9 ASSESSMENT OF EFFECTS

9.1 OVERVIEW

In accordance with Schedule 5 (clause 5 (4), clause 6 and clause 7), Schedule 6 (clause 3 (1)(g)(i)), Schedule 7 (clause 2 (1)(j)), Schedule 8 (clause 2 (1)(g)), Schedule 9 (clause 2) and section 13(4) of the FTAA, this section provides an assessment of the actual and potential effects associated with MP4.

In accordance with the findings of the specialist reports (provided in **Part B** of these application documents), the relevant actual and potential effects, as summarised in the following sub-sections of this report, are:

- Positive effects;
- Cultural effects;
- Water effects;
- Terrestrial ecology and wetland effects;
- Aquatic ecology effects;
- Landscape, natural character and visual amenity effects;
- Geotechnical effects;
- Noise effects;
- Blasting effects;
- Roading and transport effects;
- Lighting effects;
- Archaeological and heritage effects;
- Contaminated land effects;
- Effects of storage and handling of hazardous substances;
- Dust and air quality effects;
- Effects on public access and recreation;
- Social impacts; and
- Closure and aftercare.

Refer to the full reports for a more detailed assessment, these reports are included in **Part B** of these application documents.

MP4 proposes to implement the effects management and mitigation measures, summarised in **Part A.10** of this report and described in sub-sections below. A proposed set of conditions, provided in **Part D** of these application documents, have been drafted for all activities for which the MP4 is seeking approval under the FTAA within the jurisdiction of each administering agency.

It is acknowledged that some actions and commitments may be implemented outside the consent conditions framework. In particular, MP4 may see OGNZL undertake engagement and agreements with Kā Rūnaka to address cultural matters, and a separate agreement with WDC may also be required in relation to the Stoneburn drinking water supply.

9.2 BACKGROUND

As set out in **Part A.04** of this report, in June 2025 reporting officers for both the ORC and WDC recommended, under s42A of the RMA, that resource consents for the MP4 (RMA) Project be declined citing several key environmental issues.[33] While OGNZL did not agree with those recommendations, a key objective for MP4 is to address the previously identified issues to the extent practicable and establish a more robust environmental management framework to support the future of the Macraes Operation. As such, the issues raised by Council officers have been a key focus for OGNZL during the design, development and assessment of MP4. They were also a common point of reference during OGNZL's consultation on MP4 (as discussed in **Part A.08** of this report).

At the outset, OGNZL considered the key identified issues from the s42A reports and the 2025 CIA in redefining the project description for the present application and instructed its technical experts to have specific regard to those issues when assessing the effects of MP4 and considering appropriate management responses. In addition, OGNZL's consultation with the relevant administrating agencies and Kā Rūnaka has also included expert-to-expert discussions and has specifically sought to understand and resolve the previously identified issues (and any new matters arising). As a result, the assessment of effects set out in the following sections of this application (and in the referenced technical work) has been heavily guided by the key issues identified in the MP4 (RMA) process.

In considering the MP4 (RMA) issues and the advice of its experts, OGNZL has committed to significant investment in environmental enhancements and improved environmental

[33] The reporting officer for DCC recommended consents be granted.

management practices as part of MP4. These commitments purposefully address the matters raised in the s42A reports, including issues raised in the 2025 CIA provided by Kā Rūnaka, albeit in the context of an earlier iteration of the Project under different legislation, and these matters are discussed further in Section 9.4 of this report. These commitments and those otherwise necessary or desirable to manage the actual and potential effects of MP4 and to secure the expected benefits are discussed throughout the following sections and are secured through the approval conditions proffered in **Part D** of this application.

Table 9-1 provides a summary of key issues raised in the s42A reports for the MP4 (RMA) Project and the mitigation measures proposed by OGNZL in respect of each.

Table 9-1: Proposed Resolution to Key Issues from Previous Consenting Process

Key Issue/s Identified in s42A Reports	Proposed Mitigation	Relevant Subsection of this substantive application
Cultural effects		
Kā Rūnaka oppose the application, stating that it does not adequately address the magnitude, severity, and ongoing impact of effects arising from the proposal.	Continue to address Kā Rūnaka feedback from the s42A reports and 2025 CIA through step-change environmental commitments and the establishment of a stronger relationship with Kā Rūnaka that will enable greater Kā Rūnaka involvement in assessing and addressing adverse cultural impacts caused by mining, and to secure opportunities to improve cultural health, including through enabling Kā Rūnaka to exercise kaitiakitaka and rangatirataka where appropriate.	Section 9.4
Water Quality and Aquatic Ecology effects		
Existing compliance limits for contaminants (arsenic, copper, zinc, cyanide) set much higher than contemporary ecological guideline values. Significant adverse cumulative effects on aquatic life in all catchments, especially Deepdell	Adopt updated water quality triggers and compliance regimes derived in Viridis (2026) using modern ecological default guidelines and relevant alternative sources, replacing historical triggers and compliance values that were set by	Section 9.5 and 9.7

Key Issue/s Identified in s42A Reports	Proposed Mitigation	Relevant Subsection of this substantive application
Creek and the Waikouaiti River North Branch, could occur even before these existing limits are reached.	Council. The proposed new compliance criteria are generally in accordance with the ANZG 95% species protection level.	
Potential adverse water quality and aquatic ecology effects due to: > Potential for diffuse groundwater discharges to surface water not fully accounted for; > Uncertainty about the effectiveness of passive and active treatment systems for contaminants, especially over the long-term; > Some contaminant sources (e.g., waste rock in Golden Bar Pit) not included in models; and > Climate change impacts on groundwater recharge and contaminant migration have not been assessed.	To address this uncertainty, OGNZL proposes: > Interception and capture of point source and (where practical) diffuse seepage flow paths, by installing engineered seepage interception drains; > Interim and long-term Stage 1 and Stage 2 WTPs for active water treatment; > Construction and operation of Coal Creek and Camp Creek augmentation dams for the management of instream water quality and enable management of potential eutrophication so that acceptable water quality standards are maintained; > Provisions for flushing flows as required to manage periphyton growth; and > In relation to climate change, the models deal with matters such as seepage rates and climate probabilistically, to enable conservative predictions where aspects such as seepage and climate are related. The models are also designed to be updated and re-worked as more data becomes available to improve the accuracy of the predicted outcomes and thereby enable	Sections 9.5 and 9.7

Key Issue/s Identified in s42A Reports	Proposed Mitigation	Relevant Subsection of this substantive application
	implementation of the mitigation measures to be adjusted and adapted to ensure that the compliance framework is achieved.	
Existing water quality mitigation measures assumed in the models are not enforceable through current consent conditions, and some require additional consents or are still in trial phases.	Surrender existing discharge permits, which otherwise do not expire until 2052 and, once MP4 approvals are granted for new discharges, enabling implementation of the more stringent compliance criteria over a seven-year transition period.	Section 9.5.5 (also see Section 7, **Part I** and **Part F** of this report).
Terrestrial Ecology and Wetland		
The loss of ephemeral wetlands (naturally uncommon, critically endangered ecosystems) cannot be avoided, minimised, remedied, offset, or compensated for under the effects management hierarchy, and should be avoided (otherwise failing to meet national policy principles).	The loss of some ephemeral wetlands cannot be avoided because of the Project's locational and operational needs. The wetland compensation package to restore, enhance, plant, buffer and exclude stock from sedgeland, copper tussock wetland, seepage wetland, wetland shrubland and degraded ephemeral wetlands is proposed and follows good practice compensation approaches in accordance with expert advice and recommendations. This includes to explore practicable experimental wetland creation or recreation.	Section 9.6
Compensation is not available for the loss of irreplaceable or vulnerable biodiversity (e.g., rock tors important for lizard habitat and threatened moth *Orocrambus sophistes*).	Effects management hierarchy is applied through avoidance, minimisation, remediation, and compensation to manage significant adverse effects on indigenous biodiversity, consistent with national policy direction.	Section 9.6

Key Issue/s Identified in s42A Reports	Proposed Mitigation	Relevant Subsection of this substantive application
Lack of detail, baseline data, and uncertainty about long-term outcomes and governance for MEEA.	New baseline surveys informed the relevant ecological management plans with performance metrics to minimise adverse ecological effects that cannot be avoided. Long term governance of the MEEA (and other areas identified for biodiversity protection) is provided for.	Section 9.6
Incremental habitat loss and fragmentation can have disproportionate negative outcomes for biodiversity, especially in already degraded environments.	Habitat connectivity will be achieved through covenant integration linking existing protected areas such as MEEA, Cranky Jims, and Redbank. The removal of recently planted pine trees at Mt Highlay Station is also proposed to improve indigenous lizard habitat values and avoid their progressive reduction as the trees grow.	Section 9.6
Geotechnical effects		
Concern about long-term geotechnical stability given the long rehabilitation timeframes, and the practicality of management measures in perpetuity after mine closure.	Prepare and implement a Ground Control Management Plan for Macraes Road and Golden Bar Road, including stability assessments, monitoring, rainfall and ground-movement TARPs, reporting, avoidance measures and closure stability parameters.	Section 9.9
Noise effects		
The use of bunds for noise attenuation is mentioned as a standard mitigation measure, particularly for hauling activities.	Construct a noise protection bund at least 4 m above ground on OGL-owned land east of 1668 Macraes Road to address the predicted 1 dB exceedance and achieve night-time noise levels of 45 dB LAeq (15 min) or less during MP4 operations.	Section 9.10

Key Issue/s Identified in s42A Reports	Proposed Mitigation	Relevant Subsection of this substantive application
In the Waitaki District, where night-time noise limits will be exceeded at two residential receivers, careful consideration and mitigation is recommended.	Restrict surface-level earthmoving activities in specified parts of the Frasers West WRS area and Innes Mills Back Fill Stage 1 to daytime only to avoid cumulative night-time exceedances at 1668 Macraes Road.	Section 9.10
Air Quality effects		
Technical experts recommend continuous TSP monitoring near sensitive locations with real-time alerts when trigger levels are reached.	Shift continuous real-time monitoring at Macraes Village from TSP to PM_{10}. This will also address nephelometer sensitivity to relative humidity and enable comparison with applicable health-based standards and guidelines. Additional TSP monitoring to be undertaken at 1668 Macraes Road.	Section 9.17
Closure and Aftercare		
The practicalities of maintaining exclusion zones, monitoring wells, and management measures in perpetuity are questioned by technical experts.	Provision of Rehabilitation and Capitalisation Bond and establishment of a Trust to be responsible for the post closure management of the land on or within which mine activities authorised by the MP4 consents occur.	Section 9.20

To assist with informing the assessments undertaken, it is noted that existing modelling used to assess water quality mitigation measures have been updated and the modelling assumptions revisited and revised as necessary. The modelling undertaken is not intended to deliver absolute compliance measures; rather, the models are used as a "live" assessment tool to predict likely outcomes and to provide information to inform future decision making. In that regard, the modelling will continue to be updated and re-worked as new data becomes available to inform the robust environmental management framework supporting the future of the Macraes Operation.

9.3 POSITIVE EFFECTS OF MP4

As described in **Part A.01** and **A.03** of this report, MP4 will deliver significant benefits to the Otago Region and New Zealand more broadly. MP4 will increase the scale and duration of the economic and social benefits that the Macraes Operation already provide to the regional and national economy. The social impacts are assessed in Section 9.19 and the economic benefits in Section 9.3.1 below. In summary, the positive effects of MP4 are as follows:

- Job security and sustained livelihoods;
- Sustained business activity and economic stability;
- Maintained local school rolls;
- Continued local community benefits;
- Environmental benefits such as ecological improvements, more stringent water quality criteria, increased rehabilitation and long-term post-closure management activities;
- Exports of $4.5 to $7.3 billion over the life of the Project, an average of $320 to $520 million a year;
- Government revenue of $523 million to $1.4 billion from PAYE, Corporate taxes and Royalties;
- GDP of approximately $3.1 billion over the life of MP4, after allowing for imported equipment and materials;
- Support of approximately $6.1 billion of economic activity through direct, indirect and induced activity.
- Direct employment of 760 people with an average income of $100,000 ($20,000 more than the average income in Otago and nationally); and
- Indirect support of approximately 2,600 jobs across New Zealand.

9.3.1 Economic Benefits

The economic benefits of MP4 during operation and post-closure have been assessed and quantified in the economic assessments by Eaqub & Eaqub (2026a and 2026b), provided in **Part B** to these application documents, and summarised in the sub-sections below. Eaqub & Eaqub (2026a) and (2026b) assess the direct, indirect and induced effects of MP4 during operations and closure, respectively. Direct effects relate to the Macraes Operation and the workers at the mine, indirect effects are effects on jobs and income in New Zealand firms that supply the mine, and induced effects are the effects from the spending of the workers in the wider economy. Eaqub & Eaqub (2026a) have considered the effects of MP4 based on a

base case gold price (US$2,450/oz) and an upside gold price (US$4,000/oz), both conservatively below market prices in the 2026 year to date (ranging between approximately US$4,000/oz and US$5,500/oz).

9.3.1.1 Existing Economic Contributions

The existing economic contribution (revenue and spending) of the Macraes Operation in 2025 is quantified in Figure 9-1 below. The economic impact in 2025 equates to $896 million in revenue, $113 million in spending on wages, $583 million on Opex and Capex, and $147 million paid in royalties and taxes in 2025 in respect of the 2024-5 partial tax and royalty years.

So far in 2026, the Macraes Operation is contributing direct employment of 760 people, indirect employment of 2,950, and induced employment of 1,400. The total employment effect (directly, indirectly and induced) totals 5,100 nationally and 2,400 in Otago. Tax and royalty payments associated with the full 12 months of earnings in 2025, and forming part of payments made in 2026, are also expected to increase.

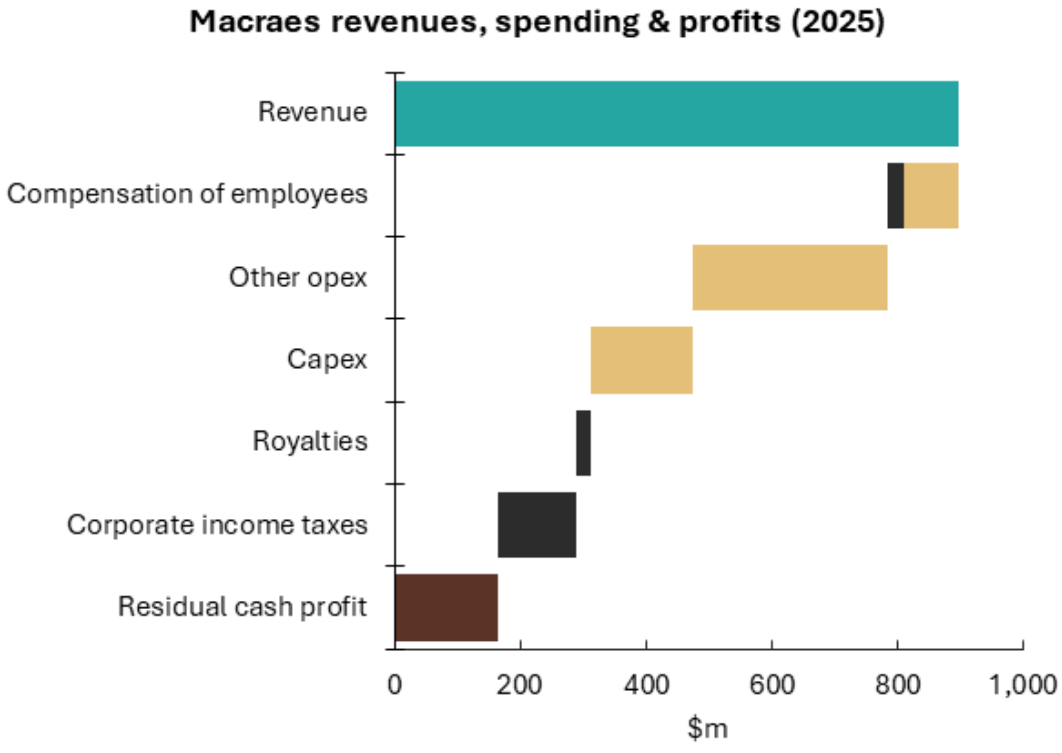

Figure 9-1: Revenue of the Macraes Operation in 2025 (Source: Eaqub & Eaqub (2026a)

9.3.1.2 Export Revenue

MP4 would extend production at the Macraes Operation by more than 1 million ounces of gold. At the base case price, this will add $4.5 billion in exports over the life of the Project, an average of $320 million a year. At the upside price, this is estimated to be $7.3 billion, or an average of $520 million a year (added to existing production) in exports.

9.3.1.3 Government Revenue

The Crown royalty payment on MP4's ~ 1 million ounces of gold is estimated at approximately $59 million at the base case price, and $196 million at the upside price. Company tax for MP4 is approximately $285 million at the base case price, and $1.0 billion at the upside. PAYE on the wages of employees for MP4 adds a further $180 million which will not change with the gold price. Overall, the Project returns between $523 million (base case) and $1.4 billion (upside) to the Crown.

9.3.1.4 Gross Domestic Product

MP4 will contribute approximately $3.1 billion to GDP over its life after allowing for imported equipment and materials. This includes direct activity at the mine and its suppliers, indirect activity in their supply chains, and induced activity from household spending.

9.3.1.5 Employment Opportunities

The Macraes Operation currently directly employs approximately 760 people and indirectly supports approximately 2,600 jobs across New Zealand when taking the suppliers and contractors of the mine and the spending of those workers into account. Without MP4, this employment will wind down commencing in 2027 with final production in 2030, rather than final production in approximately 2039.

Around 85% of Macraes' workers live in the Otago region, mostly in Dunedin and Waitaki, so incomes are generally spent locally. The average mine worker income is over $100,000 a year, $20,000 more than the average income of approximately $80,000 in Otago and nationally.

9.3.1.6 Closure and Rehabilitation

It is estimated that closure and rehabilitation of MP4 will cost around $436 million in 2026 dollars, spread over seven decades, with the majority ($420 million) spent in New Zealand. This domestic spending will support around $412 million of GDP across the whole economy over the life of the programme, including direct, indirect and induced effects.

It is expected that the work will be undertaken by local contractors and workers. The programme supports around 2,060 FTE-years of employment over its life. Roughly half of

that, around 1,060 FTE-years, occurs between 2028 and 2039, peaking in 2030, the main construction year for the water treatment plants and dams. After closure, employment of around 17 jobs a year operating the water treatment plants, monitoring, pest control, and maintaining fences and plantings will continue for around six decades.

9.3.2 Ecological Improvements

As part of the proposed approach to managing the actual and potential effects of MP4, OGNZL proffers ecological improvements as part of the proposed compensation package within the Dunedin City and Waitaki Districts (**Figure 9-2**).

Bioresearches (2026a) indicate that overall, following implementation of the compensation package, Net Positive Outcomes are expected for tussock grassland, dry shrubland, lizards, and avifauna. Wetland compensation is expected to achieve No Net Loss, and in some cases Net Positive outcomes. Improvements are also expected to benefit indigenous species not directly affected by MP4, including Otago skink, grand skink and several indigenous bird species.

A wide range of technical experts have been engaged to assist with formulating the proposed ecological improvements, and these are detailed further in Section 9.6 of this report. In summary, the improvements will include:

> The establishment of the MEEA, a 252-ha predator exclusion fenced area, alongside Murphys Link 395 ha of continuous covenant connecting MEEA to the OceanaGold Redbank Ecological Covenant, to compensate for residual effects on lizards and indigenous biodiversity;

> Removal of 265 ha of exotic pine at Mt Highlay, followed by 175 ha of Tussock planting, including 15 ha of rock tor flora restoration to enhance and protect lizard habitat;

> Creation of Cranky Jims Link through 50 ha of dry shrubland planting followed by enrichment planting. This area will buffer and connect Cranky Jims Shrubland Covenant with Island Block Covenant, creating an enriched and continuous ecological enhancement zone;

> Predator suppression within surrounding biodiversity management areas together with the MEEA to provide 1,170 ha of landscape-scale mammalian pest control to protect indigenous fauna, support ecological restoration and improve habitat quality;

> The implementation of Browser Management Areas, where control of rabbits, hares, possums, deer, pigs and other browsing mammals will reduce browsing pressure, improve the success of restoration plantings, promote natural regeneration, enhance habitat quality, and increase long-term ecosystem resilience;

Figure 9-2: Overview of MP4 Compensation Package

- An integrated pest management approach that combines predator elimination within the MEEA, predator suppression in surrounding areas, and browser control across restoration and enhancement sites;
- Hydrological restoration of key ecological processes that support wetland vegetation, soils and fauna, reducing dryland plant invasion and enhancing overall ecosystem function;
- The fencing and planting of the riparian margin in areas of the headwaters of both Waikouaiti River North Branch, and Murphys Creek;
- Provision of long-term funding to maintain the above initiatives; and
- The establishment of an enduring trust or statutory reserve with Kā Rūnaka control for the long term security of the ecological packages described above.

Further, it is noted that wetland restoration and habitat enhancement are proposed at seven different wetland locations across the Macraes Operation. Due to limitations and uncertainties regarding the likely success of wetland restoration and enhancement this has been excluded from the improvements list. However, if the restoration and enhancement efforts are successful, these efforts would provide ecological improvements to wetland habitats.

9.3.3 Other Environmental Improvements

MP4 is proposing changes to the existing water quality regime to align the site's water quality compliance criteria more closely with contemporary aquatic ecosystem protection objectives and drinking water protection requirements. Across much of the receiving environment, this includes adoption of criteria equivalent to ANZG 95% species protection levels. This will result in a higher level of protection for the receiving water environment and downstream receptors. Further detail on the proposed water quality regime is provided in Section 9.5 of this report.

To provide for the control and capture of contaminants within mine impacted waters during operations and long-term post-closure, MP4 is proposing a suite of mitigation measures. Captured water will be treated actively through a WTP prior to discharge to receiving water bodies with passive treatment technologies to be developed. Further detail on the proposed water management for MP4 is provided in Section 9.5.5 of this report.

MP4 is proposing the implementation of rehabilitation and landscape mitigation measures that will progressively reduce landscape, natural character and visual amenity effects during operations. These changes have been made to align with cultural and regulatory expectations for the natural character of the Macraes Ecological District ('**ED**') through

improved hydrological and ecological connectivity. Further detail on the proposed rehabilitation and landscape for MP4 is provided in Section 9.8.

9.3.4 Social Benefits

The social benefits of MP4 have been identified in the social impact assessment by WSP (2026). The full technical assessment is provided in **Part B** of these application documents, with a summary of the key findings set out below.

MP4 will provide a number of benefits for the communities within the local area including those within Macraes, Palmerston, Waikouaiti, Dunedin and Oamaru. They include positive effects on 'way of life' through job security and sustained livelihoods that Macraes Operation supports directly and indirectly. MP4 will allow the existing workforce of 760 people to be retained through to about 2039. MP4 will also result in secondary job security to those employed by businesses that provide goods and services to the Macraes Operation, as well as indirect employment stability in other sectors associated with a sustained local economy. The significance of these employment benefits was assessed as extremely high.

MP4 will also have positive effects on community including sustained business activity, economic stability and continued local community benefits. The Macraes Operation supports a wide range of businesses in the local area, the region, nationally and internationally. MP4 represents the continued supply of goods and services by businesses, resulting in job security and benefits to the local and wider economy. The significance of these benefits was assessed as high.

