operation and post closure.

A substantial extension termed the Macraes Phase III Project was the subject of a number of studies completed by Golder (2011) and the associated technical reports were used to support resource consent applications. The analysis undertaken by Golder included assessment of various mitigations required to maintain compliance with downstream resource consent conditions. The study showed that there was potential for non-compliance and set out a number of mitigations to prevent this occurring. Golder identified that over time sulphate concentrations are likely to exceed receiving water consent values seasonally, with risk increasing over time due to the delayed release associated with geochemical reactions of the waste rock material.

Risk of other metals exceeding compliance values was also identified. However, the analysis in this regard was noted as conservative. The Golder report advocated for an adaptive management approach, with various mitigations to be initiated over the mine life based on ongoing review of monitoring results and associated review of the analysis assumptions.

The mitigation measures noted by Golder that are most relevant to the Deepdell North III project are reproduced below for reference:

- Ongoing monitoring to confirm model projections and assess effects. The development of the site-wide Goldsim model (discussed in this report) is the most recent update to site water balance and water quality analysis and follows a number of other updates since 2011 that OGNZL has commissioned.
- Ongoing pumping of Tailings Storage Facility (TSF) water as well as various collection systems across the mine that intercept water in ponds and drains for process re-use and to prevent release.
- Pumping of TSF and other water sources to Frasers Pit following cessation of mine operations for up to 20 years following closure of each facility to allow discharge flow rates to decrease to the point where other passive mitigation measures can be installed where deemed necessary.

- Construction of a fresh water dam on Camp Creek to provide a base flow to Deepdell Creek to manage and effectively mitigate sulphate concentrations in Deepdell Creek and in the Shag River as far as the confluence with McCormicks Creek. The dam provides the opportunity also for seasonal or flow matched discharges of freshwater to effectively mitigate the sulphate concentrations in the Shag River. OGNZL holds the appropriate resource consents for the construction of this dam.[2]
- Use of passive water treatment systems in targeted locations.

The mitigation measures listed above and the associated adaptive management approach remain applicable to the site and guide OGNZLs approach to site water management. Since 2011 OGNZL has also initiated a number of programs of work to assess improved source control of contaminants and to trial passive treatment systems.

In relation to source control, OGNZL has completed a number of studies on waste rock geochemistry, construction methodology and capping. This has resulted in a change to WRS construction in the Coronation North mine area to improve seepage water quality.

For the Deepdell WRS OGNZL plan to adopt learnings from these studies including segregation of materials based on sulphur content, paddock dumping on each lift in the WRS to reduce the effects of particle size separation and resulting advection of oxygen into the WRS, a construction methodology that facilitates progressive rehabilitation and additional material on the outer face of the WRS to act as a barrier to oxygen.

OGNZL is also currently reviewing a range of passive treatment options so that systems that are effective for site conditions can be applied post closure. Treatment systems currently being trialled include activated passive treatment, constructed wetlands and irrigation of seepage water.

2.3.3 Compliance history

OGNZL has advised GHD that compliance has been achieved with resource consent surface water criteria (Table 2) at sites DC07, DC08, Shag River at Loop Road and Shag River at McCormick's on all but 3 occasions since monitoring began in 1990.

- An exceedance of sulphate values in Deepdell Creek in 2006 was due to an on-site operational issue that was corrected.
- Two exceedances reported at the Shag River at McCormicks are the result of an operational issue and are also likely to have been sampled from the wrong sampling point due to an error by the field technician who had been sampling McCormicks Creek itself not the Shag River downstream of the McCormicks Creek confluence. A review by OGNZL indicated the elevated concentrations measured at sites DC07 and DC08 in 2015 were due to very low natural flows in Deepdell Creek at the time and therefore a very low mine water dilution ratio.

The main contaminant that has been of concern in terms of approaching compliance values is sulphate. The following graphs show measured values over the last 12 months which have been well below the compliance values of 1000 g/m^3 at DC08 and 250 g/m^3 at Loop Road.

[2] The dam is consented but has not yet been constructed.

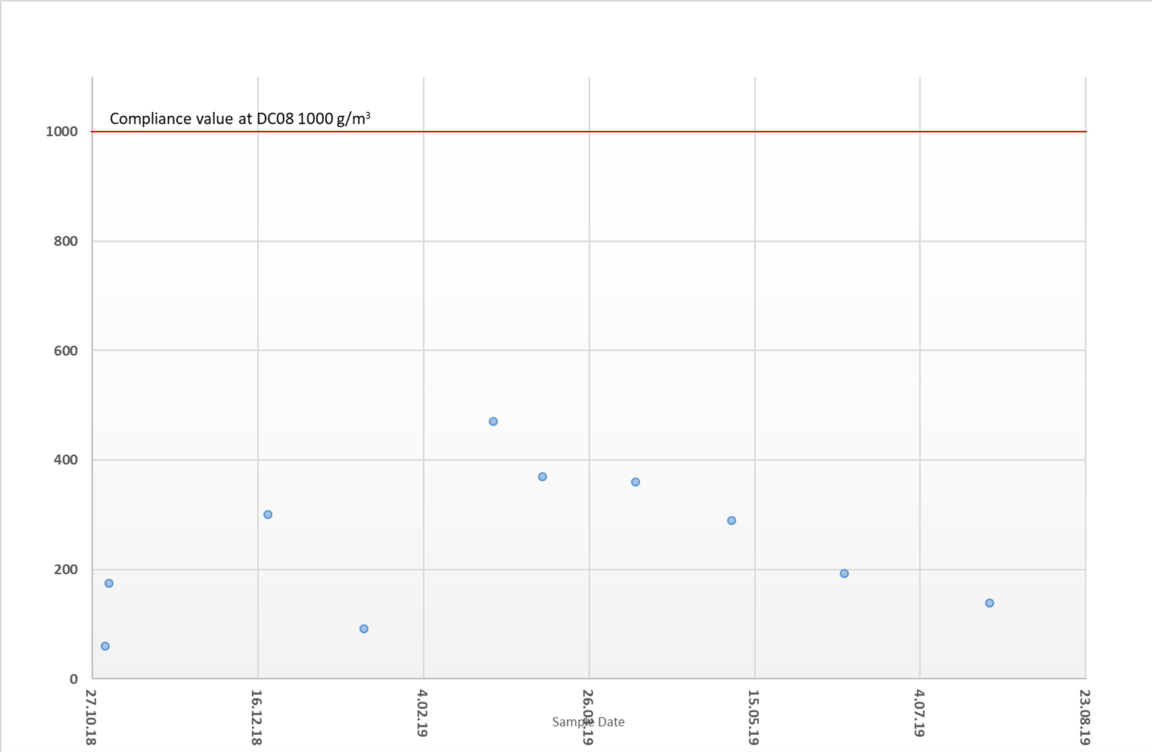


Figure 8 Sulphate concentrations in Deepdell Creek at DC08 (2018-2019) g/m^3

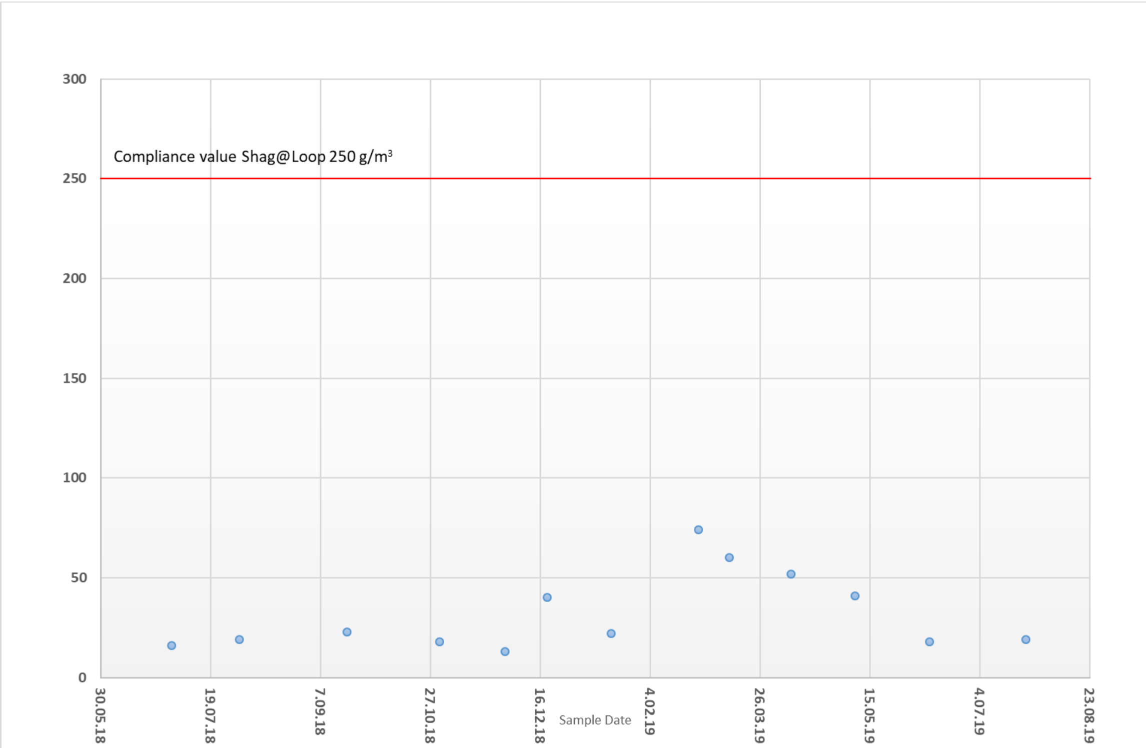


Figure 9 Sulphate concentrations in the Shag River at Loop Road (2018-2019) g/m^3

2.3.4 Emerging contaminants - Nitrates

Resource consent conditions that apply to site discharges do not currently include any nitrogen compounds. However the 2014 Plan Change 6a (Water Quality) to Otago Regional Councils' Regional Plan is being implemented and some of the Regional Plan changes relate to the management of nitrogen compound loads and concentrations in surface waters around the region. In addition the National Policy Statement for Freshwater 2014 (amended 2017) includes target values for nitrates. The ORC has committed to a Progressive Implementation Programme for implementing NPS policies. Hence it can be expected that the NPS Freshwater will be referenced when the ORC is considering consent conditions.

As a result OGNZL will need to consider the contribution of nitrogen compounds from the Macraes site to downstream receiving waters when applying for either new discharge consents or consent variations.

OGNZL commissioned WGA to undertake a study on site sources of nitrogen compounds including assessment of the nitrogen loads from existing and potential future mine water discharges to the Deepdell and Shag River catchments. The objective of the study was to establish whether current site discharges would meet Plan Change 6A and NPS Freshwater criteria as they relate to nitrogen compounds; and if required to identify mitigation measures to meet these criteria.

Potential sources of nitrogen identified by WGA that could be entrained in either surface or groundwater from the mine site include:

- *Residues from the use of ammonium nitrate explosives.*
- *Cyanide in tailings slurry from the ore processing plant.*
- *Other nitrogen containing chemicals and reagents used during ore processing – eg nitric acid*
- *The weathering of freshly exposed minerals in the waste rock.*
- *The use of fertiliser for rehabilitation purposes.*
- *Nitrogen fixing in the soils through plant growth over rehabilitated areas of the mine.*
- *Animal wastes where grazing animals may access rehabilitated areas of the mine.*
- *Natural and anthropogenic nitrogen in the mine site water supply and wastewater.*

Following completion of the WGA study OGNZL initiated a number of actions to better understand the sources of nitrogen compounds on the Macraes site.

This includes increased monitoring of site water sources and receiving waters in order to increase the sample database.

In addition, OGNZL commissioned GNS (2019) to undertake a study on mine derived source isotopes of NO_3 in order to identify the most likely source of nitrates in site runoff and seepage. The study identified both unburnt ammonium nitrate from explosives and source rock as nitrate sources. This highlighted that mine activity might not be the sole source of nitrates i.e. nitrates may also be sourced from country rock. GNS recommended further sampling and analysis to resolve ambiguities identified through the study.

Ryder (2019) has completed a study on the ecological values of the Deepdell Creek and Shag River and has recommended that the NPS Freshwater Attribute B is an appropriate target for the Deepdell Creek and Shag River. Accordingly, for this report receiving water quality has been compared to the Attribute B values for nitrate as an indication of whether compliance with similar future consent conditions will be an issue. Attribute B values are as follows:

- Nitrate-N g/m^3 (NO_3-N) – Annual median [>1.0 and ≤2.4] and Annual 95th percentile [>1.5 and ≤3.5]
- Ammoniacal-N g/m^3 (NH_4-N) – Annual median [>0.03 and ≤0.24] and Annual 95th percentile [>0.05 and ≤0.40]

For reference measured values for Nitrate-N for the last 12 months are reproduced in the following graphs.

Ammoniacal-N values measured at DC08 over the same period are recorded at 0.01 g/m^3 with a single reading of 0.03 g/m^3. All readings at the Shag monitoring point are recorded at 0.01 g/m^3.

The data indicates compliance with Attribute B values at both sites.

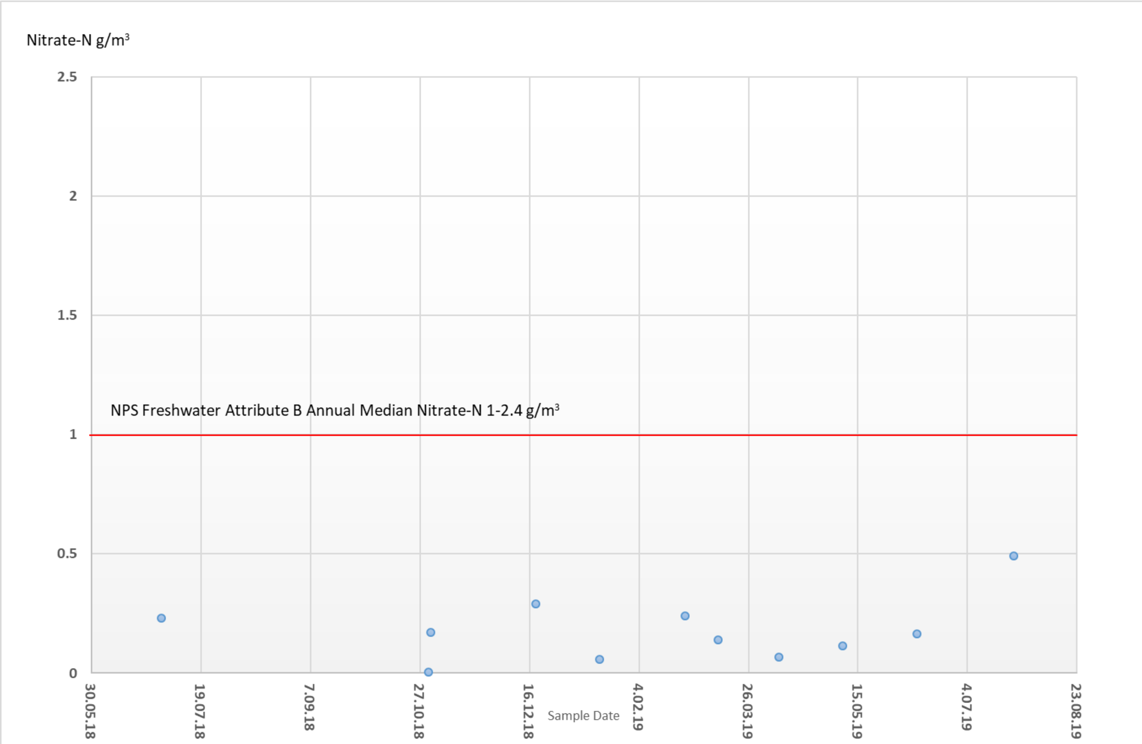


Figure 10 Nitrate-N concentrations in Deepdell Creek at DC08 (2018-2019)

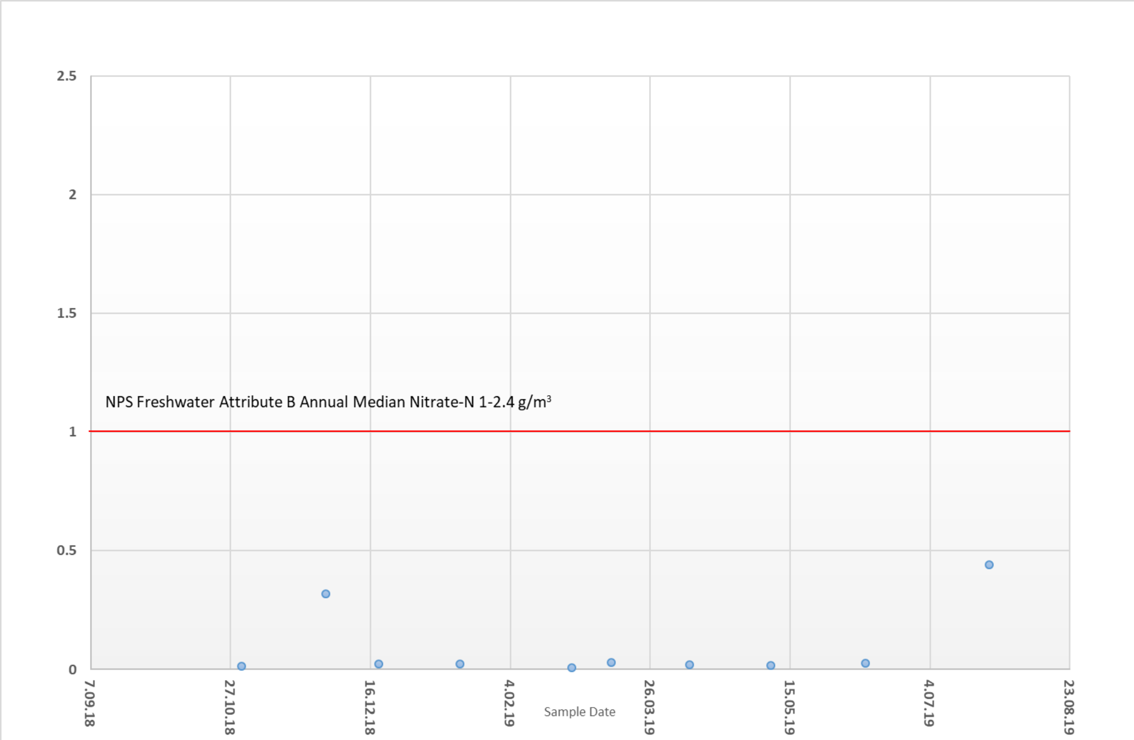


Figure 11 Nitrate-N concentrations in the Shag River at Loop Road (2018-2019)

3. Water Balance Model

3.1 Model description

A water balance model (WBM) was developed by GHD in Goldsim to assess how water gains and downstream water quality changes over the life of the Macraes mine. This model essentially updates models prepared previously by others (Golder, WGA) used to predict future water quality outcomes. A key purpose of the model is to assess how future changes, such as mine area extension and/or addition of a new WRS impacts downstream water quality; and what mitigations might be needed to stay within consent conditions. The Macraes Goldsim water balance model was developed in late 2018 and has been subject to ongoing calibration since that time. A model description is provided in Appendix A.

3.2 Water quality inputs

3.2.1 Surface water quality

The surface water quality parameters applied to the WBM are listed in Table 3. These values have been derived based on water quality monitoring data provided by OGNZL and represent mean values. Within the water balance analysis the model applies a normal distribution from mean to each water source by adopting a 20% standard deviation to represent the variances observed in the monitoring data. For each day simulated by the model a mass balance is derived to calculate downstream water quality. This approach is used to capture the majority of likely outcomes, therefore capturing the risk associated with water quality exceedances at the compliance point.

Table 3 Projected surface water quality from mine activity –mean values (g/m^3)

Parameter	Natural	Impacted	[1]Rehab Impact	Pit	Ponds	TSF
Ammonia	0.011	0.012	0.012	0.8	0.011	0.012
Arsenic	0.0018	0.04	0.02	0.2	0.0018	0.04
Copper	0.001	0.0012	0.001	0.02	0.001	0.0012
Hardness	65	1200	630	880	65	1200
Iron	0.05	0.032	0.14	0.9	0.24	0.032
Lead	0.00015	0.0002	0.00019	0.001	0.00015	0.00022
Nitrate	0.05	0.094	0.4	2.0	10.5	0.1
Sulphate	24	930	470	1400	1500	930
Zinc	0.001	0.001	0.001	0.0056	0.001	0.001

Notes

1. Rehab impact – areas other than WRS that have been rehabilitated

For the WRS's an "initial" and "final" value is applied to recognise that contaminant concentrations will change over time. Values are based on monitoring data collected by OGNZL.

Table 4 Projected surface water quality for Deepdell East III WRS (g/m3)

Parameter	Initial Deepdell WRS	Final Deepdell WRS	Rehab Deepdell WRS
Ammonia	0.5	0.02	0.01
Arsenic	0.01	0.01	0.01
Copper	0.0018	0.0013	0.0011
Hardness	200	1030	220
Iron	0.08	0.1	0.08
Lead	0.00015	0.0003	0.00015
Nitrate	1.0	0.4	0.4
Sulphate	470	150	150
Zinc	0.001	0.001	0.0012

3.2.2 WRS seepage

Understanding how sulphate concentrations in WRS seepage change over time is key to predicting receiving water quality in the future. In low flow conditions the contributions from groundwater and seepage make up the receiving water flows; seepage is thus a key contributor to the overall water quality.

OGNZL engaged Babbage to analyse available seepage water quality data from all of their WRS's in order to assess whether the concentrations of certain parameters (in particular, sulphate), are at equilibrium (stable) or likely to increase over time. Babbage (2019) approached the study by collating the water chemistry monitoring data available from OGNZL, and assessed if there were any correlations with time or geographical data, such as WRS volumes or areas. The Babbage letter report (2019) is included as Appendix B.

There were eight WRS for which seepage data was available, either directly from toe drains or measured in a silt pond down gradient.

In assessing the available data Babbage (2019) noted that "*Sulphate is the principal element of concern, and calcium and magnesium are the principal controls on sulphate in groundwater. The results show that the pH of WRS seepage is relatively stable (pH 7-8) over time and between WRS. In contrast, the concentrations of calcium, magnesium and sulphate are highest in the seepage from Northern Gully East and lowest in the seepage from Coronation North. Concentrations of all three parameters have, in general, increased over time in all WRS*"

Babbage noted the variability in the data collected from the different sites and subsequent to their initial study have developed a correlation between WRS age, seepage, depth and time. This was to provide a means of predicting changes in seepage water quality both during future operation and post closure.

WRS seepage water quality is expected to deteriorate for some contaminants such as sulphate and nitrate, while others such as lead, iron and ammonia typically stabilise at reduced concentrations.

Figure 12 shows examples of measured sulphate values against the associated aging functions applied in the WBM. For sulphate in particular, Babbage (2019) has identified a relationship between WRS average depth, active duration and typical concentration, which was used to determine the steady state values for the proposed Deepdell East WRS. The derived relationship is presented in Figure 13.

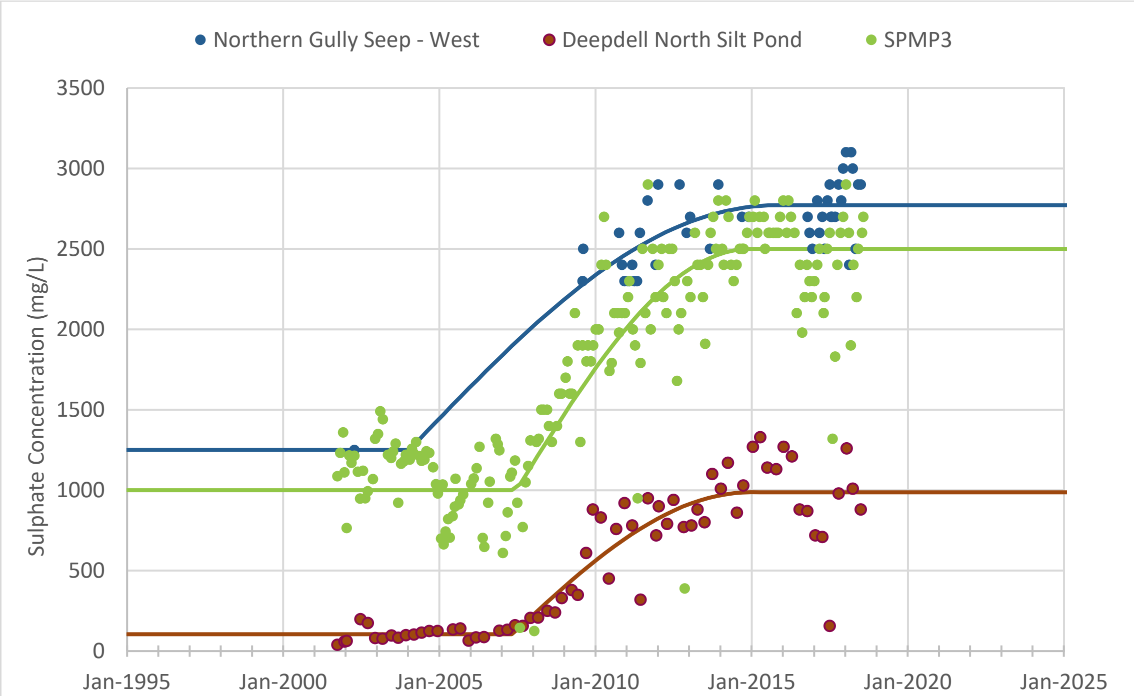


Figure 12 Example of aging function for sulphate

Table 5 summarises key data points.

Table 5 Macraes WRS data summary (compiled by Babbage 2019)

WRS	WRS Start Year	Partial cap Year	WRS completed	Average Depth (m)	Median seepage sulphate (g/m^3)	95th percentile seepage sulphate (g/m^3)
Deepdell North	2001	-	2013	16.3	1,005	1,238
North Gully West	1995	-	2003	31.3	1,263	1,534
North Gully East	1990	2003	2019	34.6	2,826	3,326
Golden Bar	2003	-	2014	29.4	1,602	1,922
Frasers West	2003	2017	2019	37.1	2,598	3,064
Coronation North	2017	-	2019	15.2	241	362
Coronation	2014	-	2019	28.3	757	953

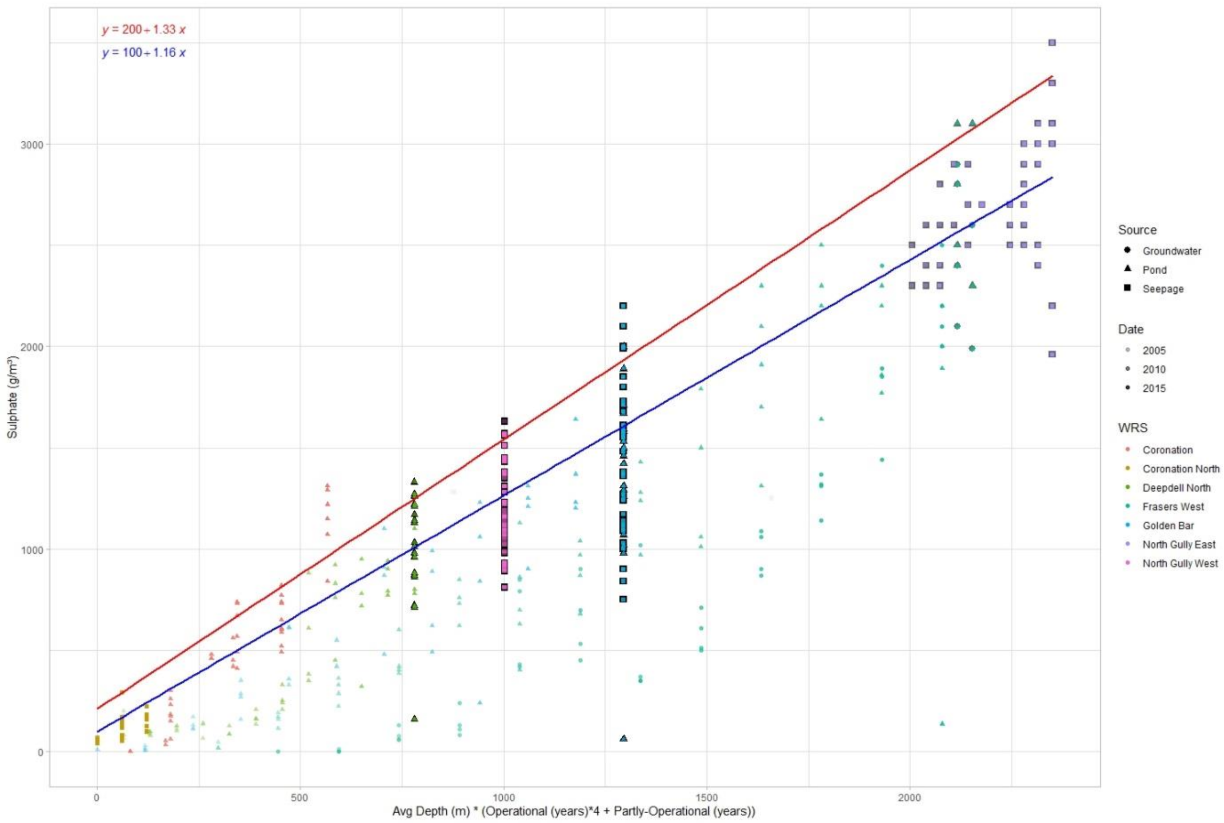


Figure 13 Derived relationship between WRS average depth, operational duration and sulphate concentration (Babbage, 2019)

Based on their analysis Babbage provided the following relationship between "Age", Average WRS depth and sulphate concentrations in seepage:

$$Median\ Sulphate = 100 + 1.17\left(\frac{Volume\ (m^3)}{Area\ (m^2)}\right)(4 \times Operation\ (Yrs) + Partial\ Operation\ (Yrs))$$

$$95^{th}\%\ Sulphate = 200 + 1.33\left(\frac{Volume\ (m^3)}{Area\ (m^2)}\right)(4 \times Operation\ (Yrs) + Partial\ Operation\ (Yrs))$$

These equations were used to generate predicted future sulphate concentrations in seepage from the Deepdell East WRS. Values for all parameters used in analysis for seepage water quality are summarised in Table 6. The WRS construction period and dimensions provided by OGNZL were applied.

Table 6 Projected seepage water quality for Deepdell East WRS (g/m^3)

Parameter	Initial Deepdell WRS	Final Deepdell WRS
Ammonia	0.5	0.02
Arsenic	0.01	0.01
Copper	0.0018	0.0013
Hardness	200	1030
Iron	0.23	0.1
Lead	0.001	0.0003
Nitrate	10.5	14
Sulphate	100	522
Zinc	0.001	0.001

Sulphate levels for the Deepdell East WRS are calculated by the Babbage formula assuming a 2.1 year operation period and 2 years to rehabilitate the WRS. The other seepage parameters are projected from water quality monitoring gathered across the mine site.

4. WBM Results

4.1 Analysis assumptions

The WBM was modified to represent the introduction of the Deepdell North III Project. The "baseline" for the project in the WBM includes the new Deepdell East WRS, Deepdell North pit development and the Back Road WRS which is already planned and consented for the site. The baseline also assumes that the Camp Creek dam will be constructed by January 2022 and releasing a constant 10 l/s of fresh water to the Deepdell Creek.

Key assumptions in summary include:

- WRS seepage water quality is based on the equations developed by Babbage (section 3.6 and parameters listed in Table 6)
- Surface water runoff quality as per Table 3 and Table 4
- Camp Creek dam constructed and releasing 10 l/s fresh water.

Key dates represented in the model are listed in Table 7.

Table 7 Key dates

Model Input	Activity	Date
Deepdell East III Pit	Pump start	Nov 2020
Deepdell East III Pit	Pump stop.	Dec 2022
Deepdell East III WRS	Construction starts	Nov 2020
Deepdell East III WRS	Construction complete	Dec 2022
Camp Creek Dam	Active	Jan 2022
Back Road WRS	Construction starts	Jan 2021
All mining ceases	Rehabilitation	Jan 2025
All rehabilitation complete	All runoff and seepage in catchment to Deepdell Creek	Jan 2045

4.2 Deepdell North pit overflow.

In the 40 year period run through the model, a pit lake begins to form post closure but does not spill within the time period covered. The overflow point is set at RL 465m and the lake is approaching RL 430m in 2060. This is shown in Figure 14. It is estimated that the lake will take a further 60 years to reach the overflow point. This gives ample time for testing of water quality and development of a treatment solution should it be needed. No further analysis was done for this study.

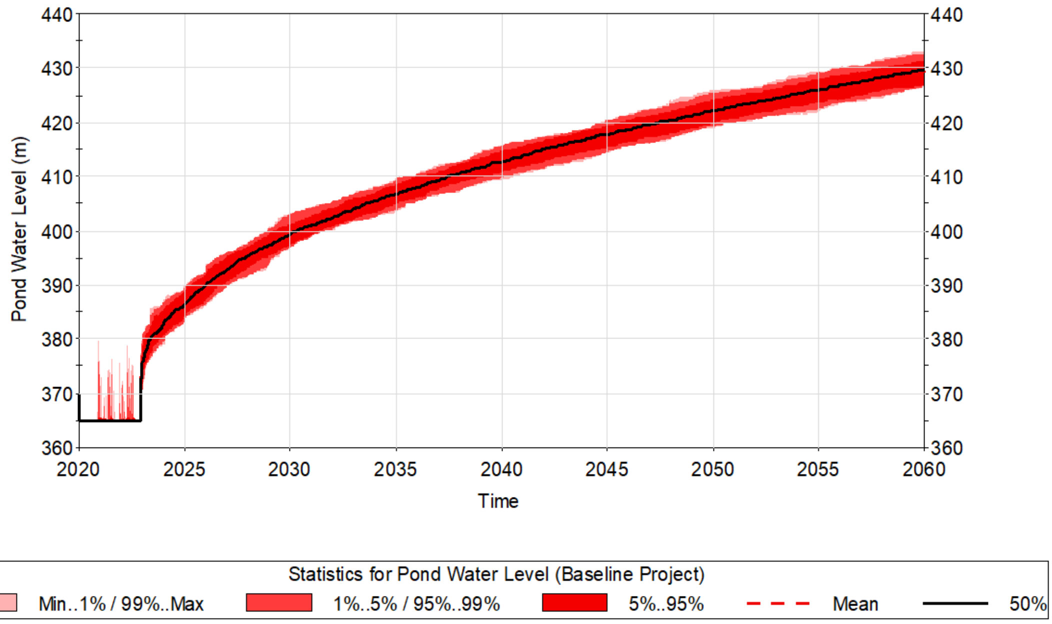


Figure 14 Deepdell North Pit lake development

4.3 Water quality analysis

4.3.1 Scenarios

In addition to the proposed development plan a number of scenarios were included (Table 8). These were to test the benefits of a number of potential mitigations to improve downstream water quality. The scenario elements included:

- Flow matched or seasonal discharge of 16 l/s from Camp Creek dam
- With the Back Road WRS removed or reduced in footprint area
- Combinations of the above

These are summarised as follows.

Table 8 Analysis scenario summary

Scenario Name	Baseline	1/2 Back Rd	Camp Creek 16 L/s
Scenario ID	1	2	3
Deepdell East WRS Footprint	70.7 ha	70.7 ha	70.7 ha
Back Road WRS Footprint	130 ha	65 ha	130 ha
Camp Creek Dam Active	YES	YES	YES
Camp Creek Dam discharge condition	Constant 10 L/s	Constant 10 L/s	Variable to 16 L/s

4.3.2 Risk based analysis

As described in Appendix A the WBM uses a risk based Monte Carlo approach. When assigning water quality to an element on any given day (e.g. WRS seepage) the model will randomly generate a water quality concentration using a normal distribution approach. This means that while most of the time water quality values will approach the mean values listed in previous tables (Table 3, Table 4, Table 6); there will be values generated that represent variation and uncertainty in the source data, and represent the risk of relatively high concentration inputs. This approach is useful for assessing the potential risk of exceeding downstream water quality consent compliance values. However, it is a conservative approach and this must be recognised when assessing results. Model outputs represented in the following section are for future median values and potential 95th percentile results. The median values are considered the most likely outcomes and the 95th percentile values are a low probability outcome (i.e 5% chance of being met or exceeded).

4.3.3 Compliance check

The following tables summarise the number of exceedances the model predicts for arsenic and sulphate for the modelled time period which covers 40 years for the baseline project (no additional mitigations). The following graphs show outputs over time for sulphate as an example of time distribution of outputs.

Table 9 WBM Scenario analysis outputs – Number of model water quality outputs that exceed consented values at DC08

Scenario	Arsenic > 0.15 g/m^3	Sulphate > 1000 g/m^3	Arsenic > 0.15 g/m^3	Sulphate > 1000 g/m^3
	Median		95th percentile	
Baseline Project	0	0	0	0
Camp Creek 16	0	0	0	0
½ Back Rd	0	0	0	0

Table 10 WBM Scenario analysis outputs – Number of model water quality outputs that exceed consented values numbers at Loop Road

Scenario	Arsenic > 0.01 g/m^3	Sulphate > 250 g/m^3	Arsenic > 0.01 g/m^3	Sulphate > 250 g/m^3
	Median		95th percentile	
Baseline Project	0	0	<5	<25
Camp Creek 16	0	0	<5	<25
½ Back Rd	0	0	<5	<20

Figure 15 and Figure 16 show the predicted variation in sulphate concentrations over time at DC08 and at Loop Road.