The Macraes Operation supports key community infrastructure in Macraes and results in a range of community benefits in the local area. These benefits include the mine's support of Stanleys Hotel and Macraes Moonlight School, access to emergency response services, road and infrastructure maintenance, and the availability of a wide range of services to communities within the local area. MP4 will result in the continuation of the benefits described in WSP (2026). The significance of these benefits was assessed as extremely high.

9.4 CULTURAL EFFECTS

In respect of the MP4 FTAA application, OGNZL has been consulting with iwi since December 2025 and has endeavoured to build and maintain relationships as the project has developed. Consultation with iwi is summarised in **Part A.08** of this report. The Project raises important cultural issues and opportunities that OGNZL and iwi are working through with care.

As described earlier in this substantive application, the 2025 CIA was completed by Aukaha on behalf of Kāti Huirapa Rūnaka ki Puketeraki, Te Rūnanga o Moeraki, and Te Rūnaka o

Ōtākou (Kā Rūnaka), for resource consents for the MP4 (RMA) Project. While some details of the current MP4 application differ from the earlier project, several fundamental matters of interest and concern to Kā Rūnaka as identified in the 2025 CIA remain relevant. In **Table 9-2** below is an assessment of MP4 FTAA against the cultural impacts previously identified.

Kā Rūnaka is preparing an updated Treaty Settlement Impact Assessment in relation to the current application and has indicated this will be provided later. Kā Rūnaka are also expected to make formal comments on the application under section 53 under the FTAA.

Table 9-2: Cultural impacts of the MP4 (RMA) Project as outlined in the 2025 CIA and OGNZL's response to those impacts as relevant to the current MP4 FTAA project

Project component (MP4 Project)	Cultural Impact	Recommendations	OGNZL's response
To disturb, deposit and reclaim unnamed tributaries of the Waikouaiti River North Branch and Murphys Creek for the purpose of extending the Frasers WRS	Impacts on mana, mauri, whakapapa. Disturbing and reclaiming sections of waterways are all actions inconsistent with Kāi Tahu environmental management practices. Waterways have their own mana, mauri, and identity, and by altering their natural form and behaviour, these cultural values are adversely impacted. Kāi Tahu strongly oppose any discharges to waterways due to the potential impacts on both the mauri of the wai, and on mahika kai. This is especially concerning within the Waikouaiti waterway system due to the deep	MP4 should be rescoped to adopt methods that no-longer necessitate the disturbance or reclamation of natural waterways. The focus of mitigation for MP4 should move beyond management of adverse effects to active management of the impacts of the Project on the mauri of the Waikouaiti catchment. To address the impact of past disturbance and reclamation, OGL should work with mana whenua to identify and implement measures to uplift the mauri of the awa post-closure. MP4 must not engage in any activities that result in depositing contaminants into natural waterways.	The functional and operational needs of the MP4 mining activities necessitate the reclamation of streams in some instances. Where this occurs, OGNZL has considered the effects management hierarchy and given priority to avoiding adverse effects to the extent practicable. This has resulted in a redesign of the Trimbells Waste Rock Stack extension to avoid more extensive reclamation of the upper reaches of the Mare Burn as was initially proposed. Where adverse effects of stream reclamation cannot be avoided, OGNZL is committed to implementation of the remaining tiers of the effects management hierarchy and will provide offsetting or compensation for more than minor residual adverse effects. OGNZL has consulted with Kā Rūnaka in relation to these measures and proposes active involvement by Kā Rūnaka in their implementation and monitoring. In addition, MP4 commits OGNZL to the surrender of some resource consents (or parts of resource consents) enabling stream reclamation (e.g. at Back Road Waste Rock Stack and Frasers North Waste Rock Stack). MP4 will, therefore, result in a net reduction in the total length of stream authorised for reclamation. Additionally, OGNZL acknowledges the deep connection of Kāti Huirapa ki Puketeraki to the Waikouaiti River North Branch; and that to address the impact of past disturbance and reclamation, OGNZL should work with mana whenua to identify and implement measures to uplift the mauri of the awa post-closure. In an offered response to

Project component (MP4 Project)	Cultural Impact	Recommendations	OGNZL's response
	connection of Kāti Huirapa ki Puketeraki to this awa. Its network of streams, rivers, and wetlands are a major mahika kai gathering area, and the awa is the particular focus of ecological restoration projects and customary fisheries areas Kāti Huirapa Rūnaka ki Puketeraki are invested in.		these issues, the Project has been engineered to provide for reinstatement of the connection lost through mining between the headwaters and the lower reaches of this awa. At the same time, OGNZL acknowledges that the physical constraints of the site mean that opportunities to incorporate meaningful natural character and habitat enhancement into the engineered channel are limited and that the engineered solution of a channel across what will be a TSF embankment raises its own concerns for mana whenua. This part of the Project is offered on the express basis that final design and incorporation of the channel into the Project may be subject to change, acknowledging the pre-eminence of mana whenua views in this matter. Outside the formal MP4 FTAA process, OGNZL is working with Kā Rūnaka on ways to support improving the hauora and mana of key mahika kai areas within the catchments impacted by the Macraes Operation.
Frasers Backfill Embankment and Tailings Storage Facility	Impacts on mana, mauri, tapu, whakapapa. The Frasers-Innes Mills Pit Lakes will merge over the long term (>200 years). There will be no direct discharge from the lake to the Waikouaiti River. However, seepage from waste	The cultural impacts of a discharge of contaminants to the Waikouaiti River from Murphys Silt Pond would be significant. Further information is required on the passive management of discharges from the Murphys Silt Pond over the long term.	OGNZL is proposing as part of MP4 revised water quality compliance criteria that provide better environmental protection than the existing criteria contained in existing resource consents issued under the RMA. These proposed criteria are generally in accordance with the ANZG 95% species protection limits or drinking water standards. OGNZL is also committed to implementing a comprehensive management framework to ensure revised water quality compliance

Project component (MP4 Project)	Cultural Impact	Recommendations	OGNZL's response
	rock stored in Frasers Pit will discharge to the Murphys Silt Pond and the Waikouaiti River North Branch.		criteria are met during operations and post-closure. This framework is a combination of: > Contaminant source control methodologies (e.g. revised waste rock stack construction methods, interim WRS Management practices, closure capping design changes from water retaining to water shedding and rehabilitation performance standards); > Diversion and capture of mine impacted seepages; > Pit lake dosing; > Flow augmentation using freshwater dams; and > Passive and active water treatment systems. These criteria and the water management framework would form part of MP4 consent conditions to ensure the future management of potential effects of post-closure / long-term discharges from tailings storage facilities, waste rock stacks, silt ponds and pit lakes.
To discharge water from pit lakes, waste rock stacks, tailings storage and silt ponds to unnamed tributaries of the Taieri, Waikouaiti	Impacts on mana, mauri, tapu, whakapapa. Kāi Tahu strongly oppose direct and indirect discharges to waterways due to the potential impacts on both the mauri of the wai, and on mahika kai. This is especially concerning within	Active management of discharges from silt ponds within the MWMS is only proposed during operation of the Project. Further information is required on the management of discharges post closure to protect the mauri of the Taiari, Waikouaiti and Waihemo catchments.	OGNZL's existing resource consents allow for the development of pit lakes in Frasers and Innes Mills Pit and for eventual seepage through Frasers South WRS to occur, subject to the implementation of a Water Quality Management Plan and a Pit Lake Compliance and Monitoring Schedule. MP4 will require these consents to be replaced. MP4 will address these concerns by completely infilling Frasers Pit with tailings and providing a dry cap that allows clean water to shed rather than pond and contribute to ongoing seepages. Any ongoing

Project component (MP4 Project)	Cultural Impact	Recommendations	OGNZL's response
and Waihemo catchments	the Waikouaiti waterway system, as this network of streams, rivers, and wetlands are a major mahika kai gathering area for Kāi Tahu.		seepage from surrounding waste rock stacks will be mitigated by the range of management measures discussed above. OGNZL is committed to ensuring those measures operate to ensure that the new proposed water quality criteria which align with the ANZG 95% species protection limits or drinking water standards are met in waters leaving the site. Furthermore, these measures are secured post closure by the establishment of a funded trust, with governance that would give mana whenua a leading role, to oversee the maintenance of the water quality management systems.
Extension of the Coronation, Innes Mills and Golden Bar Pits	Impacts on mana, mauri, whakapapa. The proposed pit extensions further encroach on the natural habitats of mahika kai and taoka species, including kōrero geckos, southern grass skinks, McCann's skinks, and the Orocrambus sophistes moth – most of which are listed as Nationally Vulnerable or Declining by Department of Conservation | Te Papa Atawhai. Additionally, sixteen	Kāi Tahu opposes activities that irreversibly degrade or destroy taoka species habitat. This position is held even more firmly in this context due to the vulnerability of the species on-site, and the adverse impacts on naturally occurring wetlands. Kāi Tahu acknowledges the proactive methods the applicant has proposed to mitigate their impacts on mahika kai and taoka species. However, Kāi Tahu consider these methods to be insufficient in mitigating the significant adverse effects of these activities. We note that minimal attempts have been made to	The fixed location of the mineral resource limits the scope for MP4 to avoid terrestrial ecology features. Therefore, OGNZL is proposing robust remediation, mitigation, offset and compensation measures that will result in improved outcomes for the Macraes ED. The mitigation and compensation proposals now proffered as part of MP4 are significantly stronger than the earlier proposals. Further, OGNZL is working with Kā Rūnaka to ensure Kā Rūnaka can appropriately exercise kaitiakitaka, including long term control and management of key ecological protection areas, and the ability to use suitable monitoring and management measures in accordance with Kā Rūnaka values. Similarly, the fixed location of the mineral resource limits the scope for MP4 to avoid effects to the receiving water environment. OGNZL is proposing as part of MP4 revised water quality compliance criteria that

Project component (MP4 Project)	Cultural Impact	Recommendations	OGNZL's response
	rare and/or taoka plant species, ~37 ha of tussock grasslands, and seven wetland areas will also be negatively impacted by these extensions. Kāi Tahu have an intergenerational responsibility to protect the native species and habitats within their takiwā. The cumulative impacts of the Project and the impact of the pit extensions on vulnerable and culturally significant native species is a major concern for Kāi Tahu.	avoid damaging taoka species and their habitats, with methods mostly focusing on mitigation and offsetting. At all times, avoidance should be prioritised. Where remediation or mitigation are appropriate, however, Kāi Tahu expect to be involved at all levels. This is especially relevant in this context where several mana whenua-led organisations have relevant, practical ecological restoration expertise. Kāi Tahu are also concerned that the habitat the applicant proposes constructing for taoka species relocation is of a poorer quality than the habitat that is being damaged or destroyed. If this type of mitigation is being proposed, the replacement habitat must be of the same or higher quality, with regular ecological monitoring and adaptive management in place to ensure translocated species thrive.	provide enhanced environmental protection and a water management framework that would form part of MP4 consent conditions to ensure the future management of potential effects of post-closure / long-term discharges.
Impacts on terrestrial ecology	Potential adverse effects of the Project on herpetofauna extend to two 'At Risk' (korero gecko and tussock skink) and one 'Not	The assessment of effects is limited to the lizard taxa that are currently present or have the potential to be later found. Historically, endangered species such as Otago skinks	Lizards will be managed in accordance with a wildlife approval. OGNZL intends to follow the salvage program that has been successfully deployed in recent months at Coronation North Stage 5 and that Kā Rūnaka have been actively involved with. The actions

Project component (MP4 Project)	Cultural Impact	Recommendations	OGNZL's response
	threatened' (McCann's skink) taxon confirmed to be present in the Zone of Influence. The impacts may extend to additional threatened or 'At Risk' species if they are later found to be present.	and grand skinks would have been present (they currently occupy only 8% of their former habitat), so any damage or removal of their former habitat will impact on the future recovery of those species.	proposed in respect of that approval are expected to result in an overall protective benefit to lizards. Therefore, while OGNZL accepts that the loss of a small area of lizard habitat may have residual cultural impacts, it considers these likely to be less than minor. In addition, the MEEA is now extended to include the only known population of Otago skinks on OGNZL's landholding, providing significant protection for this population from the current effects of predators.
	The number of lizards proposed to be salvaged is capped at approximately 2100, which is approximately 2 – 10% of the lizard population estimated to occur in the MP4 and Coronation 5 impact areas.	The significant mokomoko mortality is not supported by Kāi Tahu. The salvage of 80% of the impacted population is sought.	
Impacts on wai māori	Impacts on mana, mauri, tapu and whakapapa. The application notes that significant investment has been made on the basis that the consented water quality compliance limits will endure until at least 2046. The technical review concludes that the current compliance criteria	Kāi Tahu do not support the use of Awa Tīpuna for the disposal and dilution of contaminants from the Project. The consents for Macraes Phase 4 should require more conservative management of water quality during operation of the mine and post-closure. The water quality criteria for Arsenic, Cyanide, Copper and Zinc should be compliant with the ANZG 90% protection limits.	Please refer to responses above. It is notable that the proposed criteria are generally set at a 95% species protection level (this is superior to the 90% recommended in the 2025 CIA) and commitments offered in the maintenance of water quality are supported by long-term water management proposals.

Project component (MP4 Project)	Cultural Impact	Recommendations	OGNZL's response
	are inappropriate as they allow for significant adverse effects.		
	The current compliance limit of 1,000 mg/L for sulphate is considered sufficient by OGL, and predicted concentrations are below this. Ryder (2019) concludes that: "Recent toxicity testing conducted using Taieri flathead galaxias (eggs and larvae), seepage water from local waste rock stacks and Mare Burn water, showed no effects at a sulphate concentration greater than 1,000 g/m3.91	Kāi Tahu do not support the use of Awa Tīpuna for the disposal and dilution of contaminants from the Project. The consents for Macraes Phase 4 should require more conservative management of water quality during operation of the mine and post-closure. Although there are no current national guidelines for sulphate, the 309 mg/L compliance threshold recommended by the Ministry of Environment, British Columbia (2013) is supported by Kāi Tahu.	
Impacts on wāhi tīpuna values and associations	Impacts on mana, mauri, and whakapapa. The landscape and visual assessment states that "any potential adverse landscape effects arising from the Proposal at the four Project Sites will be at worst 'Moderate'	The landscape and visual assessment has omitted consideration of Tangata Whenua interests and is therefore inconsistent with the expectations of Te Tiriti o Waitangi and Te Tangi a te Manu. The assessment excludes mana whenua as a receptor and omits fundamental underpinning aspects of the Te Tangi a te Manu methodology that	To address this concern, OGNZL has undertaken and is continuing with engagement with Kā Rūnaka as detailed in Section 8.8.13 of this substantive application to inform further development of the Landscape Assessment considerations regarding potential effects on associative and perceptual values held by tangata whenua.

Project component (MP4 Project)	Cultural Impact	Recommendations	OGNZL's response
	given the areas already highly modified character." The assessment does not speak to the impacts of open cut mining on the associative and perceptual values of this wāhi tīpuna landscape.	require an assessment of the impacts of mining on associative and perceptual values for Tangata Whenua.	
Overall Cultural Impacts of the Project	Impacts on mana, whakapapa. The ability to exercise rakatirataka and carry out kaitiakitaka obligations in respect to te taiao is an important contributor to upholding the mana of mana whenua. Kāi Tahu have significant concerns about the limited extent to which this has been recognised in the Macraes Gold Project to date. The ongoing modifications to the whenua and the wai increase the difficulty of maintaining and restoring connections with these places.	The ability to maintain ahikāroa and connection with the whenua and wai requires both a healthy environment and social and economic sustainability. OGL should work with Kāi Tahu to identify ways in which they can support the efforts of Kāi Tahu to reconnect whānau with the places affected by the Project.	OGNZL has sought to improve its understanding of Kā Rūnaka concerns and aspirations in relation to MP4 and the Macraes Operation, as well as in respect to wider interests in the catchments. Together with Kā Rūnaka OGNZL is considering appropriate mechanisms (including outside of MP4 approvals) to recognise and provide for Kā Rūnaka the ability to exercise rakatirataka and carry out kaitiakitaka obligations. MP4 avoids environmental effects to the extent possible and responds to the cultural impacts identified in the 2025 CIA as described in the sections above. OGNZL have made commitments relating to: > Establishing cultural induction for OGNZL new employees; > Establishing a Joint Steering Group (JSG) between OGNZL and Kā Rūnaka for advising and providing guidance on cultural, ecological and water quality related impacts and effects of not only MP4 but Macraes Operation legacy impacts as well;

Project component (MP4 Project)	Cultural Impact	Recommendations	OGNZL's response
			> Options for including Kā Rūnaka expertise as part of the ecological compensation and rehabilitation workstreams; > Scholarships and cadetships to build-up intergenerational knowledge; > Undertaking a cultural health baseline study; > Establishing a cultural health monitoring program; > Subject to the view of Kā Rūnaka on the proposal, Waikouaiti River North Branch re-establishment (from 2031); > Naturalisation and riparian vegetation planting along the upper reaches of affected waterways; > Ecological Covenants in perpetuity enabling Kā Rūnaka to exercise rakatirataka and carry out kaitiakitaka obligations; and > Similar provision in relation to long term monitoring and management of the closed mine site.

9.5 WATER EFFECTS

The Macraes Operation and proposed MP4 activities are located within the Shag River/ Waihemo, Taieri and Waikouaiti River North Branch catchments. Water management has been a fundamental component of the Macraes Operation since the present mining phase commenced in 1990. Over time, and in accordance with consents granted under the RMA, the site has evolved from a relatively simple mining operation to a highly integrated mining and water management system incorporating:

- Pit dewatering systems;
- Diversion channels;
- Sediment management facilities;
- Tailings management infrastructure;
- Water storage reservoirs;
- Pit lake management systems;
- Groundwater monitoring networks; and
- Surface water monitoring programmes.

From the outset, a key objective of the MP4 water management workstream was to establish a more stringent future water quality regime than that which had historically been applied at Macraes. This reflects both the evolution of contemporary environmental expectations and the significant body of feedback received through the MP4 RMA process. In particular, the combined feedback contained in the section 42A reports and the 2025 CIA clearly indicated that the expectations of the Councils and Kā Rūnaka were that a significant step change was required in the way water is managed at the site, including improvements in both water quality outcomes and the quality of discharges from the operation.

In response, the MP4 water management workstream has been developed to progressively achieve improved water quality and environmental outcomes over the remaining life of mine and into closure. This is proposed to be achieved through a combination of engineering controls, operational practices, monitoring programmes and treatment systems focused on improvement of mine water management and discharges across the site. This is in addition to ecological enhancements and restoration measures described in Section 9.3.2 of this report which would also contribute towards improved water quality.

The proposed water quality regime seeks to align the site's water quality compliance criteria more closely with contemporary aquatic ecosystem protection objectives and drinking water protection requirements. Across much of the receiving environment, this includes

adoption of criteria equivalent to ANZG 95% species protection levels. For downstream receptors who rely on surface water for potable use, additional criteria are proposed to protect drinking water quality.

A substantial number of investigations have been completed to inform the proposed water management workstream for MP4. These investigations involve multiple technical disciplines including hydrogeology, hydrology, surface and ground water quality modelling, environmental geochemistry and hydrogeochemical pit lake modelling and represent the most integrated evaluation of water effects undertaken for the site to date.

Importantly, the workstream has moved beyond assessment of individual mine components and instead considers cumulative interactions between waste rock, tailings facilities, pit lakes, groundwater systems and receiving watercourses. The integrated water modelling approach has enabled the performance of proposed mitigation measures to be assessed both individually and in combination, providing confidence that the proposed water quality compliance framework can be achieved.

Together, these studies provide a comprehensive understanding of contaminant sources, migration pathways, the receiving environments that may be affected, and the mitigation measures required to manage both operational and closure-related risks. They also provide an understanding of existing background water quality conditions and the extent to which these may be influenced by factors outside OGNZL's control. The investigations relevant to the MP4 project are included in various reports presented in **Part B** of these application documents. The interrelationships between the various reports and assessments are shown diagrammatically in **Figure 9-3**.

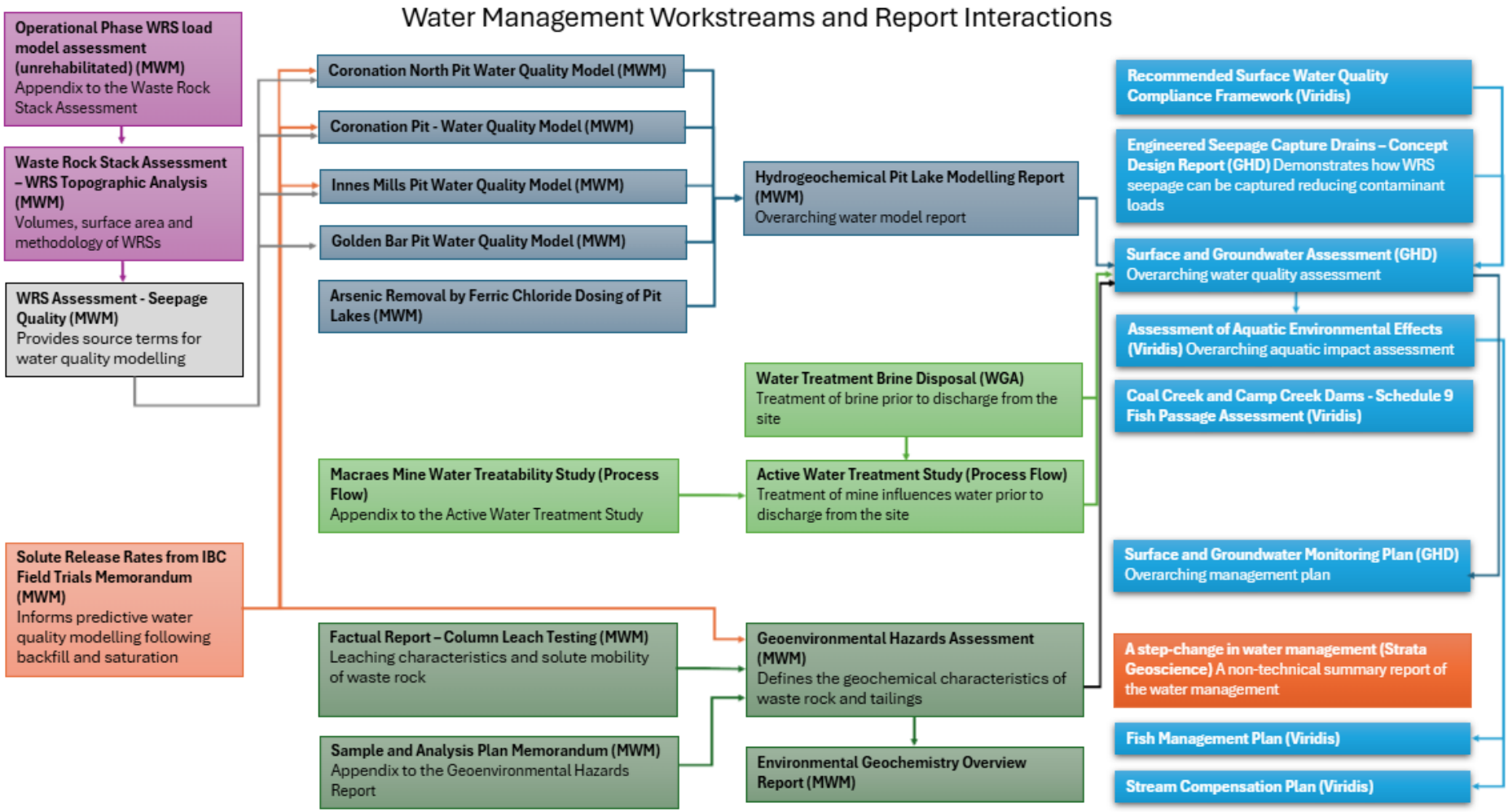

Figure 9-3: MP4 water management workstreams and report interactions

9.5.1.1.1 Assessment Methodology

The assessment of the actual and potential effects of MP4 on surface water and groundwater has been prepared by GHD (2026a). The assessment draws upon a suite of integrated investigations encompassing hydrogeology, groundwater modelling, surface water modelling, environmental geochemistry and hydrogeochemical pit lake modelling.