At DC08 sulphate values for the baseline condition are predicted to vary over time around a median of 100 to 200 g/m^3 (seasonal variation); with 95th percentile results occasionally reaching 400 to 600 g/m^3 through the post closure period. Predictions through the operational period and post closure period indicate median concentrations below current measurements and this represents the dilution effects of the Camp Creek Dam coming online and recent climatic conditions. Initially a gradual increase in predicted sulphate concentrations from WRS seepage sources occurs and this aligns with the analysis completed by Babbage.

Values are predicted to remain consistently under the compliance limit. Arsenic and iron concentrations are predicted well below compliance values.

At Loop Road the median results similarly stay within compliance over the 40 year time period run in the model. Predictions are similar to those values currently measured which demonstrate reduced impact of dilution from the Camp Creek Dam at Loop Road due to the relatively higher base flows.

As shown in Table 10 the Monte Carlo simulation did identify the potential to exceed the 95th percentile guidance values for both arsenic and sulphate in the long term.

A rise in contaminant concentration is identified from 2045 onwards. Mining ceases by 2025, and 2045 is the period in the model when direct management of discharges has ceased and it is assumed that all water generated on the mine is diverted back to natural catchments (i.e. there is no reuse or water being pumped into the underground workings or pits). This introduces surface runoff that has been classified in the model as “rehab impacted” as well as WRS runoff and seepage (refer Table 4). This classification covers all mining areas other than the WRS and that captured within pits (i.e. the TSF’s, roads and restored process area). The classification is broad and potential water quality improvement from the various sources will likely be better than assumed in the model.

The mean concentration of sulphate in this type of runoff is assumed to be 470 g/m^3 and the mean assumed arsenic concentration is 0.02 g/m^3. In a Monte Carlo analysis there will be some simulations where the upper possible deviation from these values are applied. As noted previously, the 95th percentile analysis runs are a low probability of occurrence. This risk based analysis provides useful guidance of risk, however the median values are those that are most likely to occur.

At both sites a rise in concentrations is indicated between 2055 and 2058, which corresponds with modelled overtopping of the Golden Point pit. This is considered to be a conservative result as the pit lake water quality used in the model is based on current measured values. The pit receives water from a number of poor quality sources that will not contribute post closure.

4.3.4 Nitrates

Figure 17 and Figure 18 show the predicted variation in nitrates over time at DC08 and at Loop Road. These graphs show the median predicted values are well below the NPS Freshwater Attribute B range (annual median >1.0 and ≤2.4) over the 40 year period modelled.

The Monte Carlo simulation applied in the WBM did identify the potential to exceed the NPS Freshwater 95th percentile guidance value, particularly through the first 1 to 2 years of the project as the Camp Creek Dam is activated. Current measured values at DC08 are below 1 g/m^3. The median model outputs align well with current measured values and are thus taken as most representative of future values. Any future change in source nitrate concentrations (i.e from site seepage or runoff) will be identified through monitoring.

The Loop Road analysis results fit within the Attribute B median and 95th percentile values for Nitrate-N over the 40 year period modelled.

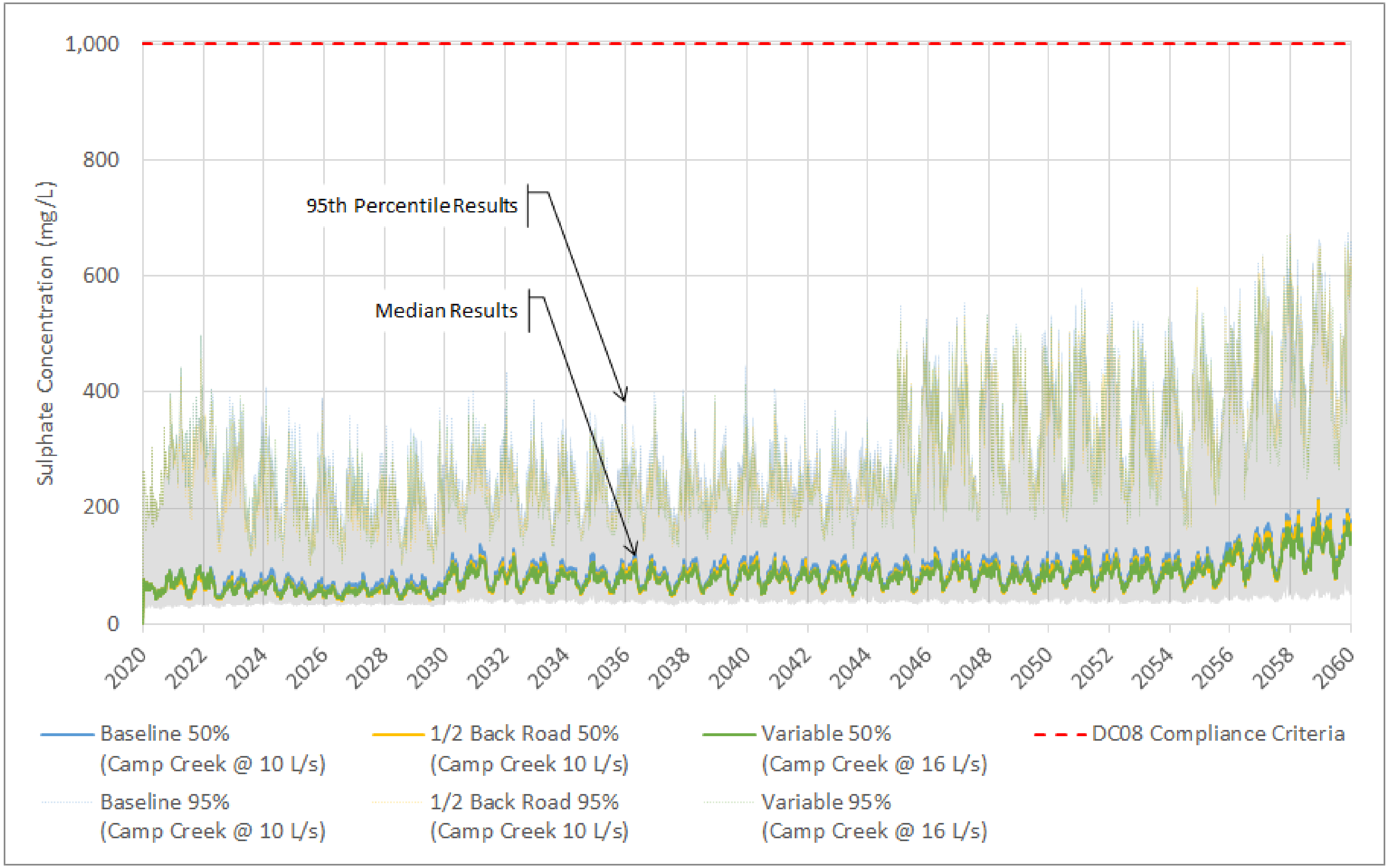


Figure 15 Predicted Sulphate concentrations over time at DC08 (50th and 95th percentile values)

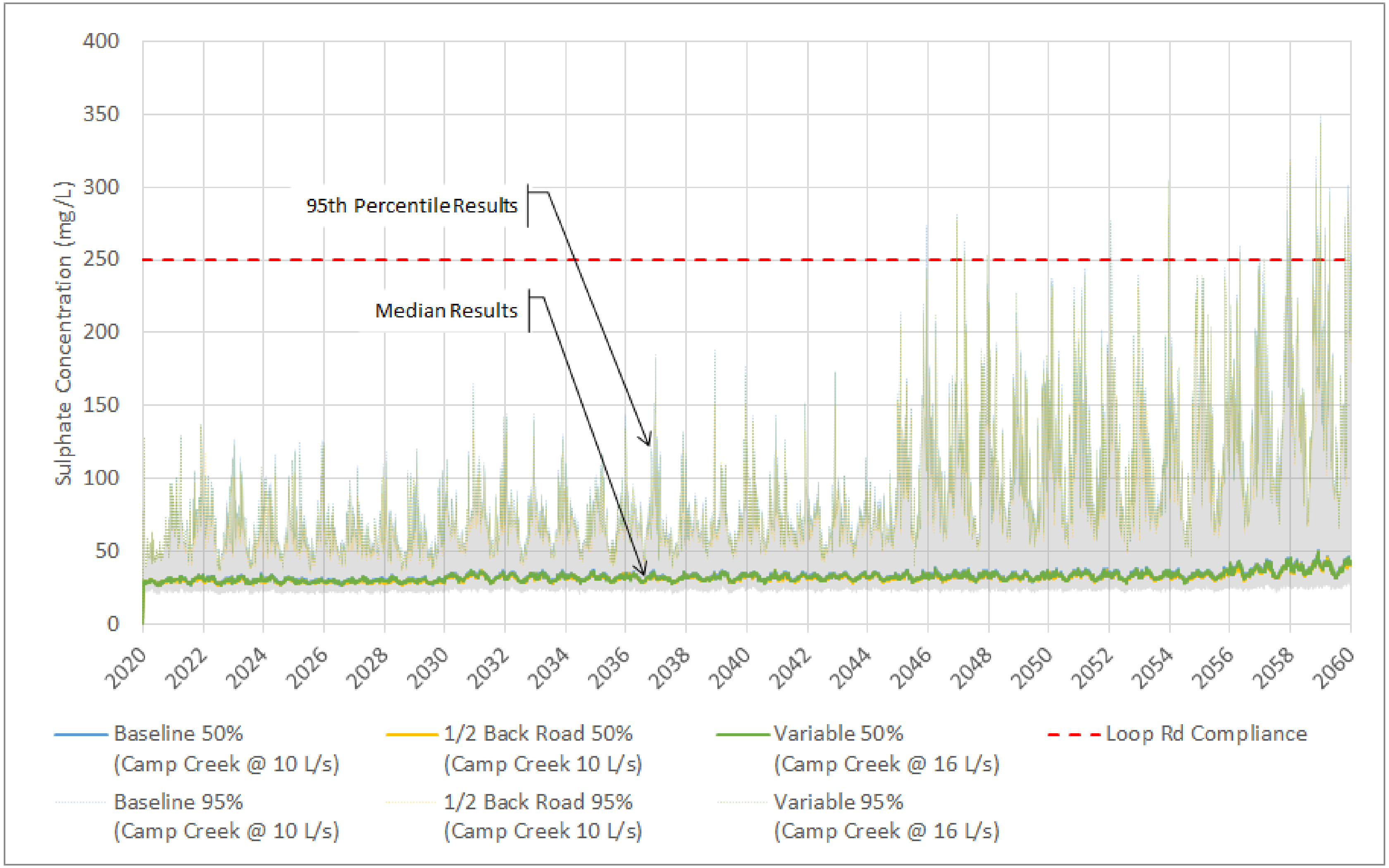


Figure 16 Predicted Sulphate concentrations over time at Shag River (50th and 95th percentile values)

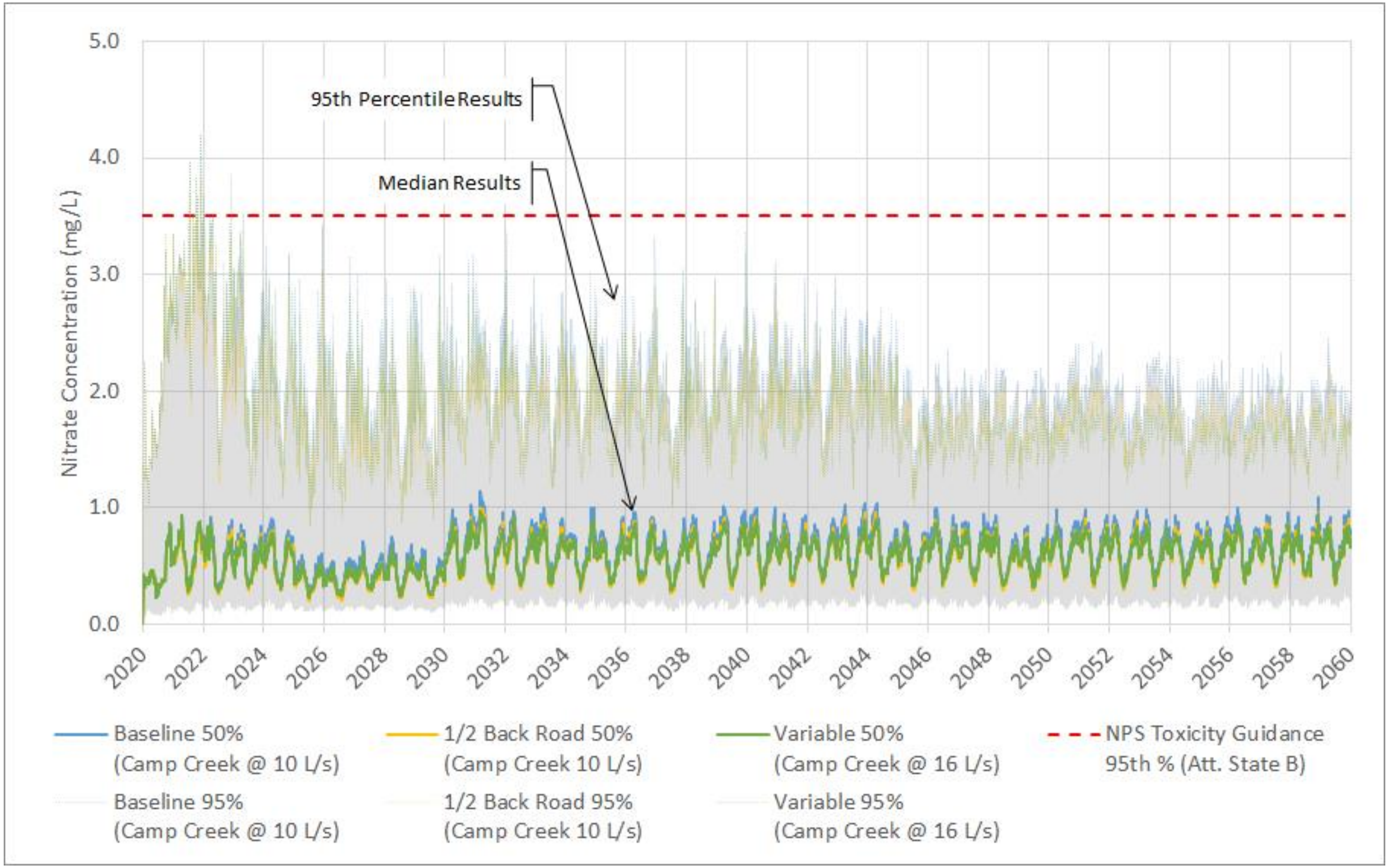


Figure 17 Predicted Nitrate-N concentrations over time at DC08 (50th and 95th percentile values)

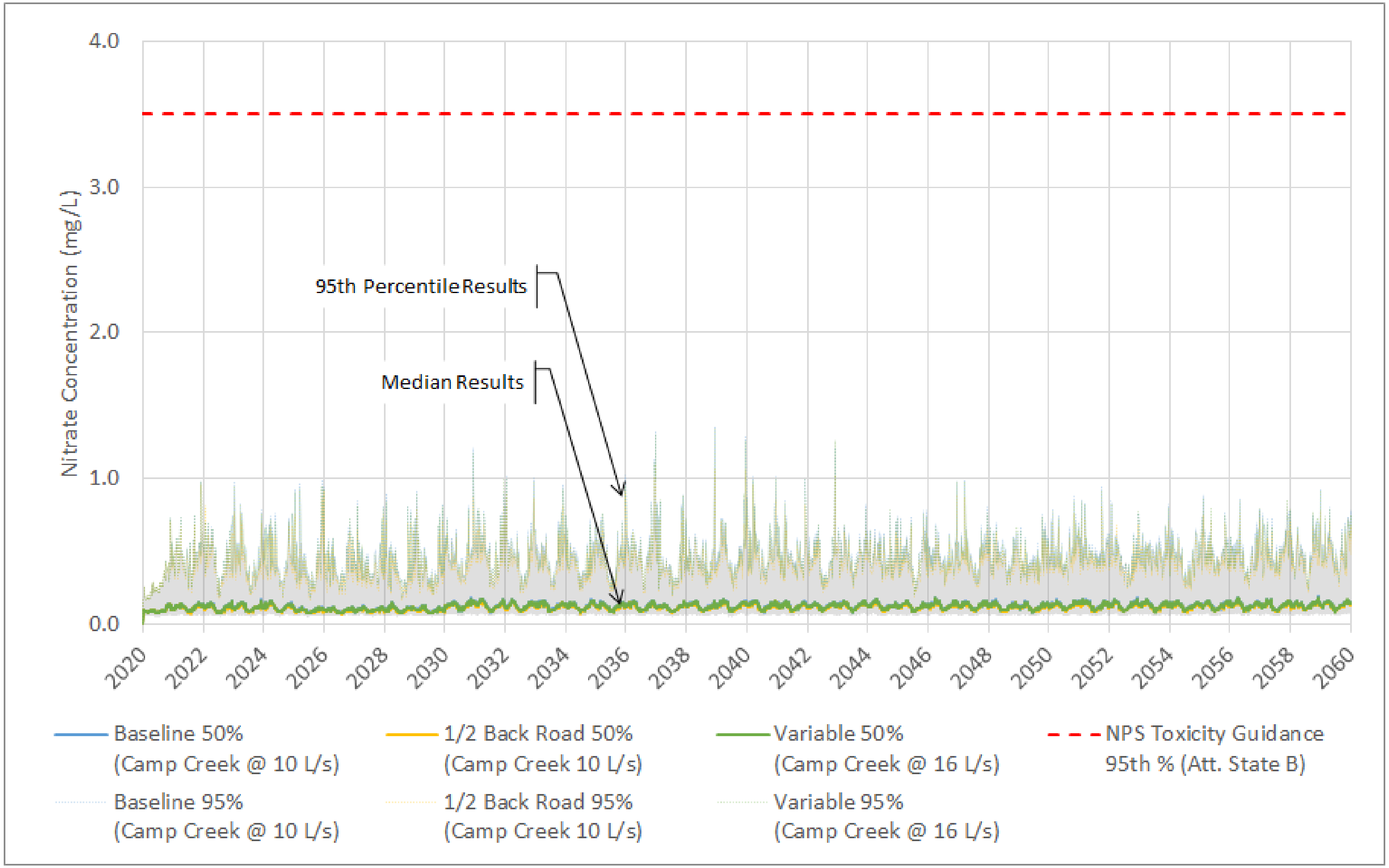


Figure 18 Predicted Nitrate-N concentrations over time at Shag River (50th and 95th percentile values)

4.3.5 Highlay Creek

Figure 19 shows the Highlay Creek in relation to the new WRS. The figure shows that part of the WRS (18.8ha) will drain towards the Highlay Creek. The WRS area is relatively small compared to the overall catchment upstream of the Deepdell Creek confluence (2%).

Samples (#17) taken from the creek at site HC01 indicate median sulphate concentrations below 10 g/m^3 and a maximum recording of 70 g/m^3. The median Nitrate value (Nitrate-N) is 0.09 g/m^3 and the maximum reading is 0.49 g/m^3.

A simple mass balance analysis was undertaken to assess what change WRS seepage might make to the stream water quality. The analysis showed some elevation in parameters due to the introduction of seepage, but not beyond compliance values applicable at DC08. For example median sulphate values post closure were predicted to increase from 7 g/m^3 to 59 g/m^3 in low flow conditions.

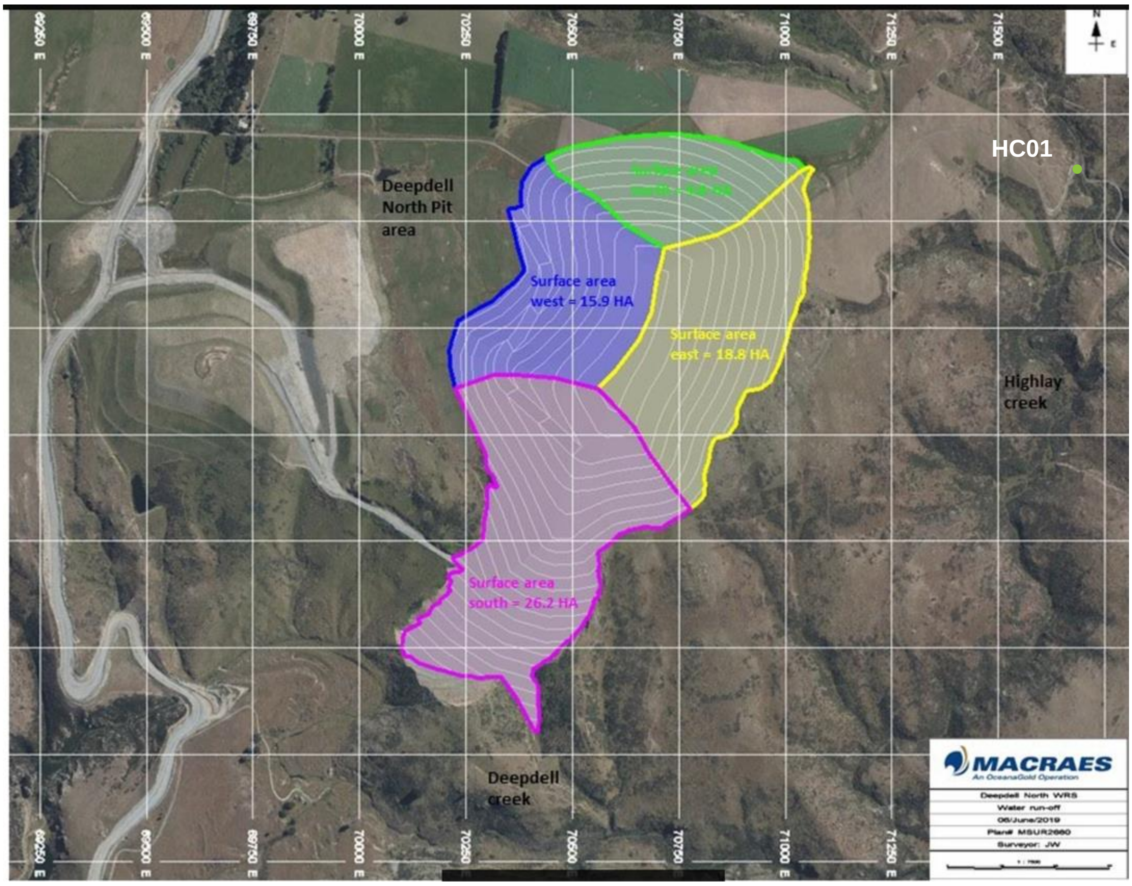


Figure 19 Highlay Creek in relation to Deepdell East WRS

5. Potential downstream flow impacts

A high level review of the impact of the project on flows in the Deepdell and Highlay Creek was undertaken. Flows could reduce through the following activities:

- Excavation and dewatering of the Deepdell North Stage III pit
- Backfill of the Deepdell South pit
- Construction of the Deepdell East WRS
- Construction of silt ponds associated with the Deepdell East WRS.

The mechanisms that will affect the flows within the catchment include:

- Removing an area of the catchment that would normally provide runoff through excavation of the pit
- Localised drawdown of the groundwater table due to dewatering the pit
- Affecting the permeability of a portion of the catchment through constructing the WRS
- Delaying runoff transmission to the streams through construction of silt ponds
- Adding an additional surface producing runoff area through backfilling the Deepdell South Pit.

As a high level assessment the following comments can be made regarding the potential effects of these activities and mechanisms on the flows within the Deepdell and Highlay Creek catchments:

- The catchment area reporting to DC07 below the Deepdell North pit is 55.6 km^2. By comparison, the area affected by the proposed project is 1.1 km^2 (0.8 km^2 new disturbance) or 2% of the catchment area.
- The affected catchment area contributing to the monitoring point HC01 is approximately 0.25 km^2 within a total catchment of 5.5 km^2, corresponding to a 4.5% disturbance. Runoff from this area may be reduced or delayed through the construction of the WRS, however runoff is unlikely to be curtailed completely. Hence, the effect of the activity on this catchment would likely be less than 5% of the base flow.

An unknown quantity is the effect that dewatering within the proposed Deepdell North pit would have on the groundwater table and resultant base flow to the stream. Based on anecdotal evidence that the stream flow is very low during dry periods, it is assumed that the groundwater contribution is not significant through this reach.

The construction and activation of the Camp Creek Dam would mitigate the expected reduction in direct runoff from the affected areas during low flow periods. Overall the effects on stream flows are expected to be minimal with potential for low flow benefits on activation of the Camp Creek Dam.

6. Water Quality Monitoring

6.1 Approach

OGNZL has a well established water quality monitoring regime for the Macraes mine site which already captures data at key sites.

In addition to the current compliance points in Deepdell Creek and the Shag River (DC08 and Loop Road) OGNZL has a comprehensive network of sampling points across that site that they have used to build a database of site water source quality. This covers WRS seepage, silt ponds and surface water drains and this database has formed the basis for deriving representative water quality values used in our analysis.

The current level of monitoring for the two compliance points is considered appropriate to continue with and is reproduced in Appendix C for reference.

In addition OGNZL propose to obtain representative samples of groundwater seepage from the toe of the Deepdell East Waste Rock Stack and the Deepdell Waste Rock Stack at the points where the current and future silt ponds (Highlay Silt ponds, Deepdell South and North silt ponds are located. This data will serve to validate and check the sulphate predictive equations developed by Babbage (refer Appendix B).

7. Conclusions

This study specifically assessed the potential impact of the Deepdell North project on downstream water quality. The analysis completed with the WBM shows a low potential for future non-compliance with current resource consent conditions.

The WBM uses a risk based approach and the median future water quality values predicted by the model (i.e. most likely outcome) do not exceed current resource consent condition values.

Worst case (95th percentile) water quality results indicate a future potential (2045 to 2060) for exceedance of sulphate and arsenic values post closure. In the context of the analysis this is a very low probability outcome (less than once per 5 year period).

If the NPS Freshwater Attribute B nitrate levels are applied the model also predicts full compliance at both sites for median predicted water quality results. However, at DC08 a low probability to exceed Attribute B maximum values is predicted between 2045 and 2060 (less than once per 5 year period).

Based on the model outputs, the current adaptive management approach that OGNZL is applying to site water management is still applicable. No immediate risk of non-compliance is predicted; however, the modelling has identified a very low probability future potential from 2045 onwards.

The adaptive management approach OGNZL is currently following includes the following key features:

- Ongoing monitoring to confirm WBM projections and to identify and track changes in downstream water quality. The monitoring regime proposed by OGNZL is included as Appendix C for reference.
- Ongoing refinement of WRS construction to improve seepage water quality.
- Trialling of passive water treatment systems as mentioned in section 2.3.2 so that suitable methods for the site have been tested and can be implemented for the post closure period if deemed necessary at the time.
- Construction of a fresh water dam on Camp Creek (operating by January 2022) to provide a base flow to Deepdell Creek to manage and effectively mitigate sulphate concentrations in Deepdell Creek and in the Shag River as far as the confluence with McCormicks Creek.

Mitigations could also include introduction of localised treatment systems, amending WRS construction practises, delaying the diversion of flows from rehabilitated areas and reducing the footprint of future WRSs.

Given there are a range of mitigation options available and OGNZL is actively investigating a number of measures it is not considered necessary at this point in time for OGNZL to commit to a specific mitigation solution. Rather the ongoing adaptive management approach being currently applied should be continued.

The study also looked at the potential introduction of a consent limit for nitrates in line with the NPS Freshwater Attribute B values. Based on median outputs these values can be achieved.

OGNZL is currently investigating sources of nitrates in runoff and a study completed by GNS showed both country rock and unburnt explosives as potential sources of nitrates.

Before any new consent conditions are added for nitrates the sources in the surrounding catchments warrant further investigation. It is recommended that OGNZL focus on establishing monitoring to build up the understanding of the various sources of nitrogen compounds, specifically so that the mine input can be separated out.

8. References

GNS 2019, Source identification of NO_3 in mine derived discharge waters using stable isotopes.

Golder 2011c. Macraes Phase III Project. Site wide surface water model. Report produced for Oceana Gold (New Zealand) Ltd by Golder Associates (NZ) Limited. Golder report 0978110-562 R008 vD. April 2011.

Golder 2011d. Macraes Phase III Project. Water management summary report. Report produced for Oceana Gold (New Zealand) Ltd by Golder Associates (NZ) Limited. Golder report 0978110-562 R002 vE. April 2011.

Golder 2011e. Macraes Phase III Project. Water quality effects mitigation options. Report produced for Oceana Gold (New Zealand) Ltd by Golder Associates (NZ) Limited. Golder report 0978110-562 R009 vE. April 2011.

Otago Regional Council. Shag River/Waihemo catchment water quality and ecosystem. November 2014.

Ryder Environmental Limited, Deepdell North Stage III Project Aquatic Ecology Assessment for Deepdell North III Project, 2019.

WGA 2019, Macraes Gold Project – Mine Site Dissolved Nitrogen Discharges, Draft Report April 2019

WGA 2018, Macraes Gold Project – Mine Water Model Integration, Draft Report May 2018

Appendices

Appendix A - Goldsim model description

A.1.0 Introduction to Goldsim

Goldsim (refer www.goldsim.com) is a software package designed to run Monte Carlo simulations for probabilistic analysis of dynamic systems. The software package essentially provides a visual interface for an excel spreadsheet type programming environment. Within the visual interface, elements are created to represent processes and events using equations and logic based decisions.

Goldsim allows user interfaces (dashboards) to be created which are used to specify model inputs and variable data before or during simulations. Models developed in Goldsim with appropriate dashboards can be exported as an executable program that can be run with the freely available Goldsim player software.

Goldsim includes features which make it a suitable tool for water balance modelling. These include; user specified time stepping, dimensional awareness and a range of programmed elements that can be implemented. Model updates can be scheduled to occur at user specified time steps for the duration of a simulation and these can be specified to complement input data resolution such as rainfall or river flow. To improve modelling accuracy unscheduled model updates are also included to capture dynamic processes such as the time at which a reservoir begins to overflow or a discrete event is triggered.

Dimensions are specified for all input data and an internal database is applied to unit conversions to ensure consistency throughout the model. Within the Goldsim interface programmed elements are implemented to simulate a variety of dynamic and discrete events.

The range of elements that are useful for water balance modelling include;

- Containers – allow a model to be subdivided into sub-systems, for example, individual catchments or processes.
- Inputs – this category of elements allow initial conditions to be specified and lookup tables to be defined containing information such as daily rainfall.
- Stocks – these elements capture how the state of a system changes with time and can represent reservoirs, ponds or other stores.
- Functions – these elements define processes or decisions at each model update, for example, calculating catchment runoff or the current discharge quality. Scripts can also be written to simulate complex behaviour or iterative processes.
- Events – events can be set to occur at a given point in time or can be triggered where specified conditions are met. This allows conditions within the simulation to be changed, such as specifying a date from which a pond can safely overflow.
- Delays – delay elements account for the time that it takes information or material to pass from one point to another, for example, water to be treated then discharged.
- Results – results can be recorded to display final model conditions or the dynamic behaviour of a system over the simulation period. Goldsim enables model results to be viewed as deterministic for individual realisations or probabilistic where multiple model realisations have been run.

Using these features detailed water balance models can be produced which simulate short term system responses and long term behaviour under a range of conditions.

A.2.0 Macraes mine water balance model

Model Categories

The aim of the Macraes water balance model (WBM) was to capture all significant water movements across the site affected by mine operations. This is achieved through accounting for water sources, sinks and processes on site that are summarised in the following categories:

Sources at the mine site include:

- Rainfall on catchment areas
- Stream and river flows including water pumped from the Taieri River
- Mine dewatering
- Seepage flow

Sinks

- Evaporation
- Retained moisture

Processes

- Pump rates
- Pond overflow rates
- Process water reuse

The WBM was run as a probabilistic simulation for the duration of the Macraes mine where the sources and model time step are defined at daily intervals. For each year modelled an annual rainfall time series was randomly selected from the database of daily rainfall records between 1990 and 2018. The model was run for 100 realisations of the full project duration.

Figure A1 shows the WBM home page where each of the elements represents a container enclosing a model to represent the localised system. Linking each of the containers are arrows, which indicate the flow of water through the model. Each of the nodes represented in the model receive runoff, seepage and upstream flow from the corresponding catchment areas.

The WBM also includes functions to model water quality within the water management system. Contaminant concentrations were modelled from each source and a mass balance determined the downstream receiving water quality.

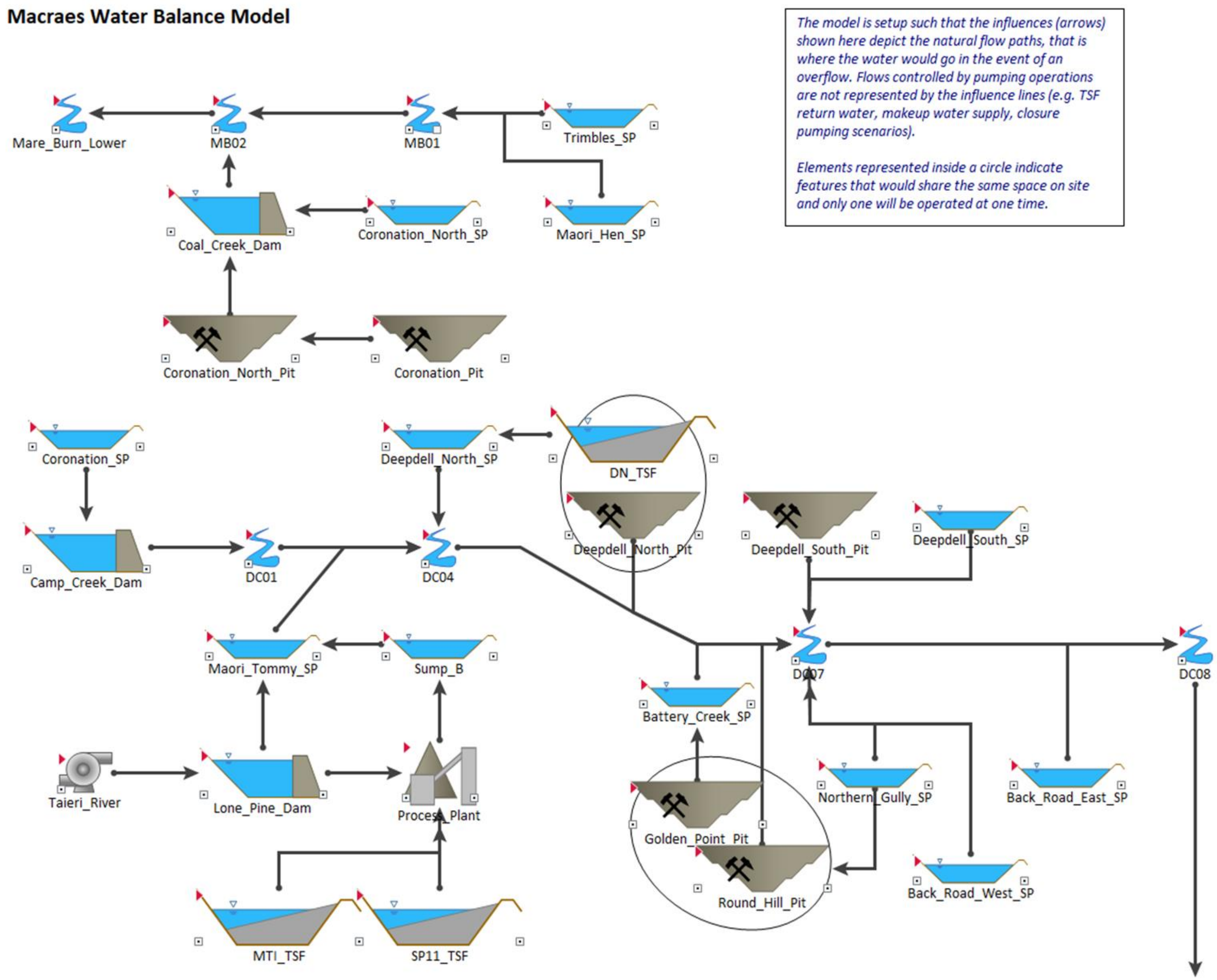


Figure A1 Macraes mine water balance model

A.3.0 Sources

Rainfall

The synthetic rainfall record applied in the WBM was developed through statistical analysis of historic rainfall records from the Deepdell and Golden Point met stations. The random selection of rainfall years over a number of simulations is useful for showing the probability of non-compliances as well as variability. A summary of mean monthly rainfall data is provided in Table A1. As shown in the table there is some variation in rainfall across the site, with the Deepdell catchment being generally drier than the Macraes gauge site.