Three 3D numerical groundwater models, covering the Golden Bar, Coronation and Central mining areas, were developed to assess groundwater inflow into the existing and proposed expanded pits during dewatering as well as during groundwater recovery for a period of 400 years. The Central Mining Area includes the Frasers and Innes Mills pits and associated tailings storage facilities. Each model was calibrated against current site conditions prior to undertaking predictive simulations.

In addition, 2D seepage modelling was undertaken for specific WRS's where there is risk of relatively undiluted seepage discharge to surface water receiving environments (e.g. seepage from Frasers South WRS to Murphys Creek).

The models are not designed to optimise outcomes for regulatory compliance. Rather, they take a probabilistic approach to key matters such as seepage rates and climate, to provide appropriately conservative predictions. The models are also designed to be updated and re-worked as additional data becomes available during the ongoing operation of MP4, enabling ongoing refinement of predictions and adaptive management of mitigation measures to ensure the proposed compliance framework continues to be achieved.

Detailed results of the groundwater modelling for the three mining areas are summarised in Section 9.5.1 to Section 9.5.3 of this report.

Surface water modelling was undertaken to assess the potential future project impacts on receiving water quality and to evaluate compliance against the recommended trigger values and surface water quality criteria as outlined in Viridis (2026b). This involved updating the existing sitewide Water Balance Model to include revised catchment boundaries and landforms to reflect both the current and future developments of the site; pit lake groundwater inflows and outflows and seepage estimates from the groundwater modelling undertaken; revised pit lake and seepage water quality estimates; and recalibration of the model with updated flow and water quality monitoring data.

The water balance assessment informs predicted overflow timeframes for the pit lakes upon closure, capture and treatment requirements, and surface water quality at key compliance locations within the receiving surface water environment to enable comparison with the proposed water quality compliance criteria. Detailed results of the surface water modelling are presented in Section 9.5.4 of this report.

Together, the groundwater and surface water modelling and assessment provide a comprehensive assessment of the potential effects of the MP4 activities, with the base-case incorporating mitigation measures including water treatment, improved seepage capture and augmentation dams, and identify any additional mitigation measures required to manage operational and long-term closure-related risks.

9.5.1.1.2 Environmental Geochemistry and Key Findings

Environmental geochemistry forms the foundation of the MP4 water management workstream. The geochemical investigations provide the scientific basis for understanding contaminant generation, identifying potential contaminants of concern, defining source terms used within the groundwater and surface water models, and informing the long-term management strategies.

A key outcome of the geochemical investigations is the confirmation that waste rock and tailings materials across the proposed development areas are predominantly non-acid forming. Accordingly, acid rock drainage will not form at the Macraes Operation as a result of the MP4 project.

Instead, the principal water quality challenge at Macraes Operation is the generation and migration of neutral metalliferous drainage and dissolved contaminants. The primary constituents of concern include sulphate and arsenic, together with more localised risks associated with nitrogen species, copper and zinc in specific catchments. This finding is consistent with the understanding developed through approximately 36 years of operations at Macraes Operation to date and underpins the water management strategy for MP4.

Although groundwater drawdown effects are relatively limited, groundwater remains an important pathway for contaminants originating from waste rock stacks, tailings storage facilities, backfilled pits and future pit lakes. Modelling indicates that seepage from these sources will contribute contaminant loads to both groundwater and surface water systems over extended timeframes. Accordingly, water quality management rather than water quantity management represents the primary long-term challenge for MP4.

Hydrogeochemical modelling of the proposed pit lakes indicates that the lake waters are expected to remain circumneutral and strongly buffered, with no indication of acid pit lake development. The pit lakes are predicted to evolve into sulphate-dominated water bodies with elevated salinity relative to natural background conditions. Arsenic is predicted to remain the principal long-term constituent of concern across all pit lakes, while zinc may remain elevated in the Coronation and Coronation North systems. These pit lakes will ultimately become long-term features of the post-mining landscape and will require ongoing management before discharge to the receiving environment occurs.

9.5.1.1.3 Proposed Mitigation Framework

To address the identified risks, MP4 proposes a comprehensive mitigation framework based on three complementary principles:

- Source control through modified WRS construction methods, interim WRS management, progressive rehabilitation of outer slopes and final capping designs to limit air and water ingress;
- Seepage capture close to source and treatment; and
- Receiving environment protection through flow augmentation, monitoring and adaptive management.

Key mitigation measures include:

- Modified WRS construction methodologies (reduced lift height and interim management);
- Progressive rehabilitation and final capping of WRS landforms;
- Approximately 3.6 km of seepage capture drains;
- Active and passive water treatment systems;
- Pit lake treatment and management strategies;
- Construction and operation of the already approved Camp Creek and Coal Creek augmentation dams; and
- An enhanced environmental monitoring programme.

Collectively, these measures are intended to progressively reduce contaminant generation, intercept contaminant migration pathways and improve downstream water quality outcomes. The proposed mitigation framework is described further in Section 9.5.5 of this report and in detail in Appendix F to GHD (2026a).

9.5.1.1.4 Evaluation of the Proposed Mitigation Framework

The proposed mitigation measures have been incorporated into the project design and, where appropriate, provided in the proposed consent conditions. Many of the proposed mitigation measures emerged through an iterative process in which early modelling identified areas of elevated risk relative to the proposed compliance framework. The proposed mitigation framework, therefore, reflects both the findings of the technical assessments and the outcomes of ongoing refinement undertaken during project development.

The surface water model has enabled the probabilistic modelling to determine if the proposed mitigation measures are both beneficial (in terms of reducing modelled risk) and practical (in terms of being able to be successfully implemented and operated). This approach has enabled prioritisation of mitigation measures that are both environmentally beneficial and capable of being successfully implemented over the life of the project.

Where uncertainty exists within the available data, the modelling generally adopts conservative assumptions to identify the potential risks rather than understating them. Therefore, the proposed conditions require the water quality model to be updated using the most recent monitoring and water quality data available prior to finalising the design of future water management and water treatment systems to ensure that the design is based on the latest information available. This adaptive process will ensure that detailed design decisions are informed by the best available information.

The water quality modelling indicates that the proposed mitigation framework is appropriate to generally achieve the proposed compliance objectives during both operational and closure phases of the project. While some modelled exceedances remain under conservative modelling scenarios, these generally occur under combinations of assumptions that are intentionally precautionary and which are unlikely to occur simultaneously in practice. In addition, active management in response to emerging water quality trends or confirmed non-compliances has not been factored into modelling. The selected mitigation infrastructure, along with other options that might be deployed, provides a range of potential avenues for active water management that are currently not available on site. These options are enabled by improved seepage management and water quality data collection.

Importantly, the modelling incorporates a range of conservative inputs and assumptions that are intended to ensure potential risks are identified and appropriately managed. These include limited representation of natural attenuation processes that are currently observed on site, conservative seepage quality assumptions and the exclusion of several adaptive management opportunities that may implemented as further monitoring data becomes available.

The modelling results are considered conservative and are likely to underestimate the environmental improvements that will occur over time. This is because the model adopts a number of precautionary assumptions, including limited beneficial reuse of treated water, no allowance for natural attenuation processes outside pit lakes, immediate discharge of groundwater seepage without accounting for groundwater travel times, and no reduction in contaminant concentrations from waste rock, pit wall runoff or tailings seepage following mine closure and rehabilitation. The model also does not incorporate potential

improvements arising from enhanced WRS management. Collectively, these assumptions are expected to overstate long-term contaminant loads and underestimate the likely improvements in water quality and environmental outcomes that would occur in practice as natural attenuation and rehabilitation processes take effect.

Accordingly, the modelling outcomes should be interpreted within the context of a deliberately precautionary assessment framework. While this approach may overstate some long-term effects, it provides confidence that the proposed mitigation measures have been assessed against a robust and conservative set of assumptions and that potential areas of risk have not been overlooked.

9.5.1.1.5 Initial Summary

Overall, the water management workstream demonstrates that MP4 can be developed within a robust environmental management framework designed to progressively improve water quality over the remaining life of mine and into closure.

While the scale and complexity of the MP4 project necessitates a staged approach to implementation of the new compliance regime, the combination of source control, seepage and contaminant capture, treatment systems, flow augmentation and adaptive management provides an effective framework designed to achieve the proposed long-term water quality and environmental outcomes. The modelling indicates that the proposed mitigation framework is capable of achieving the adopted compliance criteria during both operational and closure periods, with the framework providing for continual refinement as additional data becomes available throughout the life of the project.

The sub-sections below describe the water management approach for the site in more detail.

9.5.2 Coronation Mining Area

Potential water inflows and outflows within the Coronation Mining Area are shown in **Figure 9-4**. Groundwater drawdown and discharges from this area, such as seepage from WRSs and backfilled pits, have the potential to affect the Deepdell Creek and Mare Burn catchments. The Camp Creek and Coal Creek Dams will provide augmentation flows to these catchments.

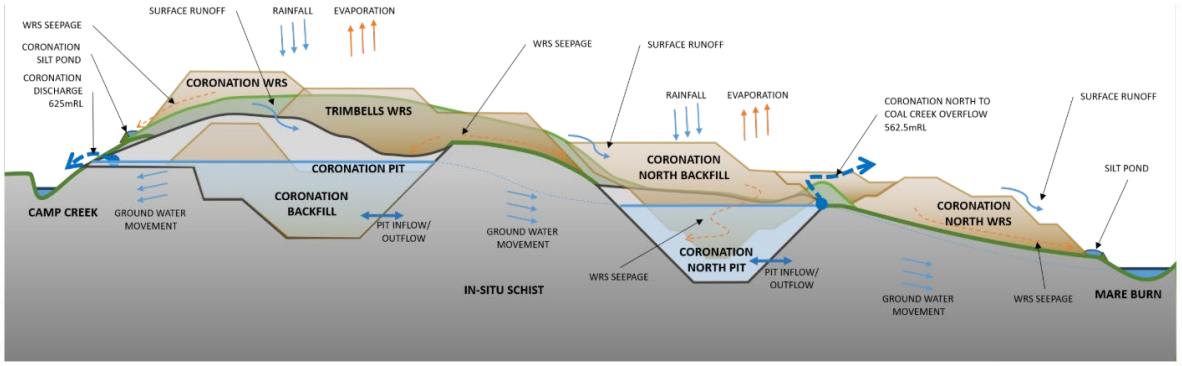

Figure 9-4: Coronation area conceptual site model

9.5.2.1 Dewatering Effects

Groundwater dewatering associated with the proposed Coronation Pit and Coronation North Pit extensions was assessed using two sequential numerical models. The first model simulates concurrent dewatering of both pits over a seven-year period from Year 1 to Year 7. Output groundwater heads from this model were adopted as initial conditions for a second model, which simulated continued dewatering of the Coronation North Pit only and the commencement of groundwater recovery within the Coronation Pit over the period 2033 to 2035. For both dewatering simulations, the greater and deeper extent of the proposed pit designs were assumed throughout the dewatering period (hence a conservative assumption).

Estimated groundwater dewatering rates (pit inflow) for the Coronation Pit decrease from approximately 7.3 L/s at the start of dewatering to approximately 2.4 L/s toward the end of the 7-year dewatering period. Predicted groundwater inflows for the Coronation North Pit decrease from approximately 10.5 L/s at the start of dewatering to approximately 6.4 L/s toward the end of the 10-year dewatering period.

Modelling results indicate that drawdown greater than 1 m is predicted to extend approximately 1,400 m to the northwest,1,000 m to the northeast, 700 m to the southwest, and 700 m to the southeast of the proposed pits area (**Figure 9-5** and **Figure 9-6**).

Groundwater recovery modelling results indicate that at the end of 400 years, groundwater levels have mostly recovered to current levels across the model domain.

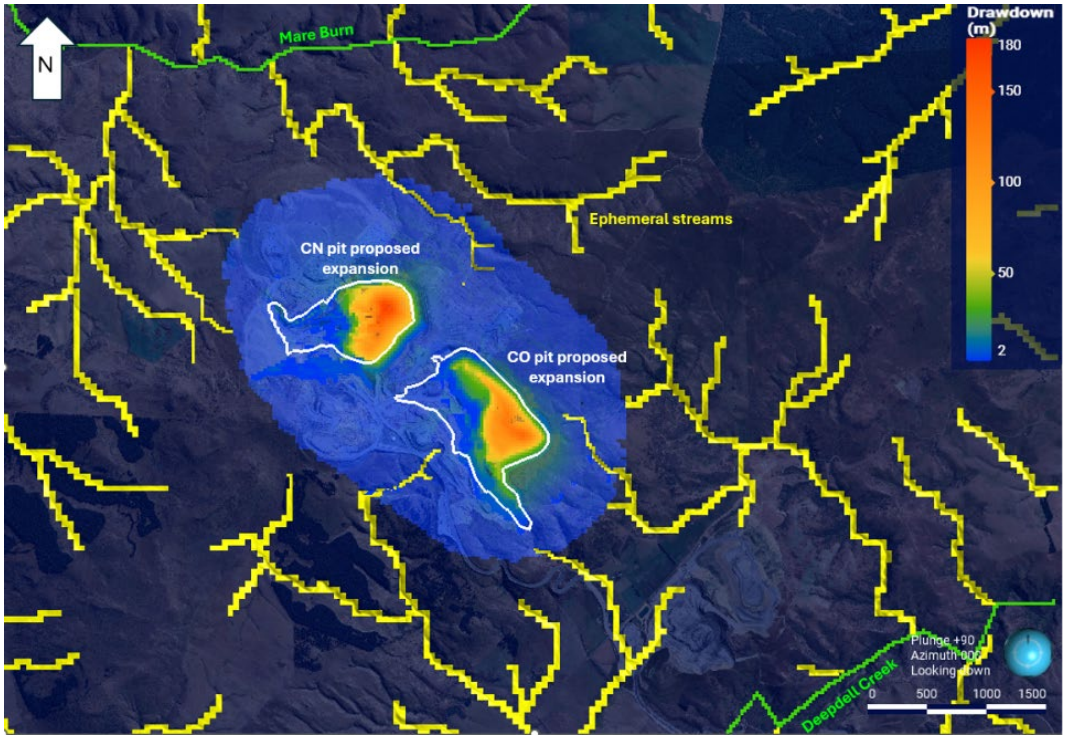

Figure 9-5: Estimated drawdown extents after 7 years of dewatering of the proposed pits (end of Coronation Pit dewatering)

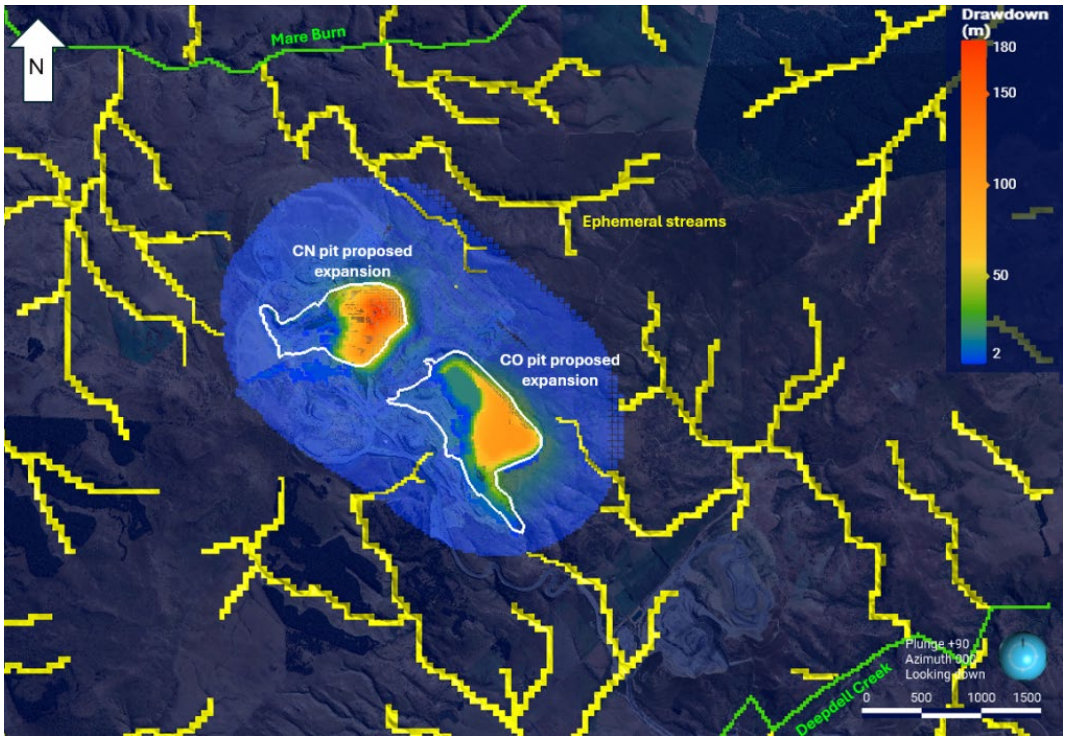

Figure 9-6: Estimated drawdown extents at the end of the dewatering of Coronation North Pit (and 3 years into the recovery of Coronation Pit)

9.5.2.2 Drawdown Effects to Surrounding Creeks / Streams

Modelling results indicate that pit dewatering is predicted to have a very small effect on groundwater contributions to Mare Burn and tributary ephemeral streams, as the predicted reduction in groundwater discharge to the creek is estimated to be less than 1.1 L/s relative to the modelled groundwater contributions to the base case (existing) conditions. This reduction is less than 3.1% of the modelled existing groundwater contribution of 33.9 L/s to Mare Burn and tributary ephemeral streams.

For the Deepdell Creek and tributary ephemeral streams, the predicted reduction in groundwater discharge is estimated to be less than 3.2 L/s relative to the modelled groundwater contributions to the base case (existing) conditions. This reduction is less than 6% of the modelled existing groundwater contribution of 53.5 L/s to Deepdell Creek and tributary ephemeral streams.

Groundwater drawdown is predicted to remain largely confined to areas close to the existing and proposed pit extensions and underground workings, and adverse effects on groundwater levels in non-OGNZL groundwater bores are considered unlikely.

9.5.2.3 Groundwater Quality Effects

Potential groundwater contaminant transport modelling was undertaken conservatively using sulphate as the primary contaminant indicator because it is expected to occur at elevated concentrations, is already present in some receiving waters due to historic mining activities and has limited attenuation potential within the groundwater system.

Modelling results indicate that the predicted sulphate plume develops primarily from the Coronation North and Coronation pits and WRS source areas and migrates preferentially along the interpreted groundwater flow paths. The maximum horizontal extent of the sulphate plume is predicted to be approximately 1,500 m to the northwest of the source areas and approximately 1,400 m to the south of the source area.

The total modelled sulphate mass discharge to the seepage capture drains, Mare Burn catchment, and Deepdell Creek catchment was estimated by combining contaminant transport model results with simulated flows across surface-water boundaries. At 400 years post-closure, the seepage capture drains are predicted to intercept approximately 525 kg/day of sulphate. Over the same period, the estimated sulphate flux to the Mare Burn catchment (including both streams and rivers) is approximately 412 kg/day, while the Deepdell Creek catchment is estimated to receive approximately 68 kg/day.

Seepage capture drains are proposed to be installed at the toe of WRSs to capture seepage generated from percolation through the WRSs. Targeted seepage modelling was undertaken

for the Coronation North WRS where surface runoff and seepage are directed towards incised channels. The modelling indicates that the position of the seepage capture drain is important to reduce the risk of seepage breakout and that installing the drain within the WRS footprint generally provides a more effective seepage control configuration than positioning the drain at the toe. Specific site investigations will be required to confirm vertical and horizontal alignment to meet the design intentions as required by the conditions proposed in **Part D** of these substantive application documents, and the Waste Rock Stack Management Plan which is provided in **Part C.** The modelling indicated that the drain is effective at intercepting seepage from the WRS; however, some flow paths were shown to still enter the underlying groundwater system within the schist bedrock.

9.5.3 Central Mining Area

Potential water inflows and outflows within the Central Mining Area are shown in **Figure 9-7**. Groundwater drawdown has the potential to affect a number of creek catchments. Discharges from the Central Mining Area have the potential to reach the Shag / Waihemo River and Waikouaiti River North Branch via several tributaries. Seepage from the Innes Mills pit lake and Frasers TSF have the potential to reach Deepdell Creek (a tributary of the Shag River), Murphys Creek and headwaters of the Waikouaiti River North Branch. Any spill water from the Innes Mills pit lake will drain directly to the headwaters of Shag River (via Deepdell Creek). Increased seepage through Frasers South WRS is also likely.

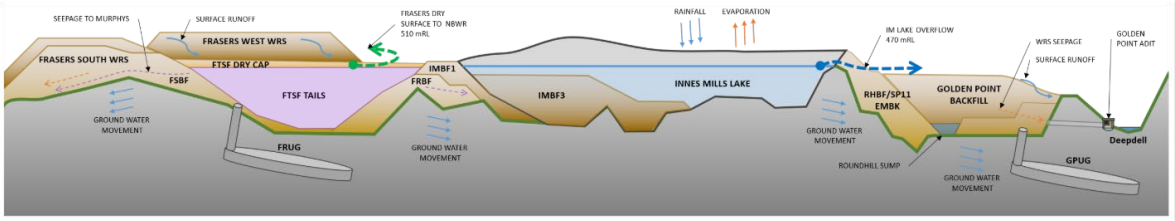

Figure 9-7: Central mine site conceptual site model

9.5.3.1 Dewatering Effects

Groundwater dewatering was modelled for the operational periods of the Innes Mills Pit and GPUG, including during their proposed expansions. Continuous dewatering of the Golden Point Pit was also modelled, as this pit must remain dry to enable access to the GPUG. To provide a conservative assessment, the model spans 11 years, from the beginning of 2025 to the end of 2035.

Estimated dewatering rates (groundwater inflow) for the proposed GPUG extension decrease from approximately 196 L/s at the start of dewatering (this is a function of the modelling approach, but not reflective of reality) to approximately 22 L/s towards the end of

the 11-year dewatering period. Estimated dewatering rates (groundwater inflow) for the proposed expansion of the Innes Mills pit decline from approximately 12 L/s to a minimum of around 2.6 L/s at year 6, then rise to approximately 14.6 L/s by year 11.

Modelling results indicate that drawdown greater than 1 m is predicted to extend approximately 3,900 m to the northeast of the proposed Innes Mills Pit area (**Figure 9-8**).

Groundwater recovery modelling results indicate that at the end of 400 years, groundwater levels have mostly recovered to existing levels across the model domain.

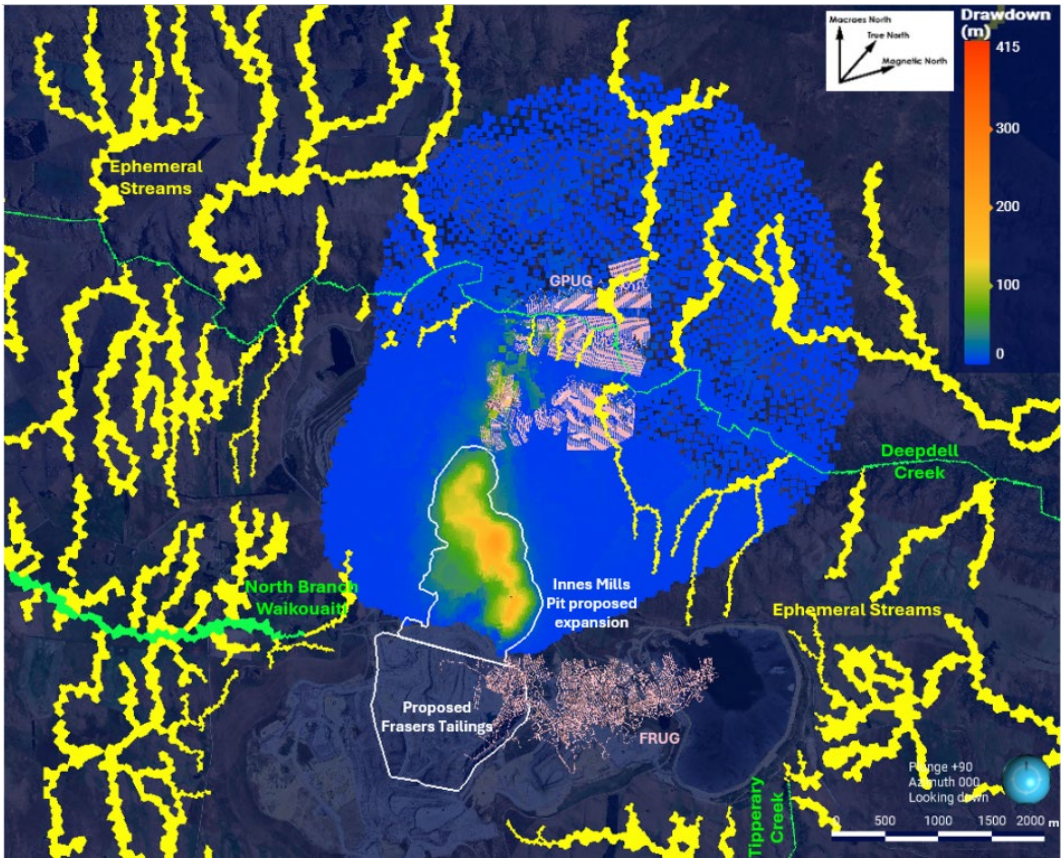

Figure 9-8: **Modelled extent of drawdown greater than 1 m after 11 years of dewatering of the proposed Innes Mills pit and GPUG extension**

9.5.3.2 Drawdown Effects to Surrounding Creeks / Streams

To assess the potential effects of dewatering of Innes Mills and GPUG extension on the surrounding creeks, modelled groundwater outflows to surface water under existing conditions were compared with those predicted by the dewatering model. The modelled changes of groundwater contribution to the creeks due to dewatering are presented in **Table 9-3**.

Table 9-3: Reduction of groundwater contribution to streams during dewatering

Streams	Modelled change of groundwater contribution due to dewatering (L/s)	% of change in groundwater contribution
Deepdell Creek to DC08	1.5	3.4% decrease
Waikouaiti River North Branch - Ross Road Ford	0.1	<0.5% decrease
Murphys and Golden Bar Creek	0.2	0.6% increase*
Tipperary Creek	0.1	<0.5% decrease
Shag River	0.1	<0.5% decrease
Notes	**Associated with the water level increase in Frasers UG and in the proposed Frasers Tailings structure*	

Groundwater drawdown is predicted to remain largely confined to areas close to the existing and proposed pit extensions and underground workings and adverse effects on groundwater levels in non-OGNZL groundwater bores are considered unlikely.

9.5.3.3 Groundwater Quality Effects

Potential groundwater contaminant transport modelling was undertaken using sulphate as the primary contaminant indicator because it is expected to occur at elevated concentrations relative to other key contaminants, is already present in some receiving waters due to mining activities and has limited attenuation potential within the groundwater system.

The maximum extent of the predicted sulphate plume at the end of the recovery model (400 years) is shown in **Figure 9-9**.

Table 9-4 provides the modelled sulphate fluxes reporting to surface water bodies.

A review of existing groundwater users (consented groundwater takes, existing bores and proposed bores) indicates that these are not expected to be intersected by the predicted plume extent, and adverse effects are, therefore, considered unlikely.

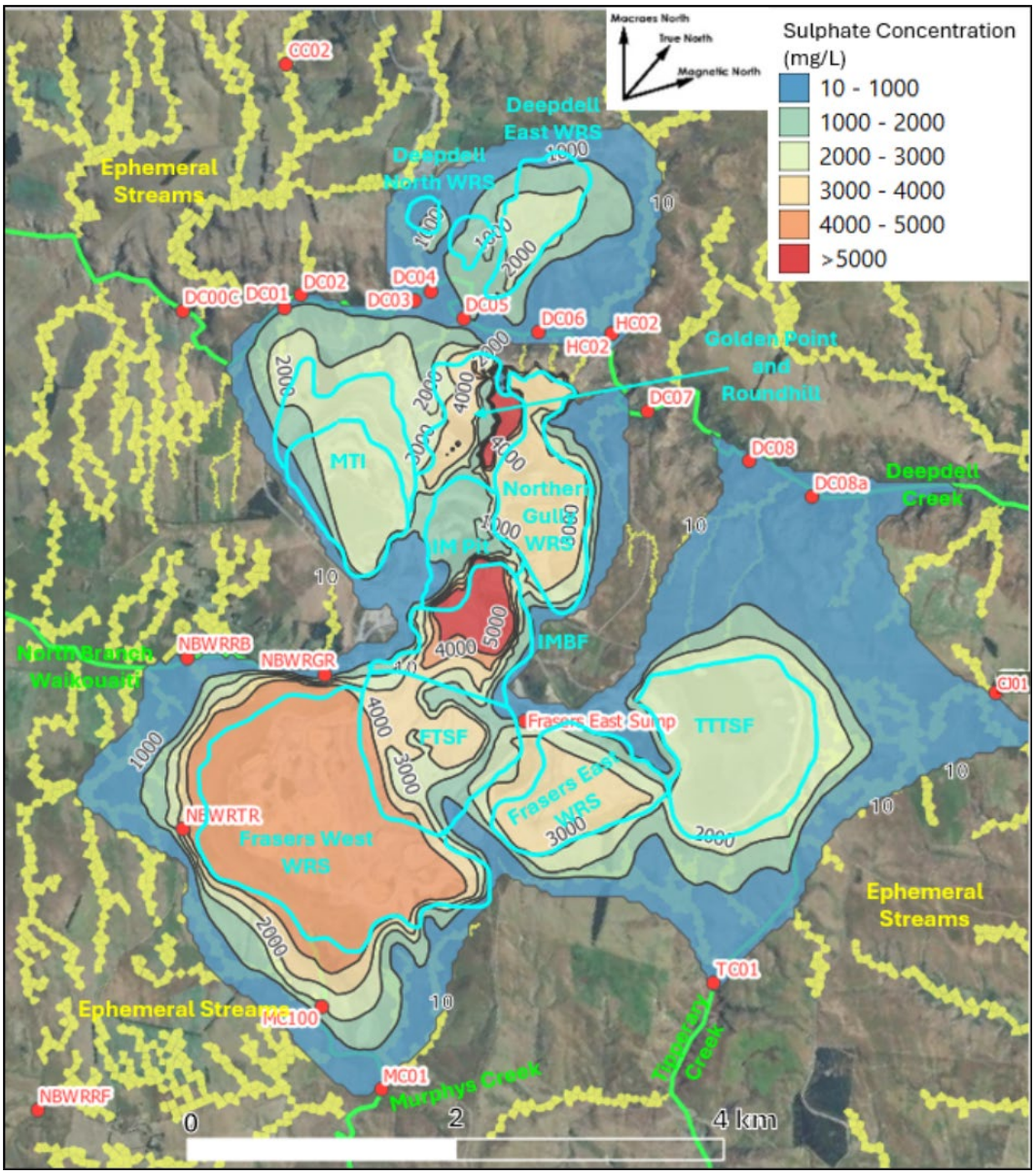

Figure 9-9: Contour plot showing sulphate plume extent at the end of the recovery model (400 years of recovery) in model layer 3

Table 9-4: Estimated sulphate flux at surface water compliance monitoring points - 400 years post-closure

Catchment	Sulphate flux (kg/day)
Deepdell Creek – DC04	125.6
Deepdell Creek – DC07	131
Deepdell Creek – DC08	34
Waikouaiti River North Branch - Ross Road Ford	109
Waikouaiti River North Branch - NB03	<1
Murphys Creek - MC02	309
Tipperary Creek - TC01	220
Cranky Jims Creek - CJ01	85
Shag River at Loop Road	<1
Shag River at McCormicks	8
Seepage capture drains	868

The Golden Point and Round Hill pit voids receive mine water seepage from existing and proposed pit backfill material, existing embankments and seepage from the proposed Innes Mills Lake. Current operational practice is to dewater from the Golden Point sump, to avoid seepage losses to Deepdell Creek via the historic adits. If left unmanaged post closure, mine affected water would seep through the adits to Deepdell Creek and degrade surface water quality. Targeted seepage modelling found that plugging the adits or constructing low permeability barriers between the pit void and Deepdell Creek was unlikely to achieve the desired water management outcomes. The resulting mitigation measure is to install bore pumps through the Golden Point Backfill to capture seepage waters accumulating within the pit and maintain water levels such that flows through the adits are avoided.

Waste streams from the WTP (brine and solids) are proposed to be placed into the Frasers TSF during operations. Following closure of Frasers TSF, any WTP solids residue will be transported to an approved landfill, and any brine will be injected into FRUG via deep well injection. The proposed storage is projected to have a negligible effect on surface-water quality (WGA 2026a) and compliance, and site-specific risks can, if necessary, be addressed through defined monitoring and operational management measures.

The proposed Frasers TSF will have a tailings level above the invert of the Murphys Creek; therefore, there is potential for seepage to preferentially follow the historical channel (flow path) of the creek. Targeted modelling found that seepage via the Murphys channel flow-path is expected to be negligible below a saturation level of ~490 m RL as the water level drops below the channel invert.

Seepage capture drains are proposed to be installed at the toe of WRSs to capture seepage generated from percolation through the WRSs. Targeted seepage modelling was undertaken for the Frasers West WRS which is adjacent to wetlands and surface water features. Although modelling results indicate that the proposed drain is effective at intercepting seepage from the WRS, a minor portion of the seepage is likely to flow through groundwater toward the Waikouaiti River North Branch channel and/or through deeper groundwater flow paths. This seepage has been captured in the groundwater model.

9.5.4 Golden Bar Mining Area

Potential water inflows and outflows within the Golden Bar Mining Area are shown in **Figure 9-10**. Groundwater drawdown and discharges from this area, such as seepage from WRS and overflows from the pit lake, have the potential to affect tributaries of Murphys Creek - Golden Bar Creek and Clydesdale Creek. Groundwater drawdown has the potential to extend into the McCormicks Creek catchment.

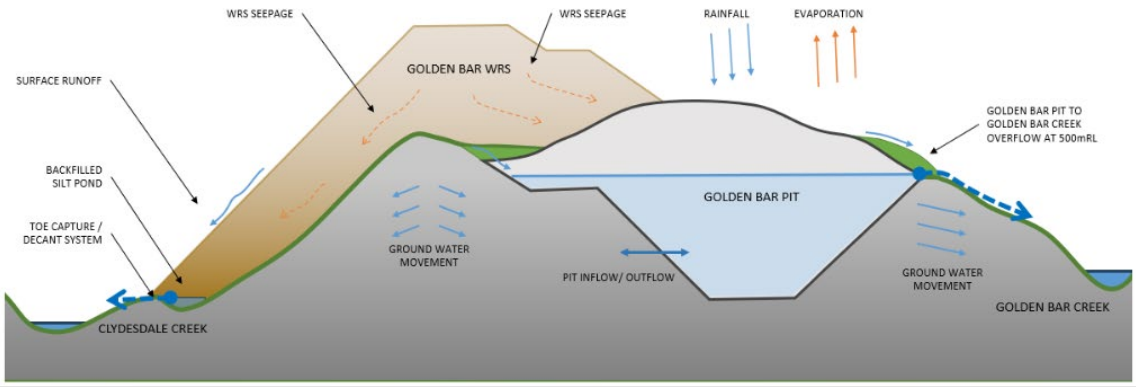

Figure 9-10: Golden Bar conceptual site model

9.5.4.1 Dewatering effects

Groundwater dewatering was modelled for Golden Bar Stage 2 and Stage 3 assuming a total of six years of dewatering. The estimated dewatering rate (groundwater inflow) for the proposed expansion of the Golden Bar pit is estimated to range from 1.4 L/s (at the beginning) to 0.7 L/s (towards the end of dewatering).

The extent of drawdown associated with dewatering of the proposed Golden Bar pit expansion modelling results indicate that drawdown greater than 1 m extends to approximately 800 m north, 500 m west, 700 m east, and 500 m south of the proposed pit as shown in **Figure 9-11**.

Groundwater recovery modelling results indicate that after approximately 60 years groundwater levels around the pit stabilise as the pit lake has recovered to the overflow level (500 mRL).

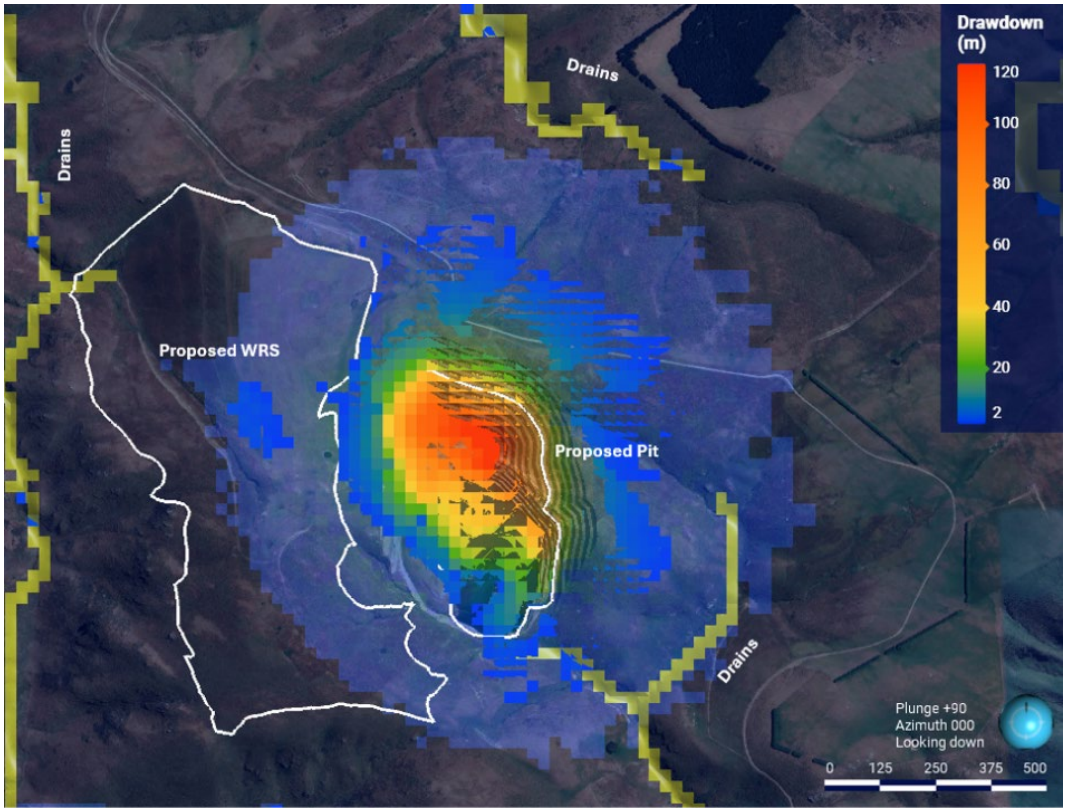

Figure 9-11: Plan view of the estimated drawdown after six years of dewatering the proposed pit (results from all model layers overlayed)

9.5.4.2 Drawdown Effects to Surrounding Creeks / Streams

Pit dewatering is predicted to have a very small effect on groundwater contributions to McCormicks Creek and tributary ephemeral streams, because the predicted reduction in groundwater discharge to the creek is estimated to be less than 0.08 L/s relative to the modelled groundwater contributions to the base case (existing) conditions. This reduction is less than 0.5% of the modelled existing groundwater contribution of 39.6 L/s to McCormicks Creek and ephemeral streams discharging to it.

Similarly, for the Murphys Creek and tributary ephemeral streams, the predicted reduction in groundwater discharge is estimated to be less than 0.15 L/s relative to the modelled groundwater contributions to the base case (existing) conditions. This reduction is less than 0.2% of the modelled existing groundwater contribution of 43.9 L/s to Murphys Creek and ephemeral streams discharging to it.

Groundwater drawdown is predicted to remain largely confined to areas close to the existing and proposed pit extensions and underground workings and adverse effects on groundwater levels in non-OGNZL groundwater bores are considered unlikely.

9.5.4.3 Groundwater Quality Effects

Potential groundwater contaminant transport modelling was undertaken conservatively using sulphate as the primary contaminant indicator because it is expected to occur at elevated concentrations, is already present in some receiving waters due to historic mining activities and has limited attenuation potential within the groundwater system. Sulphate concentrations adopted in the modelling were derived from MWM (2026e) which identified peak concentrations from long-term water quality monitoring data.

Modelling results indicate that the predicted sulphate plume develops primarily from the Golden Bar Pit and waste rock stack source areas and migrates preferentially along the interpreted groundwater flow paths. The maximum horizontal extent of the plume is predicted to be approximately 1,200 m to the northeast of the source areas and approximately 900 m to the south of the source area.

The total modelled sulphate mass discharging to the Murphys Creek and McCormicks Creek catchment ephemeral streams was estimated at 400 years post-closure, where the sulphate flux is estimated to be approximately 0.26 kg/day for the McCormicks Creek catchment (combined ephemeral streams and river boundaries) and approximately 149 kg/day for the Murphys Creek catchment. These sulphate flux estimates have been represented in the surface water mass balance model and effects on water quality discussed further in Section 9.5.4 of this report.

9.5.5 Surface Water Effects

9.5.5.1 Pit Lake Development

The sitewide Water Balance Model included the modelling of pit lake development following completion of mining. The model found the following:

> Golden Bar Pit:

- Pit level recovery commences in 2034, and a median filling time of 58 years is modelled, reaching the overflow at 500 mRL in approximately 2091;
- Total runoff is highest initially where lake levels are low and pit wall area (which contributes to the runoff) is relatively large. As the lake level rises, the proportion of direct rainfall increases as the pit walls are saturated and runoff decreases;
- WRS seepage and groundwater make up a much smaller proportion of the total inflow. Groundwater inflows are highest at lower pit lake levels before reducing and remaining relatively constant before and after the pit lake reaches the overflow level; and
- Evaporation is the dominant outflow during pit lake filling until the overflow level is reached;

- Coronation Pit:
  - The pit water level initially rises rapidly through the backfill, occupying available void space before the fill rate begins to slow at 595 mRL as groundwater inflow rates reduce. At 620 mRL the pit lake level rises above the backfill which corresponds to the sharp increase in pit lake surface area. The filling slows over the last 5 m due to the large volume available and greater surface area for evaporative losses. The median fill time is 23 years reaching the overflow at 625 mRL in approximately 2055;
  - Initially inflows are high and attributed to the addition of the backfill. When the pit lake rises above the level of the backfill, a sharp increase in rainfall inflows and a drop-off in runoff occurs as the pit lake begins to form; and
  - Evaporation is the dominant outflow once the pit lake has formed until the overflow level is reached;
- Coronation North Pit:
  - Predicted median filling time of approximately 64 years, with the pit lake overflow level of 562.5 mRL being reached in approximately 2099;
  - Total runoff inflows are high before the pit lake surface develops. As the pit lake level rises, direct rainfall inflows increase with the larger surface area before stabilising at the maximum pit lake level; and
  - Evaporation is the dominant outflow until the overflow level is reached;
- Innes Mills Pit:
  - Predicted median filling time of approximately 67 years with the pit lake overflow level of 473 mRL being reached in approximately 2098;

- Total runoff inflows are high before the pit lake surface is developed. Once the backfill is saturated and the pit lake surface becomes active, runoff decreases inversely to the direct rainfall. Direct rainfall increases with the widening pit lake surface area until the final level is reached after approximately 67 years; and
- There is initially a high loss to groundwater due to the lowered groundwater table immediately surrounding the pit, which reduces as the water table recovers. Evaporation then becomes the dominant outflow from the pit lake until the overflow is reached.

The modelled pit lakes (formed in Golden Bar Pit, Coronation Pit, Coronation North Pit and the Innes Mills Pit) are predicted to overflow following the cessation of dewatering activities after a median modelled timeframe of 58, 23, 64 and 67 years, respectively, and overflow water (based on defined water quality) directly impacts compliance monitoring locations during the modelled closure period. Overflow water quality is significantly improved by ferric chloride dosing of the pit lakes in the closure phase.

9.5.5.2 Effects on Freshwater Flow

Low flow periods are when there is the greatest risk of exceedance of the current and/or proposed receiving surface water quality compliance targets. These naturally occurring periods are when there is elevated risk of impacts from groundwater drawdown induced flow reductions and/or elevated contaminants of concern (via uncaptured seepage) causing water quality target exceedances in the receiving surface waters. The consented, but yet to be constructed, Camp Creek and Coal Creek freshwater dams are proposed to provide augmentation flows in Deepdell Creek and Mare Burn catchments, respectively, during periods of low flow, thereby reducing the risk of surface water quality compliance target exceedance and providing capacity for releasing “fresher” flows for periphyton flushing if required. Their proposed operation is detailed in Appendix F to GHD (2026a).

The results of the Water Balance Model show that, generally, there is sufficient storage available within the dams after filling such that the risk of there being no augmentation water available is low. This risk is more elevated during the filling phase, particularly if the filling phase coincides with a prolonged low flow period. The dams are proposed to be constructed and commissioned as a priority during mining Phase A (the phase of mining activities from the commencement of consents to a period no later than seven years following commencement).

9.5.5.3 Effects on the Receiving Surface Water Environment

The Water Balance Model considered potential effects to key receiving surface water catchments (Mare Burn, Deepdell Creek and Waikouaiti River North Branch) and their

respective compliance monitoring locations as well as the Shag River down hydraulic gradient of the site. The summary Water Balance Model results are presented in GHD (2026a) and detailed Water Balance Model results are presented in Appendix H to GHD (2026a). The surface water compliance monitoring locations are illustrated in **Figure 9-12**.