Table A1 Rainfall data summary (mean monthly values)

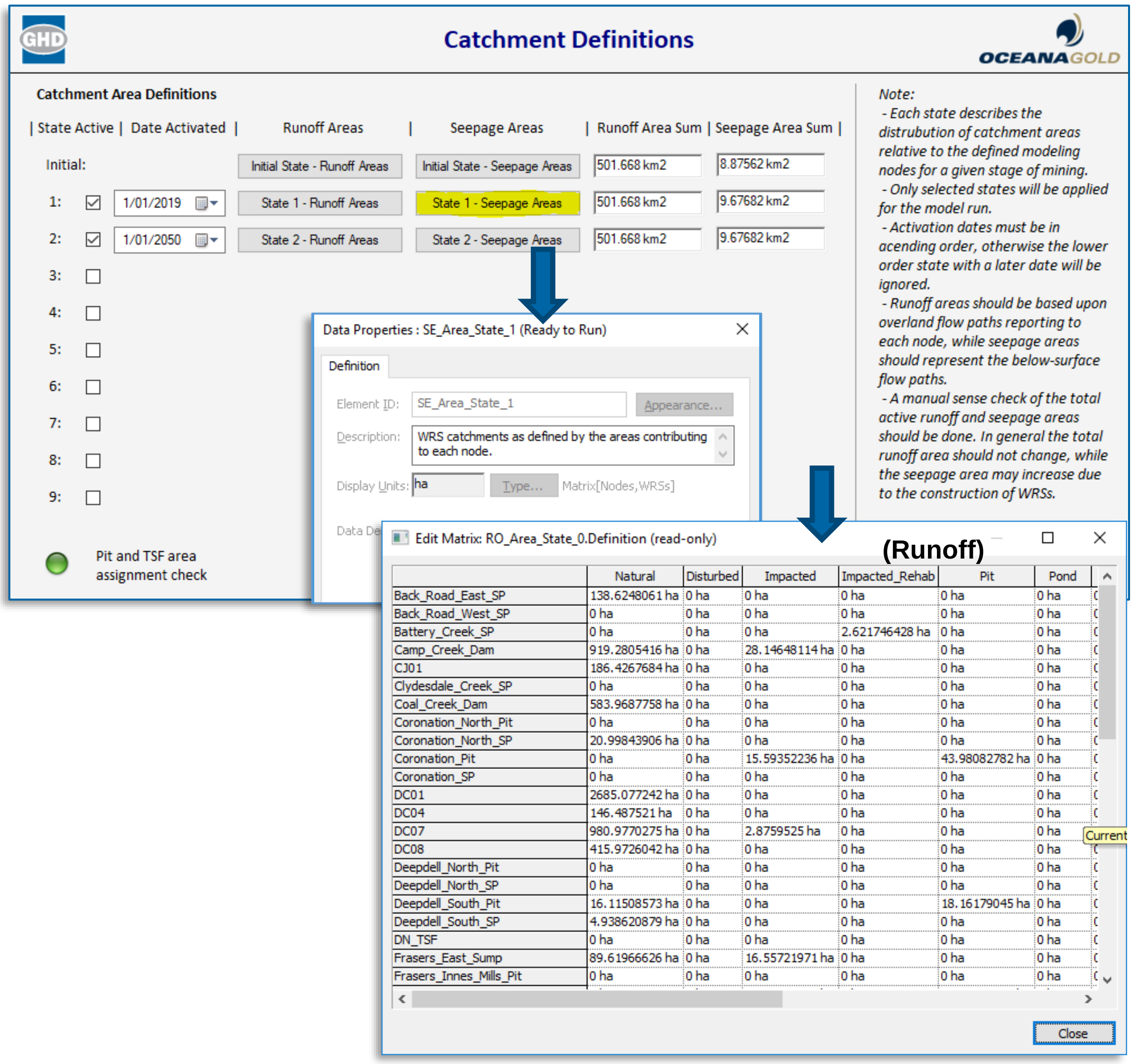
Month	Macraes mm (1991 to 2018)	Deepdell mm (2011 to 2018)
Jan	71	77
Feb	57	29
March	49	43
April	53	53
May	55	59
June	49	53
July	50	39
August	42	26
Sep	41	28
Oct	53	62
Nov	55	47
Dec	79	58
Total	**654**	**572**

Runoff Areas

The model has been setup to represent up to nine states of mine development, with different compilations of contributing catchment runoff from each of the following land uses:

- Natural
- Disturbed
- Impacted
- Mine Pit
- Silt Pond
- TSF
- WRS
- Rehabilitated – from WRS
- Rehabilitated – from Impacted

Additionally, seepage areas are defined to represent groundwater flow/seepage. The entire mine site is represented in the model; however for this study the focus is on the Deepdell catchment.



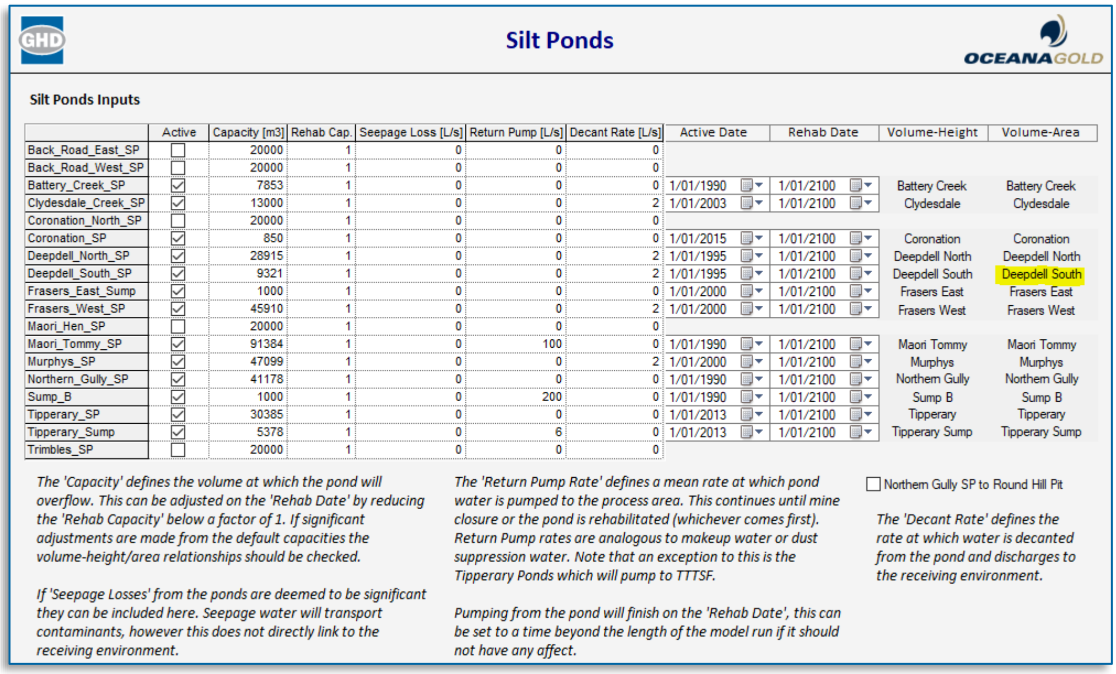
Taieri River

Taieri River water is supplied to site via approximately 15 km of pressure pipe and open channels. The consented take from the Taieri River is 15,000 m³/d and current abstraction rates are around 7,000 m³/d. This supply discharges to the Lone Pine freshwater storage reservoir before use on site.

Silt Ponds / Mine Pits / TSFs

Daily rainfall on each catchment area determines the flow into associated ponds. Silt pond characteristics such as capacity, decant rate and stage-storage curves are included within the model. The user can also switch ponds on/off, set a rehab date, pumping rate and define any appreciable seepage. The figure below shows how ponds are listed within the model.

Open pits are represented in a similar table for defining key pit information, including provisions for groundwater inflows.



Silt Ponds

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Silt Ponds Inputs

	Active	Capacity [m3]	Rehab Cap.	Seepage Loss [L/s]	Return Pump [L/s]	Decant Rate [L/s]	Active Date	Rehab Date	Volume-Height	Volume-Area
Back_Road_East_SP	☐	20000	1	0	0	0				
Back_Road_West_SP	☐	20000	1	0	0	0				
Battery_Creek_SP	☑	7853	1	0	0	0	1/01/1990	1/01/2100	Battery Creek	Battery Creek
Clydesdale_Creek_SP	☑	13000	1	0	0	2	1/01/2003	1/01/2100	Clydesdale	Clydesdale
Coronation_North_SP	☐	20000	1	0	0	0				
Coronation_SP	☑	850	1	0	0	0	1/01/2015	1/01/2100	Coronation	Coronation
Deepdell_North_SP	☑	28915	1	0	0	2	1/01/1995	1/01/2100	Deepdell North	Deepdell North
Deepdell_South_SP	☑	9321	1	0	0	2	1/01/1995	1/01/2100	Deepdell South	Deepdell South
Frasers_East_Sump	☑	1000	1	0	0	0	1/01/2000	1/01/2100	Frasers East	Frasers East
Frasers_West_SP	☑	45910	1	0	0	2	1/01/2000	1/01/2100	Frasers West	Frasers West
Maori_Hen_SP	☐	20000	1	0	0	0				
Maori_Tommy_SP	☑	91384	1	0	100	0	1/01/1990	1/01/2100	Maori Tommy	Maori Tommy
Murphys_SP	☑	47099	1	0	0	2	1/01/2000	1/01/2100	Murphys	Murphys
Northern_Gully_SP	☑	41178	1	0	0	0	1/01/1990	1/01/2100	Northern Gully	Northern Gully
Sump_B	☑	1000	1	0	200	0	1/01/1990	1/01/2100	Sump B	Sump B
Tipperary_SP	☑	30385	1	0	0	0	1/01/2013	1/01/2100	Tipperary	Tipperary
Tipperary_Sump	☑	5378	1	0	6	0	1/01/2013	1/01/2100	Tipperary Sump	Tipperary Sump
Trimbles_SP	☐	20000	1	0	0	0				

The 'Capacity' defines the volume at which the pond will overflow. This can be adjusted on the 'Rehab Date' by reducing the 'Rehab Capacity' below a factor of 1. If significant adjustments are made from the default capacities the volume-height/area relationships should be checked.

If 'Seepage Losses' from the ponds are deemed to be significant they can be included here. Seepage water will transport contaminants, however this does not directly link to the receiving environment.

The 'Return Pump Rate' defines a mean rate at which pond water is pumped to the process area. This continues until mine closure or the pond is rehabilitated (whichever comes first). Return Pump rates are analogous to makeup water or dust suppression water. Note that an exception to this is the Tipperary Ponds which will pump to TTTSF.

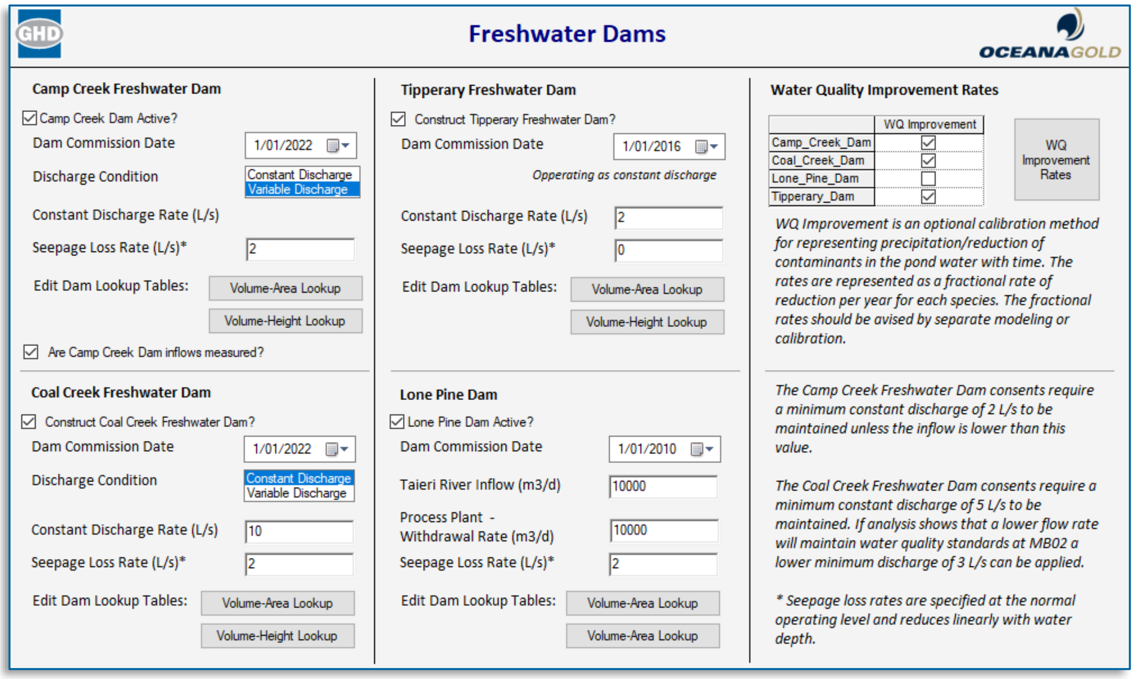
Pumping from the pond will finish on the 'Rehab Date', this can be set to a time beyond the length of the model run if it should not have any affect.

☐ Northern Gully SP to Round Hill Pit

The 'Decant Rate' defines the rate at which water is decanted from the pond and discharges to the receiving environment.

Freshwater Dams

The model allows for analysing the inclusion of freshwater dams at different times with the ability to amend the discharge rate. Storage and discharge information for the existing Lone Pine Dam, as well as possible future dams are included.



Freshwater Dams

GHD | OCEANAGOLD

Camp Creek Freshwater Dam

☑ Camp Creek Dam Active?

Dam Commission Date: 1/01/2022

Discharge Condition: Constant Discharge / Variable Discharge

Constant Discharge Rate (L/s)

Seepage Loss Rate (L/s)*: 2

Edit Dam Lookup Tables: Volume-Area Lookup | Volume-Height Lookup

☑ Are Camp Creek Dam inflows measured?

Coal Creek Freshwater Dam

☑ Construct Coal Creek Freshwater Dam?

Dam Commission Date: 1/01/2022

Discharge Condition: Constant Discharge / Variable Discharge

Constant Discharge Rate (L/s): 10

Seepage Loss Rate (L/s)*: 2

Edit Dam Lookup Tables: Volume-Area Lookup | Volume-Height Lookup

Tipperary Freshwater Dam

☑ Construct Tipperary Freshwater Dam?

Dam Commission Date: 1/01/2016

Opperating as constant discharge

Constant Discharge Rate (L/s): 2

Seepage Loss Rate (L/s)*: 0

Edit Dam Lookup Tables: Volume-Area Lookup | Volume-Height Lookup

Lone Pine Dam

☑ Lone Pine Dam Active?

Dam Commission Date: 1/01/2010

Taieri River Inflow (m3/d): 10000

Process Plant - Withdrawal Rate (m3/d): 10000

Seepage Loss Rate (L/s)*: 2

Edit Dam Lookup Tables: Volume-Area Lookup | Volume-Area Lookup

Water Quality Improvement Rates

	WQ Improvement
Camp_Creek_Dam	☑
Coal_Creek_Dam	☑
Lone_Pine_Dam	☐
Tipperary_Dam	☑

WQ Improvement Rates

WQ Improvement is an optional calibration method for representing precipitation/reduction of contaminants in the pond water with time. The rates are represented as a fractional rate of reduction per year for each species. The fractional rates should be avised by separate modeling or calibration.

The Camp Creek Freshwater Dam consents require a minimum constant discharge of 2 L/s to be maintained unless the inflow is lower than this value.

The Coal Creek Freshwater Dam consents require a minimum constant discharge of 5 L/s to be maintained. If analysis shows that a lower flow rate will maintain water quality standards at MB02 a lower minimum discharge of 3 L/s can be applied.

** Seepage loss rates are specified at the normal operating level and reduces linearly with water depth.*

A.4.0 Sinks

Evaporation

Evaporation data was available from an evaporation pan that has been operated by OGNZL since 1992 near MT1. This data was used in the model to calculate losses from water bodies including the TSFs. Evaporation routinely exceeds rainfall as can be seen from the comparison provided in Figure A2.

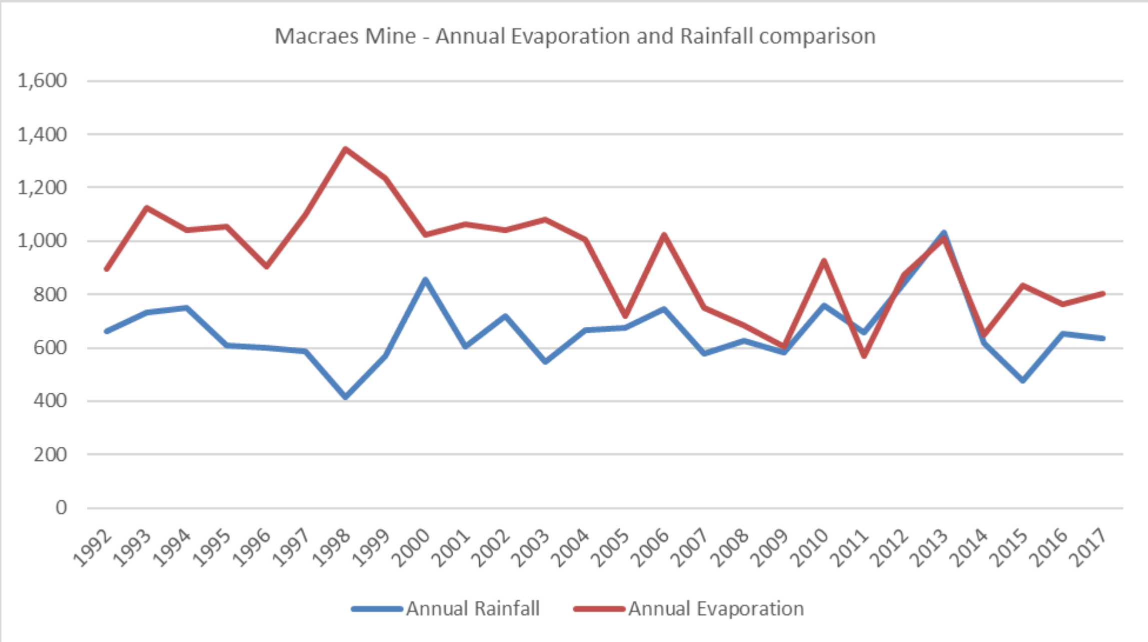


Figure A2 Comparison of annual rainfall and evaporation at Macraes

Processes

Pump capacities, pond capacities and water reuse all influence when there may be a net discharge from the site of mine impacted water (e.g. from a silt pond). Within the model all of these transfers and capacities are accounted for based on advice from OGNZL.

A.5.0 WBM model calibration

Runoff areas from all catchments was generated in the WBM using a relationship developed between rainfall and stream flow (runoff) and catchment type. The overall catchment balance is checked in the model at key nodes including the gauge locations.

A calibration of the WBM was completed with measured river flow data. For the given calibration period the WBM is shown to provide a reasonable representation of the water balance.

The following figures shows the relationship between flows generated by the AWBM unit used in the model and the associated actual flow data for the same time period. Depending on flow rate the calibration accuracy is generally within 5% which is considered acceptable.

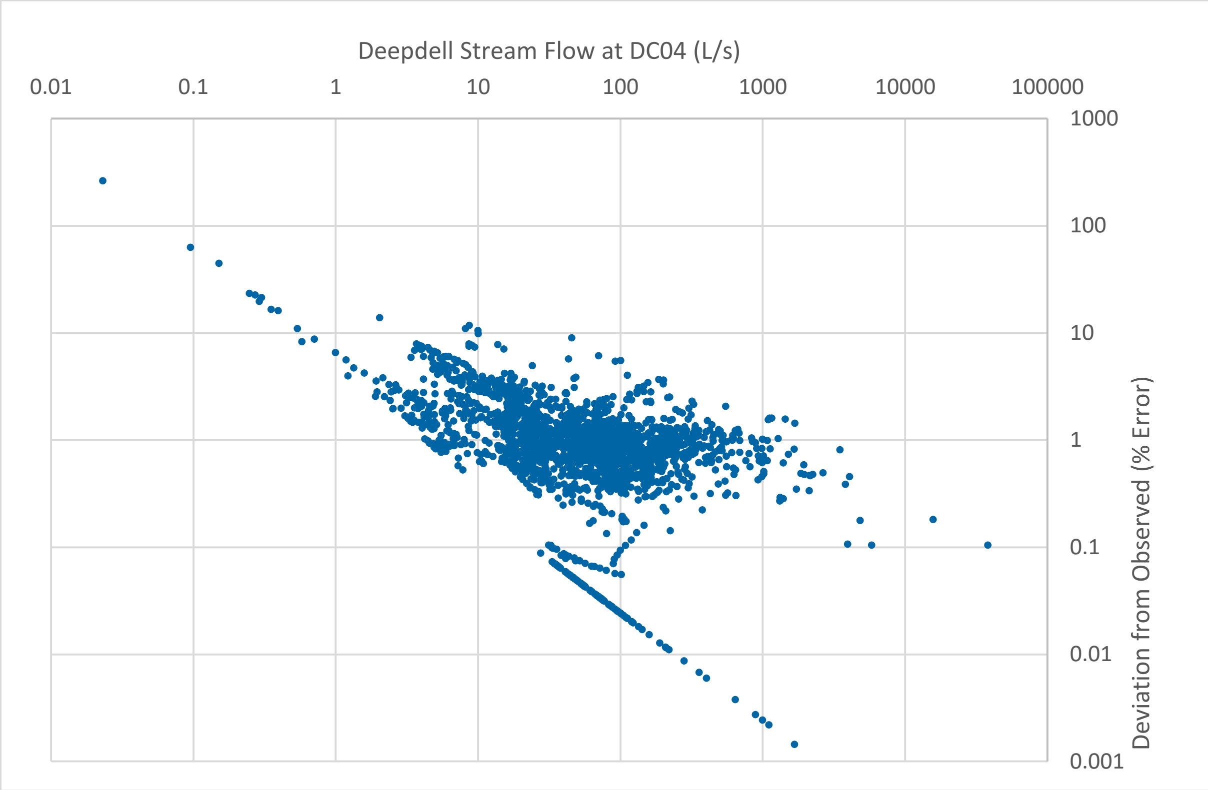


Figure A3 Flow calibration statistics for Deepdell Creek at DC04

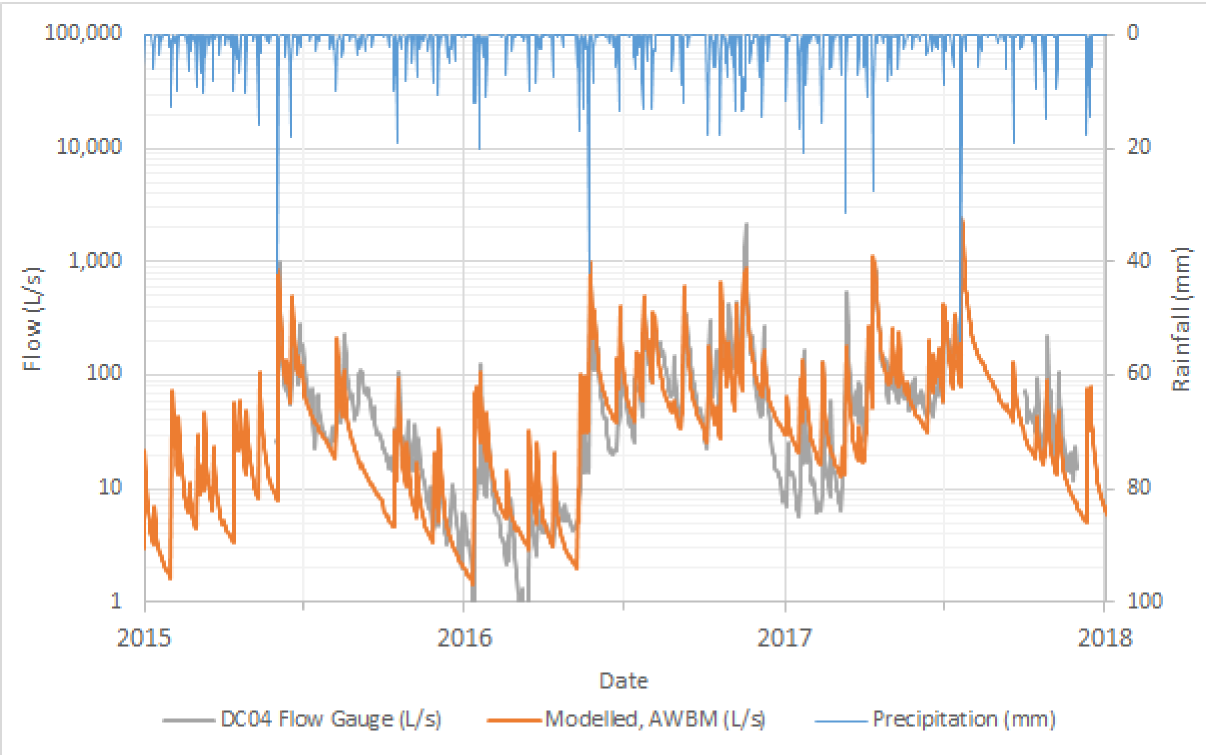


Figure A4 Flow calibration for Deepdell Creek at DC04

Contaminant concentrations are defined for water sources categorised by land use type.

Figure A5 demonstrates the correlation between measured and modelled sulphate values where the actual rainfall record is applied in place of the extended synthetic record. Modelled runoff, stream flow and evaporation rates affect the modelled concentrations in addition to the defined water source concentrations. The modelled concentrations over predict the measured median by 7% for this period indicating a level of conservatism in the results.

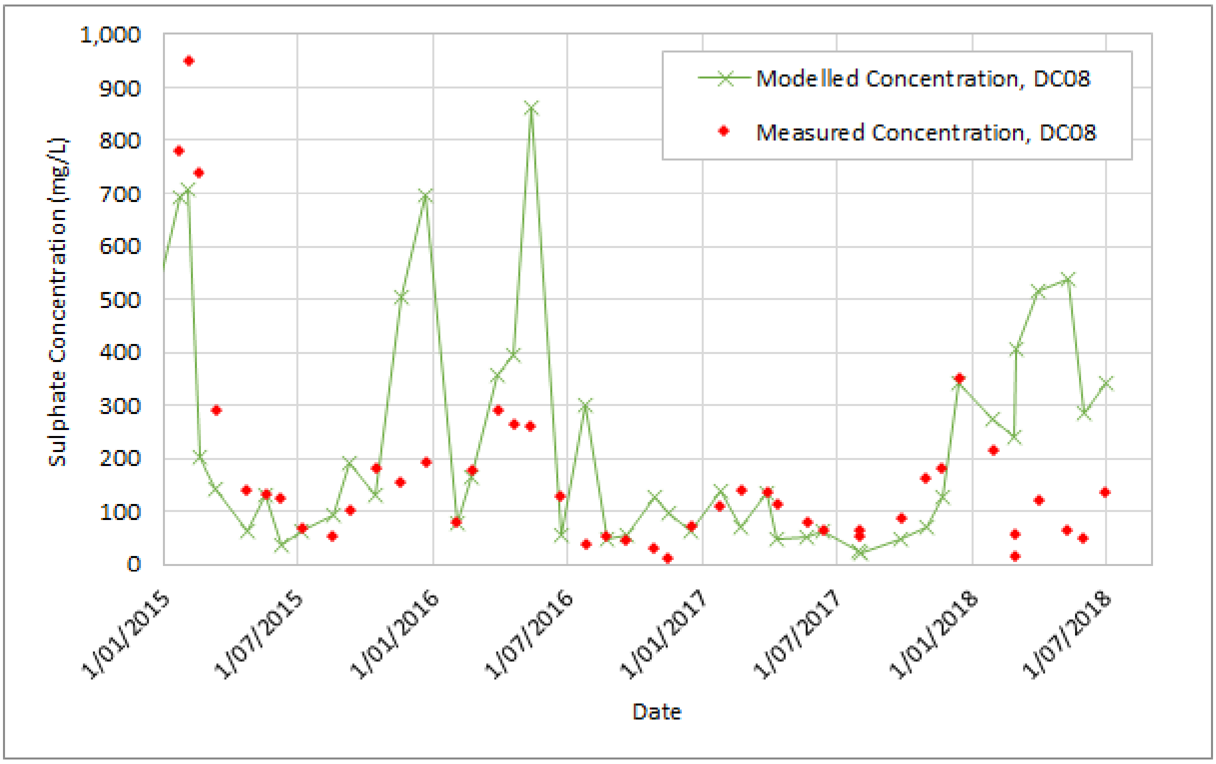


Figure A5 Calibration of Sulphate concentrations at DC08

Appendix B - Waste rock stack seepage assessment

23 August 2019 Job No: 61130 eTrack No: 200028882

Gavin Lee
OceanaGold (New Zealand) Limited
RD3
Macraes Flat 9483

WASTE ROCK STACK SEEPAGE ASSESSMENT

Dear Gavin

OceanaGold (New Zealand) Limited (OGNZL) engaged Babbage Consultants Limited (Babbage) to find out whether seepage from the North Gully waste rock stack (WRS) (as measured at North Gully Seep East) is a suitable proxy for WRS seepage across the Macraes Gold Project (MGP, the Site). Previous water models have applied the chemistry measured at North Gully Seep East (over a limited period) to all WRS across the MGP with no consideration of WRS volumes, areas or geological characteristics.

In the event North Gully Seep East seepage is found to be an unsuitable proxy for WRS seepage across the MGP, we were asked to establish a set of relationships for median and 95%ile concentrations of sulphate, based on historical data, that could be used in the site wide water model. This letter presents the methodology and results of our assessments.

Approach

The initial scope of the work was to identify trends in the chemistry of water samples from different WRS at the Site and assess if the concentrations of certain parameters (in particular, sulphate) are at equilibrium (stable) or likely to increase over time. Babbage proposed to carry out this work by looking at the recent water chemistry from several WRS and creating a thermodynamic model in PHREEQC to assess whether the chemistry of the WRS was stabilising or might continue to increase.

After this initial analysis, possible correlations between the available data (physical properties of the WRS, time, age, and seepage quality) were considered to assess if there was a possible relationship and equations that could substitute the original value (for sulphate) used in the site-wide water model.

Available Data

In October 2018, Babbage carried out a site visit to familiarise itself with the location of the WRS and general geography, hydrology and layout of the Site.

OGNZL provided Babbage surface and groundwater chemistry data from locations in and around the Site. OGNZL also provided Babbage two sets of contour surveys covering the Site, one before mining

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(base contours) and one from a recent survey in 2018. Intermediary contours were provided for the Coronation WRS that were collected on an approximately three-monthly basis between January 2015 and March 2019. In summary, the data used for this assessment were:

- Site contours, base and recent (from OGNZL)
- Water chemistry from samples of surface water and groundwater taken at different locations around the Site since 1998 (from OGNZL)
- Aerial photography (from Google and LINZ)
- Rivers and road data (from LINZ)

There were no data available on the age of the WRS or intermediary contours (to assess increase in areas and depths over time), except for Coronation WRS.

Waste Rock Stack Seepage Quality

There were eight WRS for which seepage data were available, either directly or as measured in a silt pond downgradient (as was the case for Coronation WRS) or groundwater monitoring results. These WRS are listed below with the associated monitoring site in parenthesis:

- Coronation North (Maori Hen Gully Seepage)
- Coronation (Coronation Silt Pond)
- Frasers East (Frasers East WRS Seepage)
- Frasers West (Murphy's Creek Silt Pond, FDB06 and FDB08 groundwater)
- North Gully East (North Gully Seep East)
- North Gully West (North Gully Seep West)
- Golden Bar (Clydesdale WRS Seepage and Silt Pond)
- Deepdell North (Deepdell North Silt Pond)

The concentrations of sulphate and other analytes for Frasers East WRS were much higher than any other WRS data. OGNZL mentioned that it is likely that water from the tailings dam is percolating to the sampling location where samples for Frasers East WRS are taken. Therefore, the data for Frasers East WRS was not considered in this analysis.

The concentrations of calcium, magnesium and sulphate in the seepage from the WRS are summarised in Figure 1 along with pH. Sulphate is the principal element of concern, and calcium and magnesium are the principal controls on sulphate in groundwater. The results show the pH of WRS seepage is relatively stable (pH 6-8) over time and between WRS. In contrast, the concentrations of calcium, magnesium and sulphate are highest in the seepage from North Gully East and lowest in the seepage from Coronation North. Concentrations of all three parameters have, in general, increased over time in all five WRS.

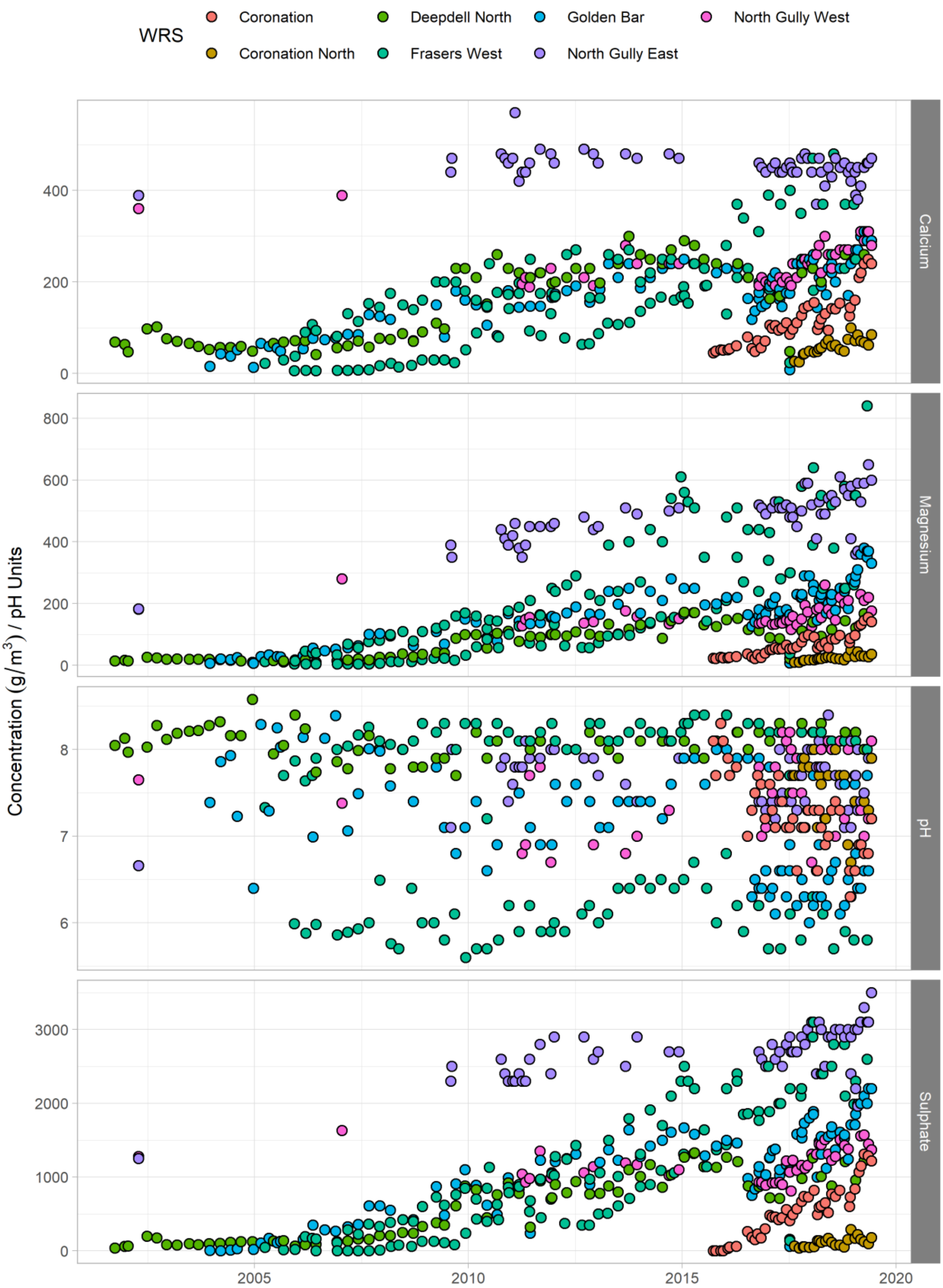


Figure 1. Waste rock stack seepage quality over time.

Thermodynamic Modelling

To assess whether WRS chemistry was stabilising, or might continue to increase, thermodynamical models for the North Gully East, Frasers East and Coronation WRS were developed in PHREEQCi, a geochemical modelling package. The results of modelling indicate the system is approximately at equilibrium for calcium-sulphate assemblages (e.g., calcite) but undersaturated with respect to epsomite, a magnesium-sulphate mineral. These results indicate that if there is epsomite in the WRS, then, especially for actively growing stacks, there is the potential for sulphate concentrations to continue to increase over time.

These results are broadly consistent with the WRS seepage quality data. As shown in Figure 2a, except for Frasers West, there is a linear correlation between calcium and magnesium at lower concentrations, but at high concentrations there is proportionately more magnesium than calcium in the solutions. In addition, as shown on Figure 2b, there is a correlation between magnesium and sulphate, especially at elevated magnesium concentrations (i.e., where calcium is less of an influence).