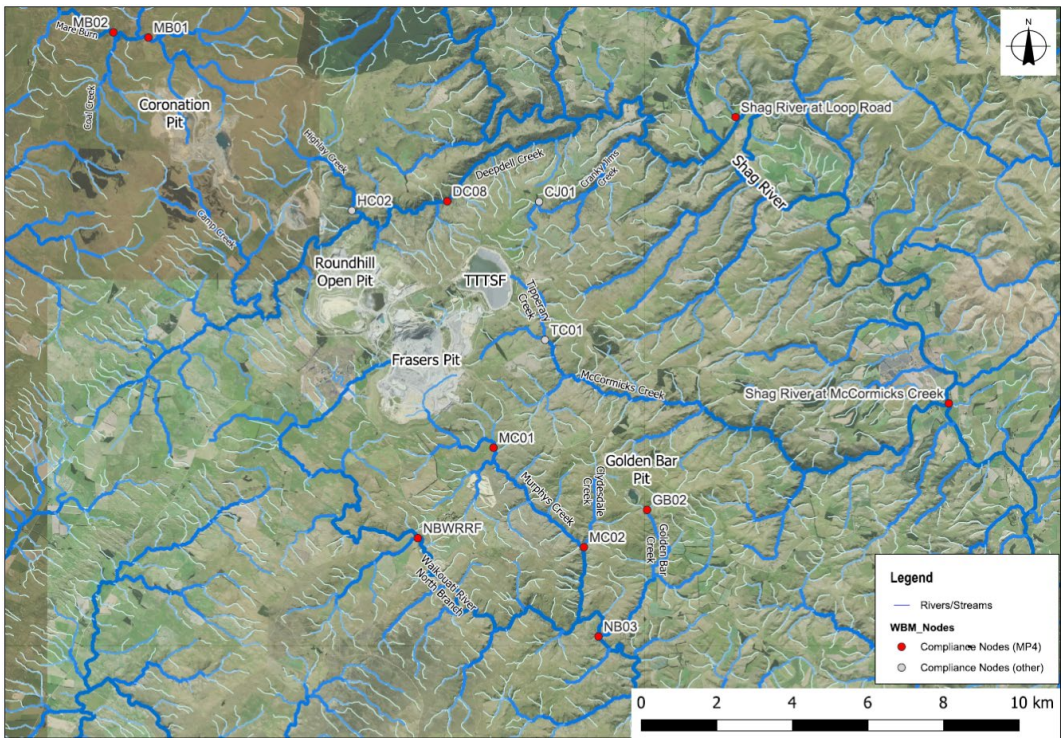

Figure 9-12: Site surface water compliance locations

Applicable trigger values for effects were based on the compliance criteria defined by Viridis (2026b) which reviewed the current compliance criteria at Macraes Operation with respect to the protection of aquatic ecology health. The proposed "contaminant" compliance criteria are generally in accordance with the ANZG 95% species protection limits with the following exceptions:

- Deepdell Creek (DC08), where pre 1990 water monitoring results showed already elevated levels of metals due to both historical (1860's) mining and the fact that the mineral-rich Hyde Macraes Shear Zone (the orebody), outcrops through the creek and surrounding catchments;
- Compliance limits at Waikouaiti River North Branch 03 ("**NB03**"), "Shag at Loop Road" and "Shag at McCormicks" which are linked to more stringent drinking water standards; and
- Two existing compliance points, Mare Burn 01 ("**MB01**") and North Branch Waikouaiti River at Ross Road Ford ("**NBWRRF**"), which are so close to the contaminant sources as

to prove practically impossible for OGNZL to offer sufficient mitigations to achieve the 95% level protection for all parameters. Furthermore, both these compliance points are in streams that have catchment compliance points further downstream (MB02 and NB03), for which the company proposes 95% and drinking water standard protections. Once the planned mitigations are implemented, MP4 is proposing to apply the 95% protection levels at the compliance sites linked to a conditioned adaptive management approach.

The Water Balance Model predicts that, generally, long term concentration of contaminants of concern are lower during low flow periods compared to current conditions and this reflects the interception and capture of seepage, the operation of the augmentation dams, capping of the WRSs and the operation of the active WTP. The active WTP is estimated to treat an average of approximately 45 L/s of captured seepage waters on closure, being waters that would otherwise contribute to the contaminant load within the receiving surface water environment. This volume is modelled to decrease by nearly half to 23 L/s within 10 years of closure.

Some increases in concentrations are then predicted as a result of pit lake overflow in the post closure period. Pit lake contaminant loads are reduced by dosing pit lakes with ferric chloride, which aides in precipitating and adsorbing metals from the pit lakes and storing them as solid materials at the base of the pit.

Modelling indicates that when the proposed mitigation measures are combined with water provided by the Camp and Coal Creek augmentation dams, the proposed surface water quality compliance criteria will be met most of the time. The effect of the mitigation measures to be initiated during mining Phase A and becoming operational ready for Phase B (phase of mining activities following the implementation of operational water quality measures) and beyond is clear in the modelling results presented in GHD (2026a).

There are some compliance exceptions with modelled results indicating non-compliance with the proposed water quality criteria for some contaminants of concern during both the mining and closure phases. During mining, uncaptured seepage contributes to modelled copper exceedances within the Mare Burn at compliance location MB01 and modelled zinc exceedances within the Waikouaiti River North Branch at compliance locations Murphys Creek 01 and NBWRRF. This is a result of current high infiltration rates to the Frasers, Trimbells and Coronation North WRSs. These infiltration rates (and resultant uncaptured seepage volumes) are temporary, as they are significantly reduced with appropriate capping (proposed at closure) and the installation of the capture drains (proposed during the mining phase).

To address the higher WRS infiltration rates during the operational phase of the project, interim WRS management practices will be implemented to manage any sections of WRSs that will be dormant for 12 months or more as active water shedding (reduced permeability) areas. These interim management measures are expected to reduce contaminated WRS seepage but are not captured in the modelling or presented results.

In addition, modelled copper and nitrate-N concentrations are over-represented at compliance locations MB01 and NBWRRF respectively compared to the current baseline data. This suggests that there are likely natural attenuation processes occurring upstream of these locations that directly influence the downstream concentrations of copper and nitrate-N. Modelled concentrations and non-compliances (where applicable) are therefore not supported by the current in-stream dataset for copper and nitrate-N at these respective locations and are likely a result of the mass conservative nature of the Water Balance Model.

During the closure phase, potential non-compliances are reduced compared to mining phase non-compliance projections, reflecting the capping and rehabilitation of the WRSs at closure and the reduction in the uncaptured seepage volume (and mass) reporting to the receiving surface water environment. Remaining modelled non-compliance projections are largely associated with the pit lake overflows. It is considered that active management and treatment of pit lake water quality and representation of revised treatment outcomes in the Water Balance Model have the potential to significantly reduce these modelled exceedances before these pit lakes are discharged to the environment. There are also potential long-term management solutions allowing control of the lake discharges as a contingency measure if deemed necessary for receiving water quality outcomes. Further, as noted above, the model generally contains assumptions that are intentionally precautionary and the predicted outcomes should be viewed within this context.

9.5.6 Mitigation and Management Framework

Proposed monitoring and mitigation measures represented in the Water Balance Model are summarised in **Table 9-5** and outlined in detail in Appendix F of GHD (2026a). The measures include physical infrastructure and management practices to be implemented, and aspects of mine design that have been made through project refinement for the purpose of improving confidence in the suitability of long-term water quality outcomes.

Table 9-5: Summary of mitigation measures

Type	Mitigation	Overview	Objectives
Source control	WRS construction methodology	Lift height limitations, interim WRS management and amended capping design approach to minimise infiltration.	Reduced lift heights reduce air and water ingress. Interim Management provides short term water shedding. Rehabilitated WRS promoting water shedding and minimising infiltration.
	Mine design	Amended mine designs to improve water quality outcomes and reduce risks.	The outcomes of these adjustments are captured in the project description and allow for improved long-term water management.
	Water diversion	Permanent water diversion constructed around Trimbells WRS to Trimbells Gully.	Reduction of potential seepage through the WRS that could have been generated by ponding against the stack.
Discharge controls	Return pumping	Pumping of silt pond water to the MWMS.	The capture and return of contaminated water reduce potential contaminant discharges to receiving water bodies.
	Seepage capture	Interception and capture of point source and diffuse seepage flow paths, by installing engineered seepage interception drains	Contaminated seepage waters are captured near the source (i.e. at WRS margins) and returned to the MWMS and/or the WTP, reducing contaminant loads to receiving water bodies.
Water Treatment	Water Treatment Plant (WTP)	Treatment of captured WRS seepage and TSF underdrain waters prior to discharge to receiving water bodies.	Significant reductions in contaminant mass load discharges to receiving waters. Not relying on dilution to meet water quality compliance.
	Pit lake water treatment	In pit ferric chloride dosing for treatment of arsenic.	Reduced arsenic concentrations in developing and overflow pit lakes.
	Passive water treatment	Application of passive treatment technologies for treatment of mine waters.	For future development. Not proposed as a baseline mitigation measure for the Project.

Type	Mitigation	Overview	Objectives
Flow augmentation	Flow augmentation dams	Camp Creek Dam for low flow augmentation in Deepdell Creek. Coal Creek Dam for low flow augmentation in the Mare Burn.	Provides flow augmentation to mitigate potential flow losses within the catchments due to mining activities. Reduces contaminant concentrations in receiving waters during low flow periods.
	Flushing flows	Flushing flows from augmentation dams and WTP discharges.	Help to manage eutrophication effects and periphyton growth through dry summers

The proposed implementation timeline for these measures is provided in Figure 6-28 and requires improved monitoring of surface water and groundwater to be implemented during the early phases of the project, along with detailed design and construction of physical water management features to take place.

9.5.6.1 Water Treatment Plant

As described in **Table 9-5** above, a key aspect of the ongoing water management at the site is the provision of active water treatment by way of a WTP (or multiple WTPs) if required.

As detailed in GHD (2026c), the proposed seepage capture system would intercept mine-affected water before it reaches the receiving environment and convey it to a WTP for treatment prior to discharge (or to the MWMS). This approach is intended to provide an environmental benefit by capturing and treating seepage that would otherwise enter surface water untreated, while enabling treated water to be returned to appropriate receiving catchments.

Treated water from the WTP would be discharged to the Mare Burn, Deepdell Creek/Shag River, Waikouaiti River North Branch and relevant sub-catchments. The Water Balance Model framework is based on returning treated water broadly in proportion to the seepage captured from each catchment to support minimum environmental flows, while allowing operational flexibility to optimise receiving water quality outcomes, maintain flow continuity, support flushing or storage recovery, and accommodate maintenance requirements.

Proposed discharge flow rates

GHD (2026c) proposes that discharge flow rates be controlled through an operating envelope rather than fixed modelled limits. For most discharge locations, the maximum rate

would be the greater of either three times the relevant median flow or the recent peak daily average seepage capture rate, typically assessed over the preceding seven days. This avoids constraining treatment and return of captured seepage where actual capture rates exceed the median-flow based allowance.

The framework also provides for minimum return flows in parts of the Waikouaiti River North Branch system, including no less than 10 L/s to the main branch and no less than 2 L/s to the Waikouaiti River North Branch Tributary, where relevant. No maximum flow rate is proposed for discharges directly to Coal Creek Dam or Camp Creek Dam while those dams are below spilling level, although discharges to tributaries of those dams would still need to observe the three-times-median-flow approach.

Proposed water quality limits

GHD (2026c) proposes that the quality of treated WTP discharge be monitored at the WTP outlet before water is distributed to receiving waterways. The proposed limits are based on receiving water trigger values and include fixed limits for pH, turbidity, sulphate, arsenic, boron and iron, together with toxicity-modifier adjusted limits for ammoniacal nitrogen, nitrate nitrogen, copper, lead, nickel, zinc and weak acid dissociable cyanide.

Key proposed limits include:

- pH 6.5–9.0;
- turbidity 5 NTU;
- sulphate 100 g/m^3;
- nitrate nitrogen of 1.1–2.6 g N/m^3 depending on hardness;
- arsenic 0.013 g/m^3;
- boron 0.94 g/m^3; and
- iron 0.28 g/m^3.

Equivalent trigger values are also identified for ammoniacal nitrogen, copper, lead, nickel, zinc and WAD cyanide, with adjustments based on relevant receiving water characteristics such as pH, temperature, hardness and dissolved organic carbon.

Overall recommendations

GHD (2026c) recommends that WTP discharges be managed to prioritise receiving environment water quality and ecological outcomes. Where practical, treated discharges should be routed through existing silt ponds with decant structures to provide buffering and smooth changes in flow. Flow monitoring should be established at seepage capture

locations and in receiving environments before WTP commissioning to provide baseline data and inform discharge limits. Site investigations should also be undertaken to support detailed design of discharge points and minimise localised scour.

A WTP Discharge Management Plan should be developed through commissioning to guide flow distribution, monitoring responses and contingency actions if discharge criteria are not met. Potential responses include recirculation through the WTP, use of temporary on-site storage, assessment of receiving water capacity, or discharge to larger water bodies where sufficient dilution is available and water quality outcomes can be maintained or improved.

Overall, the proposed WTP discharge framework is intended to enable the capture, treatment and return of mine-affected seepage while maintaining compliance with receiving water quality and ecological objectives. This is to be achieved through defined discharge quality limits from the WTP, catchment-based flow management, receiving environment monitoring, and adaptive management under a WTP Discharge Management Plan.

9.5.6.2 Additional Mitigation and Management Measures

Additional mitigation and management measures to be implemented, as recommended by GHD (2026a), include:

- Electronic weather stations including evaporation measurements will be maintained near Coronation North, Golden Point and Frasers South areas to improve certainty on model calibrations and environmental assessments;
- Additional studies will be undertaken to categorise attenuation of some contaminants in the receiving waters;
- Source contaminant reduction and passive treatment options will continue to be investigated with the aim of reducing the ongoing reliance on active water treatment systems;
- Management options for WTP brine will be further investigated for the purpose of increasing the fraction of treated water that can be returned, increasing stream flows, and reducing disposal volumes of brine during mining and post closure. Though it is noted that long-term storage in the FRUG is projected to have a negligible effect;
- In-pit water treatment for arsenic (and potentially other metals) removal will be trialled and monitored to (i) improve the understanding of the expected efficiency of the treatment, and (ii) improve understanding of future treatment frequencies and appropriate delivery mechanisms for these treatments, to determine the reliability at which the target in-pit water quality objectives can be met;

- Provision will be made for active management of pit lake discharges through discharge control and treatment if required to meet receiving environment water quality objectives in the long-term;
- A detailed WRS construction and capping/rehabilitation methodology will be developed and implemented to promote water shedding and evapotranspiration capabilities, including localised adjustments being made to existing WRSs to reduce surface ponding and areas promoting infiltration, and site wide monitoring of seepage flow rates will be undertaken;
- Interim WRS management will be introduced to address the current high infiltration rates during the mining phases;
- Seepage monitoring and collection systems will be constructed early to improve understanding of the flow rates captured by these systems and the required sizing for water treatment and transmission infrastructure; and
- The Water Balance Model will be updated prior to the commissioning and detailed design of the full scale WTP.

A separate Water Monitoring Plan has been developed that outlines detailed monitoring requirements for the site. The following aspects of this plan will be implemented to support the modelling and mitigations proposed:

- Groundwater detection bores will be constructed for the ongoing monitoring of potential plume migration with continuous monitoring of groundwater levels, EC, and temperature and quarterly groundwater quality sampling;
- Surface water flow and water quality monitoring will be undertaken at or near MB02, DC08 and NB03. Monthly compliance sampling will be undertaken in accordance with Viridis (2026b). Due to the extensive nature of the site and the magnitude of changes in the compliance regime, a transition phase is necessary to implement the required measures before the new compliance criteria apply. A transition period of seven years from consent granting (Phase A) is proposed. During year 7, comparing the monitoring results with the new compliance regime will indicate any remaining compliance issues (if there are any), and, if necessary, additional mitigations, timeframe and what interim limits/compliance regimes can be considered as the mine transitions to Phase B of mining;
- Mine water flow and water quality will be monitored at mine water seepage and discharge locations;

- Pit dewatering flow rates will be monitored, including any controlled and/or intentional discharges to pits. It is noted that MP4 is not proposing maximum rates of take for dewatering of open pits in the consent conditions. As this is stored water, arbitrarily capping the rate at which it can be abstracted does not provide for the management of any environmental effect;
- Pit lake development rates will be monitored, once dewatering ceases; and
- Performance monitoring of the WTP.

The surface water modelling has indicated an elevated likelihood of sulphate non-compliances at NB03, for which the more stringent drinking water standards apply. OGNZL has commenced discussions with WDC regarding a potential partnership to upgrade and/or replace the Stoneburn drinking water supply in this location. The Stoneburn Community Water Supply Scheme is already presenting challenges for WDC due to existing water quality issues associated with naturally occurring and land-use related organic contaminants within the catchment, which are unrelated to OGNZL's mining activities. Any improvements to the scheme would, therefore, provide benefits beyond addressing the potential effects identified through the surface water modelling.

Where a permanent alternative water supply for the scheme can be provided, OGNZL could seek to remove the drinking-water-specific criteria at NB03 with the 95% aquatic species protection criteria continuing to apply.

9.5.7 Summary and Conclusion

In summary, MP4 represents a step-change in water management for the Macraes Operation. It proposes a more protective compliance regime, applies a deliberately conservative modelling approach, and commits to a staged mitigation and monitoring framework designed to improve receiving water quality performance over time and secure these outcomes post closure.

Following the proposed transition period, MP4 would replace the existing surface water quality compliance regime with materially more protective criteria. Those criteria are based on contemporary freshwater ecosystem guidance and current drinking water protection standards and are supported by a staged management framework intended to secure improved long-term receiving water quality outcomes.

The integrated groundwater, mine water and surface water modelling has been used to identify the principal water quality challenges, test the effectiveness of proposed mitigation measures, and inform the conditions and monitoring framework needed to manage those challenges over the life of MP4 and into closure. The predicted outcomes from the modelling

can be viewed within the context of a deliberately risk-averse assessment approach and provide a conservative assessment of the likely outcomes arising from the proposed water quality management measures.

Predicted groundwater drawdown effects are generally localised around the proposed mining areas, groundwater inflows are moderate and manageable, and post-mining groundwater recovery is expected to occur over time as pit lakes develop and the groundwater system re-establishes equilibrium. On that basis, adverse effects on groundwater users, arising from drawdown or changes in groundwater quality are considered unlikely.

Modelling indicates that seepage (from WRSs, TSFs and pit lakes) is expected to move predominantly through shallow, weathered schist and near-surface flow pathways before reporting to existing mine water management infrastructure, silt ponds, seepage capture drains to be developed during MP4, or local surface water receiving environments. The modelling outputs support the inclusion of seepage capture drains and related water management measures as key controls for reducing currently uncaptured seepage and contaminant mass reporting to Deepdell Creek, Murphys Creek, and the wider receiving water environment.

The water quality modelling has been informed by environmental monitoring data collected over more than 30 years of operations at the Macraes Operation. Where modelling inputs cannot be definitively determined, conservative values have been used. The enhanced monitoring and data gathering proposed as part of MP4 will allow the model to be updated over time and will provide a stronger basis for confirming actual water quality outcomes against the proposed compliance regime.

MP4 sets a more protective standard for the Macraes Operation, but the scale and complexity of the site mean the full suite of mitigation measures identified in Section 9.5.5 of this report, will be implemented in a staged manner. The proposed transition period, of seven years, is therefore an implementation mechanism as it allows the new monitoring, seepage capture, treatment, rehabilitation and adaptive management measures and augmentation dams to be brought online before the proposed compliance regime applies in full.

Overall, the combination of mine water management measures, seepage controls, water treatment, rehabilitation activities, monitoring, adaptive management and proposed consent conditions provides a comprehensive framework for avoiding, remedying or mitigating adverse water effects. Once implemented, that framework is expected to deliver receiving water quality outcomes that are materially more protective of aquatic life and drinking water values than the existing consent regime.

9.6 TERRESTRIAL ECOLOGY AND WETLAND EFFECTS

Bioresearches (2026a) summarises the assessment of the actual and potential effects of MP4 on terrestrial and wetland ecology and Bioresearches (2026b) contains the more thorough assessment. This report assesses the effects on the following terrestrial and wetland values for MP4, which are summarised in Section 2.13 and 2.14 in Bioresearches (2026a):

> Invertebrate values provided in Bioresearches (2026c);

> Lizard values provided in Bioresearches (2026d);

> Avifauna values provided in Bioresearches (2026e);

> Bat values provided in Bioresearches (2026f); and

> Vegetation and wetland values provided in Whirika (2026).

The residual effects and the proposed offset and compensation measures include:

> Terrestrial ecology residual effects provided in Bioresearches (2026g); and

> Wetland value residual effects provided in Bioresearches (2026h).

A summary of the overall terrestrial and wetland ecology values, impacts of MP4, proposed management of impacts and proffered ecological enhancements is provided in Bioresearches (2026a).

These various reports are provided in **Part B** of these application documents. The effects informed by the technical reports listed above have been summarised and collated in the sub-headings below. The interrelationships between the various reports and assessments are shown diagrammatically in **Figure 9-13**.

It is noted that effects on terrestrial ecology and wetlands have been assessed holistically and are not separated by individual mining area. Where effects are specific to a particular mining area or location, these are identified and detailed in the relevant sections below.

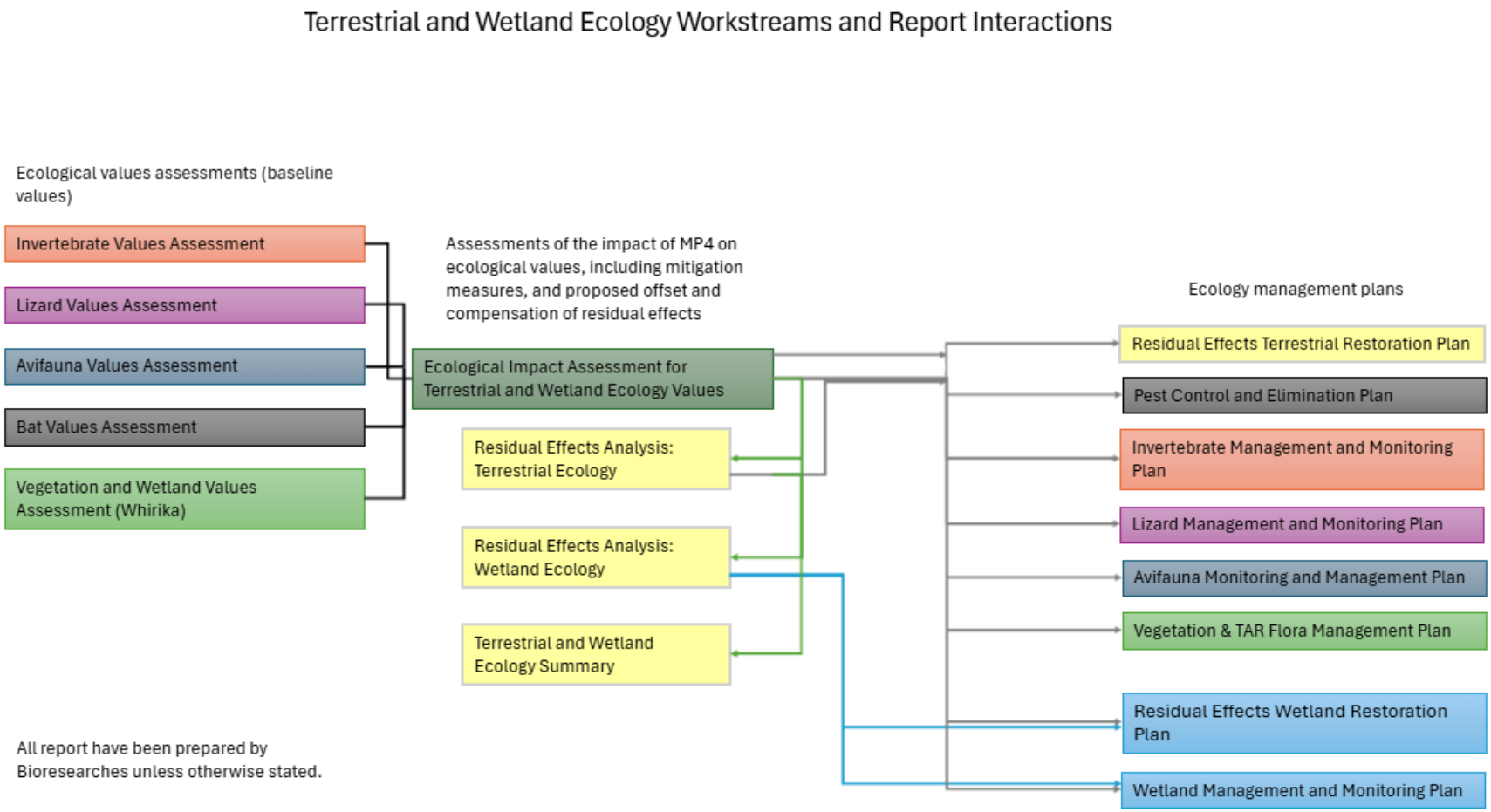

Figure 9-13: MP4 terrestrial and wetland ecology workstreams and report interactions

9.6.1 Effects on Bats

Bioresearches (2026f) considers ecological values of bats for MP4, and confirms that there are no pekapeka, or any other bat species, located within or adjacent to the Macraes Operation, including MP4. Accordingly, bats are not included in the assessment of environmental effects undertaken by Bioresearches (2026b).

9.6.2 Terrestrial Vegetation

MP4 will result in both direct and indirect effects on terrestrial vegetation across the Coronation North Mining Area, the Central Mining Area, and the Golden Bar Mining / Haul Road Areas. The assessed non-consented impact area for MP4, comprising the direct impact footprint and a precautionary 20 m buffer, is approximately 319.8 ha. Of this 319.8 ha, 220 ha comprises modified land cover (exotic grassland, mine-disturbed land, roads, pine and rehabilitated mine surfaces) and indigenous terrestrial habitat mainly comprising approximately 90.01 ha tussock grassland, 3.06 ha dry shrubland and 0.26 ha rock habitat.

9.6.2.1 Direct Effects on Terrestrial Vegetation

Direct effects will mainly result from vegetation clearance, earthworks, pit expansion, infrastructure development, and landform changes. These activities will permanently remove vegetation communities within the MP4 footprint, including narrow-leaved tussock grassland, shrubland, rock habitat, riparian vegetation, and wetlands (including ephemeral wetlands, seepages, and sedgelands).

MP4 will result in the total direct loss (plus additional 20 m edge) of terrestrial ecosystem extent comprising 90 ha very high value tall tussock grassland, 3.06 ha moderate value dry shrubland and 0.26 ha very high value rock habitat (including associated vegetation and flora communities). The greatest loss, approximately 90 ha tall tussock grassland (primarily at Coronation North and Golden Bar Haul Road and Mining Area) has a proportional impact of high magnitude in comparison to the low magnitude for dry shrubland and rock habitat.

The tall tussock grassland supports a high concentration of Threatened and At Risk (“**TAR**”) plant records, with the highest recorded within the Coronation North Area as noted above. Vegetation removal may therefore result in direct loss of individual plants, reduction in habitat extent, and fragmentation of remaining habitat. Within the direct loss footprint is a total of 27 TAR flora species including two Regionally critical species, 10 other Regionally Threatened species and 12 At-Risk species. All of these species occur in the Coronation Area and a few of them occur at other areas.

Wetland and riparian vegetation cover a small part of the footprint but are among the most sensitive and highest-value ecosystems affected. Key risks include direct vegetation loss, altered hydrology from drainage or dewatering, sedimentation, and increased weed invasion. Ephemeral wetlands are a particular interest because they are rare nationally (although not uncommon locally) and can support specialised flora, including TAR species. They are highly sensitive to both direct disturbance and changes in water availability and quality with causes including climate pressures and land use such as mining, forestry and farming, and many ephemeral wetlands in the area are of low ecological value because of these factors.

9.6.2.2 Indirect Effects on Terrestrial Vegetation

Indirect effects are those effects that will occur beyond the direct loss footprint and may alter retained terrestrial vegetation through dust deposition, weed invasion, altered microclimate conditions, disturbance and sedimentation, and changes to surface runoff and soil moisture.

Indirect effects on terrestrial vegetation from dust depositions include reduced photosynthetic performance, reduced plant vigour, altered species composition and increased susceptibility to drought stress. With the localised nature of these effects and the proposed standard dust suppression measures, the magnitude of effect is low.

Weed invasion may reduce indigenous vegetation conditions due to competing resources, suppression of indigenous regeneration and altering the structure and composition of indigenous vegetation resulting in a low magnitude of effect.

Sedimentation and surface water effects can result in adjacent vegetation communities experiencing soil burial, altered substrate conditions and reduced vegetation health and recruitment. With the proposed sedimentation control measures in place, the magnitude of effect is low.

The cumulative effects on indigenous vegetation may arise through incremental loss of tussock grassland, ongoing fragmentation of shrubland remnants, progressive reduction in habitat quality and continued pressure from weeds and land-use change.

9.6.2.3 Mitigation Approaches and Residual Effects

Avoidance and minimisation measures have been incorporated into MP4 design to reduce potential effects on terrestrial vegetation and associated ecological values wherever practicable. A key avoidance outcome has been the removal of the 188 ha Back Road WRS and the 41 ha Frasers North WRS from the MP4 footprint, which avoids significant impacts on tussock grassland, shrubland, and riparian habitats. Their removal has been made

possible by additional in-pit backfill such as Innes Mills backfill and an increase in height of the Frasers West WRS.

Further avoidance has been achieved through iterative refinement of the MP4 layout and retention of vegetation outside of required disturbance areas. However, due to the fixed nature of the ore bodies, complete avoidance of vegetation effects is not feasible.

Where impacts on indigenous vegetation and TAR species cannot be avoided, a suite of mitigation and compensation measures will be implemented. These measures are supported by the Vegetation and TAR Flora Management Plan and related management plans (provided in **Part C** of these application documents), and are designed to minimise disturbance, maintain ecological function in retained areas, and provide for the salvage and establishment of affected species where practicable.

A range of mitigation measures will be implemented in accordance with the mitigation hierarchy. The following mitigation measures are proposed:

- Avoidance of high-value vegetation through project design refinement and exclusion of areas where disturbance is unnecessary;
- Clear demarcation of construction footprints and no-go areas to prevent accidental vegetation clearance;
- Implementation of the Vegetation and TAR Flora Management Plan, including:
  - Vegetation and plant salvage (including tussock transfer where appropriate);
  - Seed collection and propagation;
  - Translocation to suitable recipient sites; and
  - Post-transfer monitoring and adaptive management.
- Targeted monitoring and triggered management for TAR plant species within a 100 m buffer of the project footprint;
- Protection of retained vegetation through exclusion fencing and construction controls;
- Staged vegetation clearance (where practicable) to reduce disturbance extent and allow progressive management;
- Dust suppression measures (e.g., watering, stabilisation of exposed surfaces, haul road management);
- Erosion and sediment controls to prevent sediment deposition in retained vegetation, wetlands, and riparian areas;

- Maintenance of hydrological inputs to wetlands, seepages, and other moisture-dependent vegetation where practicable;
- Management of drainage and runoff to minimise indirect hydrological effects;
- Identification and protection of retained rock outcrops and avoidance of unnecessary disturbance to rocky habitats;
- Salvage or direct transfer of rock-associated vegetation and substrate where feasible;
- Implementation of weed hygiene protocols and ongoing weed management;
- Progressive rehabilitation of disturbed areas to reduce weed establishment and edge effects;
- Restrictions on vehicle and stock access to sensitive or retained vegetation areas; and
- Stock exclusion and pest plant and animal control at translocation and recipient sites.

These mitigation measures will substantially reduce the extent and severity of effects, but some residual effects are expected to remain as a result of unavoidable permanent clearance of directly affected vegetation.

The ecological effect of MP4 on terrestrial vegetation is summarised in **Table 9-6**. With the implementation of the above proposed mitigation measures, the level of residual effect for more most vegetation communities throughout MP4 will be reduced to low or very low. However, in Coronation North, the magnitude of effect on very high-value tussock grassland cannot be avoided or mitigated due to the large extent of habitat affected therefore the residual effect is very-high. In addition, the rock habitats, where high-value schist outcrops are affected, will experience moderate residual effects due to the difficulty of fully restoring ecological complexity and function. Where required, the residual effects will be compensated for as set out in Section 9.6.7 of this report.

Table 9-6: Ecological Effect Pre and Post Mitigation and Residual Level of Effect (Modified from Bioresearches, 2026a)

Location	Vegetation system / ecosystem	Value	Magnitude of Effect	Overall Level of Effect (unmitigated)	Residual Level of Effect
Coronation North	Tussock grassland	Very High	High	High	Very High
	Dry Shrubland	Moderate	Low	Low	Low
	Rock	Very High	Low	Low	Moderate

Location	Vegetation system / ecosystem	Value	Magnitude of Effect	Overall Level of Effect (unmitigated)	Residual Level of Effect
GPUG Extension	All vegetation	High	Low	Low	Very Low
Central Mining Area	Tussock grassland	Low	Low	Low	Very Low
	Dry Shrubland	Low	Negligible	Negligible	Very Low
	Rock	N/A	N/A	N/A	N/A
Golden Bar Haul Road and Mining Area	Tussock grassland	Low	High	High	Low
	Dry Shrubland	Moderate	Low	Low	Very Low
	Rock habitat	High	Low	Low	Low

9.6.3 Invertebrates

MP4 has the potential to generate both direct and indirect effects on terrestrial invertebrate communities through vegetation clearance, soil disturbance, and ongoing mining activities. To provide an informed and proportionate assessment of potential impacts, the magnitude of effects on invertebrates was assigned with a focus on conservation status, species distribution, spatial scale, duration, and ecosystem role. Also considered in assigning magnitude of effect is the significance within te ao Māori, where all living things are connected through whakapapa and contribute to the health and mauri of ecosystems.

The effects on invertebrates are expected to be most pronounced within tussock grassland habitats, which support relatively high indigenous invertebrate diversity, including habitat for conservation-listed Lepidoptera. While only a limited number of TAR species have been recorded within or near the Macraes Operation (most notably the moths *Orocrambus sophistes* (Nationally Vulnerable) and *Bityla sericea* (Naturally Uncommon)), the presence of these species within the MP4 footprint remains uncertain and may be highly localised or transient. Accordingly, the assessment focuses on potential effects arising from the loss and modification of tussock grassland habitat, impacts on characteristic inland Otago invertebrate assemblages, and any potential effects on TAR Lepidoptera where present.

9.6.3.1 Direct Effects on Invertebrates

MP4 will result in potential direct effects on approximately 319.8 ha of suitable habitat for invertebrate communities and thousands of individual species within the MP4 footprint plus

the 20 m buffer. MP4 will result in the permanent loss of habitat across tussock grassland, shrubland and rock habitat, as well as ecological functions, including for feeding, breeding, dispersal pathways and refuge. Mortality of invertebrates will occur during vegetation and habitat removal, particularly for less mobile taxa inhabiting soil and vegetation layers.

Vegetation clearance and the development of infrastructure will fragment habitats reducing connectivity between habitat patches. Where tussock habitats are removed, there is potential loss of habitat for indigenous Lepidoptera species, including TAR species where present.

The creation of new habitat edges may degrade adjacent vegetation making it less suitable for invertebrates by altering microclimatic conditions. Displacement of invertebrates may occur into adjacent habitats of lower quality or at population capacity, resulting in increased competition, reduced resources and decline in populations.

9.6.3.2 Indirect Effects on Invertebrates

Indirect effects are anticipated within approximately 198 ha of suitable invertebrate habitat within the wider surrounding buffer zone. These effects include disturbance and indirect alterations to adjacent habitat quality which may result in:

- Changes to hydrology from dewatering and water diversion affecting wetland and riparian invertebrate assemblages;
- Habitat structure changes in rocky habitats from subsidence caused by underground mining;
- Changes to vegetation composition and therefore host plant availability;
- Dust deposition affecting vegetation condition and food resources;
- Artificial lighting affecting nocturnal invertebrates such as moths; and
- Noise and vibration causing disturbance to some taxa.

These effects are generally expected to be localised and will be managed through the implementation of standard dust suppression measures in the ESCMP provided in **Part C** of these application documents. Some taxa have been shown to have developed a tolerance to these effects and while some short-term behavioural responses to disturbance may occur, long-term population-level effects on invertebrates are not anticipated.

Indirect effects may also occur as a result of sediment runoff from disturbed areas which could change vegetation composition and reduce habitat quality of adjacent habitat. These

effects will be localised and managed through standard erosion and sediment control measures in the ESCMP.

In addition, the establishment and spread of invasive plant and animal species may be exacerbated by mining activities which result in increased habitat disturbance, vehicle movements, and the creation of dispersal corridors. Invasive species can reduce habitat quality for some invertebrates by altering vegetation structure, degrading refuge sites, and increasing predation pressure, however the lizards in the Project area are adaptable suggesting limited and localised effects.

9.6.3.3 Cumulative Effects

Cumulative effects include effects on invertebrates from the period prior to the establishment of the mine through to the current proposed life of mine. Several areas of invertebrate habitat have been removed, affected or fragmented from past mining or agricultural activities, and although the cumulative effects have not been quantified due their complexity and uncertainty, these effects have been considered in assigning the magnitude of effect on invertebrates.

9.6.3.4 Magnitude of effect

The magnitude of effect on individual invertebrates from direct and indirect effects range from low to moderate depending on habitat quality and species presence. This reflects the widespread nature of these taxa and the availability of similar habitat in the surrounding landscape. For tussock grassland invertebrate communities, the magnitude of effect is assessed as moderate due to the loss of relatively higher-quality habitat within an already modified landscape.

The Project wide invertebrate community has a high magnitude of effect. This is due to the direct permanent loss of approximately 319.8 ha of potentially suitable habitat which includes 12.4 % of the estimated suitable habitat on OGNZL landholdings and 1.4 % of estimated suitable habitat in the Macraes ED. Indirectly, MP4 will also result in indirect effects in the wider 198 ha buffer.

9.6.3.5 Mitigation Approaches and Residual Effects

Although complete avoidance of effects on invertebrates is not possible due to the fixed location of mining infrastructure and ore bodies, avoidance and minimisation measures will be implemented to reduce effects on invertebrate communities. These measures include:

> Disturbance to higher-value tussock habitats will be avoided through project design where practicable;

- Standard operation controls will be implanted including erosion and sediment controls, dust suppression measures and lighting controls to limit light spill;
- Weed management will be undertaken to maintain indigenous vegetation and host plant availability;
- Areas of indigenous vegetation to maintain habitat availability and connectivity will be retained, and using vegetation direct transfer to relocate topsoil, seedbanks, and associated invertebrate communities to rehabilitation areas where possible;
- Accidental encroachment into retained vegetation will be minimised through exclusion fencing, flagging, and avoiding no-go areas;
- Maintain hydrological function by retaining seepage, riparian and wetland vegetation where practicable, manage road drainage and runoff, and monitor retained sensitive vegetation; and
- Salvage and relocation of invertebrates from impact areas prior to and during vegetation clearance. An Invertebrate Management and Monitoring Plan ("**IMMT**") will guide the management of invertebrate values, including targeted salvage or species-specific measures if TAR species are confirmed within areas of impact.

Despite the implementation of these measures, some residual effects on invertebrate communities will remain. For general invertebrate communities in modified habitats, residual effects are expected to be low, reflecting the resilience and widespread distribution of these taxa. For tussock grassland invertebrate communities, residual effects are expected to be low to moderate, as rehabilitation will support gradual recovery but will not immediately replicate the complexity of mature tussock ecosystems. For *Bityla sericea*, residual effects are expected to be moderate, reflecting some ongoing habitat loss despite mitigation. If *Orocrambus sophistes* is confirmed to be present within the MP4 footprint, residual effects may remain moderate due to its limited dispersal and specific habitat Mrequirements, even with targeted management.

Overall, the level of effect on invertebrates is assessed as low across most of the MP4 area due to the predominance of modified habitats and the relatively low ecological value of general invertebrate communities. The level of effect increases to "low to moderate" within tussock grassland habitats and to moderate for *Bityla sericea*. A potentially higher level of effect, ranging from moderate to high, may occur if *Orocrambus sophistes* is confirmed within the MP4 footprint. These effects will be managed through a combination of avoidance, minimisation, and, where necessary, targeted species management to reduce adverse outcomes as far as practicable (including host-plant replanting and establishment of enhancement planting).

9.6.4 Avifauna

The assessment of avifauna effects considers the potential direct, indirect and cumulative effects of MP4 on indigenous birds and their habitats within the disturbance footprint and surrounding areas. Potential effects include habitat loss and modification, disturbance from mining activities, injury or mortality during vegetation clearance and earthworks, displacement of birds from affected areas, and indirect effects on habitat quality. Particular consideration has been given to species of TAR conservation status, including South Island pied oystercatcher, banded dotterel and New Zealand pipit, as well as potential effects on breeding birds, nests, eggs and chicks.

9.6.4.1 Direct Effects on Avifauna

Direct effects on avifauna will arise from vegetation clearance, earthworks, mining activities, waterbody modification, and associated surface disturbance within the MP4 footprint. The primary effects include the permanent loss and modification of habitat, potential injury or mortality of birds, eggs, and chicks during site clearance, localised habitat fragmentation, creation of new habitat edges, and displacement of birds from affected areas. The most significant effects relate to open country ground nesting species, particularly New Zealand pipit, banded dotterel, and South Island pied oystercatcher, which utilise disturbed ground, gravel substrates, grassland, and rehabilitated mine landforms for foraging and breeding.

The total area of habitat affected across the Macraes Operation for high value avifauna includes approximately:

> 235.99 ha of suitable habitat for Kārearea / eastern falcon;

> 130.38 ha of suitable habitat for banded dotterel; and

> 130.38 ha of suitable habitat for the South Island pied oystercatcher.

There is also potential for localised effects on other avifauna species through the loss or modification of wetlands, ponds, riparian gullies, and shrubland, could reduce available habitats for foraging, roosting, breeding and movement functions of black shag, fernbird and silvereye species. These effects are anticipated to be localised because there are alterative available habitats present within the surrounding landscape.

Construction activities can result in the loss of nests, eggs, and chicks if works occur during the breeding season, particularly for ground-nesting species. These species are often cryptic, immobile, and difficult to detect prior to machinery access, increasing the likelihood of unintentional adverse effects. Adult birds are generally more mobile and can often avoid areas of active disturbance; however, eggs and chicks have little or no ability to escape

construction activities. Consequently, without appropriate management measures in place, construction works may result in nest destruction and/or chick mortality.

Habitat fragmentation and edge effects are expected to be localised and are unlikely to create significant barriers to movement for highly mobile bird species. Some displacement of birds from active work areas is anticipated during both construction and operation; however, common and mobile species are expected to relocate to suitable habitat within the surrounding landscape. Given the limited extent of fragmentation and the availability of alternative habitat, adverse effects on avifauna arising from habitat fragmentation and edge effects are not anticipated.

Direct effects on avifauna will be managed through the implementation of an Avifauna Monitoring and Management Plan ("**AMMP**") provided in **Part C** of these application documents. The AMMP sets out breeding periods and other seasonal information on how to avoid nest loss and / or chick mortality and displacement of birds during vegetation removal and construction. Other management measures include the imposition of no-go areas during construction and operation stages, sediment controls, dust management, weed control and pest animal management.

9.6.4.2 Indirect Effects on Avifauna

The proposed mining activities have the potential to indirectly affect avifauna through noise, vibration, blasting, vehicle movements, human presence, dust deposition, and artificial lighting. These factors may reduce the suitability of habitats adjacent to active work areas, resulting in temporary habitat avoidance, reduced foraging opportunities, and disturbance to breeding behaviour, particularly where works occur near nesting sites.

Open-country species, including New Zealand pipit, banded dotterel, and South Island pied oystercatcher, are most susceptible to disturbance where breeding habitat occurs in close proximity to works. Eastern falcon are also considered sensitive to disturbance; however, no nests have been identified within the impact area.

Disturbance effects are expected to be largely localised and temporary. Potential effects associated with artificial lighting are anticipated to be limited to areas surrounding active work sites, haul roads, and other illuminated infrastructure associated with MP4, where lighting may influence habitat use and behaviour. Dust deposition may also indirectly affect avifauna by reducing vegetation quality and the availability of invertebrate prey resources if not appropriately managed. However, these effects are expected to be localised and can be minimised through the implementation of appropriate management measures (as listed below).

Sediment runoff from mining activities may reduce the quality of ponds, wetlands, riparian habitats and open-water environments used by wetland and freshwater bird species. Potential indirect effects include reduced water clarity, smothering of wetland and riparian margins, and changes to aquatic prey availability, which could affect numerous avifauna species including black shag, pūkeko, pied stilt, grey teal, Australasian shoveler, paradise shelduck, New Zealand scaup and white-faced heron. These effects are also assessed as localised and manageable through management and monitoring controls.

The proposed mining activities could facilitate the spread of exotic vegetation and pest animals through vegetation clearance, soil disturbance, vehicle movements and the creation of new habitat edges. This could reduce habitat quality and increase predation pressure on indigenous birds, particularly ground-nesting species, whose eggs and chicks are vulnerable to mammalian predators. The spread of invasive plants may also alter the structure and suitability of retained open-country, wetland, riparian and shrubland habitats.

Indirect effects on avifauna will be managed through:

> The implementation of the AMMP which details approved management protocols for avifauna in relation to MP4 including pre-works checks, seasonal controls (where practicable), nest management procedures for ground-nesting and other protected birds, staged vegetation clearance and minimisation of disturbance near active nests;

> The implementation of erosion and sediment control measures, as set out in the ESCMP. Erosion and sediment effects are considered in Section 9.7.2.5 of this report;

> The management of dust, as set out in the ESCMP, further consideration of dust effects is detailed in Section 9.17 of this report;

> The management of lighting effects as described in Section 9.13 of this report; and

> Predator control, pest eradication and weed management, as detailed in Section 9.6.6 of this report.

9.6.4.3 Cumulative Effects on Avifauna

MP4 represents a continuation and extension of mining activities within an already modified pastoral and mining landscape. Consequently, cumulative effects on avifauna arise primarily from the incremental loss and modification of open-country habitats, ongoing disturbance associated with active mining operations, and the progressive reduction in breeding and foraging opportunities for indigenous bird species.

The cumulative effects are of greatest relevance to open-country species of elevated conservation value, including eastern falcon, banded dotterel, South Island pied oystercatcher, and New Zealand pipit. These species utilise habitats that occur within the

MP4 footprint, including pasture, tussock grassland, sparsely vegetated ground, gravel substrates, disturbed mine surfaces, and rehabilitated mine landforms. At a local scale, repeated habitat loss and disturbance may reduce the availability of suitable nesting and foraging areas, particularly for ground-nesting species such as banded dotterel, South Island pied oystercatcher, and New Zealand pipit.

Notwithstanding these localised effects, the MP4 impact area forms a relatively small part of a much larger pastoral and mining landscape where comparable open-country habitats remain widespread across OGNZL landholdings and the wider Macraes ED. Consequently, the proportional loss of habitat at the ED scale is low, and cumulative effects are expected to remain largely localised. Most affected species are highly mobile and capable of utilising a range of modified habitats, including rehabilitated mine landforms, which further reduces the likelihood of population-level effects. For eastern falcon, cumulative effects are more likely to arise from broader changes in prey availability, foraging opportunities, and breeding success across the wider landscape than from the loss of any individual habitat area.