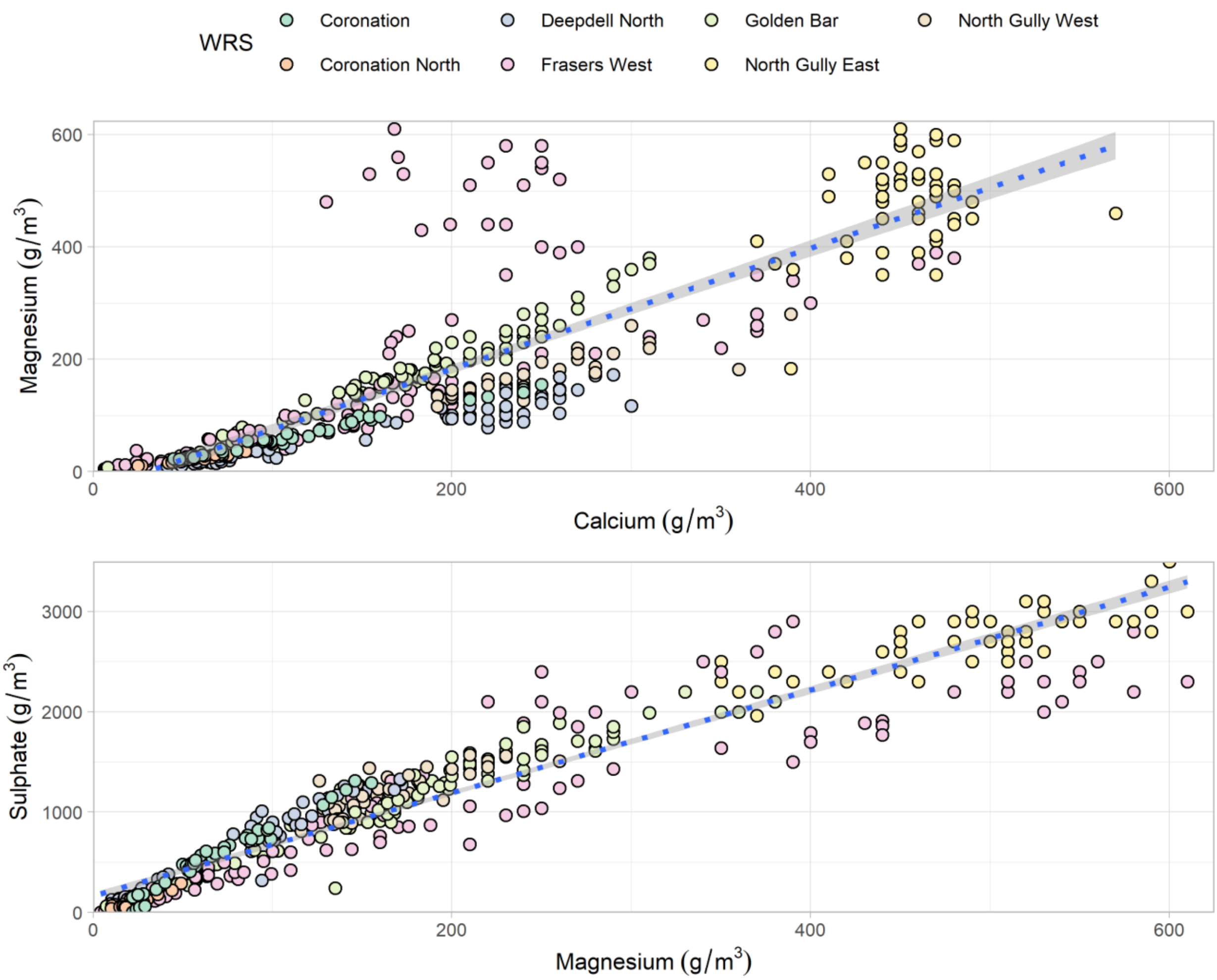


Figure 2. Correlation between a) magnesium and calcium WRS seepage concentrations (upper) and sulfate and magnesium WRS seepage concentrations (lower).

Waste Rock Stacks Areas and Volumes

A geographical information system was created with data provided by OGNZL (surface and groundwater monitoring locations and land contours) and publicly available aerial photography and river centrelines.

The contours were used to create two sets of digital elevation models (DEM), one using contours from before mining (base DEM) and one with contours from surveys done in 2018 (recent DEM). A raster analysis was done to identify elevation differences between the recent and base DEM. Areas where elevation had decreased indicated pits, while areas where elevation had increased indicated WRS.

Each WRS was delineated based on contour changes, topography files provided by OGNZL, aerial photos, and notes from the site visit. The volume, area and depth of each WRS (used in this assessment) were calculated using the data provided in a GIS environment. The location and average depth of each WRS are shown on Figure 3.

As more data was available for the Coronation WRS, including seasonal topography surveys, the changes of depth over time were calculated using each of the historical topography datasets.

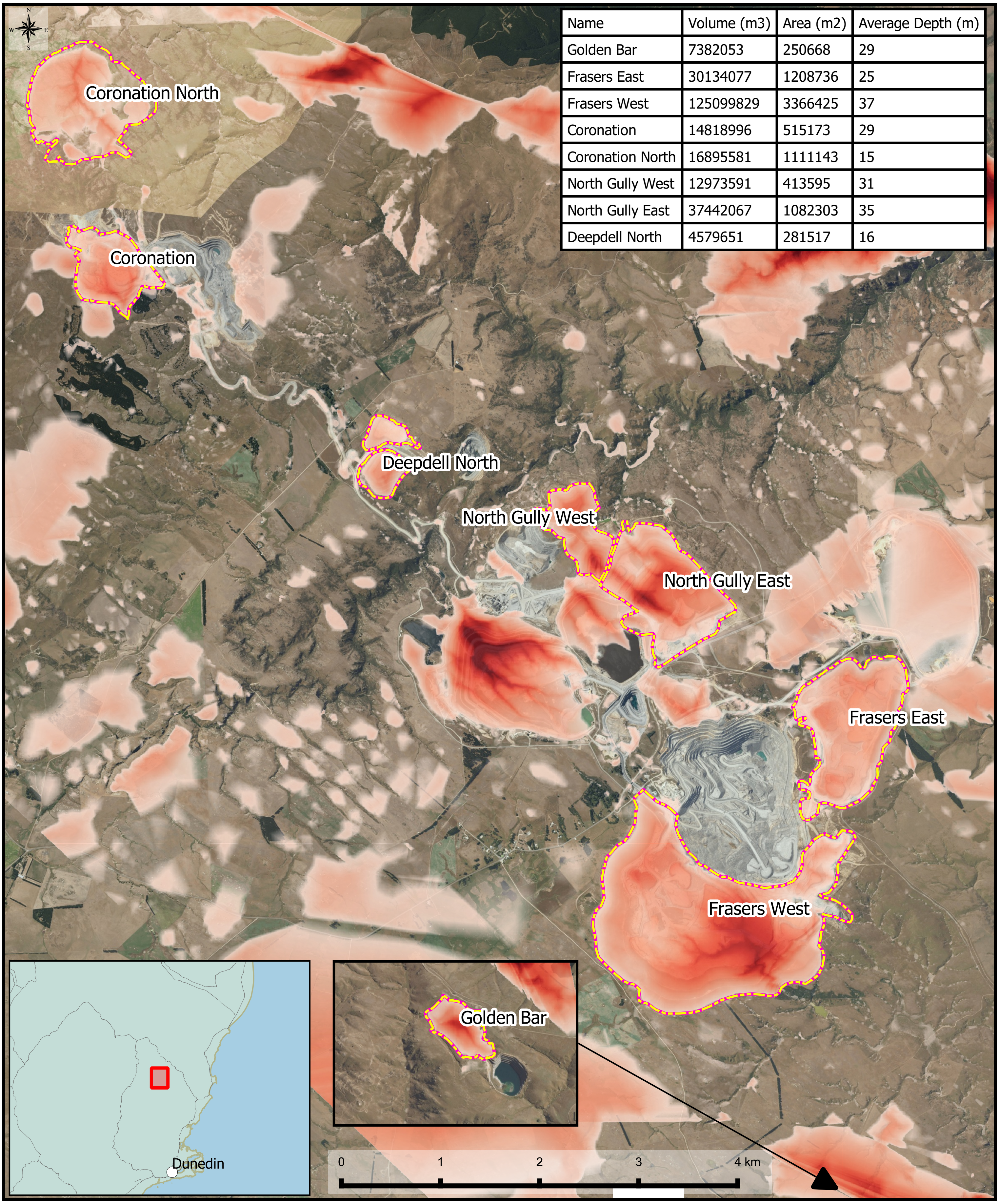
Correlations

Seepage (or silt pond) concentrations of sulphate were initially plotted against the age (in years) of the WRS. The results, in Figure 4, show that the increase in concentrations over time is not consistent between each WRS, and therefore further variables are needed for a good relationship.

It is evident from the plot (Figure 4) that sulphate concentrations in seepage from some WRS stop increasing when the WRS is capped (e.g., Deepdell North WRS) while others present a high degree of variation (e.g., Golden Bar WRS) or a slower rate of increase (e.g., North Gully East WRS). This seems to relate to whether the WRS is partially capped or fully capped. In any case, to establish a relationship between the age of a WRS and the seepage sulphate concentration, it is important to only consider the time during which the WRS was operational (i.e., age to partial capping, if relevant ,and age to full cap), otherwise the relationship will forecast ever-increasing concentrations.

The sulphate concentration was plotted against the results of the GIS analysis (i.e., area and volume), and the results and show that, individually, area(Figure 5) and volume (Figure 6) do not exhibit a good relationship with the resulting sulphate concentrations in the WRS seepage. However, when seepage concentrations are plotted against the average depth (volume/area) a strong relationship is observed (Figure 7). This is consistent with the idea that deeper stacks will increase the retention time of seepage water (as it takes longer to percolate through the WRS, staying longer in contact with the waste rock) and therefore increase the concentrations of the seepage.

The two correlations (age and average depth) were subsequently combined into one single correlation and different weight values were applied to each attribute to establish a linear relationship. The results are shown in Figure 8.



Name	Volume (m3)	Area (m2)	Average Depth (m)
Golden Bar	7382053	250668	29
Frasers East	30134077	1208736	25
Frasers West	125099829	3366425	37
Coronation	14818996	515173	29
Coronation North	16895581	1111143	15
North Gully West	12973591	413595	31
North Gully East	37442067	1082303	35
Deepdell North	4579651	281517	16

61130 Figure 3 - Oceana Gold

WRS and Positive DEM Changes

23/08/2019 by L.C.

SCALE **@ A4 1:50000**

Macraes WRS

NOTES
DEM calculated based on contour layers provided by the client.
WRS delimitation based on site visit and contours.

SOURCES
Aerial Photography: LINZ MapServices
Roads: LINZ MapServices
Topography: Client Provided

Legend

Waste Rock Stacks (WRS)

Otago Watercourses

DEM Changes (m)

0
5
20
40
55
70
80
95
>110

Babbage®

DISCLAIMER:
This map/plan is not an engineering draft.
This map/plan is illustrative only and all information should be independently verified on site before taking any action.

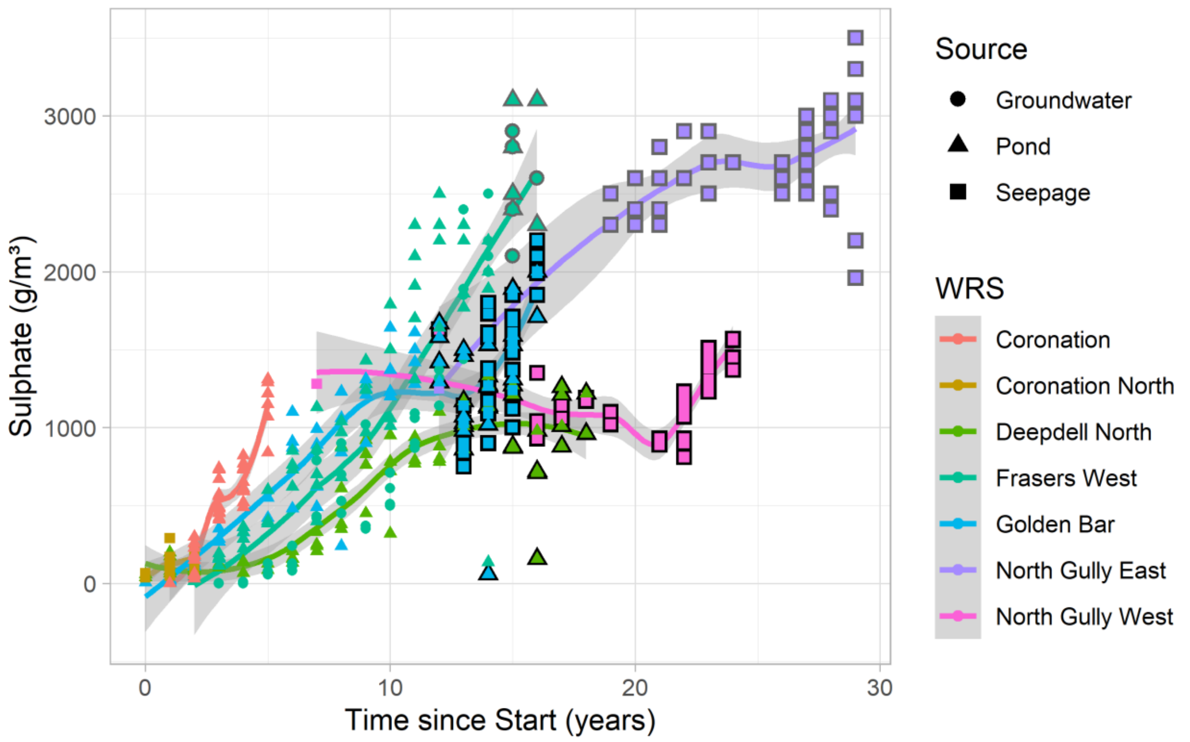


Figure 4. Sulphate concentrations in waste rock stack seepage over WRS age (in years). [1]

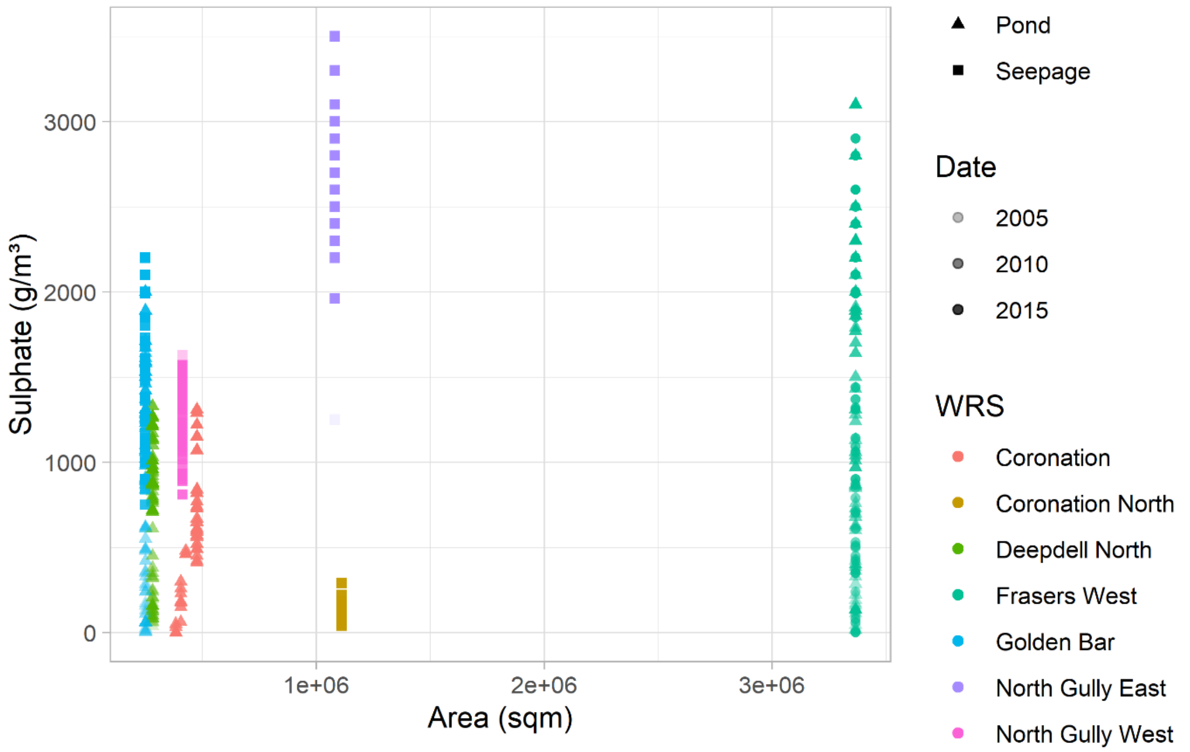


Figure 5. Sulphate concentrations in waste rock stack seepage over WRS area.

[1] In Figure 4, grey delineated data points are samples collected after partial capping, while the black delineated data points are samples collected after the WRS is fully capped.

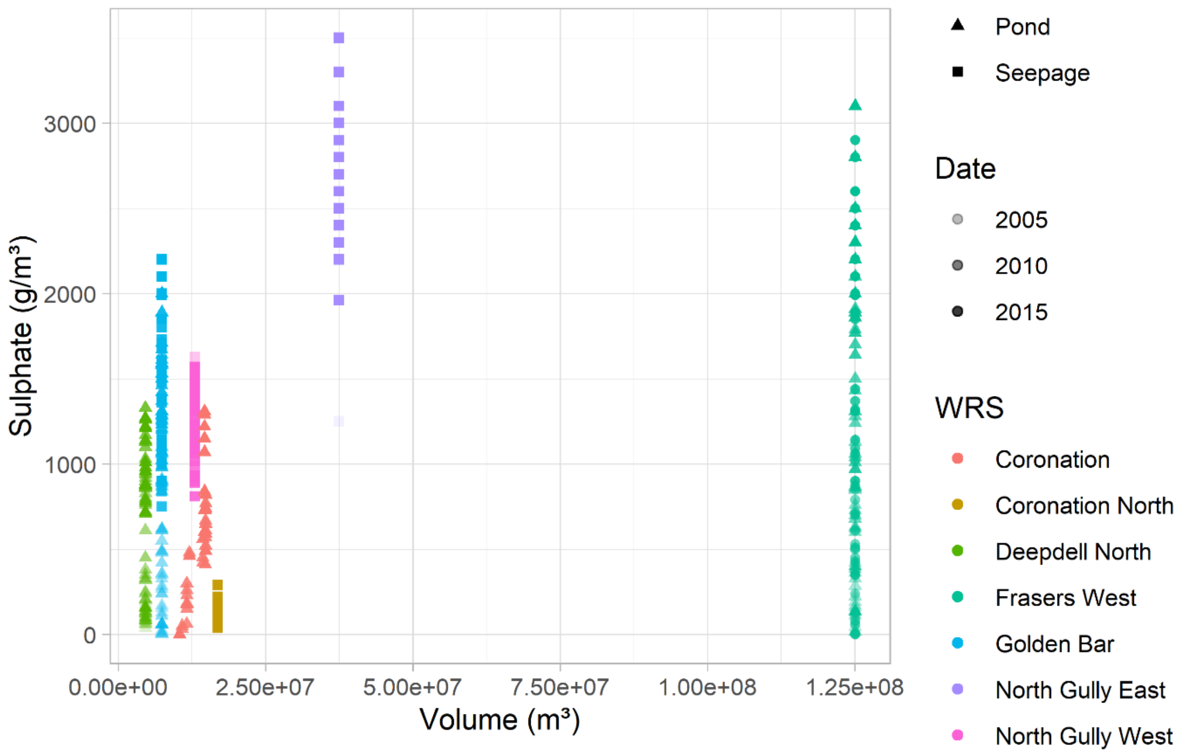


Figure 6. Sulphate concentrations in waste rock stack seepage over WRS volume.

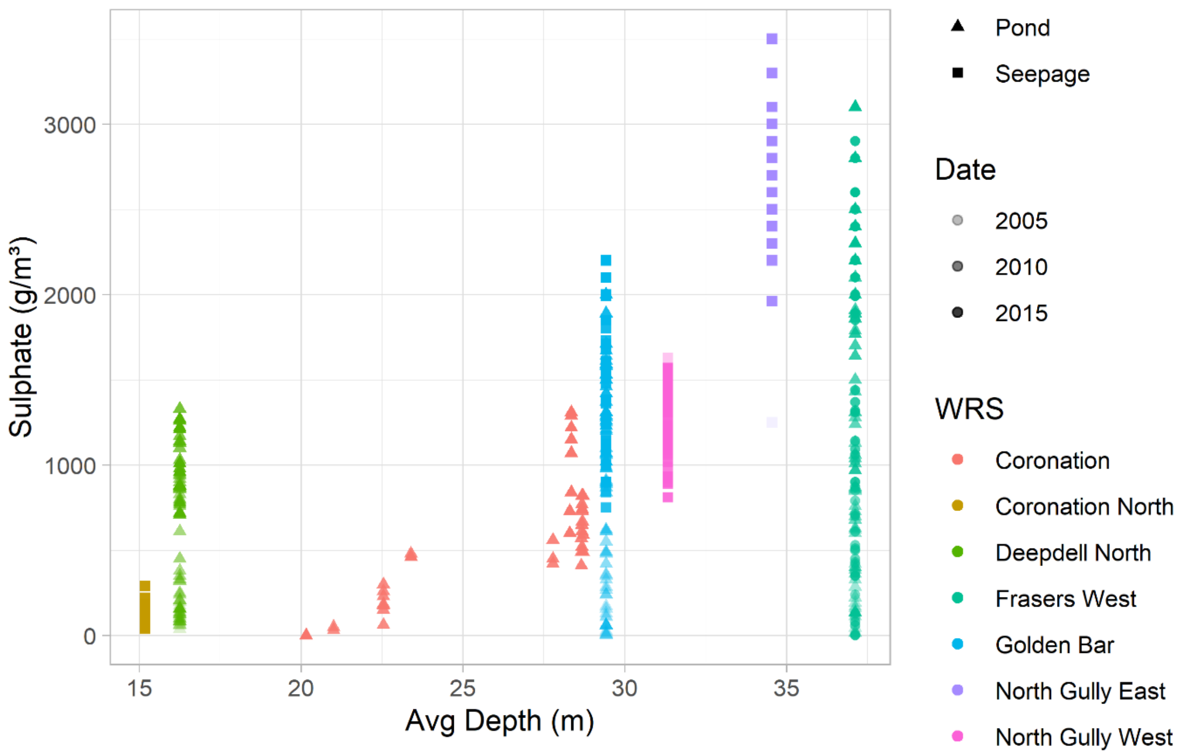


Figure 7. Sulphate concentrations in WRS seepage over WRS average depth (volume/area).

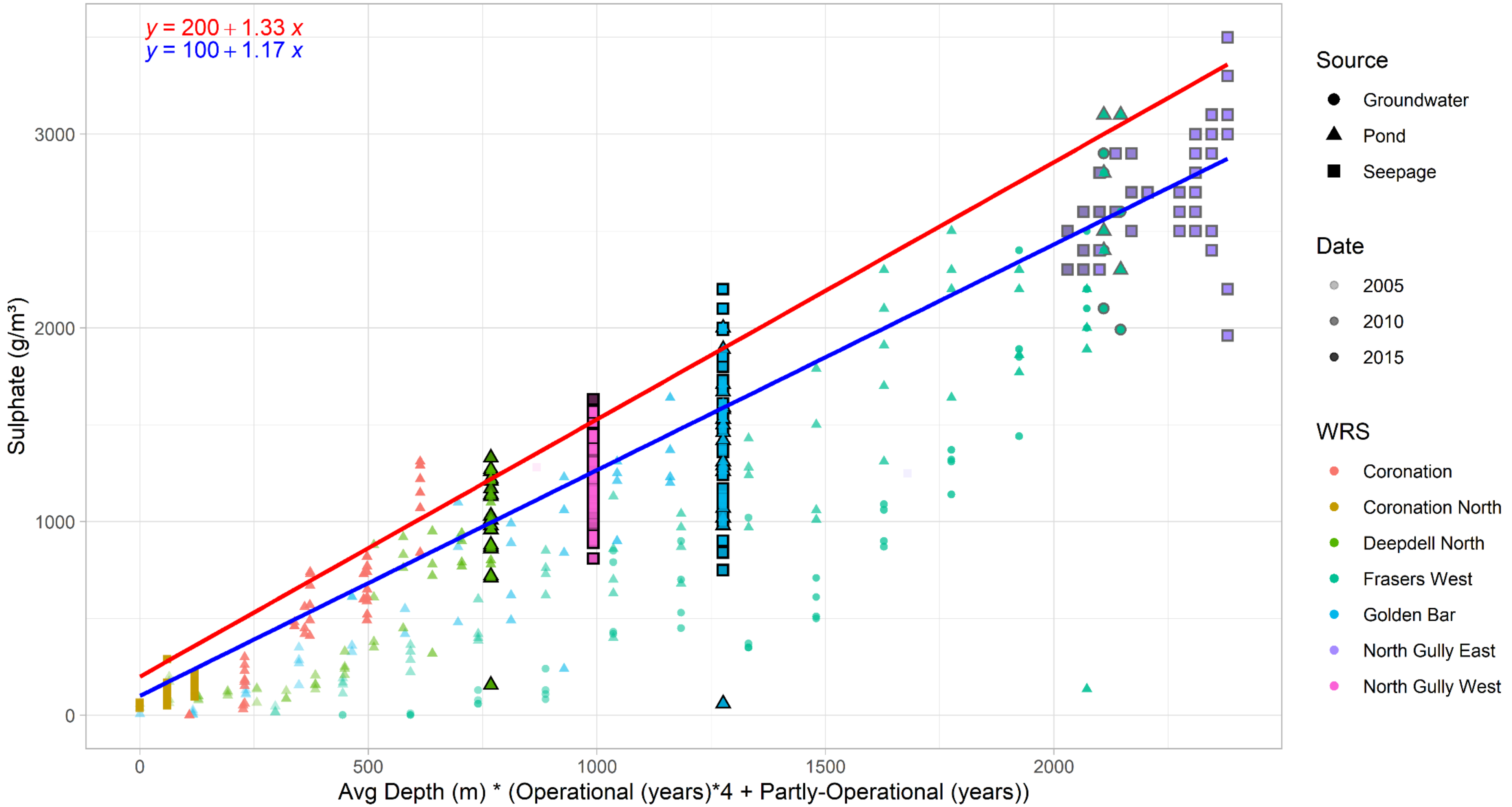


*Figure 8. Sulphate concentrations in waste rock stack seepage over (average depth) * [(full operation time * 4)+ partial operation time].*[1]

With the combined parameters (volume, area and age) and the adopted weights showing a linear relationship with the sulphate concentrations, we can establish a set of equations for the median and 95%ile values based on the data. The equations and linear relationship are shown in Figure 8, and can be written as:

$$95\%ile\ Sulphate = 200 + 1.33 * \frac{Volume}{Area} * [4 * Age1 + Age2]$$

$$Median\ Sulphate\ = 100 + 1.17 * \frac{Volume}{Area} * [4 * Age1 + Age2]$$

where:

- sulphate concentrations are in g/m^3
- Volume is the volume of the WRS, in m^3
- Area is the land footprint (not surface area) of the WRS, in m^2
- Age1 is the time the WRS was in full operation (i.e., not capped), in years
- Age2 is the time the WRS was in partial operation (i.e., partially capped), in years

Based on these data and the established relationship, the deeper and older (i.e., longer operating) WRS generally have higher concentrations of sulphate and a higher variation (as represented by the different coefficients for the median and 95%ile lines).

Observations

The plot in Figure 8 uses average depths as measured in 2018 by the GIS analysis. The exception for this is Coronation WRS, for which intermediary topography surveys were available, and therefore we can better see the evolution of the correlation.

Although North Gully East WRS has been capped (according to OGNZL) we considered it as partially capped, as the concentrations of sulphate in the seepage have been increasing (likely) due to the use of the WRS area for stockpiling low grade ore.

It is evident from the plot (Figure 8) that seepage quality from Coronation North WRS is below the median. This shows that the different methodology used in the construction of Coronation North (Mossman, pers. comm.) is working to reduce the concentration of minerals in the seepage.

In contrast, sulphate concentrations in Coronation silt pond (which was used as a proxy for Coronation WRS seepage) have recently (2019) increased above the median and 95%ile. This could be due to differences in operation or because of an increase in the average depth of the WRS subsequent to the latest available survey (March 2019).

Summary

Depending on the mineralogy of the WRS, the sulphate concentrations recently measured in the seepage from Northern Gully East may have reached a maximum. However, there is a risk sulfate concentrations will continue to increase. Accordingly, seepage from the North Gully East WRS (as measured at North Gully Seep East) is not considered a suitable proxy for WRS seepage across the Site.

Analysis of the available data shows that it is possible to establish a correlation between the age and size of the WRS and the sulphate concentration in the seepage (or silt pond when used as a proxy). The assessment resulted in two equations for expected median and 95%ile concentrations of sulphate in WRS seepage.

Recommendation

We recommend determining whether epsomite is present in the WRS to establish whether the sulphate concentrations in seepage are likely to stabilise or continue to increase. In either case, we recommend investigating sulphate remediation options and different ways to build the WRS (such as the one used in Coronation North WRS).

Closure

Thank you for providing Babbage with the opportunity to undertake this assessment. If you have any questions in relation to the contents of this letter, please contact the undersigned.

Yours sincerely

Lobo Coutinho
Environmental Engineer and Hydrogeologist

Dr Grant Allen
Senior Environmental Scientist

Babbage Consultants Ltd

Attachments: Applicability and limitations

APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of OceanaGold (New Zealand) Limited as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk.

Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions. Where opinions or judgements are to be relied on they should be independently verified with appropriate legal advice.

Maps and Images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts. Do not scale any of the maps, plans or figures in this report. Any information shown here on maps, plans and figures should be independently verified on site before taking any action. Sources for map and plan compositions include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Babbage Consultants Limited.

Appendix C – Proposed surface water quality monitoring

C.1.0 Proposed Monitoring

The water quality monitoring regime proposed by OGNZL follows.

This aligns with that currently being undertaken.

MONITORING

(i) Surface Waters

OGNZL proposes to collect monthly representative water samples from the following surface water sites (as shown on Figure 3):

(i) Deepdell Creek Compliance Point (“DC08”); and
(ii) Shag River Compliance Point 1 (“Shag River - Loop Road”)
(iii) Highlay Creek (immediately upstream of the confluence with Deepdell Creek)

All surface water sampling will occur on the same day.

Samples will be analysed for the following parameters:

Constituent	Monthly
Major cations:	
calcium	✓
magnesium	✓
potassium	✓
sodium	✓
Major anions:	
bicarbonate	✓
carbonate	✓
chloride	✓
sulphate	✓
pH	✓
Conductivity	✓
Arsenic	✓
Copper	✓
Iron	✓
Lead	✓
Zn	✓
Cyanide (WAD)	✓

(ii) Waste Rock Stack Seepage

OGNZL proposes to obtain representative samples of groundwater seepage from the toe of the Deepdell East Waste Rock Stack and the Deepdell Waste Rock Stack at the following points:

- Highlay Silt Pond 1;
- Highlay Silt Pond 2;
- Deepdell South Silt Pond; and
- Deepdell North Silt pond.

Construction of the waste rock stack will be progressive therefore commencement of monitoring of groundwater seepage will be dependent on a) waste rock being deposited in the catchment of each seepage collection point (as shown on Figure 3) and there being sufficient seepage water discharged to allow a sample to be collected.

Samples will be analysed for the following parameters at the following intervals:

Constituent	Monthly	Quarterly
Major cations:		
calcium magnesium	✓	
potassium sodium	✓	
Major anions:	✓	
	✓	
bicarbonate		
carbonate	✓	
chloride sulphate	✓	
pH	✓	
Conductivity	✓	
	✓	
Copper	✓	✓
Iron		✓
Lead		✓
Total Inorganic Nitrogen		✓
Arsenic		✓
		✓

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https://projects.ghd.com/oc/NewZealand/macraesgoldprojectwa/Delivery/Documents/06 Deepdell WRS WB Final - Rev 1.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
Rev 1	SHartwell	Stephen Douglas		Stephen Douglas		05/11/19

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F

APPENDIX F

Noise Assessment Report

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Report Number: AC17347 – 13 – F1

OceanaGold Deepdell North Stage III Gold Mine, Macraes Flat, Otago

Assessment of Environmental Noise Effects

Prepared for:
OceanaGold Corporation
Macraes Flat
EAST OTAGO 9483

Issued:
3 December 2019

ACENZ

Association of Australasian Acoustical Consultants

Revision History

Reference	Status	Date
AC17347 – 13 – R1	Revision 1	2 October 2019
AC17347 – 13 – R2	Revision 2	18 October 2019
AC17347 – 13 – R3	Revision 3	22 October 2019
AC17347 – 13 – F1	Final 1	03 December 2019

Document Acceptance

Author	Signature
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Reviewer	**Signature**
Dr Jeremy Trevathan *Ph.D. B.E.(Hons.) Assoc. NZPI® MASNZ* Managing Director	
Approver	**Signature**
Dr Jeremy Trevathan *Ph.D. B.E.(Hons.) Assoc. NZPI® MASNZ* Managing Director	

Table of Contents

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1.0 BACKGROUND

Acoustic Engineering Services (AES) have been engaged by the OceanaGold (New Zealand) Limited (the Applicant) to provide acoustic engineering advice in relation to an application for Resource Consent for Stage III of the Deepdell North gold mine, in Macraes Flat, Otago. The Applicant requires an assessment of the environmental noise emitted by the activity, with regard to section 104 (1) of the Resource Management Act 1991 (RMA), which requires the actual and potential effects of the activity on the environment to be considered.

This report should be read in conjunction with the Resource Consent application documentation, and is based on information received by email, including terrain contours, identification of neighbouring properties, and description of activity.

OceanaGold have several other existing mining operations in the area, with the Coronation and Coronation North mines to the north, other stages of the Deepdell mine to the south, and Fraser mine on the opposite side of Macraes Road. All of these pits operate pursuant to other Resource Consents.

AES have undertaken previous work at the overall Macraes Flat site, including the following:

- Clare Dykes of AES visited the Coronation North mine at Macraes Flat on the 8th of February 2018, to observe the existing activity, and measure the noise emitting equipment.

- AES have undertaken previous noise measurements at a neighbouring dwelling (C & M Howard dwelling on Horse Flat Road) in order to determine the noise levels from the Coronation North mine. An unattended monitoring station has also been set-up at the C & M Howard dwelling. The levels recorded for a six-week period were analysed and the results outlined in a report titled *Oceana Gold Mining activity, Macraes Flat – Review of unattended noise monitoring data* (AES file reference: AC17347 – 12 – R2), and dated the 21st of November 2018.

- Based on the above noise measurements, a noise model was produced to predict the current noise emissions from the Coronation North mine. The results of this were outlined in a report titled *OceanaGold Coronation North mine, Macraes Flat, Otago – Current noise emissions* (AES file reference: AC19058 – 01 – R2), and dated the 21st of March 2019.

- Attended noise monitoring was undertaken at the C & M Howard dwelling during the evening of the 24th of July 2019. The results of this were outlined in a report titled *OceanaGold Corporation, Macraes Flat, Otago – Noise levels at dwelling on Horse Flat Road and potential upgrades* (AES file reference: AC18364 – 03 – R1), and dated the 31st of July 2019.

1.1 Site and surrounding area

The proposed pit and waste rock stack areas are located in Macraes Flat, as an extension of the current mining activity. The proposed activity is located within both the Macraes Mineral Mining and Rural Scenic Zones as defined in the Waitaki District Plan – the pit within the Macraes Mining Zone, and the rock stack within the Rural Scenic Zone. There is also a Rural General Zone to the west of the site. The site currently contains a number of operating and previously operated mining pits and stacks.

The extent of the Macraes Mining Zone is shown in orange in figure 1.1 below.

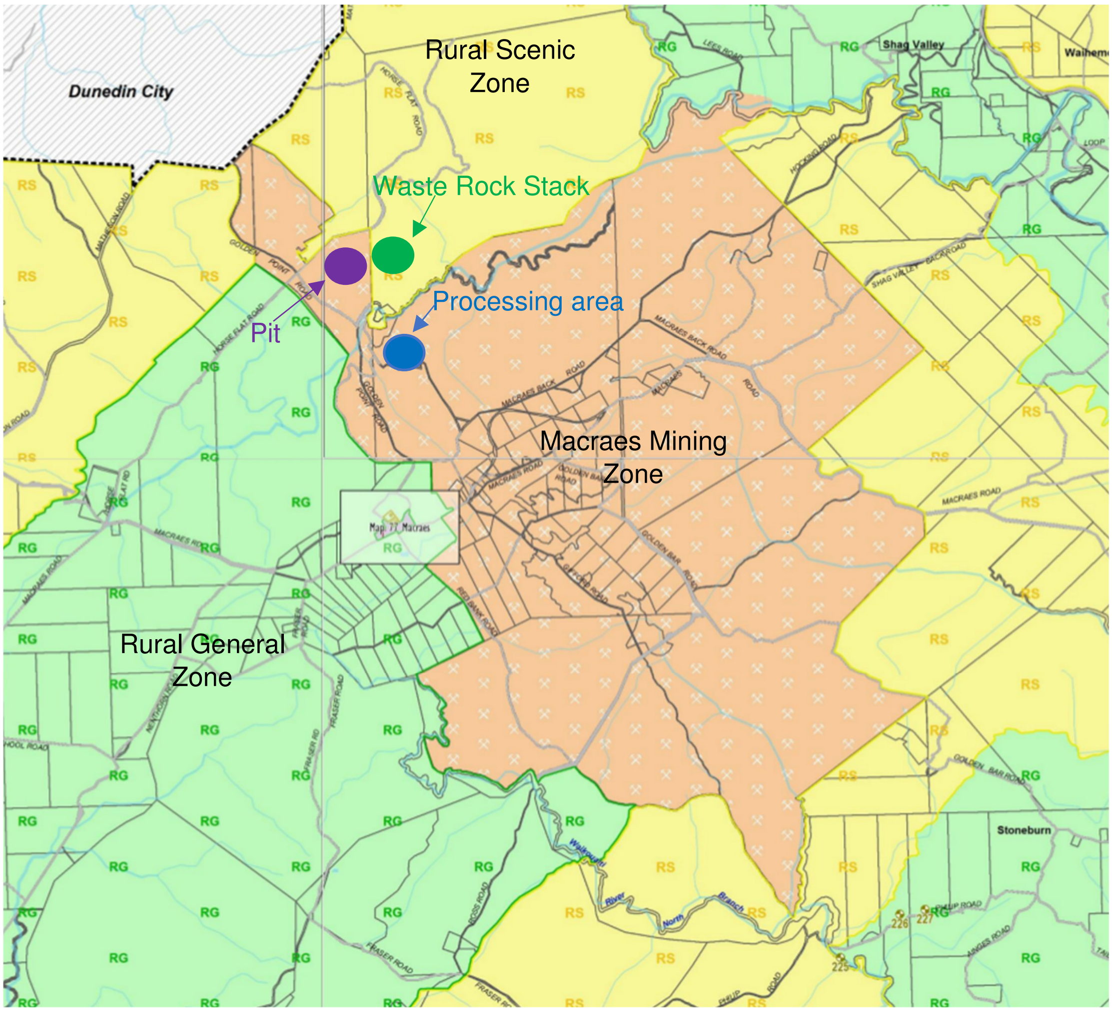

Figure 1.1 – District Plan zones with relative locations of Deepdell North Stage III areas

1.2 Identified neighbouring properties

There are a number of residential neighbours not owned by the Applicant in relatively close proximity to the site which have the potential to be affected by the proposed activity. These are located to the west of the site within the Rural General Zone. These are listed below and are shown in figure 1.2 to indicate the position of the neighbouring dwellings relative to the site:

- C & M Howard
- O'Connell
- Vanderley (Deepdell Station)
- N & M Roy
- Tisdall

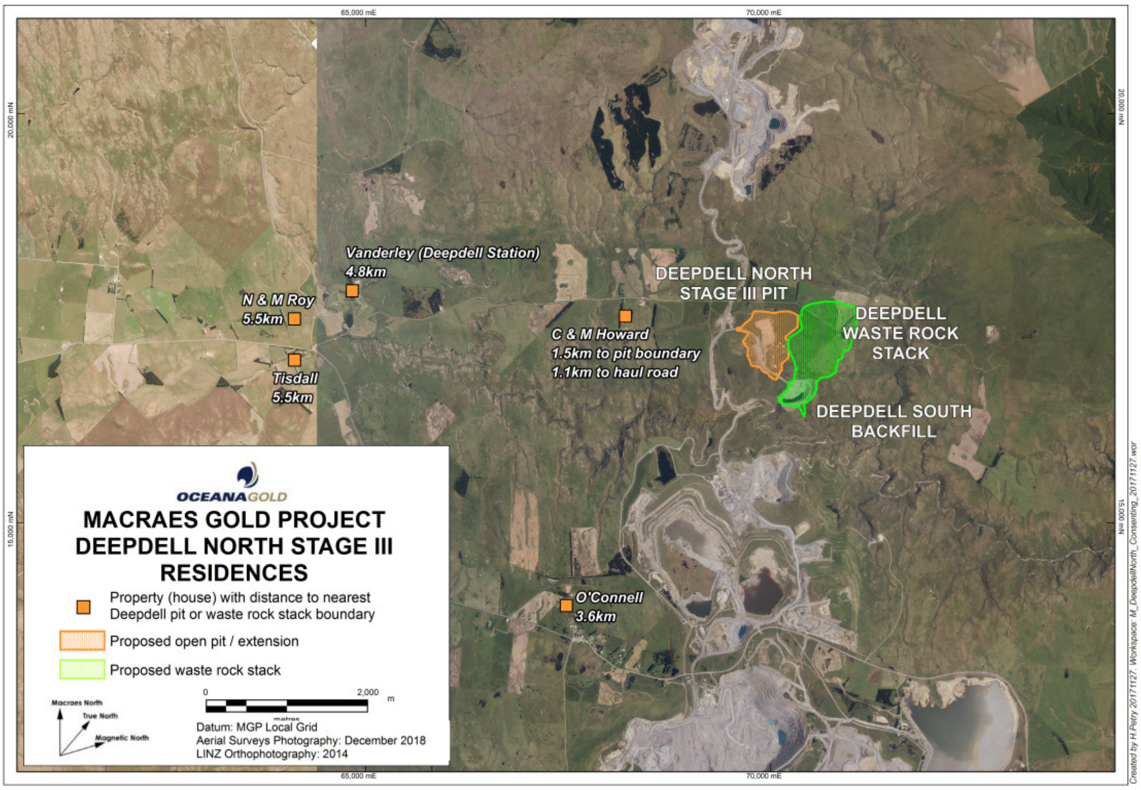

Figure 1.2 – Location of activity relative to neighbouring properties

As shown in figure 1.2, the C & M Howard dwelling is the closest to the proposed activity, approximately 1.5 kilometres to the pit boundary, and 1.1 kilometres to the haul road. The measurements of the current operation undertaken by AES discussed above were made at this dwelling.

We understand that the Howard's have provided Affected Parties Approval for this activity provided that noise levels during the night-time period are no more than 51 dB L_{Aeq} at the notional boundary of their dwelling.

The Coronation North mine to the north is still operating and there will be some cross over in the use of both pits (Coronation North and Deepdell North). Most of the Coronation North Pit activity occurs on the opposite side of the hill to the nearest dwellings. However, the gold ore trucks travel up/down the hill on the main haul road to/from the processing areas, and therefore there could be some cumulative noise effects from the pits operating simultaneously. The noise monitoring discussed in section 1.0 relates to noise from haul trucks.

1.3 Proposed activity

The proposal is to create an open pit mine in the portion of land shown in figure 1.2 above. We understand that primarily rock breaking will be undertaken using a blasting technique. This process involves using drills to create holes for the explosive to be placed within. Explosives are then loaded into the holes, with the top section 'stemmed' with aggregate. The explosives are then detonated to fracture the rock face.

The proposed operation is to take place within two main areas – being the Deepdell North Pit, the Waste Rock Stack areas – as well as on the associated haul roads.

We have been advised that the following activity is to be carried out within each of the areas:

- Deepdell North Stage III Pit – This area is where blasting will occur, and material will be excavated. This activity will commence with the removal of the waste fill on top, prior to excavating the pit.
- Waste Rock Stack – This area includes a previous open pit (Deepdell South), as well as an area of new disturbance. The waste rock (that which contains insufficient gold for economic processing) will be transported from the Deepdell North open pit along the existing Deepdell South Haul road to be deposited within this area.

In addition, the main haul roads are as shown in figure 1.3 below. The waste rock will be loaded into haul trucks and will be taken on the Waste Haul Road to the deposition area. The rocks which include gold will travel on the Ore Haul Road down to the existing processing area to the south.

There is an existing 4 metre high bund along portions of the haul road between the Coronation North mine and the Ore Haul Road. We have been advised that this is to be extended in the location shown in orange in figure 1.3 below.

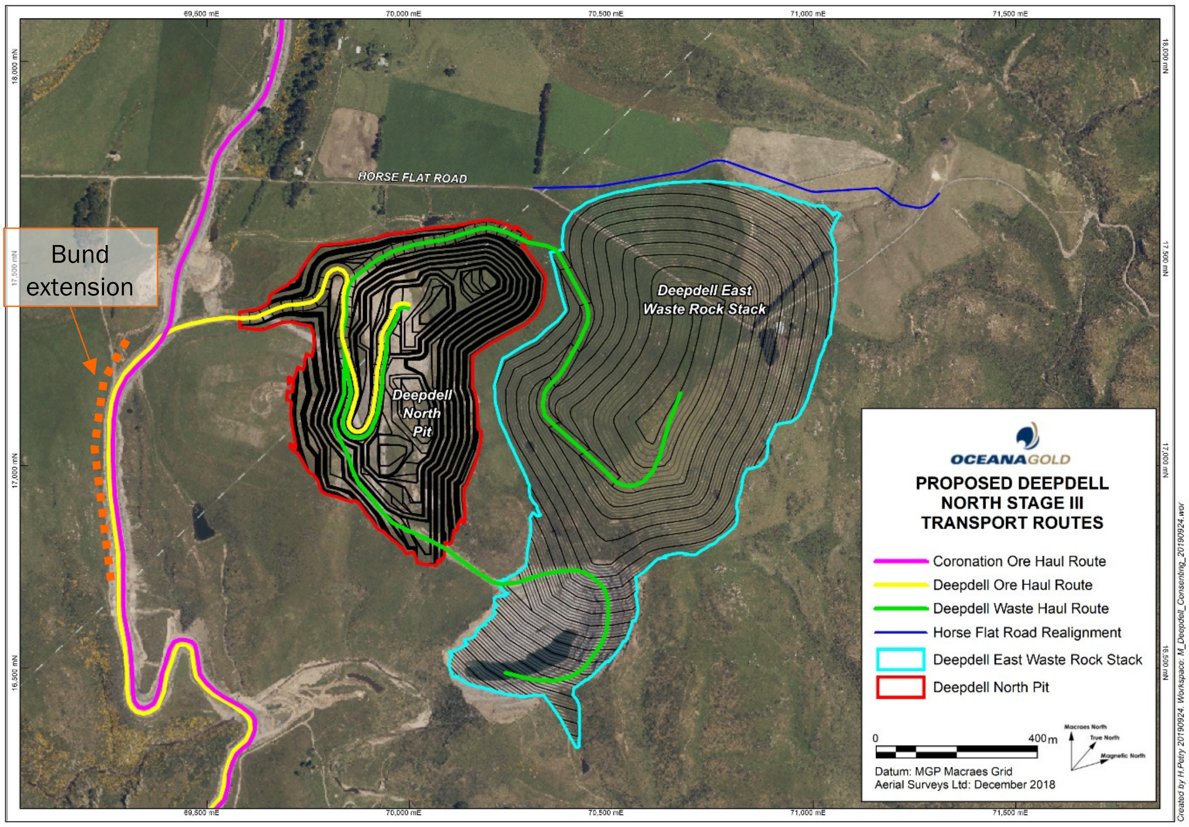

Figure 1.3 – Location of associated haul roads and bund extension

2.0 ACOUSTIC CRITERIA

The Resource Management Act requires consideration of the significance of any adverse effects associated with the proposal. Guidance as to the significance of any adverse noise effects may be obtained from several sources.

2.1 Waitaki District Plan noise limits

As stated above the site is located within both the Macraes Mining Mineral Zone and the Rural Scenic Zone, with the nearest neighbouring properties within the Rural General Zone.

The noise and vibration limits which apply to the Macraes Mining Mineral Zone are outlined in section 6.5 of the Waitaki District Plan, and are as follows:

> *Noise*
>
> *Activities shall be constructed such that the following noise levels are not exceeded at the Macraes Mining Mineral Zone Boundary:*
>
> *During daytime* — *55 dB $L_{Aeq\ (15min)}$*
> *During night-time* — *40 dB $L_{Aeq\ (15min)}$*
> *At all times* — *75 dB L_{AFmax}*
>
> *Daytime is defined as 0700 to 2200 hours Monday to Friday & 0800 to 1700 hours Saturday. Night-time is all other times and any public holiday.*
>
> *Vibration*
>
> *Activities shall be conducted such that the following ground vibration levels measured either at the Macraes Mining Zone boundary or the boundary of the Golden Point Historic Reserve shall not exceed 10 mm per second peak particular velocity measured in the frequency range 3 hertz and 12 hertz.*
>
> *Blasting*
>
> *Activities shall be conducted such that the following air blast peak over sound pressure measured either at the Macraes Mining Zone Boundary or any building within the Golden Point Historic Reserve shall not exceed 128 dB linear unweighted. The hours of blasting shall be restricted to the following:*
>
> *Monday – Friday* — *9am to 5.30pm*
> *Saturday and Sunday* — *10am to 4.30pm*

The noise limits which apply within both the Rural Scenic and the Rural General Zones are outlined in section 4.5 of the Waitaki District Plan, and are as follows:

> *Noise*
>
> *Activities shall be conducted such that the following noise limits are not exceeded at any point within the notional boundary of a habitable building on another site, other than the site from which noise generated:*
>
> *Monday to Friday 7am – 10pm* — *55 dB $L_{Aeq\ (15\ min)}$*
> *Saturday 8am – 7pm* — *55 dB $L_{Aeq\ (15\ min)}$*
> *At all other times and any public holiday* — *40 dB $L_{Aeq\ (15\ min)}$*
> *Daily 10pm to 7am the following day* — *75 dB L_{AFmax}*

Sound levels shall be measured in accordance with the provisions of NZS 6801:2008 *Acoustics – Measurement of environmental sound* and assessed in accordance with the provision of NZS 6802:2008 *Acoustics – Environmental noise*.

2.2 New Zealand Standard 6802

NZS 6802:2008 *Acoustics – Environmental Noise* outlines a guideline daytime limit of 55 dB L_{Aeq} (15 minute) and a night-time noise limit of 45 dB L_{Aeq} (15 minute) for "the reasonable protection of health and amenity associated with the use of land for residential purposes". The Standard also describes how a 3 dB adjustment may be applied to sound received for less than 50 % of the daytime period, and a 5 dB adjustment may be applied to sound received for less than 30 % of the daytime period.

2.3 World Health Organisation

Guidelines for Community Noise[1], a document produced by the World Health Organisation (WHO) based on extensive international research recommends a guideline limit of 55 dB $L_{Aeq\ (16\ hours)}$ to ensure few people are seriously annoyed in residential situations. A guideline limit of 50 dB $L_{Aeq\ (16\ hours)}$ is recommended to prevent moderate annoyance. A guideline night-time limit of 45 dB L_{Aeq} is recommended to allow occupants to sleep with windows open.

2.4 Blasting noise criteria

Due to its impulsive nature, noise from blasting is typically assessed differently to sound considered under the general noise limits discussed above. The key factor that we have considered for blasting is the airblast overpressure, which is the sound produced by the blast and transmitted through the air. It is generally reported as a linear-weighted value (dB L_{peak}) but can also be presented in A-weighting or C-weighting.

In order to determine acceptable limits for blasting, we have taken guidance from a number of additional references as follows:

- NZ 6803:1999 *Acoustics – Construction Noise*, states that the adoption of good blasting practices will reduce the inherent and associated impulsive noise and vibration, and practices should conform with the provisions of documents such as AS 2187.2:2006 provided an air blast noise limit of 120 dB L_{Cpeak} is not exceeded.

- AS 2187.2:2006 *Explosives – Storage and use, Part 2: Use of Explosives* outlines that for human comfort some regulatory authorities select the following limits:

    - For a sensitive site, where operations last for longer than 12 months or more than 20 blasts – 115 dB L_{peak} for 95 % blasts per year. 120 dB L_{peak} maximum unless agreement is reached with occupier that a higher limit may apply.

    - For a sensitive site, where operations last for less than 12 months or less than 20 blasts – 120 dB L_{peak} for 95 % blasts per year. 125 dB L_{peak} maximum unless agreement is reached with occupier that a higher limit may apply.

- A document prepared by the Australian and New Zealand Environmental Council titled *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*, dated September 1990 recommends a maximum level for air blast overpressure of 115 dB L_{peak}. It notes that this level of 115 dB L_{peak} may be exceeded on up to 5 % of the total number of blasts over a period of 12 months; however, the level should not exceed 120 dB L_{peak} at any time.

[1] Edited by Berglund, B *et al. Guidelines for community noise.* World Health Organization 1999.

This ANZEC document also states that blasting should generally take place no more than once per day, and should be limited to 0900 to 1700 hours Monday to Saturday, with none occurring on Sundays or Public Holidays.

2.5 Vibration criteria

Vibration effects are typically considered in two ways – with regard to possible structural or cosmetic damage to buildings, and human response. We note that individuals can detect levels of building vibration that are well below those required to cause any risk of damage to the building or its contents.

Mining activity is expected to generate continuous vibration for short periods of time. This vibration may potentially result in two main effects for occupants within the neighbouring buildings – perceptible (structure-borne) vibration, i.e. vibration of walls, floors etc. which is perceived by occupants through tactile sensations or audible motion such as rattling of windows; and low frequency noise, where sound waves radiated by the vibrating surfaces inside buildings are perceived by the human ear as noise – often referred to as ground-borne noise.

In order to determine acceptable limits for vibration, we have taken guidance from a number of additional references as follows:

- Table 3 of *DIN 4150-3 Structural Vibration – Part 2: Effects of vibration on structures* recommends for dwellings and buildings of a similar design and / or occupancy a guideline long-term vibration level of 5 mm/s.

- AS 2187.2:2006 *Explosives – Storage and use, Part 2: Use of Explosives* outlines that for human comfort some regulatory authorities select the following limits:

    - For a sensitive site, where operations last for longer than 12 months or more than 20 blasts – 5 mm/s for 95 % blasts per year. 10 mm/s maximum unless agreement is reached with occupier that a higher limit may apply.

    - For a sensitive site, where operations last for less than 12 months or less than 20 blasts – 10 mm/s maximum unless agreement is reached with occupier that a higher limit may apply.

- The Australian and New Zealand Environmental Council document titled *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*, dated September 1990 recommends a maximum level for ground vibration is 5 mm/sec (PPV). It notes that this level of 5 mm/sec may be exceeded on up to 5 % of the total number of blasts over a period of 12 months; however, the level should not exceed 10 mm/sec at any time.

- British Standard BS 5228-2:2009 *Code of practice for noise and vibration control on construction and open sites* also provides useful guidance regarding vibration levels and how they relate to perceptibility.

  The guideline values within this Standard are reproduced in table 2.1 below.

Table 2.1 – BS 5228-2:2009 vibration criteria

Vibration level (PPV)	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

2.6 Approved Resource Consents for existing mining activity on the site

As stated above, there are a number of areas of existing mining activity on the site, which have had the relative noise effects considered during their respective consenting processes. We have reviewed the noise assessments for the Coronation and the Coronation North activity on the site. Based on this we understand that the following conditions of consent related to noise and vibration were considered appropriate:

- *The consent holder shall ensure that all construction and operation activities associated with the mining operation are designed and conducted so that the following noise limits are not exceeded at the locations specified in Condition 8.2*

  (a) On any day between 7am and 9pm (daytime): 50 dB L_{Aeq}; and

  (b) On any day between 9pm and 7am the following day (night-time): 40 dB L_{Aeq}; and/or 70 dB L_{Amax}

  Measurement Locations

- *Noise measurements shall be taken at the notional boundary of any dwelling not owned by the consent holder.*

  Note: The notional boundary is defined as a line 20 metres from the exterior wall of any rural dwelling or the legal boundary where this is closer to the dwelling.

  Measurement and Assessment

- *All noise measurements referred to in Conditions 8.1 and 8.2 above shall be measured in accordance with the provisions of NZS 6801:2008 Acoustics: Measurement of Environmental Sound, and shall be assessed in accordance with the provisions of NZS 6802:2008 Acoustics: Environmental Noise.*

- *Vibration due to blasting or any other activity associated with the mining operation, when measured at any point within the notional boundary of any dwelling not owned by the consent holder, shall not exceed a peak particle velocity measured in the frequency range 3-12Hz of 5 mm/s provided this level may be exceeded on up to 5 % of the total number of blasts over a period of 12 months. The levels shall not exceed 10 mm/s at any time.*

- *Airblast overpressure from blasting associated with the mining operation, when measured at any point within the notional boundary of any dwelling not owned by the consent holder shall not exceed a peak non-frequency-weighted (linear or flat) level of 115 decibels (dB), provided this level may be exceeded on up to 5 % of the total number of blasts over a period of 12 months. The levels shall not* *exceed 120 dB (linear peak) at any time. For the purpose of this consent, C-frequency-weighting may be considered equivalent to the Linear or Flat-frequency-weighting.*

2.7 Discussion regarding appropriate noise levels

As stated above, the Macraes Mineral Mining Zone boundary runs through the site. Therefore, the noise / vibration limits outlined for the Macraes Mineral Mining Zone will not be met regardless of the proposed level of the activity, as equipment will be driving back and forth over the Zone boundary.

All other relevant guidance (including the previous Resource Consent Conditions) consider it appropriate to assess noise levels at the notional boundary of neighbouring dwellings not owned by the Applicant. As the dwellings are the nearest noise sensitive locations in the vicinity, we again consider the notional boundary to be the appropriate measurement location.

Based on a review of the above, the conditions of consent for the Coronation and Coronation North Pits are generally in line with other recognised guidance; however, they are more stringent in terms of the overall daytime noise limit and the hours assigned to the day when assessing noise. However, as the mining activity may operate continuously throughout the day and night-time period it is the noise emitted during the night-time period that has the potential to have the most effect on the neighbouring properties.

Overall, if noise levels from the Deepdell North pit are managed so that they are less than 40 dB L_{Aeq} during the night-time period at all neighbouring dwellings which have not provided Affected Parties Approval, in line with the previous consent conditions, we would expect the associated noise effects to be less than minor. As above, noise levels not exceeding 51 dB L_{Aeq} during the night-time period are required at the notional boundary of the C & M Howard dwelling as a condition of the Affected Parties Approval they have provided. This noise level would be expected to have a less than minor adverse effect for a dwelling with an upgraded façade and mechanical ventilation system.

The guidance in regards to blasting and vibration outlined in sections 2.4 and 2.5 is typically relatively consistent (115 dB L_{peak} and 5 mm/s). We recommend that moving forward the noise limit for blasting is 115 dB L_{peak} when received at the nearest neighbouring properties. We would also recommend a vibration limit of 5 mm/s for both blasting and general site activities.

3.0 NOISE GENERATED BY THE ACTIVITY

SoundPlan computational noise modelling based on ISO 9613 *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation* has been used to calculate the propagation of noise from the site, taking into account the topography of the area, and sound power levels for each of the noise sources.

This modelling considers enhanced propagation representative of either moderate downwind conditions (up to 5 m/s) in every direction (which would not occur in reality), or moderate ground-based temperature inversions to represent what can occur on a clear, calm night. Noise levels predicted under these conditions are taken as being at the upper limit of the 'meteorological window' described in NZS 6801:2008 and NZS 6802:2008 where valid compliance assessments are possible.

3.1 Existing mining activity site inspection

Clare Dykes of AES conducted a series of noise measurements on mining plant, equipment and heavy machinery operating at the existing Coronation North Pit, between 1300 and 1600 hours on the 8th of February 2018. Measurements were made in general accordance with NZS 6801:2008 *Acoustics – Measurement of environmental sound*. The purpose of these measurements was to acquire data which could be used for predicting the expected noise levels at the notional boundaries of the neighbouring residential properties, for a given worst-case scenario in each of the proposed mining areas.

In addition, as discussed above attended and unattended noise monitoring has been carried out at the Howard's dwelling to determine the noise effects associated with trucks using the Haul Road.

We understand that the plant to be used in the proposed Deepdell North mining operation is to be similar to, or will be that currently in use at the Coronation North Pit site. Based on our observations and discussions, we understand that the following equipment and machinery are likely to contribute most significantly to the noise emitted from the operation:

- Drills:
    - Sandvik D45KS rotary drill used for waste rock
    - Montabert CPA top hammer drill mounted on Hitachi ZX330 carrier used for ore rock
- Excavators:
    - 2 x Hitachi EX3600-6
    - 1 x Hitachi EX2500-6
- Trucks:
    - 12 x Cat 789C haul trucks
- Support:
    - 3 x Cat D10T track dozers (1 at waste rock stack, 2 in pit)
    - 2 x Cat 16H graders
    - 1 x Cat 844H wheel dozer
    - 1 x Cat 785C watercart + 1 x Cat 773F watercart

3.2 Sound power of equipment

3.2.1 Main quarrying equipment

We note that it was not possible to obtain measurements of all the specific equipment on the site – as it was not operating at the time of the measurements. However, a representative sample of equipment was obtained and the measured noise levels are in line with the reference levels provided in the relevant standards. Based on these measurements and analysis, the assumed worst-case sound power levels of the noise generating equipment which may be associated with the proposed operation are shown in table 3.1 below. This data has been used to calculate the noise expected at the nearest neighbouring dwellings due to the machinery operating.

Table 3.1 – Equipment sound power levels

Equipment or Machinery	Sound level dB L_{WA}	Notes
Drill	119	1.
Excavator	115	2.
Dozer	116	2.
Grader	115	2.

1. Worst-case assumption based on measurements undertaken of larger exploration drill on site.
2. Measured typical levels on site and referenced against the British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.*

3.2.2 Trucks

The noise level emitted by the haul trucks is more difficult to determine as the noise output of the truck varies with load, terrain and operation.

Given the changing gradient of the haul road the trucks emit varying levels of noise as they travel up / down the road. To determine the relative noise source level of the trucks as they travel on the haul road, we have calibrated our model using the results from our unattended noise monitoring at the notional boundary of the Howard dwelling. Noise from a single haul truck on the haul road under neutral weather conditions measured 37 dB $L_{Aeq\ (15\ mins)}$ at the C & M Howard dwelling.

We note that this value may be increased if the truck movements happened to occur at a time during enhanced propagation which still fell within the meteorological window outlined in NZS 6802:2008.

We have therefore considered trucks as a line source along the haul road, scaled to the measurements above, with an adjustment for enhanced propagation.

3.3 Predicted noise levels

3.3.1 Drilling holes for blasting

We understand that typically it takes approximately 6 minutes to drill the holes; however, the drill will only stop for a short amount of time between holes to relocate to the next hole and allow a sample to be taken. Therefore, we have considered the drills operating continuously for the entire 15-minute period.

We understand that the top portion of the proposed pit is all waste, and as such, the worst-case location for the waste drill will be at existing ground height. As the blasting progresses, additional screening would be provided by the rock face of the pit, and therefore we would expect the ground level drilling to be a worst-case situation, which would only occur for a limited period of time. The ore drill will only be used once the pit is established, and therefore we have considered the ore drill at a reduced height within the pit. As a worst-case assumption we have also considered a dozer operating within the Waste Rock Stack. We have considered the following two scenarios:

- Scenario 1 – Drill located at existing ground level at the top of the hill, with a dozer at the Waste Rock Stack
- Scenario 2 – Drill located at existing ground level at the bottom of the hill, with a dozer at the Waste Rock Stack

The expected noise levels from the three scenarios are outlined in table 3.1 below.

Table 3.1 – Expected noise levels from drilling operations when received at notional boundary of neighbouring residential dwellings

Dwelling	Expected noise levels (dB L_{Aeq})	
	Scenario 1	Scenario 2
C & M Howard	36	35
O'Connell	< 25	< 25
Vanderley	< 25	< 25
N & M Roy	< 25	< 25
Tisdall	< 25	< 25

This analysis indicates that noise levels of less than 40 dB L_{Aeq} are expected at the notional boundary of all neighbouring properties during these scenarios. We therefore expect the associated noise effects to be less than minor.

3.3.2 Blasting

A general assessment of blasting has been undertaken to assess the potential adverse effects on the neighbouring properties. We note that it is difficult to accurately predict airblast overpressure without site specific measurement data and therefore this analysis should only be used as a guide.

The airblast overpressure from blasting is dependent on the charge mass and distance from the site. We understand that the blasting procedures will be similar to that already undertaken at the other mining areas within the site, as outlined within the *Mining Vibration Assessment* prepared by consulting explosives engineers techNick Consulting (dated the 3rd of January 2018), and as follows:

	Ore	Waste
Diameter (mm)	102 mm	229 mm
Explos/hole (kg)	50 kg	450 kg
Explos MIC (kg) to 3 holes / delay	200 kg	1350 kg

As the waste blasting uses a greater amount of explosive, we expect the waste blasting to generate more noise than the ore blasting.

The *Mining Vibration Assessment* prepared by techNick Consulting considers the relative noise levels from the maximum waste explosive amount at varying distances. This states that noise levels of 113 dB L_{peak} could be expected at the Howard dwelling. Based on the shielding provided by the terrain, we would expect this to be a worst-case level and for the majority of the blasting locations in the Deepdell North Pit area (particularly once the pit has been developed) this would be reduced further.

The techNick Consulting document also lists a number of previous measurements which have been made during blasting events on other areas of the overall site. These measurements were at distances ranging from 800 metres up to 1500 metres (similar to the distance from the proposed Deepdell North Pit to the Howard dwelling). In all of these measurements the noise levels recorded were less than 100 dB L_{peak}.

Considering the above, we expect it is likely that noise levels of less than 115 dB L_{peak} would be received at all neighbouring dwellings; however, there are a number of variables which effect the noise levels which are site specific. To ensure that a level of 115 dB L_{peak} is not exceeded, we recommend that noise monitoring is undertaken on the site to assess compliance, determine site constraints and confirm the predictions.

We expect that as part of compulsory safety protocols, a warning siren will sound before and after the blast itself. Based on measurements of previous warning sirens, noise levels associated with the siren would be expected to be less than 50 dB L_{AFmax} at 1500 metres from the proposed Deepdell North Pit site, and therefore at all neighbouring dwellings not owned by the applicant.

In this context, while we expect the warning siren to be audible on neighbouring sites, it would not be at a level which causes startling or undue disturbance, and will be of the same order as other one-off noise events which occur regularly in a rural area. The warning siren may also be considered as a mitigating factor overall, as it reduces the likelihood that the noise from the blast itself will cause surprise.

Good control of blasting noise can be achieved through management and the use of a Blast Management Plan (BMP), which we understand are used for the other pits on the overall site. The appropriate measures determined through the site specific testing should be included within this plan. We understand that there are a number of minor variations to the blasting preparation and detonation that are possible, which in some cases may further reduce noise levels. It would be appropriate for the practicality of any such measures to be explored in this case once the operation is established, and any additional mitigation strategies captured in the Blast Management Plan.

In addition, the blasting should be limited to the following:

- Between 0900 to 1730 hours Monday to Friday, 1000 to 1630 hours Saturday, Sundays and Public Holidays.

It is also recommended that all residential receivers are informed when blasting is to be undertaken, and records are kept regarding each blast (including meteorological conditions).

3.3.3 Removal of extracted rock

For the majority of the time, the only activity on the site will be the removal of the extracted rock. This activity will consist of excavators loading the material into haul trucks and the haul trucks transporting the rock, either to the Waste Rock Stack, or to the processing plant. For this stage of the operation, during a worst-case 15-minute period we have considered the peak operation which could consist of:

- Two excavators loading trucks within the Deepdell North Pit
- One truck idling within the Deepdell North Pit
- One drill within the Deepdell North Pit
- One dozer and one grader within the Deepdell North Pit
- One dozer within the Waste Rock Stack

- Five heavy vehicle movements travelling on the waste haul road between the Deepdell North Pit and the Waste Rock Stack

- Two heavy vehicle movements travelling on the ore haul road between the Deepdell North Pit and the processing area

The expected noise levels from the above scenario at the nearest neighbouring dwellings are outlined in table 3.2 below.

Table 3.2 – Expected noise levels from general operations when received at notional boundaries of neighbouring residential dwellings

Dwellings	Expected noise levels (dB L_{Aeq})
C & M Howard	42
O'Connell	< 30
Vanderley	< 30
N & M Roy	< 30
Tisdall	< 30

This analysis indicates that noise associated with the general activity on the proposed Deepdell North Stage III Gold Mine is expected to result in noise levels of less than 40 dB L_{Aeq} at the notional boundary at the O'Connell dwelling and also those located further away. We would therefore expect the associated noise effects at these properties to be less than minor. Noise levels of less than 51 dB L_{Aeq} are expected at the C & M Howard dwelling, with noise levels of up to 42 dB L_{Aeq} predicted. As discussed in section 2.0, this noise is still lower than the WHO and NZS6802:2008 recommendations to allow occupants to sleep with windows open for ventilation. We also note that a change in noise level by 2 dB is not audible, and that this dwelling has an upgraded façade and mechanical ventilation system. We would therefore expect the associated noise effects to be less than minor.

4.0 VIBRATION GENERATED BY THE ACTIVITY

Several activities that will be carried out on the site have the potential to generate elevated vibration levels. We expect general mining activity will generate continuous vibration for short periods of time, while blasting will produce more intense vibration for shorter periods.

4.1 General pit activity

To determine the levels of vibration expected from the activity on the site, vibration measurements were also undertaken by Clare Dykes at the Coronation North Pit. Measurements were undertaken on the ground level within the pit while general pit activity was being carried out, and in a separate location in proximity to a drill.

4.1.1 Removal of extracted rock

The Profound Vibra ground vibration logger was set up within the Coronation North Pit. During the measurement period an excavator was operating in the pit (approximately 190 metres away), with another excavator at the top of the same pit face. A number of haul trucks entered, filled up and left the pit through the entrance approximately 50 metres away, with a maximum of three trucks within the pit at the same time. A dozer and a grader were also present and operating at times.

Average vibration levels within this measurement period were 0.02 mm/s, with a maximum of 0.16 mm/sec recorded when the dozer travelled past at a closer distance. Given the significant increase in distance to the nearest dwelling (1500 metres away) we expect the vibration level at all neighbouring dwellings to be significantly below 5 mm/s, and would be imperceptible.

4.1.2 Drilling

The Profound Vibra ground vibration logger was set up approximately 30 metres from an exploration drill at the Coronation North mine site. We note that this drill is larger, has more rods, and creates a deeper bore hole than those which will be used in the Deepdell North Stage III Pit, and therefore may generate more vibration than the worst-case activity.

Average vibration levels within this measurement period (including the set-up and preparation of the drill) were 0.04 mm/s, with a maximum of 0.23 mm/sec recorded as the rods were drilled into the ground. Maximum vibration levels were recorded in repeating pattern as the drill was operating.

As above, given the significant increase in distance to the nearest dwelling we expect the vibration level at all neighbouring dwellings to be significantly below 5 mm/s, and would be imperceptible.

4.2 Blasting

The theoretical prediction method that is commonly used to predict the PPV of blasting uses regression curve analysis, which predicts the PPV accurately, rather than relying on measured data which has different ground conditions, charge weight, and the like. The equation used to predict blasting vibration is based on the formula provided in the Blasters Handbook (ETI, 1998):

$$PPV = K(D/E^{1/2})^{-n}$$

Where:
- K = site constant for ground conditions
- D = distance from the charge (m)
- E = explosive charge mass (kg)
- n = site constant related to the soil conditions (usually around -1.6)

The site constant ‘K’ varies depending on the site which the charge is inserted into, the soil which the vibration propagates at, confinement of the blast holes, and rock face. Typical values can range from 200 (for hard granite-like rock on a flat site), 500 (for free near vertical face with hard or highly structured rock), to 5000 (heavily confined blast holes).

This is the equation that is used within the *Mining Vibration Assessment* prepared by techNick Consulting. Based on their previous measurements they have determined that the K value for the overall site is in the order of 1450. This results in a predicted maximum value of 3.8 mm/s at a distance of 1500 metres, representative of the location of the Howard dwelling.

The *Mining Vibration Assessment* prepared by techNick Consulting also lists a number of previous vibration measurements which have been taken during blasting events on other areas of the overall site. These measurements were at distances ranging from 800 metres up to 1500 metres (the distance from the proposed Deepdell North Pit to the Howard dwelling). The maximum vibration measurement recorded in the displayed results was 3 mm/s at a distance of 1000 metres. The other measurements ranged from 0 – 2.5 mm/s.

The range in the vibration values indicate how site specific vibration measurements are, as they rely on the specific type of rock, terrain, layers of rock etc., and that the predicted value of 3.8 mm/s would be worst-case (as all the measured levels were below this value at a closer distance). This level of vibration would subjectively be able to be felt, and may be considered intrusive during the night-time period. Therefore, as above, blasting should be limited to between 0900 to 1730 hours Monday to Friday, and 1000 to 1630 hours Saturday, Sundays and Public Holidays, and good practice methods adopted as part of a Blast Management Plan.

5.0 CUMULATIVE NOISE LEVELS

As discussed above, there will be a period of time when the Coronation North mine will be operating concurrently to the Deepdell North Stage III mine and therefore the cumulative noise effects should also be considered.

As also discussed above, unattended noise monitoring has been carried out at the notional boundary of the C&M Howard dwelling to capture the noise levels associated with haul trucks travelling on the haul road between the Coronation North mine and the processing plant during the night-time period. The noise levels from the Coronation North mine have been assessed previously and outlined in our report titled *OceanaGold Coronation North mine, Macraes Flat, Otago – Current noise emissions* (AES file reference: AC19058 – 01 – R2, dated the 21st of March 2019). Noise levels generated at the C&M Howard dwelling are dominated by the noise from the trucks on the haul road, with worst-case noise levels of 49 dB L_{Aeq} expected.

In addition, attended noise monitoring was carried out at the Howard dwelling on the evening of the 24th of July 2019. During this period, measured noise levels ranged from 46 – 51 dB L_{Aeq} approximately 2 metres from the façade of the dwelling, with the noise dominated by the mining activity. As these were measured within 3.5 metres of the façade of the dwelling, the measurements would have been affected by reflections off the building. Therefore, in line with NZS6801:2008 the effect of building reflections should be removed by subtracting 3 dB from the measured value. This would result in the measured noise levels being in line with the previous assessment. We have therefore used a noise level of 49 dB L_{Aeq} at the notional boundary of the Howard dwelling for trucks from the Coronation North mine operating on the haul road as part of the the cumulative assessment.