The residual cumulative effect relates to the incremental reduction in functional open-country habitat and potential breeding habitat for species of elevated ecological value, particularly where habitat loss occurs in combination with ongoing disturbance and predation pressure. Nevertheless, given the extensive availability of comparable habitat within the wider landscape, cumulative effects are not expected to adversely affect the long-term viability of indigenous bird populations within the Macraes ED.

Cumulative effects have been considered as part of the broader assessment. While no specific mitigation measures have been identified solely in response to cumulative effects, the mitigation measures outlined in the section above, and those below remain relevant and will contribute to managing any associated adverse effects. The AMMP provides a framework to ensure potential adverse effects are appropriately managed, and any residual effects are addressed in Section 9.6.4.5 of this report.

9.6.4.4 Effects on Taoka / Taonga Species

Taoka / taonga species are identified in Schedule 97 of the Ngāi Tahu Claims Settlement Act 1998 and are recognised for having cultural significance to Ngāi Tahu. There are 15 bird species identified within, or nearby the Macraes Operation that are classified as taoka / taonga species are, therefore, relevant to the assessment of ecological effects.

Of the taoka species identified, kārearea (eastern falcon), pīhoihoi (New Zealand pipit), and kōau (black shag) are also species of elevated ecological value due to their conservation status. Kārearea and pīhoihoi are the taoka species most directly affected by MP4, as they utilise the open-country habitats present within the Project footprint and may be subject to

habitat loss, disturbance, and potential breeding-season effects. Kōau is more closely associated with aquatic habitats and is therefore primarily relevant to the assessment of indirect effects on freshwater environments.

Other taoka bird species recorded within the Project area are common and widespread across the surrounding pastoral and mining landscape. While these species may experience localised effects arising from habitat loss, operational disturbance, and the potential loss of nests where breeding occurs within affected areas, they are mobile and have access to extensive alternative habitat within the wider landscape. As a result, effects on these species are expected to be localised and of limited consequence at a broader landscape scale.

The management and mitigation approaches detailed in the previous sub-sections of this report are still relevant, however, only Ngāi Tahu can determine the effects on these taoka / taonga species within the context of effects on cultural values. OGNZL is committed to ongoing engagement with mana whenua to avoid, remedy and mitigate any adverse effects on taoka / taonga species of avifauna. Furthermore, the residual effects and associated compensation package for avifauna remain relevant to the assessment of impacts on taoka / taonga species and associated cultural values.

9.6.4.5 Mitigation Approaches and Residual Effects

Following implementation of the mitigation measures outlined above, residual effects on avifauna are expected to be low overall. Avoidance and minimisation measures will be applied in accordance with the mitigation hierarchy, primarily through implementation of the AMMP and the management methods described previously.

For common and widespread species, residual effects are expected to be minor (low to very low) due to their adaptability and the availability of suitable habitat within the surrounding landscape. For At Risk ground-nesting species, including banded dotterel and South Island pied oystercatcher, residual effects are expected to be moderate and will primarily relate to localised habitat loss and the potential for disturbance during the breeding season. Similarly, residual effects on eastern falcon are expected to be moderate and largely restricted to localised disturbance and minor reductions in foraging habitat.

To address these residual effects, a biodiversity compensation package has been developed and assessed using the Biodiversity Offset Accounting Model ("**BOAM**"). While some uncertainty remains regarding species responses and the assumptions underpinning the BOAM assessment, the results indicate that the proposed compensation package generates an overall net positive biodiversity outcome for the three assessed species of avifauna, (that is, the long-term avifauna gains outweigh losses). This demonstrates that, collectively, the

compensation measures are sufficient to address residual effects and achieve a net gain for avifauna.

A precautionary approach to implementation, including robust monitoring and adaptive management as reflected in the proposed consent conditions, will further support the achievement of the predicted outcomes.

9.6.4.6 Summary of Effects on Avifauna

In summary, MP4 will result in permanent habitat loss at a local scale and some residual disturbance effects for avifauna. However, the application of avoidance and minimisation measures, together with the proposed biodiversity compensation package, is expected to reduce residual effects to an acceptable level and provide an overall net positive biodiversity outcome. Consequently, residual effects on avifauna are expected to be localised, manageable, and more than offset by the gains achieved through compensation and pest management initiatives.

9.6.5 Lizards

MP4 has the potential to result in a range of direct and indirect adverse effects on lizard populations through the clearance, modification, degradation, and fragmentation of habitat, including tussock grassland, shrubland, and schist rock outcrops. These habitats provide essential ecological functions for lizards, including refuge, basking sites, foraging opportunities, breeding habitat, and dispersal pathways. The magnitude of effects for lizards represents a worst-case scenario and all management and monitoring scenarios have been developed taking a conservative approach.

It is noted that despite intensive searching, no Otago skink, grand skink, Otago green skink, herbfield skink or jewelled gecko populations were confirmed within areas proposed for direct disturbance under MP4. Otago skinks were confirmed at Murphys Creek, outside the MP4 impact footprint, during surveys of potential mitigation areas. A possible Otago green skink observation was made at Camp Creek within an already consented disturbance area. For these reasons, no further effects assessment of these lizards has been undertaken.

9.6.5.1 Direct Effects on Lizards

Direct effects will occur across 238.7 ha of suitable lizard habitat (including the 20 m buffer area) and approximately 155,000 individual lizards within the MP4 footprint. MP4 will result in the permanent loss and modification of tussock grassland, shrubland, and rock tor habitats, all of which provide critical ecological resources for lizards. The removal of schist rock outcrops represents the most significant direct effect, as these habitats support specialised species such as kōrero gecko and cannot be readily replaced. Vegetation

clearance and ground disturbance will also result in the injury or mortality of lizards during construction, particularly for low-mobility species with strong site fidelity. Habitat fragmentation caused by infrastructure development will reduce connectivity between habitat patches, potentially isolating populations and limiting dispersal. In addition, the creation of new habitat edges may degrade adjacent habitats through altered microclimatic conditions and increased predator exposure, while displacement of lizards into surrounding areas may lead to increased competition and reduced habitat suitability.

Direct effects on lizards have been summarised in sub-headings for the respective mining area but are detailed in full in Bioresearches (2026d).

9.6.5.1.1 Coronation Mining Area

The magnitude of effect on lizard species in the Coronation Mining Area is assessed as moderate prior to mitigation and is expected to remain moderate following the implementation of the proposed mitigation measures. This reflects the permanent nature of some habitat loss and disturbance effects, despite the application of avoidance, minimisation, and management measures. The proposed mitigation package is expected to reduce the extent of adverse effects; however, residual effects will remain at a moderate level. Mitigation measures and the assessment of residual effects are summarised in Section 9.6.5.5 of this report.

Direct effects on lizards in the Coronation Mining Area include:

- Potential injury or permanent loss of approximately 22,500 individual McCann's skink during vegetation and habitat removal which is roughly 1.6% of the estimated population on OGNZL holdings and 0.2% of the estimated population in the Macraes ED;
- Potential injury or permanent loss of approximately 30,300 southern grass skink which is roughly 3.7% of the estimated population on OGNZL landholdings and 0.4% of the estimated population in the Macraes ED;
- Potential injury or permanent loss of approximately 2,050 korero gecko individuals which is roughly 3.1 % of the estimated population on OGNZL landholdings and 0.7 % of the estimated population in the Macraes ED;
- The permanent loss of 83.1 ha of suitable habitat for McCann's skink, southern grass skink and korero gecko, which is 6.4% of the estimated habitat on OGNZL landholdings and 0.7% of the estimated habitat in the Macraes ED; and
- The permanent loss of 48 rock outcrops, which has a total extent of 0.167 ha.

9.6.5.1.2 Central Mining Area

The magnitude of effect on lizard species in the Central Mining Area is assessed as moderate both before and after mitigation. This reflects the permanent nature of some habitat loss and disturbance effects, despite the application of avoidance, minimisation, and management measures. The proposed mitigation package is expected to reduce the extent of adverse effects; however, residual effects will remain at a moderate level. Details of the mitigation measures and residual effects assessment are provided in Section 9.6.5.5 of this report.

Direct effects on lizards in the Central Mining Area include:

- Potential injury or permanent loss of approximately 12,400 McCann's skink individuals which is roughly 2.9 % of the estimated population on OGNZL landholdings and 0.3% of the estimated population in the Macraes ED;
- Potential injury or permanent loss of approximately 18,100 southern grass skink individuals which is roughly 2.0 % of the estimated population on OGNZL landholdings and 0.2 % of the estimated population in the Macraes ED;
- Potential injury or permanent loss of approximately 1,200 korero gecko individuals which is roughly 2.4 % of the estimated population on OGNZL landholdings and 0.5 % of the estimated population in the Macraes ED; and
- The permanent loss of 49.9 ha of suitable habitat for McCann's skink, southern grass skink and korero gecko, which is 3.8 % of the estimated habitat on OGNZL landholdings and 0.4 % of the estimated habitat in the Macraes ED.

With regard to the GPUG extension area, Bioresearches (2026d) found that there are no direct effects anticipated for the McCann's skink, southern grass skink or korero gecko.

9.6.5.1.3 Golden Bar Mining Area

The magnitude of effect on lizard species in the Golden Bar Minig Area is assessed as moderate both before and after mitigation. This reflects the permanent nature of some habitat loss and disturbance effects, despite the application of avoidance, minimisation, and management measures. The proposed mitigation package is expected to reduce the extent of adverse effects; however, residual effects will remain at a moderate level. Details of the mitigation measures and residual effects assessment are provided in Section 9.6.5.5.

Direct effects on lizards in the Golden Bar Haul Road include:

- Injury or permanent loss of approximately 6,700 McCann's skink individuals, which is roughly 2.9% of the estimated population on OGNZL landholdings and 0.3% of the estimated population in the Macraes ED;
- Injury or permanent loss of approximately 9,800 southern grass skink individuals, which is roughly 1.2 % of the estimated population on OGNZL landholdings and 0.4% of the estimated population in the Macraes ED;
- Injury or permanent loss of approximately 650 korero gecko individuals, which is roughly 1.0% of the estimated population on OGNZL landholdings and 0.6% of the estimated population in the Macraes ED;
- The permanent loss of 26.4 ha of suitable habitat for McCann's skink, southern grass skink and korero gecko, which is 2.0 % of the estimated habitat on OGNZL landholdings and 0.2% of the estimated habitat in the Macraes ED; and
- Permanent loss of two rock outcrops (total extent: 0.015 ha).

Direct effects are anticipated for the Golden Bar Mining Area; these are summarised below:

- Injury or permanent loss of approximately 18,900 McCann's skink individuals, which is roughly 2.9% of the estimated population on OGNZL landholdings and 0.3% of the estimated population in the Macraes ED;
- Injury or permanent loss approximately 27,500 southern grass skink individuals, which is roughly 3.4 % of the estimated population on OGNZL landholdings and 0.4 % of the estimated population in the Macraes ED;
- Injury or permanent loss of approximately 1,800 korero gecko individuals, which is roughly 2.8 % of the estimated population on OGNZL landholdings and 0.6 % of the estimated population in the Macraes ED;
- The permanent loss of 73.8 ha of suitable habitat for McCann's skink, southern grass skink and korero gecko, which is 5.7 % of the estimated habitat on OGNZL landholdings and 0.2 % of the estimated habitat in the Macraes ED; and
- Permanent loss of 14 rock outcrops (total extent: 0.118 ha).

9.6.5.2 Indirect Effects on Lizards

Potential indirect effects are anticipated across approximately 180.8 ha of suitable lizard habitat surrounding the MP4 footprint and were generally consistent amongst mining areas. A precautionary approach has been adopted due to the inherent uncertainty associated with predicting the extent and severity of indirect ecological effects.

Vegetation loss is described as a direct effect in the section above, however habitat degradation specifically on the edges of the MP4 footprint is considered as an indirect effect. The degradation can occur through disturbance effects such as vibration and blasting, dust deposition, artificial lighting, drainage pattern changes and sediment runoff. Noise and vibration from blasting and heavy machinery may temporarily disturb lizards, displace individuals from refuges, and reduce habitat suitability in nearby areas, particularly within rocky habitats where refuge sites occur within schist outcrops and rock crevices. Changes to local hydrology resulting from drainage, dewatering, or altered surface water interactions may also influence habitat quality, particularly for species associated with damper habitats. However, these effects are expected to be limited due to the continued influence of rainfall-derived soil moisture, the mobility of lizards, and the implementation of water management measures.

Ground subsidence associated with underground mining has the potential to alter refuge structures, drainage patterns, and vegetation communities. While localised effects may occur, particularly in areas such as Deepdell Creek, any changes to rocky refuges are not expected to materially affect lizard populations, and areas with higher subsidence risk will be managed through avoidance and site-specific controls.

Additional indirect effects may arise from dust deposition, artificial lighting, sediment runoff, and the spread of exotic plant and animal species. Dust may affect vegetation health and prey availability, while artificial lighting could influence the behaviour of nocturnal gecko species and increase predator risk. Sediment runoff has the potential to affect adjacent habitats through vegetation changes and reduced habitat quality. Mining activities may also facilitate the spread of pest species through habitat disturbance and increased access. However, these effects are expected to be localised, manageable, and largely confined to areas immediately adjacent to active operations.

In summary, while short-term behavioural responses and localised habitat quality changes are anticipated, Bioresearches (2026d) found that indirect effects are not expected to result in significant population-level impacts on lizards beyond the MP4 footprint and immediate surrounding areas.

9.6.5.3 Cumulative Effects on Lizards

Cumulative effects are an important consideration, given the long history of mining and land-use change within the Macraes ED. Historical habitat loss and fragmentation, combined with ongoing agricultural intensification and mining activities, have already contributed to declines in several lizard species and the reduction of high-quality habitats. MP4 will contribute incrementally to these cumulative pressures, potentially exacerbating long-term declines if not effectively managed. While cumulative effects are difficult to

quantify, they have been considered in the assessment of magnitude, particularly in the context of observed population declines and the reduction of complex habitats such as schist tors and intact tussock grassland.

The magnitude of effect on lizards varies depending on habitat type, species ecology, and conservation status. For more widespread and adaptable species, such as grassland and shrubland-associated skinks, the magnitude of effect is generally assessed as low to moderate due to the availability of similar habitat in the surrounding landscape. For rock-dwelling species with more specialised habitat requirements, the magnitude is considered moderate to high due to the limited availability and irreplaceable nature of schist habitats. Greater weight is applied to species with higher conservation status and ecological importance, as these populations are less resilient to disturbance. The spatial scale of effects, duration of habitat loss, and the ecological role of each species have also been considered, with permanent habitat loss and long-term changes assigned higher magnitudes.

9.6.5.4 Taoka / Taonga Species

While no lizard species are identified as taoka species in Schedule 97 of the Ngāi Tahu Claims Settlement Act 1998, evidence presented by Jade Watkin (2026) confirms the cultural significance of kārara (lizards) to Kāi Tahu.[34] Lizards, including tussock skink, McCann's skink, and Kawarau gecko (a close relative of kōrero gecko), are recognised as spiritual guardians of wāhi tapu and urupā, valued kaitiaki, and an important component of Kāi Tahu whakapapa.

Accordingly, the assessment of effects on lizards extends beyond ecological considerations alone and recognises the cultural values associated with indigenous lizard species. MP4 has the potential to affect culturally significant lizard populations through habitat loss, habitat modification, disturbance, displacement, and mortality associated with vegetation clearance and mining activities. These effects are particularly relevant where they affect species or habitats that contribute to the continued presence and ecological function of indigenous lizards within the wider Macraes landscape.

As mentioned in the avifauna section of this report, only Ngāi Tahu can identify any actual or potential effects on cultural values. OGNZL is committed to ongoing discussions with Kā Rūnaka around how to appropriately avoid, remedy and mitigate adverse effects on cultural values associated with lizards as part of MP4.

---

[34] Expert Evidence of Jade Watkin for ecology and Kāi Tahu Cultural Values (10 April 2026) on the application made under the FTAA by Matakanui Gold Limited (Santana Minerals).

9.6.5.5 Mitigation Approaches and Residual Effects

Avoidance and minimisation measures will be implemented to reduce the scale and severity of effects on lizard populations. These include:

- The avoidance of high-value habitats where practicable, particularly schist rock outcrops, through detailed design and construction planning;
- Vegetation clearance will be staged to allow lizards to disperse from active work areas, and pre-clearance surveys and salvage operations will be undertaken where required to relocate individuals from high-risk areas;
- Habitat retention and the protection of adjacent vegetation will be prioritised to maintain ecological connectivity;
- Implementation of erosion and sediment control measures to minimise sediment discharge to adjacent habitats;
- Use of sediment retention ponds and water management systems to reduce drainage-related effects and maintain catchment hydrology;
- Hydrological management will aim to maintain suitable conditions in adjacent habitats;
- Dust suppression, erosion and sediment control, and weed management will be managed to maintain habitat quality;
- Artificial lighting will be managed to minimise impacts on nocturnal species and spill into adjacent habitats where practicable;
- Establishment of avoidance areas (orange no-go zones) in locations where subsidence risk on Deepdell Creek is greatest;
- Progressive rehabilitation of disturbed land to restore habitat values over time;
- Monitoring and adaptive management where indirect effects are identified beyond predicted levels; and
- Biosecurity measures that will reduce the spread of invasive species.

These mitigation measures and actions will be implemented as detailed in the Lizard Management and Monitoring Plan ("**LMP**") provided in **Part C** of these application documents.

The implementation of these mitigation measures will substantially reduce the extent and severity of effects, however residual effects on lizard populations are expected to remain. The ecological effect of MP4 on lizards is summarised in **Table 9-7**. With the implementation of the above proposed mitigation measures, the level of residual effect for McCann's skink

will be reduced to low in all mining areas. However, the southern grass skink and korero gecko will have a high residual effect in all mining areas, with the exception of the GPUG extension area.

Table 9-7: Ecological Effect of Lizards Pre and Post Mitigation and Residual Level of Effect (Modified from Bioresearches, 2026c)

Location	Vegetation system / ecosystem	Ecological Value	Magnitude of Effect (prior to mitigation)	Residual Level of Effect
Coronation North	McCann's Skink	Low	Moderate	Low
	Southern grass skink	High	Moderate	High
	Korero gecko	High	Moderate	High
GPUG Extension	McCann's Skink	Low	Negligible	Very Low
	Southern grass skink	High	Negligible	Very Low
	Korero gecko	High	Negligible	Very Low
Central Mining Area	McCann's Skink	Low	Moderate	Low
	Southern grass skink	High	Moderate	High
	Korero gecko	High	Moderate	High
Golden Bar Haul Road	McCann's Skink	Low	Moderate	Low
	Southern grass skink	High	Moderate	High
	Korero gecko	High	Moderate	High
Frasers West Seepage Capture Drains	McCann's Skink	Low	Low	Very Low
	Southern grass skink	High	Low	Low
	Korero gecko	-	-	

Location	Vegetation system / ecosystem	Ecological Value	Magnitude of Effect (prior to mitigation)	Residual Level of Effect
Golden Bar Mining Area	McCann's Skink	Low	Moderate	Low
	Southern grass skink	High	Moderate	High
	Korero gecko	High	Moderate	High
MP4 Project overall	McCann's Skink	Low	High	Moderate
	Southern grass skink	High	High	Very High
	Korero gecko	High	High	Very High

Residual effects will be addressed through the proposed compensation package informed by BOAMs. Noting a BOAM was not developed for kōrero gecko due to insufficient baseline density data; the BOAM compare predicted residual losses of lizard habitat and individuals with the expected gains from salvage and relocation, habitat enhancement and restoration, predator exclusion within the MEEA, predator suppression, browser control, and long-term habitat protection. The BOAM outputs indicate that the proposed compensation package is expected to deliver a net positive outcome for lizards over time, provided the measures are implemented, monitored and adaptively managed as proposed. The compensation package includes:

> The establishment of a 252 ha predator-proof fence to create a predator-free sanctuary for indigenous lizards, also referred to as the MEEA;

> Landscape-scale pest control across an approximately 1,170 ha buffer surrounding the fenced area;

> The stock-fencing of approximately 355 ha of existing tussock grassland which will be protected in perpetuity;

> The stock-fencing of approximately 87.84 ha of existing dry shrubland which will be protected in perpetuity;

> The stock-fencing of approximately 44.5 ha of existing rock outcrop/tor which will be protected in perpetuity;

> The removal of approximately 265 ha of plantation forestry at Mt Highlay; and

> The establishment of Murphys Link and lizard release area, an approximately 395.54 ha legally protected connection between the MEEA predator-exclusion fence and the high value Redback Covenant (which supports the endangered grand skink).

The broader MP4 terrestrial biodiversity compensation package could also have benefits on lizards and lizard habitats. The proposed compensation package provides a rare opportunity to restore threatened fauna not directly affected by MP4, including a population of the Regionally Endangered Otago skink within the MEEA, and to re-establish components of the historically depleted podocarp forest ecosystem within the Macraes ED through enrichment planting at Cranky Jims Link. These outcomes extend beyond addressing project-related effects and contribute to broader biodiversity restoration objectives within the district.

Collectively, the proposed restoration and protection measures are expected to deliver substantial benefits for terrestrial ecology and lizard species achieving a neutral outcome for lizard values.

9.6.6 Mammalian Pests

Alliance Ecology (2026) has prepared a Pest Control and Elimination Plan ("**PCEP**") provided in **Part C** of these application documents.

MP4 proposes an intensive pest management approach as part of the compensation package for terrestrial vegetation, invertebrates, avifauna and lizards. This approach will result in a substantial reduction in the abundance and distribution of introduced mammalian pest species within MP4's biodiversity management areas. Target species include rodents (rats and mice), mustelids, possums, feral cats, hedgehogs, rabbits, hares, deer, pigs and other ungulates. Within the MEEA, a predator exclusion fence and associated eradication programme will be used to achieve and maintain near-zero abundance of target pest species through ongoing surveillance, maintenance and rapid incursion response. In surrounding suppression and browser management areas, pest populations will be maintained at low densities through trapping, baiting, shooting and other approved control methods.

The direct effect of MP4 will be a reduction in pest animal populations within managed areas. While this represents an adverse effect on the target pest species, it is intentional and forms a key component of the Project's biodiversity compensation and enhancement strategy. Reducing predator abundance will decrease predation pressure on indigenous lizards, birds and invertebrates, while browser control will reduce grazing and browsing impacts on indigenous vegetation and restoration plantings.

The pest management programme is expected to result in significant positive ecological outcomes well ahead of the implementation of Predator Free 2050 at a national level, including improved habitat quality, increased survival and recruitment of native fauna, enhanced restoration success, greater ecological connectivity and improved ecosystem resilience. These benefits are anticipated to extend beyond the immediate management areas and contribute to long-term biodiversity gains across the wider Macraes landscape.

9.6.7 Compensation for Loss of Terrestrial Biodiversity

As detailed in the sections above, MP4 results in more than minor residual adverse effects on terrestrial biodiversity following the application of the effects management hierarchy. These residual effects arise from the permanent loss of indigenous vegetation and habitats (particularly tussock grassland, grey scrub, and rock outcrops) as well as associated impacts on fauna, including population-level effects on indigenous lizards and the loss of habitat for avifauna, including several TAR species. Given the scale and permanence of these effects, they cannot be fully addressed through avoidance, remediation, or mitigation alone, and therefore require a robust residual effects management response in the form of biodiversity compensation.