We have considered the cumulative noise levels from both the existing use of the haul road and the proposed Deepdell North Stage III activities. We note that as shown above the proposed Deepdell North Stage III activities have the greatest effect on the Howard dwelling, and the noise levels are greatly reduced at other surrounding dwellings with the expected noise levels well below the District Plan noise limits. Therefore, while the Howard's have provided Affected Parties Approval, we have still considered the cumulative noise levels at the Howard dwelling to ensure the noise levels remain below 51 dB L_{Aeq}. Cumulative noise levels from the activities when received at all other neighbouring properties not owned by the applicant would be less than 35 dB L_{Aeq}, and the associated noise effects would be less than minor.

As noted above, we have considered the following scenarios:

- Scenario 1 – Drill located at existing ground level at the top of the hill, with a dozer at Deepdell South Pit Backfill area
- Scenario 2 – Drill located at existing ground level at the bottom of the hill, with a dozer at Deepdell South Pit Backfill area
- Scenario 3 – Removal of extracted rock (two excavators, one idling truck, one dozer, and one grader in pit, one dozer in Horse Flat Waste Rock Stack, five heavy vehicle movements on the main waste haul road to Horse Flat Waste Rock Stack, two heavy vehicle movements on the ore road to the processing plant)

The expected cumulative noise levels from the current activity on the haul road and the proposed Deepdell North Stage III mine are shown for the Howard dwelling in table 5.1 below.

Figure 5.1 – Expected cumulative noise levels at the notional boundary of the Howard dwelling

Stage of activity	Specific scenario	Deepdell expected noise level (dB L_{Aeq})	Coronation North current noise level (dB L_{Aeq})	Cumulative noise level (dB L_{Aeq})
Drilling	Scenario 1	36	49	49
	Scenario 2	35	49	49
General site	Scenario 3	42	49	49

As shown above, we do not expect the Deepdell North activity to result in a measurable increase in noise levels when received at the Howard dwelling. Therefore, we expect that the additional effect of the Deepdell North mine on the current Coronation North activity would be less than minor.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Noise from all sources expected to be associated with the proposed mining activity as part of the Deepdell North gold mine has been considered.

As the mining activity may operate continuously throughout the day and night-time period it is the noise emitted during the night-time period that will potentially have the most effect on the neighbouring properties. Based on a review of the District Plan, previous consents and other relevant guidance, if noise levels from the Deepdell mine pit are managed so that they are less than 40 dB L_{Aeq} during the night-time period at the notional boundary of all neighbouring properties which have not provided affected parties approval, we would expect the associated noise effects to be less than minor. Noise levels of less than 51 dB L_{Aeq} during the night-time period at the notional boundary of the C & M Howard dwelling are required by the terms of their Affected Parties Approval.

Our measurements and calculations predict noise levels of less than 40 dB L_{Aeq} at all notional boundaries of neighbouring dwellings which have not provided Affected Parties Approval. We would therefore expect the associated noise effects to be less than minor. Noise levels of up to 42 dB L_{Aeq} associated with general mine operations are expected at the notional boundary of the C & M Howard dwelling. As discussed above, we would also expect the associated noise effects to be less than minor at this dwelling.

During the period when the Coronation North and the Deepdell North mines are operating concurrently cumulative noise levels from the activities when received at all neighbouring properties which have not provided Affected Parties Approval would be less than 35 dB L_{Aeq}, and the associated noise effects would be less than minor. Noise levels would remain at 49 dB L_{Aeq} at the notional boundary of the C & M Howard dwelling, and the noise effects associated with the additional Deepdell North activity would also be less than minor.

Based on our analysis we also expect noise and vibration levels from blasting to be reasonable at the notional boundary of the neighbouring dwellings, provided the following mitigation measures are adopted:

- Blasting is limited between 0900 to 1730 hours Monday to Friday, and 1000 to 1630 hours Saturday, Sundays and Public Holidays.

- The Noise, Vibration & Management Plan for the overall OceanaGold activity at Macraes Flat is updated to include the Deepdell North mine site (including monitoring and notification requirements).

Vibration from general mine operations would also be expected to meet the acoustic criterion of 5 mm/s at all neighbouring dwellings.

Overall, we expect the noise and vibration effects associated with the proposal will not create unacceptably unpleasant living conditions for the neighbours, and would not cause a significant deterioration of the quality of the rural environment.

G

APPENDIX G

Air Blast and Vibration Report

Environmental Update

May 2019

for
Marty Hughes <marty.hughes@oceanagold.com>
Senior Projects Engineer
OceanaGold (New Zealand) Limited

Mining Airblast Assessment – Deepdell North Stage III Project Macraes New Zealand with revised WRS

I am a mining engineer who has specialised in explosives technology and commercial blasting applications for my 45+ year career. As outlined in my CV, I work in most areas of civil and mining blasting including opencut and construction blasting. A major portion of my work in the past 30 years has been in managing Risk Assessments, blasting project evaluation, auditing blasting performances and training engineers and shotfirers in safe & efficient blasting.

Nick Elith B.E. Mining
MAusIMM, Member ISEE
Principal Blasting Consultant
techNick Consulting P/L
Consulting Explosives Engineers

24 May 2019

Limit of Liability
TechNick makes considerable effort to ensure an accurate understanding of client requirements but recognises in particular the uncertainties of site geology. The information contained in this report is as accurate as possible based on provided data. TechNick accepts no liability to any person for any injury, loss or damage resulting from the use of or reliance upon the information contained in this report or for any injury, loss or damage resulting from the omission of any information in this report. No expressed or implied warranties are given other than mandatory obligations implied by Commonwealth, State or Territory legislation.

Contents

1. Report Objectives

a. In this report I have considered the nature of predicted airblast levels at the nearest sensitive sites and particularly residential houses.

b. I also respond to items raised in the email from council as reproduced here:
   i. *While meeting the standard, it is noted that the Howard residence is getting close to the 95 percentile 115 dBL limit.*
   ii. *discuss the frequency of blasting that is likely to occur*
   iii. *what depth does the pit need to be to substantially reduce airblast levels, and likely length of time to get to that depth?*
   iv. *Comment on ANZS 2006 - how the 115 dBL was arrived at in the standard and whether the limit has at all been criticised since the standards last iteration in 2006*

c. Consider whether there are any changed vibration or airblast effects from the new WRS construction

2. Executive Summary

- Calculations based on the AS / NZ Standard 2187.2 (2006) indicate air-overpressure levels that are comfortably below those specified as conditions of consent and compliance.
- Airblast levels can be readily mitigated using best practice techniques to ensure that significant adverse effects do not arise.
- An airblast level of less than 120dBL is acceptable for human comfort and well below any level of damage to housing. The two residences beyond 1km will experience acceptable airblast levels well below this.
- There would be no increase in vibration or airblast effects on residences as a result of proposed changes to WRS construction area.

3. ANZStandard 2187.2 2006

Extracts: ESTIMATION OF GROUND VIBRATION & AIRBLAST LEVELS - **J7.1 Introduction**

"The accurate estimation of ground vibration and airblast levels is a complex task. The blasting process is highly non-linear and the variability of most rock types also contributes to the difficulty in accurate predictions of the environmental outcomes. The random character of the blasting outcomes suggests the need for probability distributions to describe strictly the range of possible ground vibration and airblast levels. In the absence of either field data or the opportunity to conduct blasting trials in the region of interest, it is possible to estimate likely ground vibration and airblast levels using simple charge weight scaling laws. Such laws incorporate the charge weight per delay and the distance from the blast to the monitoring location. Two site parameters are assumed and these influence the peak level and the rate of decay for the levels."

4. Discussion

Process:

1. first calculate predicted pressure levels for kg and distance in kPa
2. secondly calculate dBL levels equivalent to the kPa pressures

ANZStandard 2187.2 2006: section J7.2 Airblast overpressure
Airblast levels have been commonly estimated using the following cube root scaling formula:

$$P = K_a X \left(\frac{R}{Q^{1/3}}\right)^{\alpha}$$

Where

- P = pressure (kPa)
- Q = explosives charge mass (kg)
- R = distance from charge (m)
- K_a = site constant
- a = site exponent

For confined blasthole charges, when using a site exponent **(ά) of -1.45**, the site constant (*K*a) is commonly in the **range 10 to 100**.

$$P = 40 X \left(\frac{R}{Q^{1/3}}\right)^{-1.45}$$

Most airblast standards, and instruments, normally give a maximum PPV read-out in dBL so it is useful to try to convert the kPa values to dBL equivalent. Unfortunately, there is not a single direct conversion from kPa to dBL since the dBL logarithmic scale is in effect a ratio of over-pressure compared to a reference pressure relating to the threshold of hearing which is the starting point of the decibel scale involving frequency. Various international formulae make different assumptions as to the frequency which means that they may lean toward the impact on structural damage or to the effects on human comfort. I believe the AS/NZ Standard formula is biased toward human comfort.

Traditionally the conditions of consent for blasting overpressures are stated in terms of dBL limits, eg: *"Airblast overpressure from blasting associated with the mining operation, when measured at any point within the notional boundary of any dwelling not owned by the consent holder, school or church outside the Macraes Mining Project Mineral Zone as defined by the Waitaki District Plan, deemed operative on 23 August 2010 shall not exceed a peak non-frequency-weighted (Linear or flat) level of 115 decibels (dB)"*

There are numerous different assumptions and methods to convert kPa to a dBL equivalent and the results can vary significantly. I have re-worked this calculation using the latest formula from ANZS 2187.2 2006:

$$SPL\ (dBL) = 10 \log_{10}\left(\frac{kPa}{2 X 10^{-5}}\right)^2$$

[dBL =10*LOG$_{10}$((P /0.00002))^2]

Where P = pressure value in kPa

*** NOTE that the dBL values differ from the previous report because at that time I had used an international formula with a different frequency assumption.*

The following table gives an indication of calculated air over-pressure values (kPa) using the latest AS/New Zealand 2187.2 formula, and equivalent dBL levels for the larger 1350kg per hole waste blasting designs using a site exponent (ά) of -1.45, the site constant (Ka) of 40 which is appropriate given the blast design methodology.

MIC (kg)	Distance (metres)	Overpressure (kPa)	Airblast (dBL)
1350	1500 m *	0.032	103
1350	2000 m	0.021	92
1350	2300 m	0.017	86
1350	3600 m **	0.009	71

- * Howard residence = ~1500m
- ** O'Connell residence = ~3600m

i. *Council email point i … "While meeting the standard, it is noted that the Howard residence is getting close to the 95 percentile 115 dBL limit."*

According to the above calculations using the current AS/NZ Standard, the predicted airblast levels are well below the 115 dBL limit. At the existing Macraes goldmine operations actual measured historic data shows that airblast / overpressure readings have never exceeded the 115 dBL level and in fact were rarely over 100dBL. This is in fact not surprising since many airblast predictive calculations are based on typical hard rock, opencut, operations with substantial bench heights and free-faces which are susceptible to airblast generation. The style of mass, paddock blasting employed at OceanaGold is of a different nature and the airblast levels will be less than many formulae predict as evidenced by the historical readings.

5. Regulations NZ

Health and Safety at Work (Hazardous Substances) Regulations 2017 - Extracts

The Health and Safety at Work (Hazardous Substances) Regulations in the references give a less common specification for airblast, by stating overpressure limits in terms of pressure kPa. dBL is more relevant to the impact on persons.

#9.30: Duty of PCBU to control adverse effects of intended detonation or deflagration
(1) A PCBU with management or control of a class 1 substance must limit the quantity of any class 1 substances to be detonated or deflagrated at any place within a workplace, so as to ensure that—
(a) no place where a person may legally be present is,—
(i) for a vulnerable facility, subject to a blast overpressure more than 2 kPa, and for an area of high intensity land use, to a blast overpressure of more than 5 kPa;
…………………...

From the table of calculations above it can be seen that the kPa levels expected at the residences in question are:

- Howard residence = 0.032 kPa
- O'Connell residence= 0.009 kPa

The Health and Safety at Work (Hazardous Substances) Regulations 2017 have very high levels of maximum pressures which are most commonly applied to blasting operations in relation to structural damage or serious human injury. The ANZS

2187.2 2006 values are explicitly applied to blasting operations in relation to human comfort and are much lower. These have been applicable to blasting in the Macraes area for many years.

ii. Council email ii: discuss the frequency of blasting that is likely to occur

Generally, it is expected to blast 5 days a week. When they start mining Deepdell another pit in Coronation will be concurrently mining so blasts will be split between them during 2019 and then more blasting in DDN than the other pit as total movement drops off in 2020. By mid-2020 all blasting will be in Deepdell, but it will be at some depth by then. (see next point)

iii. Council email iii: what depth does the pit need to be to substantially reduce airblast levels, and likely length of time to get to that depth?.

It should be noted that good blast design practices as employed at Macraes over many years will have a far greater effect on maintaining low airblast levels than progressively taking the working benches down below the surrounding land horizon. Good blast design practices include in particular, ensuring an adequate degree of confinement of blast charges by employing ample stemming and maintaining good drill accuracy and avoiding overcharging. Gradually developing the working benches down below the surrounding land horizon will achieve further airblast reductions.

iv. Council email iv: Comment on ANZS 2006 - how the 115 dBL was arrived at in the standard and whether the limit has at all been criticise since the standards last iteration in 2006

Most of my explosives engineering professional services over the past 25 years has involved references to the Standard AS/NZ 21878.2. I do not know of any criticisms of the appropriateness of this aspect of the Standard and the Standard is intentionally conservative, stating that it is for human comfort rather than for any threshold of damage. Having said this, I know that worldwide the science of air and ground wave motions is constantly developing, and future updates will most likely have further mathematics incorporated to include frequency implications.

This is not a criticism, but simply notes that ongoing updates will incorporate better science and understanding. Such advances will not necessarily produce increased predictions. The ANZS 2006 I have used is the latest edition that I have available from around the world.

6. Factors that have the most effect on airblast.

Blast designs for the Deepdell North Open Pit including drilling, charging, stemming and firing procedures will be essentially the same as those used at the existing Macraes goldmine operations where historic data shows that airblast / overpressure readings have never exceeded the 115 dBL level. This will be largely because the A/NZS 2187.2 predictive formulae are based on typical hard rock, opencut, operations with substantial bench heights and free-faces. This gives an inherent safety buffer on all predictions at Deepdell because of the confined nature of their blasting methodology.

As noted in the ANZStandard 2187.2, *"Airblast is proportional to the cube root of the charge mass. This limits the effectiveness of charge mass reduction as a method of reducing airblast levels; Other factors are often more important, especially confinement of blasthole charges"*.

It has been demonstrated above that there is a substantial factor of safety in the planned designs. More significantly it is a simple matter to make design changes to the degree of confinement, mainly through adjustments to stemming lengths, which have the most dramatic effect on airblast reductions and this will be done on a blast-by-blast basis according to actual airblast recordings.

The changed WRS construction area is in the direction essentially away from the residences in question, so is unlikely to either diminish or increase vibration or airblast effects from previously stated estimations.

In my previous report there are mitigation strategies that will reduce airblast and in particular to monitor the results from every blast and adjust ongoing blast designs so as to remain well below any airblast limits. This is a simple process as stated here.

Design factors to reduce airblast

1. Style of blast (Paddock blast Vs high free-face)
2. Charge confinement - Depth of burial / Stemming length
3. Charge confinement - Front row burdens, hole spacings
4. Exposed detonating cord initiation system
5. Atmospheric conditions – inversions or strong, unfavourable wind
6. Maximum explosives charge per delay (but only by cube root scaling)
7. Delay intervals
8. Topography, bunds, deep pits
9. Protective shielding such as the now-existing dump giving added buffering

7. Conclusions

i. An airblast level of 120 decibels is acceptable for human comfort and well below any level of damage to housing. AS/NZ 2187.2 states that damage (even of a cosmetic nature) has not been found to occur at airblast levels below 133 dBL

ii. Using the latest formula, the two private residences have predicted airblast levels of 103 dBL (Howard's residence 1.5 km) and 71 dBL at O'Connell residence (3.6 km). These values are well below human discomfort levels and can be further reduced by increasing stemming if there is any concern.

iii. There would be no adverse vibration or airblast effects on residences as a result of proposed changes to WRS construction area.

Yours faithfully

Nick

Nick Elith B.E. (Mining)
Explosives Engineer
Special Blasting Applications

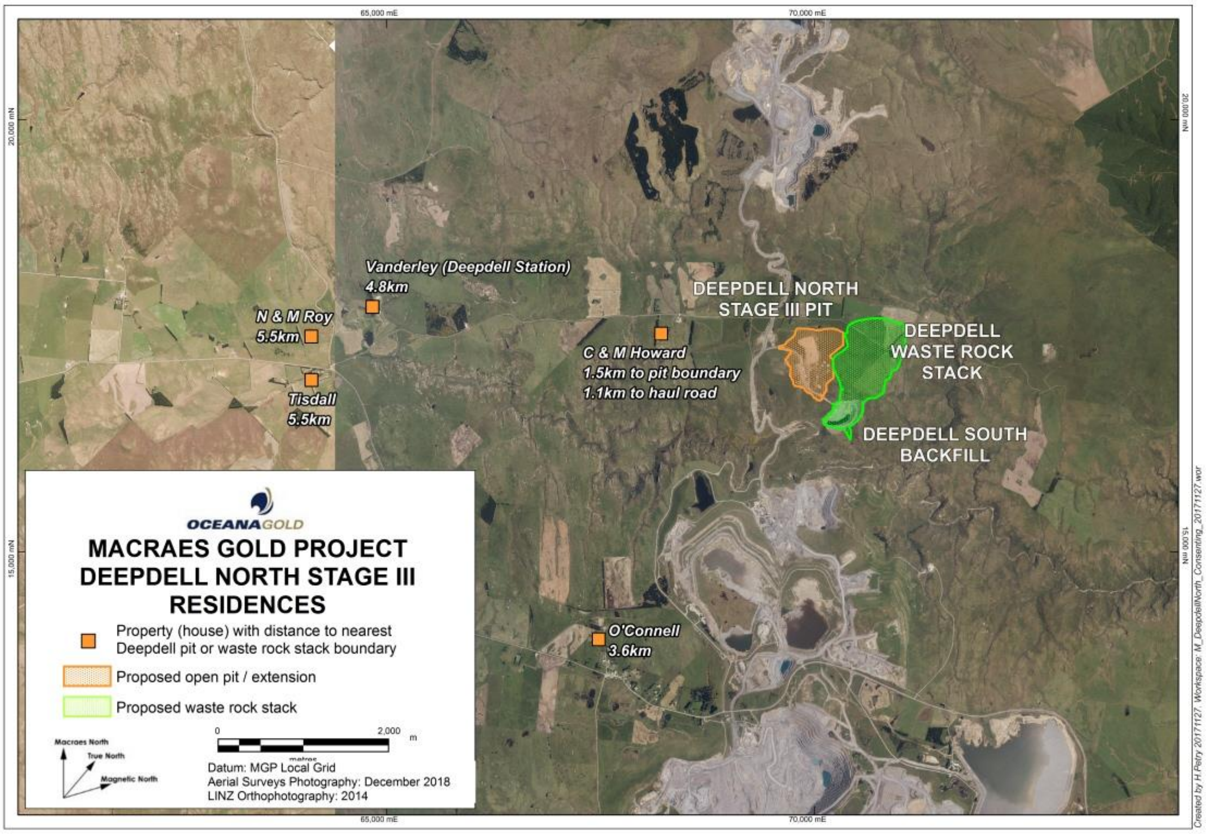

Figure of proposed new WRS construction areas

APPENDIX H

Heritage Report

DEEPDELL NORTH STAGE III MACRAES

Archaeological Assessment
December 2019

Origin
CONSULTANTS

Archaeological Assessment for Deepdell North Stage III

Archaeological Sites: I42/15

Commissioned by Oceana Gold (New Zealand) Limited

Prepared by Benjamin Teele

Origin Consultants Ltd

December 2019

Contents

List of Figures

Introduction

This archaeological assessment has been prepared for Oceana Gold (New Zealand) Limited (OceanaGold), for the proposed expansion of the Deepdell mine workings, titled Deepdell North Stage III (Figure 1, Figure 2). An archaeological assessment was deemed a requirement as the works will cover a wide area, in which several archaeological sites have been previously recorded, with several additional features identified during site surveys. The assessment has been produced to determine the impact of the proposed works and whether an archaeological authority application is required under the Heritage New Zealand Pouhere Taonga Act (2014).

The assessment site is focused on the northern end of Horse Flat Road, northwest from the Macraes Township (Figure 3). The northern portion of the site crosses Horse Flat Road and extends into a small unnamed tributary of Highly Creek. The southern portion continues along the valley floor to the south of Horse Flat Road towards Deepdell Creek, incorporating the northern edge associated with this creek and an open mining pit. The legal description of the site is:

- Part Section 10 Block VII Highlay SD;
- Part Section 11 Blk VII Highlay SD;
- Part Section 12 Blk VII Highlay SD;
- Part Section 1 Block VIII Highlay SD;
- Lot 1 DP 21303;
- Lot 1 DP 22318;
- Road parcel.

The assessment site contains several previously recorded archaeological sites. Several of these were identified during earlier mining operations in the 1990s and were the subject of previous authorities and archaeological reports. Transcription errors in these sites' locations, introduced during the digitisation of the ArchSite Records, have been resolved. The sites have been updated based on the findings of this assessment and a previous survey. Additionally, the 19th century pastoral site of Bellfield Homestead and a disused water race located near Horse Flat were not identified during earlier survey work. These have now been added to ArchSite. Additional sites have been recorded from a survey of part of Highlay Creek in the upper part of its catchment.

The purpose of this assessment is to identify archaeological material that may be affected by the proposed Deepdell North Stage III project. It provides appropriate recommendations for the mitigation and management of any archaeological material encountered. The author of this report is Benjamin Teele, Principal Archaeologist of Origin Consultants, and member of the New Zealand Archaeological Association.

Figure 1. Location of the site northwest of Macraes Township (Google Earth).

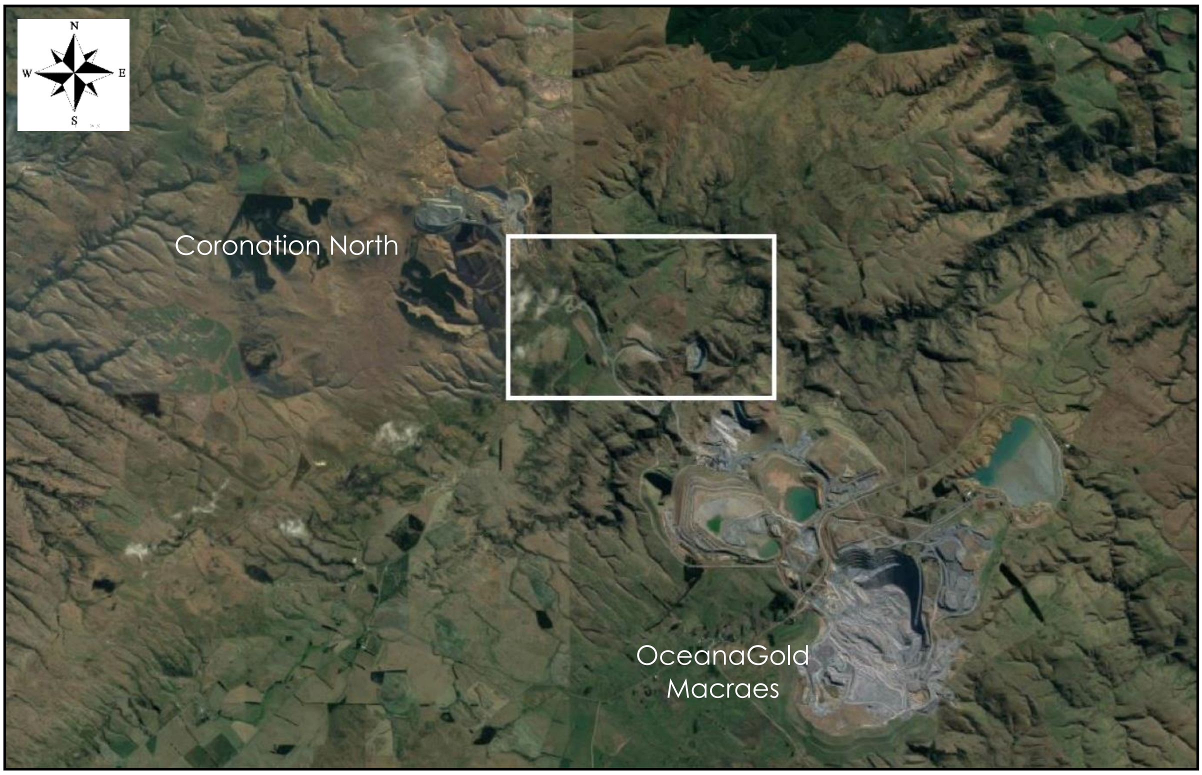

Figure 2. Location of the site in relation to OceanaGold's open cast mining around Macraes and the Coronation North mine (Google Earth).

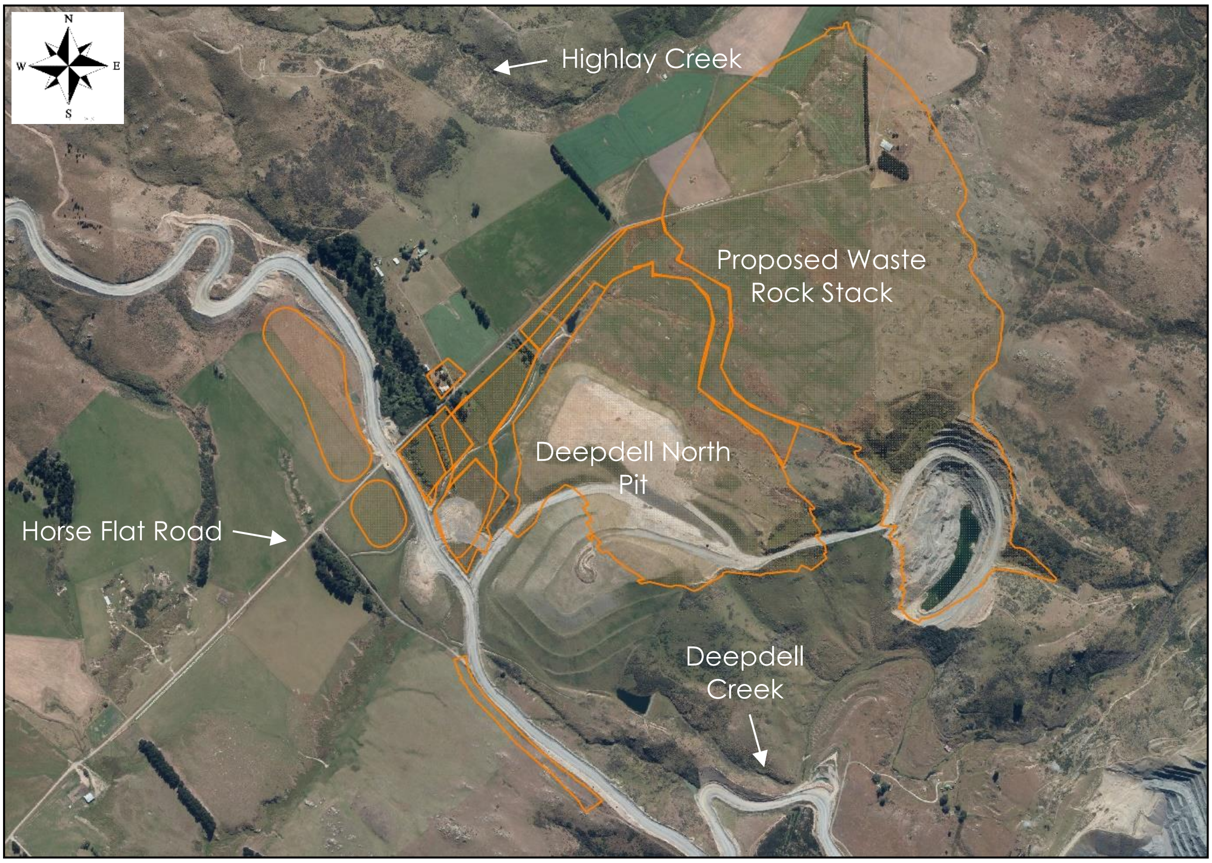

Figure 3. Location of assessment area in relation to Horse Flat Road and Deepdell Creek. The red lines demarcate the proposed areas of disturbance.

Statutory Requirements

There are two main pieces of legislation in New Zealand that control work affecting archaeological sites. These are the Heritage New Zealand Pouhere Taonga Act 2014 ('HNZPT Act 2014') and the Resource Management Act 1991 (RMA).

Heritage New Zealand Pouhere Taonga ('HNZPT') administers the HNZPT Act 2014. The Act contains a consent (authority) process for any work affecting archaeological sites, where an archaeological site is defined as:

(a) any place in New Zealand, including any building or structure (or part of a building or structure), that --:

(i) Was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and

(ii) Provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and

(iii) Includes a site for which a declaration is made under section 43(1)

Any persons who intend carrying out work that may damage, modify or destroy an archaeological site, or to investigate a site using invasive archaeological techniques, must first obtain an authority from HNZPT. The process applies to sites on land of all tenure including public, private and designated land. The HNZPT Act 2014 contains penalties for unauthorised site damage or destruction.

The archaeological authority process applies to all sites that fit the HNZPT Act 2014 definition, regardless of whether:

- The site is recorded in the NZ Archaeological Association Site Recording Scheme or registered by HNZPT,
- The site only becomes known about as a result of ground disturbance, and/ or
- The activity is permitted under a district or regional plan, or a resource or building consent has been granted.

Once an authority has been granted, modification of an archaeological site is only allowed following the expiration of the appeals period or after the Environment Court determines any appeals. Any directly affected party has the right to appeal the decision within 15 working days of receiving notice of the determination. HNZPT may impose conditions on the authority that must be adhered to by the authority holder (Section 52). Provision exists for a review of the conditions (see Section 53). The authority remains current for a period of up to 35 years, as specified in the authority. If no period is specified in the authority, it remains current for a period of five years from the commencement date.

The authority is tied to the land for which it applies, regardless of changes in the ownership of the land. Prior to any changes of ownership, the landowner must give notice to HNZPT and advise the succeeding landowner of the authority, its conditions, and terms of consent.

HNZPT also maintains the List of Historic Places, Historic Areas, Wahi Tapu and Wahi Tapu Areas. The List can include archaeological sites. The purpose of the List is to inform members of the public about such places and to assist with their protection under the Resource Management Act (1991).

The RMA requires City, District and Regional Councils to manage the use, development, and protection of natural and physical resources in a way that provides for the wellbeing of today's communities while safeguarding the options of future generations. The protection of historic heritage from inappropriate subdivision, use, and development is identified as a matter of national importance (section 6f).

Historic heritage is defined as those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, derived from archaeological, architectural, cultural, historic, scientific, or technological qualities.

Historic heritage includes:

- historic sites, structures, places, and areas
- archaeological sites;
- sites of significance to Māori, including wahi tapu;
- surroundings associated with the natural and physical resources (RMA section 2).

These categories are not mutually exclusive and some archaeological sites may include above ground structures or may also be places that are of significance to Māori.

Where resource consent is required for any activity the assessment of effects is required to address cultural and historic heritage matters (RMA 4th Schedule and the District Plan assessment criteria).

Methodology

An archaeological assessment is required to accompany an application for an archaeological authority, as stipulated in the Heritage New Zealand Pouhere Taonga Act (2014). The archaeological assessment for this site was carried out using desk-top research methods and has included several site visits to the area to assess any current standing structures and site features.

The desk-top assessment methodology consulted a wide range of archival sources to try to establish and clarify the historical development and chronology of the site. The assessment used the following types of sources to trace the history of the area around Horse Flat and Deepdell Creek.

- 19th century surveyors' maps and section subdivision maps;
- Land titles and land transfer surveys (LINZ);
- Photographic and documentary archives (Hocken Library, Dunedin City Library Heritage Collections, on-line archive repositories - Archives NZ, DigitalNZ, Hocken Library, National Library of NZ, Museum of New Zealand/Te Papa Tongarewa; PapersPast);
- Mine warden reports;
- Retrolens;
- NZAA ArchSite;
- Local histories and similar publications.

Archaeological surveys were undertaken during visits to the area on the:

- 14th of January 2016 - area north of Horse Flat Road;
- 25th of July, 2017 - area south of Horse Flat Road;
- 21st of September 2017 - surveyed the area around Highlay Creek;
- 11th of December, 2017 – inspection of the Bellfield Homestead complex;
- 6th of March, 2019 – area east of Horse Flat Road.

These visits were undertaken by Benjamin Teele of Origin Consultants with the assistance of OceanaGold. These visits were undertaken to make a visual assessment of the site which included an appraisal of:

- The approximate age and architectural style of any extant structures on the site.
- The environs within the site including spatial usage such as recent earthworks, topography, vegetation and any ground-level features of relevance.

The visual assessment was supported by digital photographs that recorded the features of the site. Features outside the survey areas were not recorded. However, where known their presence is noted in this report.

After accessing the northern part of the site by farm track, a survey was undertaken on foot within the assessment boundary. All archaeological features encountered during the survey were photographed and were mapped using a Garmin Oregon 450 handheld GPS. GPS coordinates were taken from the most accessible point of each feature. Several linear features were recorded in a series of GPS coordinates, and do not provide the exact termination points of the linear features. These features were then marked on an aerial overlay of the site.

Physical Environment or Setting

The site assessment area is located approximately 7 kilometres northwest from the Macraes Township. The site's terrain is a mixture of pasture along the flat, intersected by small streams running off the surrounding slopes. Most of the northern part of the site is situated within Horse Flat. This area has been formed through alluvial action, is generally flat, and is mostly in pasture. Most of the flat has been fenced off into paddocks. There are three clusters of buildings, two north of Horse Flat Road and one at the eastern end. One set of buildings is identified as Bellfield Homestead, and is located towards the northern edge of the valley floor. A nearby cluster of more modern buildings is located immediately next to Horse Flat Road. The eastern buildings are in the form of a woolshed. A large mature shelterbelt was planted parallel to what is now the haul road for OceanaGold. To the south, a modern open mining pit and rock stack forms the southern part of the site. The northern edge of the site forms part of the upper portion of Highlay Creek. This area is hilly and is cut by several tributaries of Highlay Creek.

Historical Background to the Assessment Area

Māori Settlement

The earliest human occupation of the South Island and Otago region is considered to be by Polynesian settlers dating from around 1280AD who quickly spread across the region, developing different types of settlement sites dependent on the available local resources and environmental conditions (Wilmshurst, Anderson, Higham, & Worthy, 2008). These included settled village sites along the coast adjacent to rich and sustained food resources such as seals and moa; seasonal inland sites for collecting stone resources and hunting; and comparable seasonal coastal sites for 'fishing and moa processing' (Hamel, 2001). Such settlement and exploitation of the abundant resources was not without its impacts however, with much of the forest along the coastal region reduced in extent, changes in patterns of hunting and fishing, and the use of smaller, more mobile occupation sites by the 16th and 17th centuries. This was followed by further changes in subsistence, based on organised food gathering and processing that created settled village communities along the Otago coastline from the mid-18th century onwards (Hamel, 2001).

The plateau country around the Macraes Township appears to have been used consistently, but not intensively, by Māori. This began with early expeditions for resource gathering, particularly moa, and continued into the period of European contact, with adjustments to the resources being targeted. In 2000, Hamel identified around 40 sites within the Strath Taieri and on the Macraes plateau, which included small moa hunter sites, silcrete quarries, ovens, rock shelters and caches, findspots and a possible rock art site. Migration in the spring and early summer up the Taieri River is recorded as a traditional activity by the Otakou people. Eels and birds, particularly weka, were collected, cabbage tree stems were cooked, and tikumu (for weaving) and taramea were harvested. Traditional activities in the area appear to have focused along the Taieri and the adjacent wetlands, as opposed to the exposed plateau country. However, silcrete was an important resource from the earliest exploration phase, and the area was likely visited regularly to collect this material, with one large site recorded near Nenthorn (I43/23)(Hamel, 2000).

European Settlement

The first significant European presence in the area was the result of the discovery of gold in May, 1862. The gold was discovered in Deepdell Creek by James Crombie and his associates. Following this discovery, word spread, and as more miners arrived in the area, further gold was found in the surrounding creeks. With the subsequent large influx of miners to the area, the township of Macraes was formed on Macraes Flat, three kilometres to the south of Deepdell Creek. Gold was the main focus of historic mining activities in the area and was concentrated at Golden Point. Initial mining was alluvial and used methods of potholing and ground sluicing. These methods appear to have been focused on the numerous small creeks and gullies in the area and undertaken by individuals and small groups who constructed temporary camps and huts. In 1865 the population of Macraes was reported to be 380. A topographical sketch of the Highlay District was produced by W. Arthur the district surveyor in August, 1867. This map shows the main geographical points, including Sister Peaks, Highlay Hill, Horse Flat, and Trimbells Gully. Another topographical map of the Highlay District shows the location of the Macraes Township, along with what appears to be the location of alluvial workings on part of Horse Flat, the upper reaches of Highlay Creek, and around Trimbells Gully and the Mare Burn (Figure 4). The date of this survey is uncertain, but it corresponds to an outline of the 1867 topographical sketch, suggesting it was produced at a roughly contemporaneous time.

Alluvial mining methods were later superseded by crushing for gold and scheelite (Hall-Jones, 2005). The first hard-rock mine was established in the area in 1866 and was originally called the "Eclipse", before being renamed as the Duke of Edinburgh (Petchey 1998). Hard-rock mining often involved the use of a small battery for crushing stone, a dam, shafts, and areas of prospecting pits and trenching.

The mining population declined into the 1870s, and by 1872 mining at the Duke of Edinburgh had ceased. There was a period of stagnation through the 1880s, until an increase in the 1890s. At the end of the 19th and beginning of the 20th centuries, a number of hard-rock mines were established in the Macraes area, including the Golden Bell, Maritana, Deepdell, Golden Point, Mt Highlay, and Round Hill mines. These mines operated at a significantly larger scale than the earlier alluvial workings and required more machinery and manpower. As a result, these were often operated as companies, with shareholders subscribing to the operation of the mine.

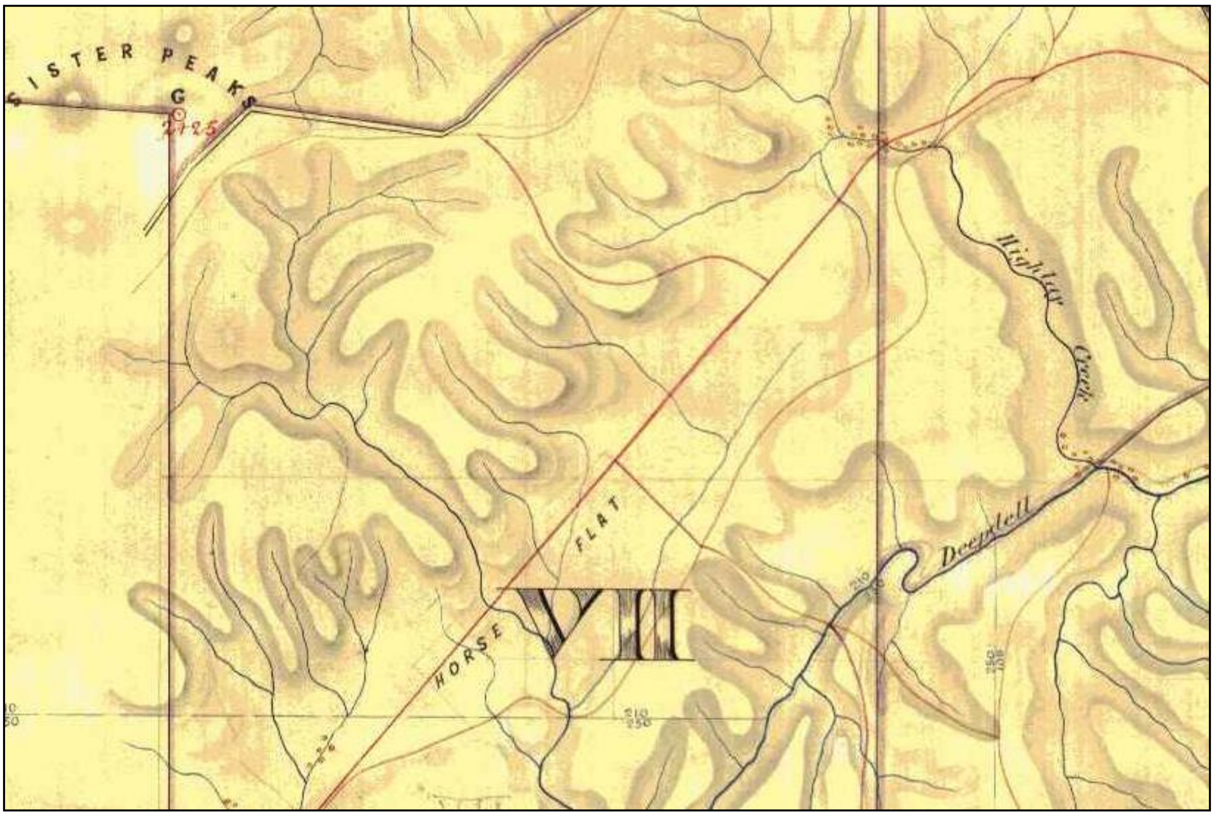

Figure 4. Topographical plan of Highlay District (cropped)(SO 620). No known date, but likely around 1867, and related to topographical sketch SO 4535.

In addition to mining operations, large parts of the area had been designated as pastoral runs in the 1850s. The most prominent of which in the Macraes area was known as Deepdell, and the homestead was situated to the northwest of the Macraes Township. In 1855, J. M. Saunders applied for Run 109, which extended from the Shag River to just south of what was later called Macraes Flat. This application appears to have lapsed and was taken over by Charles Hopkinson. Macraes Flat is suggested to have been named after a shepherd working for Hopkinson who lived in the area (Thompson, 1949).

As a result of miner agitation for land suitable to farm, part of this run was designated the Macraes 100 in 1874, which provided smaller blocks of land available to be purchased. The 1874 survey (SO 625) of the area designated the boundaries of these blocks, as well as the auriferous reserves designated for mining operations. The Deepdell run was broken up and divided into considerably smaller parcels in 1888 as part of the government's policy of breaking up large pastoral runs.

Following the decline of mining operations in the area, the land was given over to farming for a significant portion of the 20th century. Relatively small-scale mining prospecting occurred sporadically throughout the century, before more substantial mining operations began in 1990.

Horse Flat Area

The Horse Flat area was originally part of the Macraes rush, and early mining attempts were focused on easily accessible workings. In 1865 it appears that miners who had followed the rushes of the West Coast had begun to return to Macrae's, and had begun to work some rich claims along Horse Flat (Otago Daily Times, 1865). By 1866, reports were noting the success of claims that were being worked, with the only major restriction being the lack of water (Otago Witness, 1866). The creeks and gullies in the area provided the water needed for washing and sluicing rock to aid in acquiring alluvial gold deposits. However, the limited supply of water from these sources required the need to construct water races and dams. At least seven water races were constructed to feed an area of alluvial gold workings on the edge of Horse Flat. Five of these were built on the banks of Camp Creek, which was the main watercourse running out the Coronation Mine area. Two others fed reservoirs nearby (Petchey 1998).

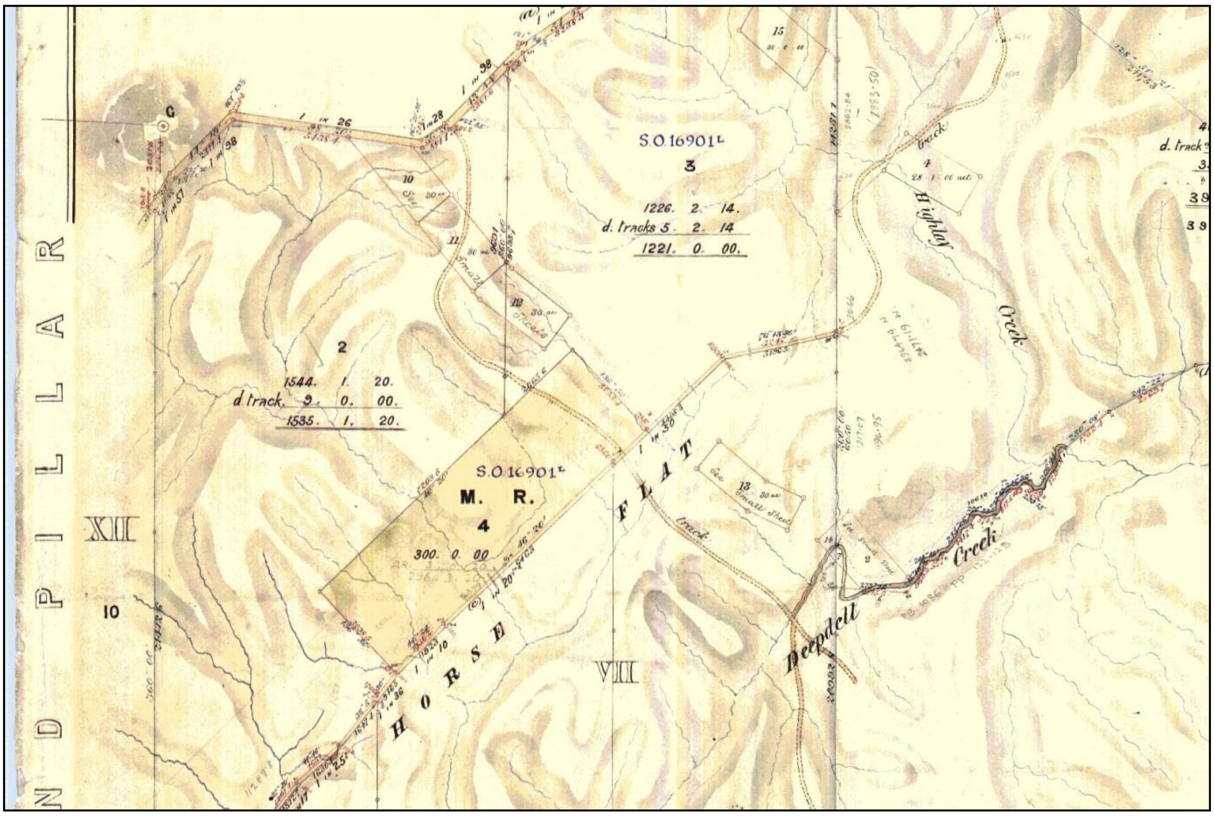

Figure 5. Survey map from 1888 showing the area around Horse Flat including specific mining claims and the mining reserve of Section 4 (cropped)(SO 629).

As the easier alluvial deposits were worked out along the flat, water races began to be constructed in the late 1860s and into the early 1870s. These races are recorded as "pushing forward" in 1871, suggesting that there was a strong interest in continuing to mine claims in the area (Otago Witness, 1871b). It appears that there were a reasonable number of Chinese miners working claims along the Flat in 1871, with a report on mining operations noting that a group of "Celestials' had struck a shaft on a spur near Horse Flat and found payable gold at the bottom. This caused a small rush to the area. Additionally, Chinese miners were involved in cutting a water race to allow them to work the bed of Highlay Creek towards the Shag River (Evening Star, 1871). Other races were brought in the same year by European miners with the intent to work parts of the flat (Otago Witness, 1871a).

Mining operations appear to have diminished in the area in the 1870s and 1880s and reflected a wider regional trend of the decline of gold mining in Otago. It wasn't until the late 1880s, that the establishment of hard-rock mining operations created a renewed interest in the area. In 1892, there was a rush of alluvial miners to Horse

Flat, above the old workings close to Deepdell Station (Hamel, 1994). The area appears to have been worked successfully over the next several years, particularly by the Chinese. Warden's reports from that period note that some of the Chinese miners had been doing very well working those claims along the flat (Appendix to the Journals of the House of Representatives, 1897).

In the late 1880s quartz mining became established on a larger scale, with an annual Mines Report mentioning a "large reef crossing Deepdell Creek about three miles down from where the road from Macraes to Hyde crosses it". In 1888, there was an application for a Licenced Holding by three groups: John Laverty & Party (Section 10 – Eureka Gold Mining Company); H Wilson (Section 11 – Naseby Gold Mining Company); and Charles McGregor and party (Section 12 – Mountain Den Gold Mining Company). The area of their focus was on three 30-acre plots on a "leading ridge between Mount Highlay and (the) sisters" (Petchey 1998). The results of these endeavours appear to have been poor or they failed altogether, as no further mention of this claim appears in subsequent annual Mines Reports. The annual mine report in 1890 mentioned the discovery of several more reefs, the Maritana, the Golden Point, and the Orient. It is likely that this late 1880s period of intense prospecting for reef gold saw the discovery of the Coronation lode (Petchey 1998). It appears that the mining operations which were focused on the Coronation lode did not occur for several years after its discovery – it was probably not until Robert Arthur Mathewson was granted a Special Quartz Claim 3517 for part of Section 10, which was originally licenced by John Laverty & Party. This enterprise was funded by a Dunedin share broker, with Thomas and Orr listed as owners. During 1911-1912 it was worked as the Coronation Mine. Two trial crushing's were undertaken; the first was 18 tons, and the second 50 tons. The Coronation Reef appears to have acquired its name during this second, more intensive, phase of mining operations (Petchey 1998). Mine warden reports from 1912 note the area was still being worked. However, by 1913 there was no further mention of mining operations (Barr & O'Connell 2013). Both the 1880s/90s and 1911/1912 episodes of mining operations did little more than prospect the reef (Petchey 1998).

In 1888, the run known as Deepdell was divided up, and parcelled off. This division saw the need for new surveys of the area, and the designation of new sections and mining reserves (Figure 5). Part of "Deep Dell' was advertised for auction to sell Run No. 109, which was located on Section 3, Block VII, Highlay District, and Run 85 on Section 1 (Mount Ida Chronicle, 1888). Alexander McLellan purchased Section 3 for a rateable value of £53 per annum. McLennan, originally from Scotland, moved to New Zealand and took up a position as a shepherd on Deep Dell Station. In 1892, McLennan appears to have tried to sell the land he had acquired four years earlier. Within the particulars of the proposed sale it was noted that the buildings and improvements on these runs inlcuded a five-roomed dwelling house (Figure 6), woolshed, sheep yards etc (Otago Daily Times, 1892). It appears that he was unsuccessful in finding a seller, as is noted as the owner of the land through the 1890s. In July 1894, it is mentioned that Alexander McLennan had a daughter at Bellfield, which appears to be the name he gave to his homestead (Otago Daily Times, 1894). Issues over the granting of reserves to McLennan for running his stock appear in 1898. When the Deepdell Station was cut up in 1888, a reserve of 300 acres was set apart for the use and benefit of miners. After McLennan became the lessee of Section 3, he included 130 acres of the reserve when he fenced his run. McLennan was accused of abusing the rights of the reserve for miners, including using part of it as a mustering paddock and grazed stock on it during the summer. It appears that many of the miners lived on this reserve at various times, including Chinese (Otago Witness, 1898). A brief mention of the controversy over the reserve noted that miners had made homes for themselves, and had small residence areas after the manner of Highland crofts, where they grew wheat, oats, and other crops, and sometimes a horse and a cow (Otago Witness, 1893). Following McLennan's success at Horse Flat, he sold his run sometime after 1905. He later took up farming at the Dunrobin Station in the Shag Valley, before he was killed in a motorcar accident in 1918 (Otago Daily Times, 1918).

Figure 6. Bellfield Homestead complex in the latter half of the 20th century (credit Colin Howard) Note the old woolshed/stable building at the rear which was subsequently demolished.

Previous Archaeological Work

Allingham (2011) conducted an iwi archaeological assessment in 2011 and noted that the Macraes Flat area was part of a major trail network running north-south and east-west, linking the Waihemo Valley directly with the lower Taieri wetlands bordering Maunga Atua. Two potential rock shelters and a quartzite blade located near the Coronation Mine workings suggest the possibility of further unrecorded archaeological sites and lithic scatters associated with Maori use and occupation of the area. The two potential rock shelters were noted in the large schist outcrops in the upper catchment of Camp Creek around 250 metres west of the quartzite blade find site. The quartzite blade was found on a ridge top in one of the few places in the southern block of the survey area where the actual ground surface was visible. No pre-contact material has been recorded within the current mining area, but Allingham (2013) noted that the open ground surface of the Coronation area consists largely of dense tussock grassland which obscures subtle ground features, making identification of sites difficult.

Early archaeological surveys by Hamel (1991, 1994) identified and recorded a number of mining sites in the Macraes district (Figure 7). These surveys were restricted to a specific area, focused around Golden Point Road at Horse Flat. She recorded mining activity along Horse Flat, as well on the higher terrain to the south. Hamel divided the Horse Flat workings into alluvial workings (generally larger areas of workings, characterised by irregular open pits or faces in the floors of gullies, usually with one low side or a tail race leading out of them)(I42/13); or quartz mining (generally larger operations, but with relatively small pits, much more tidy in shape and with limited drainage - although they may occasionally have a narrow channel cut to drain water from adits). These latter sites are generally located on ridge tops or higher slopes, along definable reefs (Barr, 2011). Two hard rock mines in the site assessment area were identified as the Golden Bell mine and the Deepdell mine.

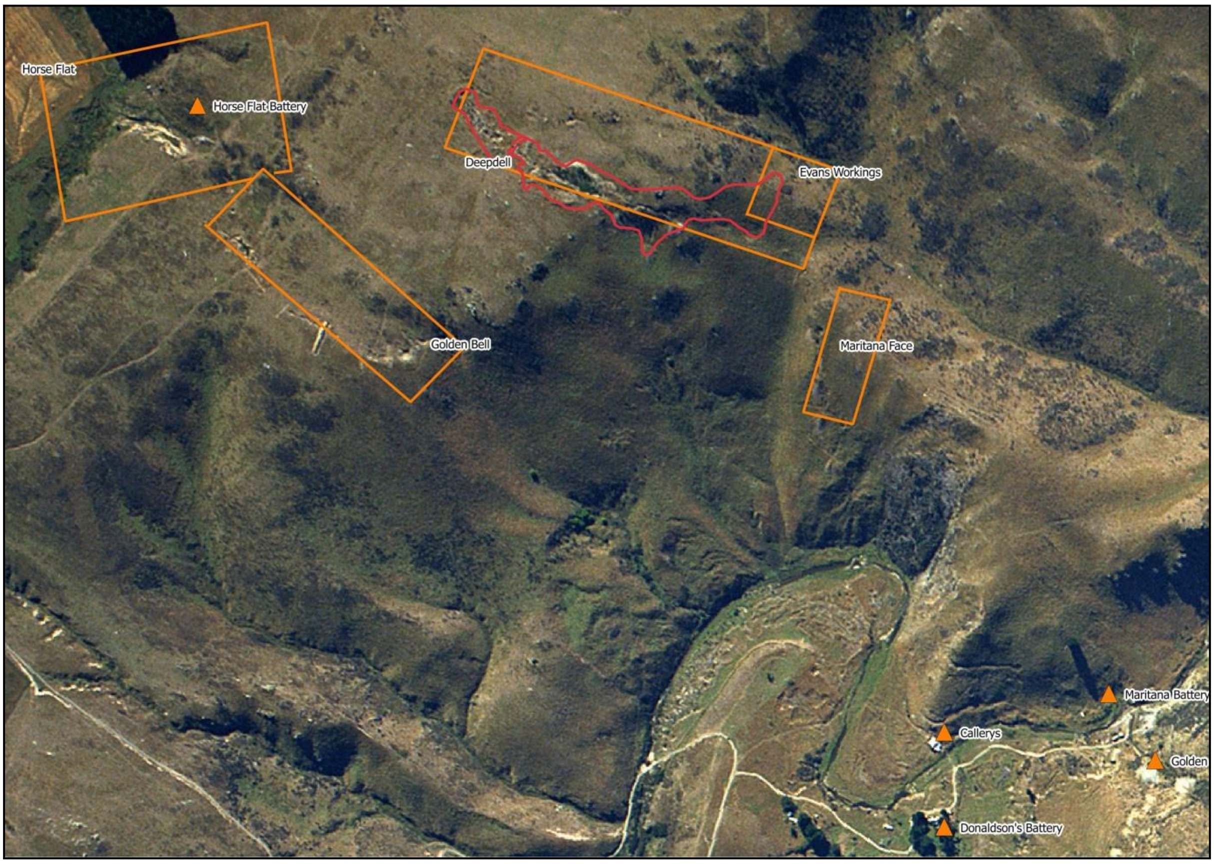

Figure 7. 1988 aerial of site area showing location of mines mentioned in Hamel (1994).

Each of these two mines had established batteries at the Horse Flat end of the line by 1903-1906 and 1912-1924 respectively. She noted that the workings along the Deepdell line are larger and more complex than the Golden Bell line. Adits into the Evans Levels were formed in 1915 and were recorded at the end of the eastern Deepdell line. No tramline was needed to shift material to the Horse Flat battery as the ground was easy for drays to cart the ore (Hamel, 1994).

The Golden Bell mine (I42/14), originally known as the Golden Quarry mine, was worked to the west of the ridge. This area was mined using open pits, or short adits with mullock heaps spread out in front of them (Hamel, 2000). Hoists would have been used to lift spoil out of the pits, and traces of shelter huts were also noted. Pits in the Golden Bell line were thought to be earlier than those in the Deepdell line, but both were recorded as being damaged by bulldozer working and recent trenching.

Her investigation into the Deepdell mine (I42/15) identified that it left an area of workings running northwest to southeast along the ridgeline. She also noted that the workings of the Deepdell line were larger and more complex than on the Golden Bell line. There was a large grouping of activity at the top of the hill, which ended in a particularly large shallow pit. Several adits were shown on the geological map of the area produced by Williamson in 1939, with only one, in a collapsed state, identified among a group of two large trenches and about six pits and terraces with associated heaps of spoil. The mullock heaps were recorded as much larger than on the Golden Bell line, and were spread around the adit entrances, which were in pits rather than trenches. Many of these pits and mullock heaps were identified by Hamel as being created between 1912-1924, and many have been damaged by subsequent activity. Towards the eastern end of the Deepdell line, Michael Sutherland bulldozed a large trench and pushed mullock heaps into lines 2-4.5m high in the 1960s. Hughie Fraser cut an adit into the trench for scheelite in the 1960s. Traces of shelter huts were found within both the Deepdell and Golden Bell workings (Hamel, 1994).

The Evans Drive, recorded at the eastern end of the Deepdell workings, was ascribed a date by Hamel of 1915. The Evans level adit was developed using a Mines Department subsidy of 120 pounds, and scheelite mined from a narrow stringer off the adit. Three adits were recorded in a trench, and another three down the southern slope towards Deepdell Creek. The mine workings down the steep slopes above Deepdell Creek were difficult to locate in the tussock. Hamel determined that the workings shown in a 1919 map of the area were surface trenches. The adits created in 1915 were developed to provide ore passes for rock, which was subsequently dropped from the Deepdell line down to the Golden Point batteries. The ore entered through a shaft at the top of the hill and was taken via a drive to emerge at Evans No. 1. This area would have allowed the stockpiling of ore for a short aerial cable to the top of the Maritana Face. There was also easy ground for drays to cart the ore to the Horse Flat battery (Hamel, 1994). The company then became the Deepdell Gold and Silver Company (Hamel, 1991)

Following Hamel's work in the early 1990s, Petchey (1994, 1997, 2001, 2002) undertook several additional surveys and assessments in the area associated with an expansion of modern mining. Petchey produced in 1994 a wider landscape map of all the mining features in the area around Golden Point and Horse Flat batteries. Three years later he produced an assessment for the impact of the proposed expansion of Deepdell Pit. Further archaeological recording was undertaken by Petchey in 2001 as part of archaeological authority 9900/18. One year later he produced a short report on the archaeological investigations associated with Maritana mine.

The construction of the Deepdell North Pit resulted in the destruction of historic mine workings associated with the Golden Bell and Horse Flat mines (Figure 8)(O'Keeffe, 1999). Golden Point was registered by the NZHPT as an historic area in 1994. The registered area included a piece of land north of the original Golden Point reserve. In 2006, the area around Deepdell mine (I42/15) was registered under a heritage covenant, but no specific boundaries of this covenant were determined at the time.

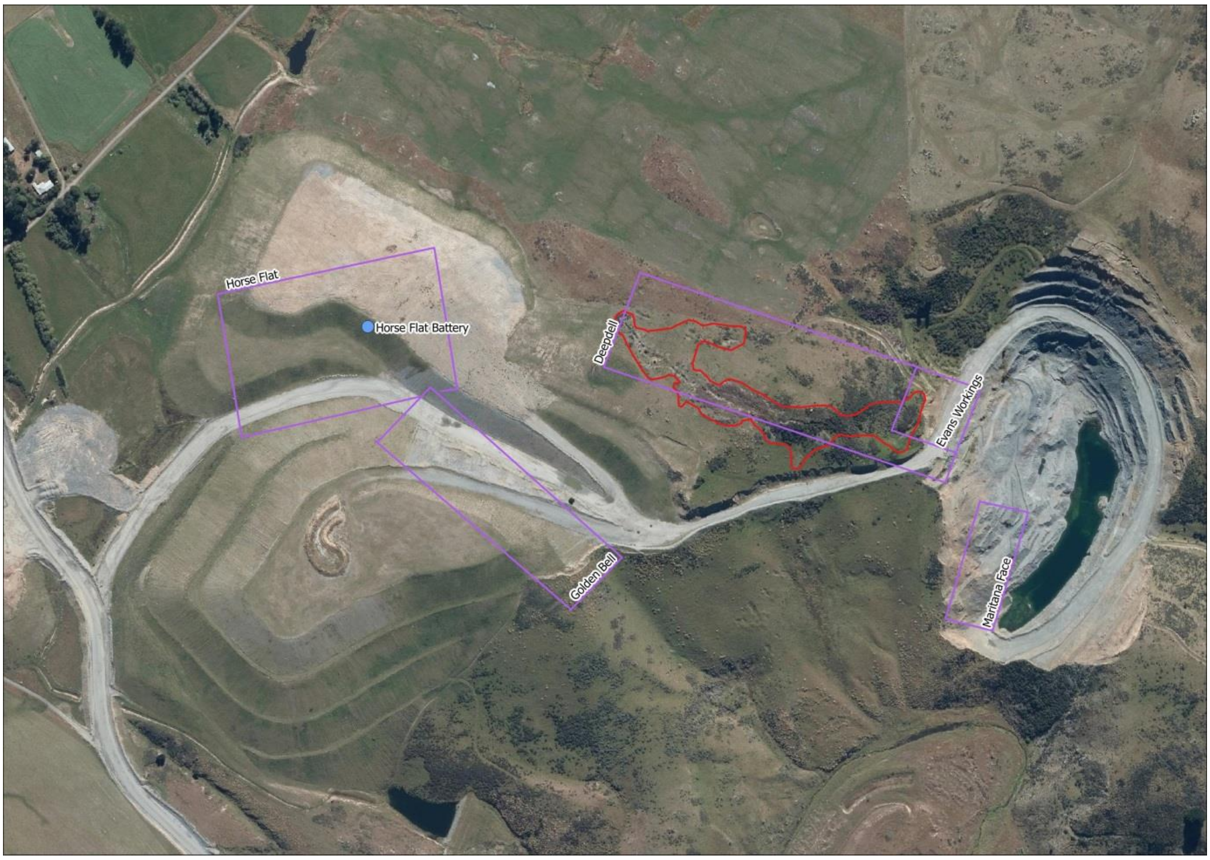

Figure 8. 2017 aerial imagery showing landscape modification in the Deepdell area overlain with original hard-rock mining claim boundaries in purple and original battery location in blue. Red line indicates extent of remaining surface features associated with Deepdell/Evan's Workings claim.

Further survey work was undertaken by OPUS International Consultants in 2010 focused on Camp Creek and the extensions of the Frasers Waste Rock Stack (Barr, 2010). Barr (2011) compiled a report focused on the Macraes mining area and the recent mining operations. This included a high-level water race above Horse Flat whose origin appears to be from Highlay Creek (I42/205). Barr also recorded three stone buildings and associated features adjacent to Highlay Creek, east of Horse Flat Road I42/185).

This work was followed by an archaeological survey undertaken by OPUS (Keith, 2012) that was commissioned by OceanaGold, and was based on a 150ha block on the northern corner of Deepdell Station. This survey encompassed additional historic mine workings associated with the Coronation Mine and identified a further 11 archaeological sites within the survey area. The original site record for Coronation Mine, as identified by Petchey, was subsequently updated. Barr and O'Connell (2013) further updated the site record forms after an additional survey in 2013. No further archaeological features were identified during this survey.

Four authorities to modify archaeological sites (I42/93 – Coronation Mine) have been issued by the Historic Places Trust since 1999 (HPT Authorities 1998/124; 2003/210; 2006/01; 2014/395). The authorities were issued for the purposes of gold exploration activities, with each later authority replacing those that had expired.

The collection of buildings identified as Bellfield Homestead (I42/219) and a 19th century water race (I42/220) were recorded in 2016 following a site visit by the author. Additional sites in Highlay Creek were recorded in 2017.

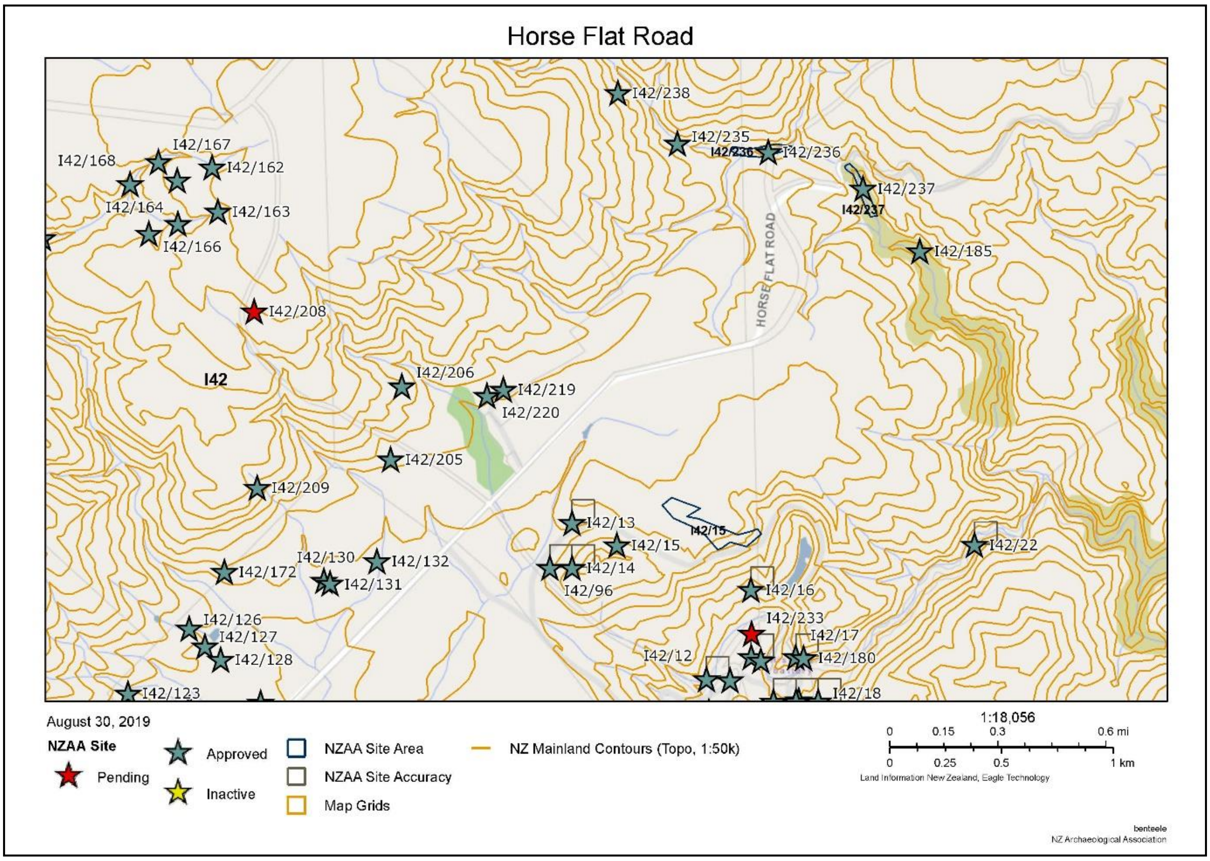

Figure 9. Map showing record of archaeological sites in the area of Horse Flat, Deepdell Creek, and Highlay Creek (ArchSite 2019).

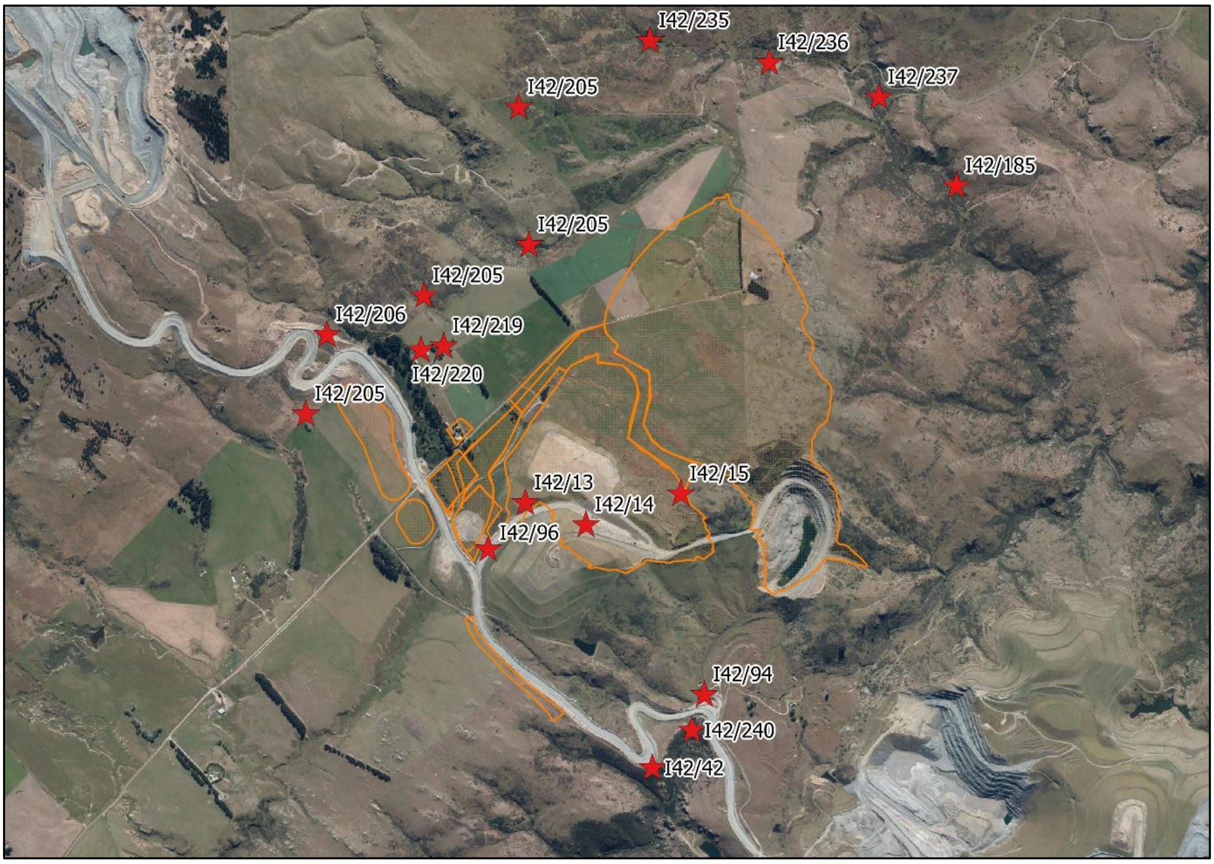

Figure 10. List of recorded archaeological sites overlain over modern aerial imagery, 2019.

Constraints and Limitations

The key constraints and limitations on the archaeological assessment for the Deepdell North Stage III Project are considered to be as follows:

- This assessment is based upon desk-based research and a visual survey of the site – no intrusive or investigatory work into the site or its environs has been undertaken to confirm the results of the assessment.
- The area under assessment is extensive, and consists of variable terrain characterised by Horse Flat, Highlay Creek, and Deepdell Creek. Significant patches are covered by a mixture of native and exotic scrub. These factors make a systematic survey of the area difficult, and any small, discrete features are only likely to be recorded if uncovered fortuitously.
- There is a poor record of historic surveys and photographs from the area around Horse Flat. The small-scale alluvial mining ventures undertaken in the Highlay and Horse Flat area appear to have been unrecorded. Larger hard-rock quartz mining undertakings were photographed to some extent, but these mines lie outside the assessment area.

Outcomes - Research Results

Historical Documentation

There is clear documentation from early newspaper accounts of the early alluvial works in the areas north of Macraes. In 1862, the area of Horse Flat was part of the wider rush to Macrae's, with alluvial workings and water race's constructed to work the flat, as well as Highlay Creek. These activities were usually small scale, focused on extracting the more easily accessible deposits. As these deposits became worked out, water races were constructed to allow ground sluicing of claims. The time and expense of constructing water races resulted in their progress being well recorded in regional newspapers. Alluvial workings continued in an erratic fashion through to the end of the 19th century, with good returns noted for miners working the flat. Of particular note is the significant Chinese presence along Horse Flat, particularly in the 1880s and 1890s. They are recorded as getting significant returns from their endeavours, which was improved by the construction of water-races. Most of the earlier alluvial works were undertaken using a technique called paddocking, but with the construction of races sluicing was possible. In the late 1880s, there was a resurgence of hard-rock mining operations, and included several claims to the southeast around Deepdell Creek (Otago Witness, 1889). These were undertaken through the formation of mining companies. The investiture in capital and the proposed wealth to be extracted from some of these claims made them the subject of considerable interest. The success of the Donaldson brothers operations at Deep Dell for gold and scheelite encouraged more prospecting in the area (Otago Daily Times, 1904). At the beginning of the 20th century, several claims were established or renewed,

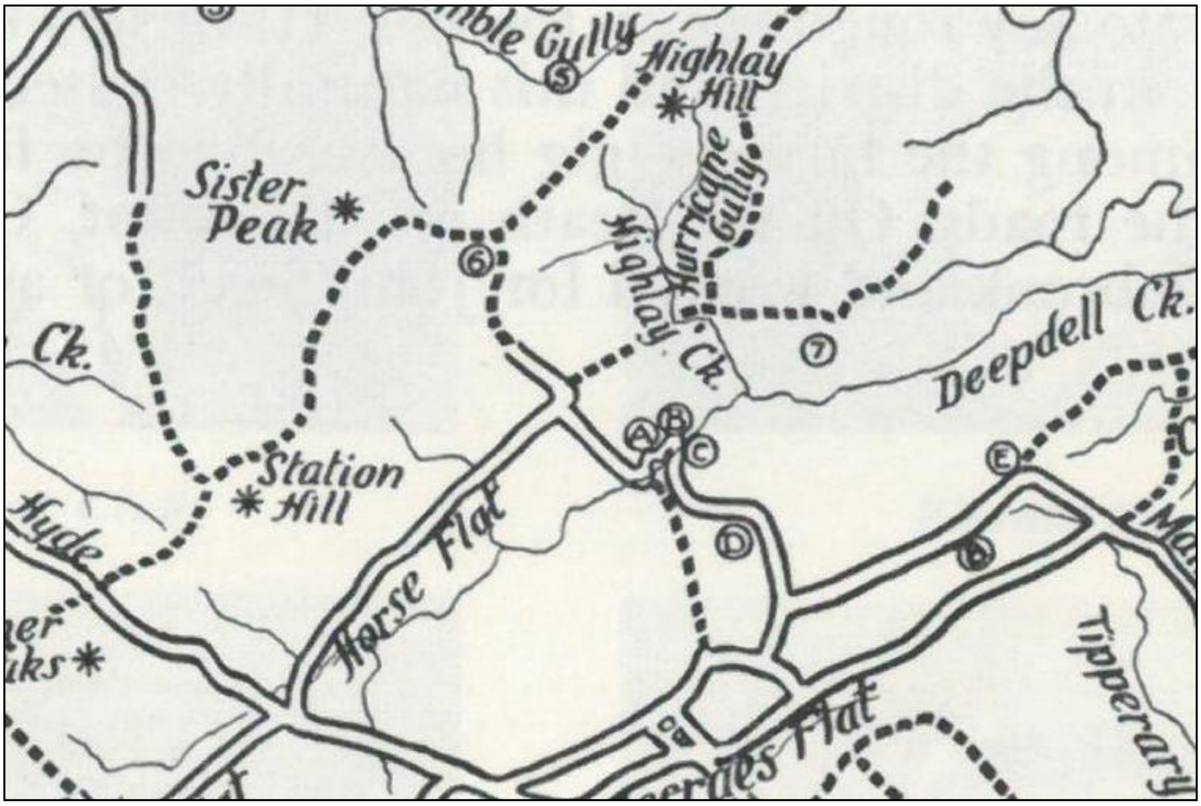

Figure 11. Recorded hard-rock gold-mining claims by Thomson in 1949 , with a cluster of claims (A,B,C)around Deepdell Creek. Claim number 6, Coronation mine, has already been the subject of earlier archaeological authorities.

In addition to alluvial mining, the area also became part of a pastoral farm run from Bellfield Homestead. This homestead area was likely formed in 1888, the year the larger Deep Dell run was broken up and was built and run by the original head shepherd of Deep Dell, Alexander McLennan. It appears that he constructed a small villa, as well as the usual buildings associated with running a sheep farm, including woolshed, barn, pig sty, and stables (pers. comm. Colin Howard, 2016)(Figure 12-Figure 13).

Figure 12. View of the original house at Bellfield, circa 1890s with storage shed visible to the rear (credit Colin Howard).

Figure 13. A view from above the homestead with the older woolshed visible along the driveway (credit Colin Howard).

On-site Observations

Five site visits were undertaken to the site in 2016, 2017, and 2019. The assessment site boundaries have been revised a number of times. The current boundaries are centred on Horse Flat Road and stretches north towards Highlay Creek and to the south towards Deepdell Creek.

The initial site survey involved the investigation of the slopes above Bellfield Homestead, as well as investigation of areas along the valley floor, and previous survey of the area to the southeast which was the focus of early hard rock mining ventures. The survey began on the slopes of Sisters Peak. No observable archaeological features were recorded until the gully systems immediately above Horse Flat were reached. Part of this area has already been the subject of previous archaeological surveys involving Coronation Mine. A water race on the north western slope above Horse Flat was recorded by Barr as I42/205 (Figure 14-Figure 16) as was a group of wooden posts forming a rectangular enclosure (I42/206), later determined to relate to dog trialling activities. Due to the mapping limitations of the NZAA site recording scheme, the extent of the water race was not fully recorded. This water race is still partly visible on both sides of the modern access road up to Coronation Pit. Its full extent to the south was not recorded as it was beyond the survey area. On high resolution aerial imagery, the water race can be observed running in a north-easterly direction along the slope. During the ground survey, the portion of race originally recorded southwest of the haul road could not be relocated. However, immediately to the northeast on the opposite side of a tributary of Highlay Creek, a water race was recorded contouring the slope. It is likely that this is the same race originally recorded as I42/205. This race was followed north towards Highlay Creek until it reached the edge of the survey area. Based on the topography of the water race, it appears to run from the catchment area of Highlay Creek, south and west. This water race is likely to be one of those mentioned in relation to the Highlay Creek diggings that were undertaken in the Horse Flat area. The collection of wooden posts recorded by Barr was not relocated (I42/206).

Figure 14. Water-race on the northwest slope above Horse Flat (visible in the distance).

Figure 15. Western end of water race where it appears to have been truncated.

Figure 16. Continuation of water race into Highlay Creek catchment beyond survey area.

Below the water race, the survey area incorporated a segment of Horse Flat. The flat has been extensively ploughed as part of the larger pastoral lease that covers the area. A cluster of buildings form the homestead area of this station. As already noted above, these buildings form part of Bellfield Homestead (Figure 17-Figure 19). They are located on the northwest side of Horse Flat Road, immediately to the northeast of the current mine access road to the Coronation Pit. These buildings were not identified as an archaeological site during previous archaeological surveys of the area. They will not be impacted under the current proposed mine boundaries.

Figure 17. Looking southeast towards Bellfield Homestead from the hillslope above with Horse Flat Creek below.

Figure 18. Front of modified villa looking north.

Figure 19. Modern implement shed.

Immediately behind the cluster of homestead buildings to the north are the remains of a water-race (Figure 20)(I42/220). This race runs approximately parallel to the road, and the section around the homestead has been preserved, presumably because it avoided being ploughed. According to oral histories, this race was constructed by Chinese alluvial miners, and was subsequently used as a source of water for the homestead (pers. Comm. Colin Howard). This may be the race referenced in an application by Louis Gay Tan to construct along Horse Flat in 1887/1888 (Archives New Zealand R24695040). To the south of the homestead next to Horse Flat Road is a concrete axillary building, likely used for milking. It is 20th century in origin.

Figure 20. Water-race running behind the Bellfield Homestead complex and recorded as I42/220. This race is possibly the one constructed by Chinese alluvial miners in the 1890s.

Figure 21. Concrete axillary building next to Horse Flat Road.

The rest of the site to the south is characterised by fields on both sides of Horse Flat Road, and the modern mining landscape south towards Deepdell Creek (Figure 22-Figure 26). The area designated for the new mine has already been extensively modified at a landscape scale from previous mining operations over the past 25 years.

Figure 22. View looking southwest down Horse Flat Road with pasture on either side.

Figure 23. View from Horse Flat Road looking south towards landscape modification from modern mining operations.

A portion of early 20th century workings associated with the Deepdell Mine and Evans Workings are incorporated within the proposed pit boundaries. The heritage values of these workings, which are under a heritage covenant, have been assessed in a separate report (Teele, 2017). This initial covenant (no. 766279.1) did not specify a covenant boundary. Subsequent agreement between Heritage New Zealand Pouhere Taonga and OceanaGold saw a variation to heritage covenant (31/01/2019) and a new boundary identified. This is shown in Figure 24.

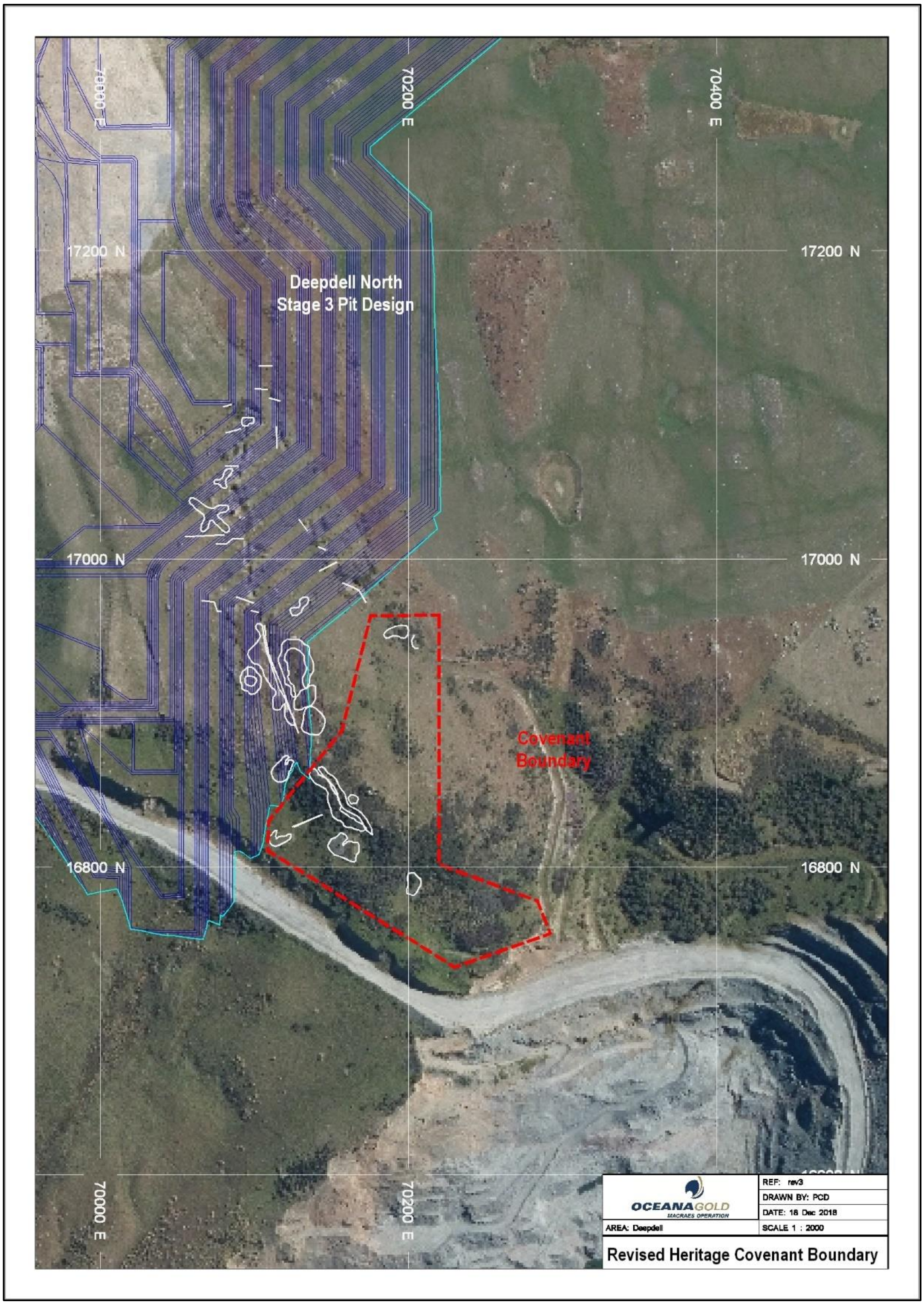

Figure 24. Revised heritage covenant boundary for Evan's Workings (I42/15).

Figure 25. View looking north towards Sisters Peak and Bellfield Homestead from area of Deepdell mine workings.

Figure 26. View of remains of workings associated with Deepdell Mine and Evan's Workings with modern mining operations visible in the background.

The eastern portion of the assessment site where the proposed waste rock stack would be located is a mix of grassed paddocks and woody shrubland. A small tributary to Highlay Creek is formed to the north of Horse Flat Road (Figure 27-Figure 28). A number of archaeological sites were recorded within Highlay Creek to the north and east of the assessment site. A 20th century woolshed is situated behind a shelterbelt at the eastern end of Horse Flat Road (Figure 29-Figure 30). The paddocks to the south are divided by a fence and contain a mix of ploughed areas and small hillocks (Figure 31). The southern portion descends steeply downhill to the current Deepdell mine (Figure 32). There were no archaeological features recorded within this area.

Figure 27. Small tributary to Highlay Creek to the north of Horse Flat Road.

Figure 28. View looking north up Highlay Creek, with visible alluvial features in the form of paddocking outside of survey area.

Figure 29. View looking north towards Highlay Creek with shelterbelt on left.

Figure 30. 20th century woolshed at eastern end of Horse Flat Road.

Figure 31. Paddock areas forming eastern part of assessment site where waste rock stack will be located.

Figure 32. Southern edge of site adjacent to current Deepdell Pit.

Archaeological and Other Values

Based on the research and site survey results, no pre-1900 recorded archaeological sites will be impacted by the proposed works. As such, no assessment of archaeological values has been undertaken.

Assessment of Effects

Proposed Site Development Works

Open Pit Excavation:

- Current footprint 38ha, 18.7ha of disturbing previously mined areas and 19.6 ha of new disturbance. Potential to expand if upcoming exploration is successful.
- Quantities: Ore 3.5Mt, Backfill waste 9.4Mt, in-situ oxide waste (brown rock) 2.4Mt, in-situ fresh waste 41.5Mt. Total movement 57Mt
- Haul roads 30m wide. Roads within pit footprint only.
- The top of the pit excavation is at about 520mRL and the base of the pit is at 370mRL, making the total pit depth 150m.
- Water management during operations would require pumping of stormwater runoff (primarily) out of the pit and into the existing drain that drains to the Deepdell North Silt Pond
- At closure, the pit lake would be expected to flood and drain out the lowest point to the south (note: need to discuss details of this as this would mean directly down to Deepdell Ck. May be better to either build a small 'tails standard' embankment to force drainage to north or alternatively construct a cutoff drain to direct runoff to DDS silt pond).
- Ancillary infrastructure associated with the open pit (park-up areas, smoko and ablutions, portable fuel tank etc.) would be located immediately west of the pit in the same areas previously used for these purposes.

Waste rock disposal – Deepdell Waste Rock Stack:

- Backfill of the exiting Deepdell South Pit (13.2ha)
- Extending north from Deepdell South Pit to beyond Horse Flat Road covering a total area of 70.8 ha (covering an area of 70.8 ha, of which 57.6ha will be new disturbance.
- Storage quantity 21.6Mm3 to 540mRL (current design height) but has the potential be constructed to 580Mm3.
- A short haul road required between Deepdell North Pit and Waste Rock Stack.
- Water run-off from the waste rock stack is presented in Figure 2.
- No additional infrastructure will be required.

Stockpiles

- Stockpiles for rehabilitation materials are to be formed along the Coronation Haul Road in currently disturbed areas and adjacent to the Pit, to the north east.

Roads

- Horse Flat Road will be permanently moved to the north due to the construction of the waste rock stack. The realignment of this road will involve the installation of at least one culvert.

Project Closure

- Pit: Not backfilled. Where possible (i.e. rock is soft or within existing backfill) the excavation levels above the final lake level will be shaped to provide aesthetically pleasing and suitable areas for vegetation establishment. Surface and ground water flow to be directed into the pit void to create a lake. This lake to drain as per notes above.

- Waste disposal. Final land use will pastural, with slopes to be dozed down to a 3H : 1V slope and rehabilitated back into pasture using standard site techniques. Note that this will substantially soften the visual amenity from the Golden Point historic reserve.
- Site establishment areas and haul roads will be rehabilitated using standard site techniques.

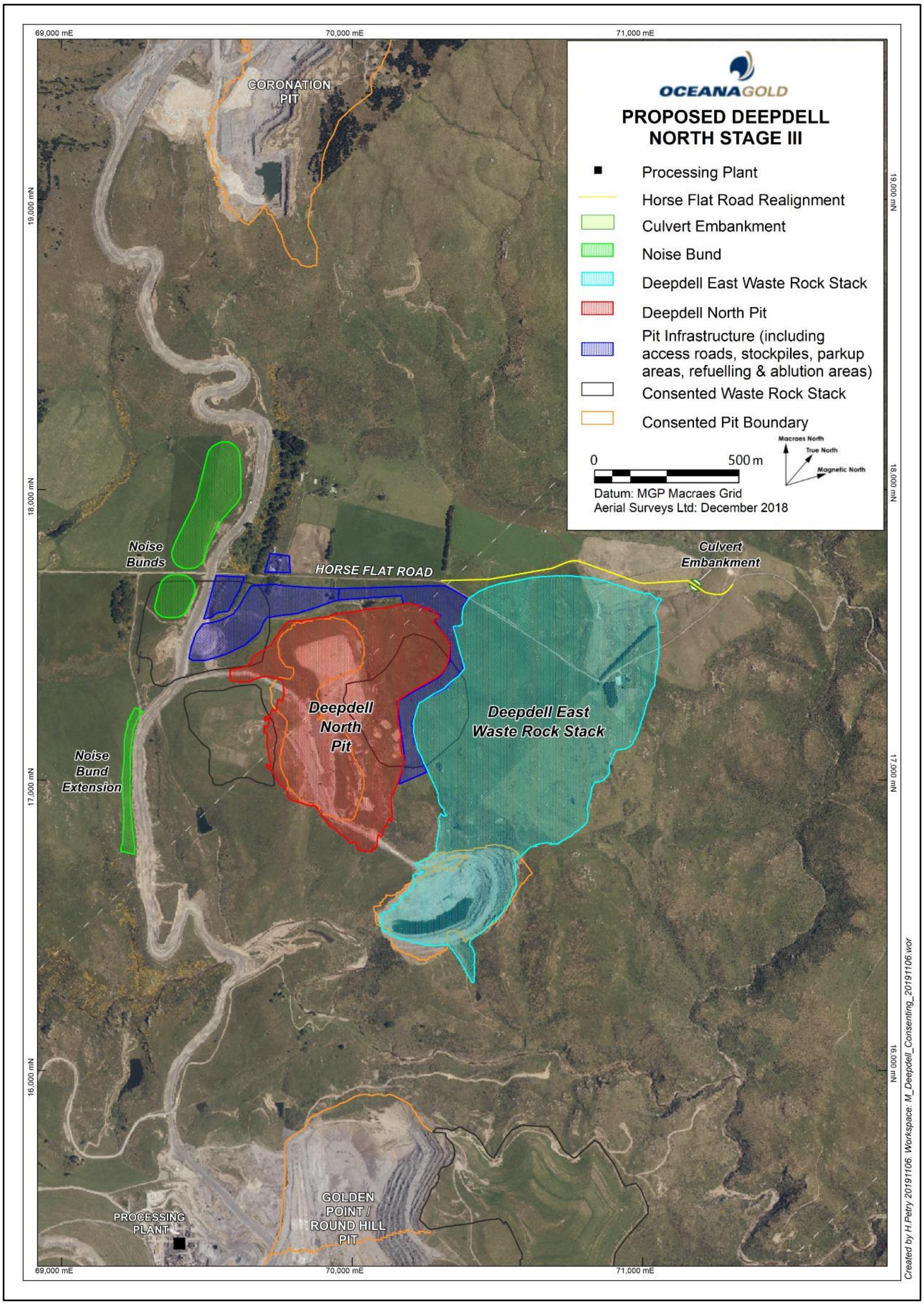

Figure 33. Proposed mine and associated elements at Deepdell North Stage III (OceanaGold -October 2019).

The Effects of the Proposed Works

The proposed expansion of mining in the Deepdell/Horse Flat area will have no known effects on pre-1900 recorded archaeological sites. Amendments to the initial boundaries for the project have resulted in the exclusion of all recorded archaeological sites that have not already been destroyed under previous archaeological authorities.

The creation of the new pit will damage parts of I42/15, with the remaining portion of the pit being opened over previously disturbed ground from earlier modern mining operations. I42/15, identified as an early 20th century hard-rock mining site is not therefore considered an archaeological site under the 2014 HNZPT Act. The heritage covenant boundaries for the site are outside of the proposed pit boundaries. The values and possible mitigation factors have previously been assessed in a separate report (Teele, 2017). This covenant area has been redefined after discussions between Heritage New Zealand Pouhere Taonga staff and OceanaGold in 2018. The remaining portion of the pit to the north will incorporate mostly previously ploughed land which has removed any earlier possible trace of alluvial mining features.

The creation of a new waste rock stack to the along the eastern part of Horse Flat Road will not impact any known archaeological features. The extensive modification of the Horse Flat area has already removed any remaining traces of alluvial mining in the fields along either side of the road.

Alternative Options

OceanaGold has considered a number of alternative options with regard to the location and extent of the waste rock stack required to accommodate the proposed Deepdell North Stage III open pit excavation. The current proposed boundaries are a result of the consideration of these options and as a result have the least impact on the archaeological values for sites in the area.

Site Management

There are no site management conditions.

Conclusion and Recommendations

Assessment summary

This report provides an assessment of the impact of the proposed expansion of mining operations in the Deepdell/Horse Flat area which will include the re-mining and extension of Deepdell North pit, a new waste rock stack, and backfilling of the Deepdell South Pit. While the scale of the assessment area is substantial, most of the work will be in either areas mined previously by OceanaGold or in areas where 20th century farming activity has removed any early trace of human activity. The condition of other alluvial features in the Horse Flat area has previously been the focus of archaeological surveys. Petchey in 2001 noted that alluvial workings along the flat have been badly damaged by stock and by ploughing (Petchey, 2001). The survey undertaken for this assessment confirmed this, with no evidence of pre-1900 sites within the area identified in Figure 3 and Figure 33.

Recommendations

Based on the proposed plans identified as Deepdell North Stage III to create a new pit and waste rock stack, Origin Consultants make the following recommendations based on the findings of this report:

- Under the Heritage New Zealand Pouhere Taonga Act 2014 an archaeological site is defined as one associated with human activity that occurred before 1900 and which may be able through archaeological investigation by archaeological methods to provide evidence relating to the history of New Zealand. As such the only recorded site within the potential disturbance area forms part of Evan's Workings, which has a clear post-1900 date. The area of this site under a heritage covenant is also outside the pit boundary. As such, there is **no** archaeological authority requirement under the Heritage New Zealand Pouhere Taonga Act 2014.

- Other recorded sites (I42/13, I42/14, I42/96) are noted as having already been destroyed within the proposed area of mining under prior archaeological authorities issued under the Historic Places Trust Act 1993.
- The backfilling of the Deepdell South Pit will not impact on any known archaeological features. As such, these works do not require an authority under the Act.
- As a first principle, every practical effort should be made to avoid damage to any archaeological site if discovered. In this instance, works within the gullies on Horse Flat and near Deepdell Creek have a low chance of encountering unrecorded sites. In the event that unexpected archaeological features are encountered during works, any features should be cordoned off and the archaeologist notified immediately so that the feature can be investigated and recorded, as appropriate, prior to any more disturbance. In the event that the feature holds a significantly high archaeological or heritage value, discussion with appropriate parties should be undertaken to determine if further disruption is practical and preventable.
- If at any stage during site works pre-European (Māori) material is discovered, Heritage New Zealand should be consulted in the first instance and an Accidental Discovery Protocol followed. This states that if pre-European material is encountered in the area that is undergoing work, then all work is to cease immediately with a 20m exclusion zone established around the find with damage to any material minimised or avoided. Once the Regional Archaeologist has been contacted, they will advise on the best way to proceed. Any pre-European artefacts will be, prima facie, property of the Crown and will be submitted to the appropriate institutions.

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Appendix A – NZAA Site Record Forms

ARCHSITE archaeological site recording scheme

Site Record Form

NZAA SITE NUMBER: I42/15

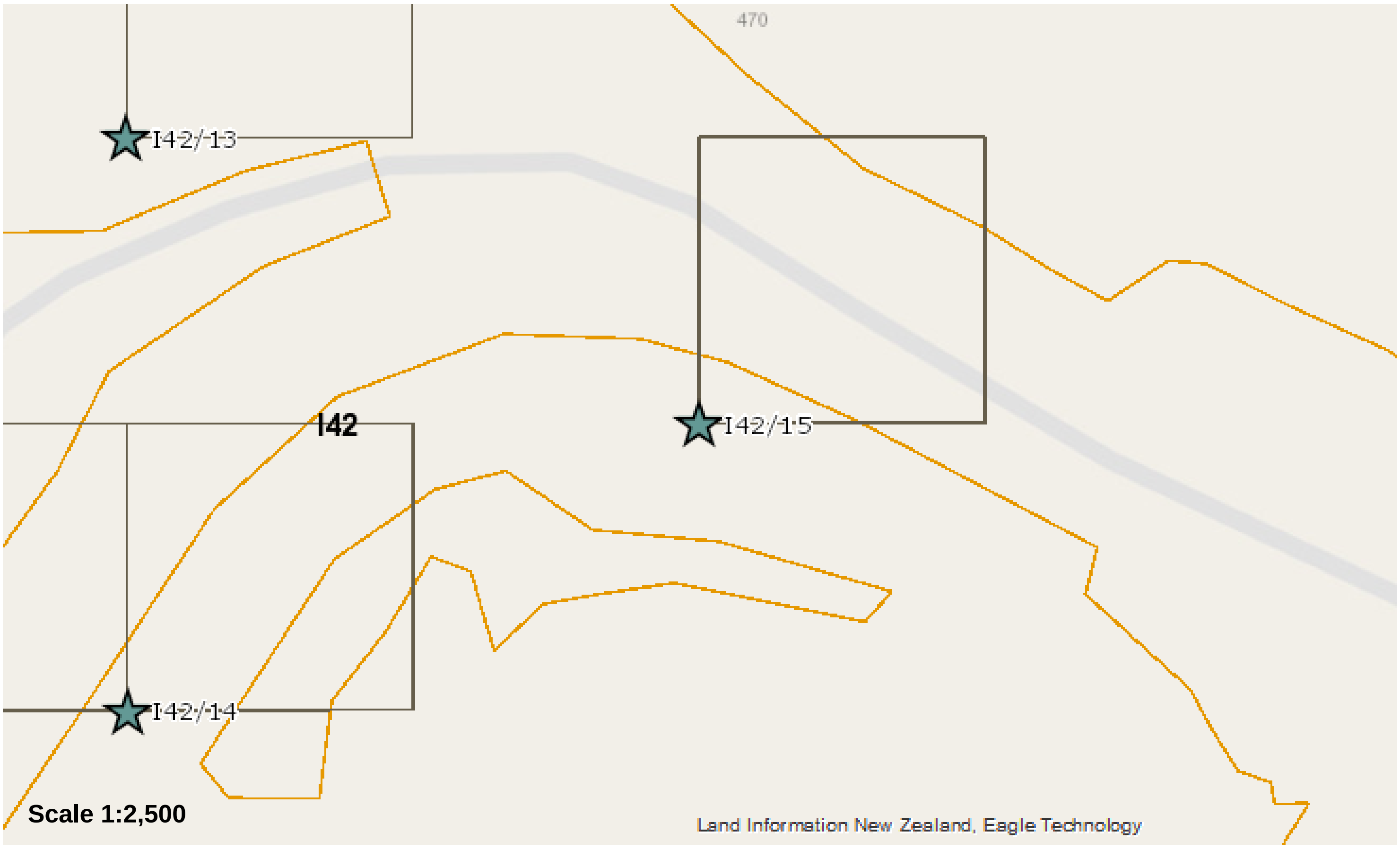
SITE TYPE: Mining - gold

SITE NAME(s):

DATE RECORDED:

SITE COORDINATES (NZTM) Easting: 1397633 **Northing:** 4975443 **Source:** CINZAS

IMPERIAL SITE NUMBER: **METRIC SITE NUMBER:** I42/15



Finding aids to the location of the site

Brief description

QUARTZ WORKINGS

Recorded features

Other sites associated with this site

SITE RECORD HISTORY	NZAA SITE NUMBER: I42/15

Site description

Condition of the site

Statement of condition

Current land use:

Threats:

SITE RECORD INVENTORY	NZAA SITE NUMBER: I42/15

Supporting documentation held in ArchSite

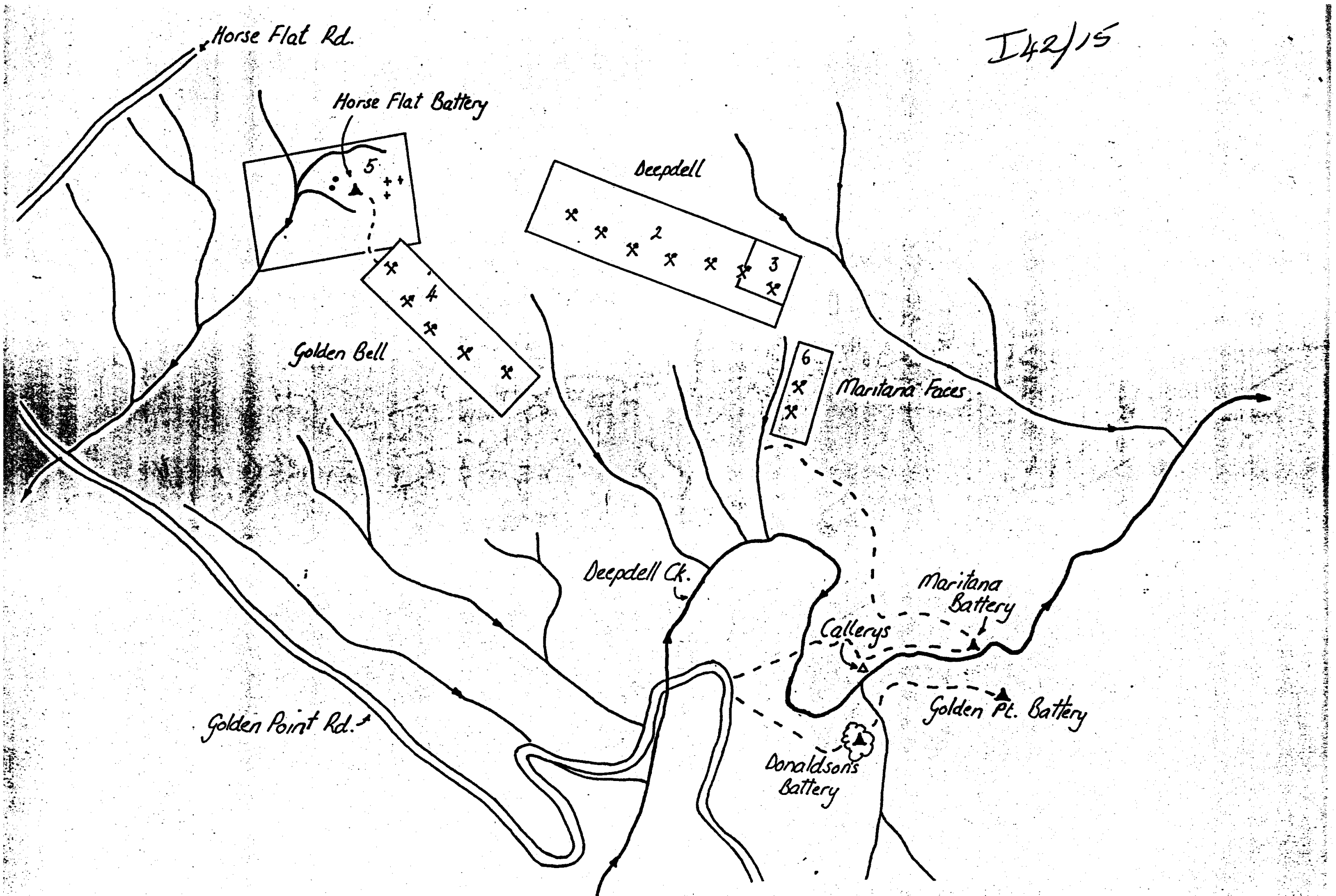


Figure 1a General map of the Horse Flat sites and positions of other figures.

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

SITE RECORD FORM (METRIC)

Metric map number I42
Metric map name Dunback
Metric map edition First

NZAA METRIC SITE NUMBER I42/15
DATE VISITED August 1991
SITE TYPE Quartz workings
SITE NAME: MAORI Deepdell
OTHER

YY

Grid Reference Easting 2 ~~1~~3 0 7 5 0 0 Northing 5 5 3 7 1 0 0

1. Aids to relocation of site (attach a sketch map)

The battery and cyanide tanks are in a creek bed which is 400 m south east of Horse Flat Road. The drives extend in an arc south east towards Maritana Mine, starting about 400 m south of the battery.

2. State of site and possible future damage

The battery area will be destroyed by Macraes Mining Co under the 1993 resource consents, but the drives are unlikely to be affected, except by exploration activities.

3. Description of site *(Supply full details, history, local environment, references, sketches etc. If extra sheets are attached, include a summary here)*

The site is described in "Changes in gold mining at Macraes", Jill Hamel, 1991, (Figs4a, 9,9a,11, 13, pp 6, 9 10. It is difficult to separate the battery evidence of this mine and Golden Bell (I42/14) from one another but most of the surface evidence left probably belongs to the Deepdell mine.

4 Owner Address Macraes Mining Company,
P O Box 84,
Palmerston, Otago.

Tenant/Manager Address

5. Nature of information *(hearsay, brief or extended visit, etc)* General survey

Photographs *(reference numbers and where they are held)*

Aerial photographs *(reference numbers and clarity of site)*

6. Reported by Address Jill Hamel,
42 Ann Street, Dunedin

Filekeeper G. Hamel
Date 4/10/93

7. New Zealand Historic Places Trust *(for office use)*

D	M	Type of Site
		Local environment today
A	I	Land classification

A	C	Present condition and future danger of destruction
T	C	Local body

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APPENDIX I

Health, Safety and Environment
Compliance Standards

8.9 Hazardous Materials and Chemical Substances

Purpose

To implement and maintain systems of work that ensures the effective selection, purchase, transportation, handling, and storage of hazardous substances, compliance with all legislative / licence requirements and to minimise their potential adverse impacts on the environment.

Minimum Standards

8.9.1 The Business Unit shall ensure compliance with host countries legislative requirements regarding the safe transport, storage, use, handling and disposal of hazardous materials.

8.9.2 Risk assessments shall be conducted to identify the risk exposure associated with the security, transportation, storage and handling of hazardous materials generated and used by the Business Unit activities.

8.9.3 A Plan must be developed and will describe all systems processes, procedures, controls and safeguards undertaken to manage risks identified in the risk assessment.

8.9.4 The General Manager of the operation shall review and authorise the Plan and will be accountable for and will be accountable for its implementation and ongoing effectiveness.

8.9.5 Processes shall be implemented to ensure all substances have been assessed and approved prior to being allowed on site.

8.9.6 All substances shall have a current MSDS readily available and within 5 years' currency of issue date.

8.9.7 Each Business Unit must maintain a Hazardous Substances Register that provides details of the following:

- the product name;
- the United Nations code;
- storage locations, requirements and precautions;
- summary of maximum inventories;
- approved disposal methods; and
- hazardous substance identification as identified by any statutory approval requirement.

8.9.8 All personnel handling hazardous substances as part of their work activities shall be trained and competent in the safe use, handling and storage of these substances.

8.9.9 Signage must be in place on all storage vessels, containers and tanks that complies with host country legislation or MSDS requirements.

8.9.10 Wherever there may be a significant change to the type or volume of chemicals used or stored, the Business Unit must determine the need for any required licence / permit changes. Processes shall be in place to ensure this occurs prior to any modifications being made.

8.9.11 Storage tanks and piping must be certified and approved for the conditions of use and be made of a suitable material to be impervious to the chemicals stored in them. They are to be routinely inspected and maintained and situated above ground by preference.

8.9.12 Piping and flow lines shall be colour-coded and marked to indicate the contents and direction of flow.

8.9.13 Automatic plant control systems shall be in place wherever practicable to eliminate the need for operator intervention. Such controls shall incorporate fail safe systems in the event of emergencies. Where automatic control is not practicable, risk assessment shall be used to identify and implement operational options that reduce the risk to As Low as Reasonably Practicable (ALARP).

8.9.14 Stored hazardous substances must be adequately segregated based on:

- Quantity of materials stored;
- Physical state of the chemicals (solid, liquid or gas);
- Degree of incompatibility;
- Manufacturer's instructions; and
- Known behaviour of the materials.

8.9.15 For all new installations, environmentally hazardous chemicals will be stored within low permeability, bunded compounds designed in compliance to AS 1940 – 2004 The Storage and Handling of Flammable and Combustible Liquids.

8.9.16 All bunded compounds will be maintained to ensure:

- capability to allow recovery of liquid;
- chemical resistant to the substances stored;
- valves, pumps and meters associated with transfer are operable as required;
- equipment is adequately protected and contained;
- any potential jetting from any storage vessel or fitting is captured within the bunded area; and
- incompatible chemicals are physically segregated and do not come into contact with each other.

8.9.17 Spill response kits shall be made available and placed in work areas where hydrocarbons and other substances may require containment and clean up.

8.9.18 Training must be provided to employees who may need to conduct spill recovery and clean-up.

Radiation

8.9.19 Where radiation sources are used by a Business Unit, a Radiation Safety Officer shall be appointed.

8.9.20 A register of all radiation sources must be maintained, and an annual audit completed and documented.

8.9.21 All radiation sources shall be sign posted and all unused or expired sources securely held in a locked storage facility that meets the host country legislation. These disused radiation gauges shall be removed off site by an approved contractor, at intervals not exceeding 10 years.

8.9.22 Radiation sources shall be tested for the presence of leaks on a regular basis using an approved radiation leak detection device.