A comprehensive, landscape-scale biodiversity compensation package has been developed in accordance with the National Policy Statement for Indigenous Biodiversity (“**NPS-IB**”), supported by application of the BOAM. While the modelling framework identifies limits to achieving a strict offset, it demonstrates that a well-designed compensation approach can deliver an overall net positive biodiversity outcome when accounting for time lags, uncertainty, and risk. Accordingly, the proposed measures focus on restoration, enhancement, protection, and long-term management of indigenous biodiversity within the Macraes ED, ensuring ecological alignment with the impact area and durability of outcomes. The ecological response has been developed on the basis that ecological outcomes should be maximised in a manner that is proportionate, durable, and capable of implementation over the life of the Project and appropriately manages ecological effects while enabling the delivery of a project that provides significant regional and national benefits.

The compensation strategy has been described throughout this report and is focused on three key areas:

> MEEA and Murphys Link;

> Cranky Jims Link; and

> The Mt Highlay Restoration Area.

These areas collectively provide a connected and ecologically representative landscape for delivering biodiversity gains. Across these areas, the approach integrates habitat restoration, pest control, covenant protection, and ecological connectivity to address the specific residual effects of the MP4 at an integrated landscape scale. The ecological package has been designed to achieve an outcome that is as close as reasonably practicable to a net-zero ecological effect outcome when assessed against the direct effects generated by the Project. This has been pursued through a comprehensive suite of avoidance measures, impact minimisation, habitat protection, restoration works, offsetting, long-term management commitments, monitoring and adaptive management provisions.

Key elements of the compensation approach and the residual effects they address include:

- A total of 435 ha of large-scale habitat protection and enhancement comprising 355 ha of tussock grassland protection, 48 ha of shrubland protection, and 32 ha rock tor habitat protection at the MEEA and Murphys Link, aided by the establishment of a 252 ha predator-proof fence at MEEA (which includes a rare population of Otago skink within the footprint) and mammalian pest management across approximately 1,170 ha surrounding the fence;
- Extensive restoration planting comprising 175 ha tussock grassland and 15 ha rock outcrop edge planting at Mt Highlay; 50 ha planting and 6.5 ha protection of dry shrubland and 0.56 ha rock outcrop and tor protection at Cranky Jims;
- Approximately 395 ha of continuous habitat connectivity and covenant integration, including linking existing protected areas such as MEEA, Cranky Jims, and Redbank;
- Targeted fauna management, including intensive pest control and habitat enhancement for lizards and avifauna;
- Restoration of rare and functionally extinct ecosystems, particularly podocarp forest elements within Cranky Jims Link;
- Removal of degrading land uses and weed control, including the removal of planted exotic pine saplings from an area of approximately 265 ha at Mt Highlay and ongoing control of invasive species; and
- Monitoring and adaptive management, implemented through the Residual Effects Terrestrial Restoration Plan ("**RETRP**").

Collectively, these measures compensate for residual adverse effects by replacing and significantly expanding indigenous habitat extent, improving habitat quality and ecological condition, supporting recovery and uplift of indigenous species populations, and enhancing landscape-scale ecological function and connectivity. While some effects cannot be

directly offset on a like for like basis, the integrated compensation approach delivers substantial and enduring biodiversity gains that exceed the magnitude of the residual losses.

Overall, subject to implementation of the proposed restoration, protection, and monitoring measures, the compensation package is considered sufficient to address MP4's residual terrestrial ecological effects and achieve a net positive biodiversity outcome at the landscape scale, consistent with the requirements of the NPS-IB and the requirements of the FTAA. When the direct effects response is considered in isolation, the programme achieves an outcome that approaches ecological neutrality and reflects a high degree of ecological responsibility. When broader enhancement initiatives are considered alongside the direct-effects response, the overall ecological outcome is materially improved beyond that reflected in the direct-effects response alone and achieves an overall ecological outcome that is comprehensive, proportionate, and directed toward achieving enduring ecological outcomes. It reflects a level of ecological management that is commensurate with the scale and significance of the effects, while recognising the practical and economic realities associated with achieving further incremental gains.

9.6.8 Natural Inland Wetlands

MP4 will result in both direct and indirect effects on natural inland wetlands through vegetation clearance, reclamation, soil disturbance, hydrological modification, and ongoing mining activities. Effects on wetlands will be realised in wetland ecosystem types present throughout the disturbance footprint and within the 100 m buffer zone. A precautionary approach has been adopted whereby all mapped wetland areas (including 0.82 ha that did not meet strict delineation criteria) are treated as natural inland wetlands, recognising seasonal variability and the potential for underrepresentation of wetland extent during summer surveys. Riparian vegetation has also been incorporated into the wetland extent due to its functional and compositional similarity.

9.6.8.1 Direct Effects

MP4 will have direct effects on wetlands across the Macraes Operation. **Table 9-8** below provides a summary of the total extent of direct loss of wetland ecosystems across the different mining areas. Within OGNZL Landholdings, the total wetland loss represents 20.77% of the currently mapped wetland extent; though, additional wetland extent is likely to be present within the landholdings which has not been identified through the mapping exercise.

Table 9-8: Extent of predicted effect (direct loss plus additional 20 m edge) of natural wetland ecosystems per project area

Ecosystem	Value	Coronation North	Central Mining Area	Golden Bar / Haul Road	Camp Creek	Coal Creek	Total Affected area (ha)	Extent Within OGNZL Landholdings (ha)
Ephemeral	Moderate to Very High	0.39	0.62	0.13	-	-	1.14	9.70
Sedgeland	Low to Moderate	0.55	0.12	0.76	0.05	0.26	1.74	13.24
Freshwater herbaceous	Low to High	1.66	0.03	0.41	0.19	2.49	4.78	30.59
Shrubland wetland	Moderate	0.01	-	0.02	-	-	0.03	0.082
Seepage	High	0.02	-	-	-	-	0.02	0.13
Copper Tussock	High	-	-	-	-	0.21	0.21	0.95
Induced wetland	Negligible to Low	0.35	-	-	-	3.23	3.58	-
Total		**2.97**	**0.77**	**1.33**	**0.24**	**2.96**	**11.50**	**55.36**

Direct effects will arise from the permanent reclamation of wetlands which have been assumed for within the MP4 footprint and conservatively also includes areas within a 20 m buffer. Direct effects also conservatively include potential dewatering of wetlands though these effects may not be realised as the drawdown estimates from GHD (2026a) do not account for potential contributions to wetlands from shallow and perched groundwater, or surface water. A total of approximately 11.50 ha of wetland may be directly lost, resulting in reductions in wetland extent at both local and ED scales. Affected wetland types with moderate to very high values include ephemeral wetlands, sedgelands, freshwater herbaceous wetlands, seepage wetlands, and wetland shrublands. These ecosystems are generally limited in extent but are of elevated ecological value due to their rarity, naturalness, and association with TAR plant species. The most significant direct effect relates to the loss of ephemeral wetlands, with approximately 1.14 ha to be affected. These wetlands are classified as critically endangered ecosystems nationally and can support highly specialised plant assemblages. Despite representing a relatively small proportion of their wider ED extent (approximately 0.84%), and often dominated by exotic grasses, their loss is considered significant due to their ecological importance and limited resilience.

While these wetland losses represent small proportions at a regional scale, they contribute to cumulative wetland reduction and involve ecosystems of varying ecological value, including habitats capable of supporting TAR flora. These direct effects are permanent and irreversible, resulting in loss of ecosystem extent, ecological function, and habitat complexity.

9.6.8.2 Indirect Effects

MP4 will also have indirect effects on wetlands across the Macraes Operation. **Table 9-9** below provides a summary of the total extent of indirect loss of wetland ecosystems across the different mining areas.

Table 9-9: Extent of indirect (outside works footprint, within 20 to 100 m buffer) effect of wetland ecosystems per project area

Ecosystem	Coronation North	Central Mining Area	Golden Bar / Haul Road	Camp Creek	Coal Creek	WRS	Total Affected area (ha)
Ephemeral	-	2.64	1.23	-	-	-	3.87
Sedgeland	0.16	0.13	1.07	-	-		1.36

Ecosystem	Coronation North	Central Mining Area	Golden Bar / Haul Road	Camp Creek	Coal Creek	WRS	Total Affected area (ha)
Freshwater herbaceous	0.12	0.08	0.6	-	0.39	0.97	2.16
Shrubland wetland	-	-	-	-	-	-	-
Seepage	-	-	-	-	-	-	-
Copper tussock	0.08	-		-	-	-	0.08
Total	**0.36**	**2.85**	**2.9**	**-**	**0.39**	**0.97**	**7.47**

Indirect effects on wetlands are primarily associated with changes to hydrology, including reduced overland flow paths and surface water flows, and alterations to contributing catchments. Drainage may reduce soil saturation and disrupt wetland hydrological regimes, potentially leading to drying, loss of wetland function, and transition to terrestrial vegetation communities. These effects are particularly important for ephemeral wetlands, where prolonged drying may alter vegetation dynamics and seedbank viability, potentially resulting in permanent ecosystem shift.

Drainage may occur due to earthworks intercepting groundwater or altering surface water catchment, predominantly for construction of Golden Bar Haul Road and Macraes Road realignment. Drainage may also occur due to reduction in surface flows and low drawdown levels as result of catchment loss from mining activities at Coronation. The potential draining of wetlands will be minimised through construction design and mitigated through the implementation of sediment retention ponds and discharging equivalent catchment volumes back into the wider contributing catchment. The magnitude of effect for the drainage of wetlands has conservatively been assessed as low as the activities which may alter surface water are unlikely to modify hydrological function or result in a reduction of wetland values.

Conversely, increases in catchment inputs due to water diversion or discharge may raise water levels in some wetlands, potentially expanding wetland extent into adjacent terrestrial areas. While this may represent a locally positive hydrological effect, it may also alter vegetation composition and reduce habitat heterogeneity by favouring more water-tolerant species. Overall, the potential catchment increase from sediment retention ponds is

considered to have a low magnitude effect, with potential positive outcomes where any induced wetlands are appropriately managed through stock exclusion, weed control, and indigenous planting.

Works near wetlands could result in accidental encroachment from earthworks, vehicle movements, sediment retention pond construction, material storage, slope failures, or contaminant discharges. This may reduce wetland extent and ecological values through vegetation damage, soil compaction, altered hydrology, and reduced water quality. Overall, accidental encroachment is considered to have a low to moderate magnitude effect, with the potential for both temporary disturbance and permanent wetland degradation.

Works near wetlands may generate sediment and dust that can degrade wetland condition and downstream receiving environments. Potential effects include vegetation smothering, reduced photosynthesis, infilling of wetland pools and channels, poorer water quality, and impacts on aquatic habitats through increased turbidity. Sediment may also be transported downstream, particularly during wet periods, extending effects beyond the immediate work area. Without mitigation, sedimentation and dust are considered to have a high magnitude effect due to the potential for significant adverse impacts on wetlands and downstream ecosystems.

Water quality may be altered from the introduction of contaminants through discharge of mine-related water to wetlands, potentially reducing wetland condition and ecological values. However, with the proposed water management and treatment measures in place, adverse effects are expected to be minimal. Overall, water discharges are assessed as having a low magnitude effect, with wetlands also providing additional natural filtration before water reaches downstream environments.

Indirect effects resulting from the Camp Creek and Coal Creek Dams are expected, primarily upstream of the reservoirs, where water levels may increase due to damming. This may extend wetland conditions into tributaries and gullies, potentially creating new or expanded wetland areas and, in some cases, providing a localised positive effect. However, these changes may also alter vegetation composition and reduce habitat diversity.

9.6.8.3 Mitigation Approaches and Residual Effects

The loss of 11.5 ha of wetlands as a result of direct effects from the MP4 project was assessed to be of moderate magnitude due to the overall extent of wetland loss, and its relative proportion within the local landscape.

The highest levels of effect occur for ephemeral and seepage wetlands at Coronation Mining Area, where effects are assessed as very high due to their ecological importance and the

high magnitude of loss. High levels of effect are also identified for freshwater herbaceous wetlands at Coronation North and ephemeral wetlands in the Central Mining Area and the Golden Bar Mining Area. Most other wetland types experience moderate to low levels of effect.

The indirect level of effect ranges from very low to low on all wetlands types in the Coronation Mining Area, Central Mining Area, Golden Bar Mining Area and Golden Bar Haul Road as a result of dewatering and drainage, catchment increase, sedimentation and dust and accidental encroachment. Indirect effects can be effectively managed through mitigation reducing the overall level of effect to very low or low.

Avoidance and minimisation measures have been incorporated into project design where practicable, including the removal of the Back Road WRS from the footprint, thereby avoiding significant wetland loss. Additional measures include clear demarcation of wetland boundaries including the 20 m buffer area, staged reclamation, erosion and sediment control, dust suppression, and management of drainage and hydrology. Potential hydrological mitigation measures include groundwater recharge and flow augmentation to maintain wetland function where necessary. Details regarding the monitoring and management of dewatering and drainage is provided within the WMMP. TAR wetland plants will be managed through the Vegetation and TAR Flora Management Plan, including salvage, propagation, and monitoring.

Residual adverse effects will remain for some high-value wetland types where direct reclamation cannot be avoided. These will require the implementation of offsetting or compensation measures outlined in Section 9.6.8.4 of this report, via the proposed consent conditions.

9.6.8.4 Compensation for Loss of Natural Inland Wetlands

MP4 proposes a comprehensive biodiversity compensation package to address residual adverse effects arising from the loss and degradation of natural inland wetlands as described above. Following application of the effects management hierarchy, these losses are unavoidable, resulting in residual adverse effects that are more than minor and require further management under the NPS-FM.

A strict aquatic biodiversity offset is not considered feasible due to constraints in replicating equivalent wetland extent and hydrological conditions within the receiving environment. Creation of new wetlands would require significant modification of existing stream systems, resulting in additional adverse effects on freshwater values. Therefore, a comprehensive aquatic biodiversity compensation approach has been adopted.

The compensation strategy focuses on the restoration, enhancement, protection, and long-term management of currently degraded wetland ecosystems within OGNZL owned lands forming part of the Macraes ED, ensuring ecological and spatial alignment with impacted habitats. Using the BOAM, the package has been designed to remain as close as practicable to like for like outcomes, while applying a precautionary and conservative framework. A minimum 1:2 loss to restoration ratio ensures a net increase in wetland extent and condition.

Key compensation measures include:

> Restoration and enhancement of approximately 2.78 ha of degraded ephemeral wetlands;

> Restoration and enhancement of approximately 5.48 ha of sedgeland wetland;

> Establishment and enhancement of approximately 5.06 ha of copper tussock wetland;

> Restoration and protection of approximately 0.12 ha of shrubland wetland;

> Enhancement and establishment of TAR wetland plants;

> Protection and stock exclusion of approximately 0.22 ha of headwater seep wetland; and

> Protection and stock exclusion of approximately 0.96 ha of wetland, and 2.48 ha of riparian habitats.

The proposed Camp Creek and Coal Creek wetland compensation package also includes restoration, enhancement and protection actions across multiple locations within OGL landholdings. The key components include:

> Restoration and enhancement of approximately 1.47 ha of sedgeland wetland;

> Restoration, establishment and enhancement of approximately 0.54 ha of copper tussock;

> Enhancement and establishment of TAR wetland plants; and

> Protection and stock exclusion of 9 ha of wetland.

Additional measures, such as the experimental creation of ephemeral wetlands, are proposed to deliver further biodiversity benefits but are not relied upon in the quantitative assessment.

The compensation package also incorporates robust implementation, monitoring and assurance mechanisms through the WMMP provided in **Part C** of these application

documents. These include baseline surveys, defined performance targets, permanent monitoring plots, hydrological monitoring, and adaptive management triggers to ensure that ecological outcomes are achieved and sustained over time.

In summary, the proposed compensation package addresses residual adverse effects by replacing lost wetland extent with a greater area of restored habitat, improving ecological condition and function, and enhancing biodiversity values and connectivity across the landscape.

The proposed compensation package is expected to deliver positive ecological outcomes that outweigh the residual adverse effects and is considered sufficient to address impacts as a result of MP4 on natural inland wetlands in accordance with the NPS-FM and is appropriate, proportionate and consistent with the purpose and decision-making framework of the Act.

9.7 AQUATIC ECOLOGY AND FRESHWATER EFFECTS

An assessment of non-wetland aquatic environmental effects has been prepared by Viridis (2026a), whereas Viridis (2026c) is a memorandum that assesses effects associated with fish passage for the proposed Coal Creek and Camp Creek dams associated with MP4. These technical assessments are provided in **Part B** of these application documents.

A summary of the key conclusions of the various reports has been provided below. It is noted that the below section is not separated into mining areas, instead summaries are provided for the freshwater and aquatic ecology effects in alignment with the relevant technical reports.

9.7.1 Effects of Discharges

9.7.1.1 Effects on Flow

MP4 is anticipated to alter receiving-environment flows through seepage capture, augmentation dam releases, treated-water returns, flushing flows, and, in the longer term, pit lake overflows. In many receiving environments, these changes are expected to provide positive effects on aquatic ecology through increased flow permanence, a reduction in the frequency and duration of dry periods, improved habitat availability and enhanced flow continuity. These benefits may reduce the likelihood of stagnant water conditions that support nuisance algae growth and elevated water temperatures. However, some localised flow reductions are also predicted, particularly within Murphys Creek and the Golden Bar Creek.

The changes to the receiving environment flows can increase the risk of:

- Erosion, scour and sediment transportation, particularly near discharge points or where increase flow velocities interact with unstable banks or bed material; and
- Excess fine sediment generation which can smother benthic habitat, disturb channel morphology and contribute to secondary water quality effects such as increased turbidity.

More sedimentation related effects are detailed in Section 9.7.2.5 below.

Further, this could also lead to an increase in the total area of wetted habitat, and it could also alter habitat type and heterogeneity. Over time, such changes may be reflected in aquatic community composition, through a shift towards or dominance of taxa better adapted to deeper or faster-flowing conditions.

To ensure any effects on the receiving-environment flows are appropriately managed, Viridis (2026a) recommend the following mitigation measures:

- A discharge outlet design that includes outlet configuration, energy dissipation and erosion protection (such as a riprap) where appropriate;
- Applying site-specific approaches including ground infiltration approaches instead of direct discharge (where appropriate) to further reduce the potential for localised hydraulic disturbance; and
- Continuous flow monitoring systems at Deepdell Creek and other key receiving environment locations to monitor and identify any unexpected changes following the implementation of MP4.

The proposed mitigation and offsetting are also summarised in **Part A.10** of this report and incorporated into the proposed consent conditions, included in **Part D** of this substantive application documents.

9.7.1.2 Effects on Water Quality

The proposed approach to water quality is expected to have positive aquatic ecology effects through alignment with best-practice guidance and relevant freshwater regulations. Robust protection for aquatic ecosystems is provided by targeting key stressors and managing both short-term and long-term impacts. The trigger values and compliance criteria are also expected to improve water quality for most parameters compared with both existing conditions and the outcomes permitted under current consent limits.

The trigger values and compliance criteria would improve water quality throughout the waterbodies impacted by the Macraes Operation, reducing exposure to toxicants and ionic stressors, lowering the risk of chronic toxicity to aquatic organisms and better managing

nutrient enrichment and associated eutrophication responses. The proposed framework provides a higher level of protection than what is currently consented and therefore, would have positive effects on the receiving environment.

9.7.2 Effects of Physical Works

9.7.2.1 Stream Works

The proposed works will result in the reclamation and partial realignment of Trimbells Gully, and the partial reclamation of the Clydesdale Creek tributary, leading to a permanent reduction in overall stream extent. At Trimbells Gully, this comprises the loss of approximately 180 m of permanent stream and 670 m of intermittent stream (850 m total). While there is a reduction in channel length, the realigned section of Trimbells Gully will be designed to maintain hydrological function and improve habitat quality and diversity. Stream Ecological Valuation ("**SEV**") results indicate that ecological values are expected to increase following realignment, demonstrating that ecological function can be maintained or enhanced despite the reduced spatial extent of stream habitat.

Avoidance and mitigation have been incorporated into the proposal where practicable, including refinement of the Trimbells Gully WRS footprint to retain upper catchment values and minimise stream loss, and the design of the realigned channel to enhance in-stream and riparian habitat. However, some residual loss of stream habitat is unavoidable due to site constraints. To address these residual effects, a programme of ecological compensation is proposed, involving the restoration and enhancement of alternative stream reaches within the wider catchment. Permanent habitat loss will be compensated through enhancement of Murphys Creek, while intermittent habitat loss will be addressed through enhancement of the Waikouaiti River North Branch.

The proposed compensation focuses on improving existing degraded stream environments to achieve an overall ecological uplift. The Waikouaiti River North Branch currently exhibits very low ecological values, with artificial channelisation, poor water quality, and limited riparian vegetation, and therefore presents a significant opportunity for improvement. Murphys Creek, while of moderate ecological value, will benefit from enhanced riparian planting, stock exclusion, and improved habitat connectivity. The extent of proposed enhancement exceeds the minimum required based on ecological compensation ratios, with approximately 640 m of enhancement proposed for Murphys Creek and around 950 m for the Waikouaiti River North Branch with full implementation of the MP4 project. Subject to appropriate design, implementation, and ongoing management, the proposed mitigation and compensation measures are anticipated to reduce the overall level of effect of the

stream works to low, while achieving no net loss and potentially an overall net gain in freshwater ecological values within the catchment.

9.7.2.2 Effects on Fish

Stream reclamation and realignment works have the potential to cause injury or mortality to fish. However, Viridis (2026a) found that affected stream reaches are in upper catchment areas where fish presence is highly unlikely. eDNA sampling indicates that fish are absent from Trimbells Gully, and the presence of complete fish barriers in Trimbells Gully and the Clydesdale Creek tributary sediment ponds, restricts any potential fish access. Effects for fish during reclamation and realignment works are moderate pre-mitigation and reduced to a low level of effect post-mitigation.

A precautionary approach to mitigation is proposed to manage potential effects on fish. Despite the low likelihood of fish, fish salvage will be undertaken prior to reclamation works within the permanent reach of Trimbells Gully, to avoid any potential injury or mortality. Fish salvage is not necessary upstream of the sediment pond barriers in Trimbells Gully and the Clydesdale Creek tributary, because existing barriers effectively prevent fish passage. In addition, sediment generation during works will be managed through appropriate erosion and sediment control measures (addressed separately) to minimise downstream sedimentation effects on fish habitats where fish are known to be present.

Further, Section 9.7.4 of this report details any actual or potential effects on fish passage for the Coal Creek and Camp Creek dams.

9.7.2.3 Effects on Invertebrates

Stream reclamation and instream works may result in the removal and alteration of aquatic macroinvertebrate habitat, potentially displacing or eliminating individuals present within the works area. However, the existing macroinvertebrate community is dominated by common, pollution tolerant species. Given their short life cycles and high capacity for recolonisation, effects are expected to be temporary, with rapid recovery likely from downstream source populations once habitat and flow are re-established. For these reasons, effects on invertebrates have a low overall effect.

Effects will be managed by enabling natural recovery processes, with recolonisation expected to occur quickly from downstream populations following completion of works. Ensuring the realigned channel maintains flow and suitable habitat conditions will support recovery. In addition, implementation of erosion and sediment controls during works (addressed in Section 9.7.2.5 of this report) will minimise further habitat degradation and support the re-establishment of macroinvertebrate communities.

9.7.2.4 Effects on Riparian Vegetation

The proposed works will result in the loss of existing riparian vegetation along the Trimbells Gully tributary, which is dominated by native red tussock and provides important ecological functions such as shading, organic matter input, and bank stability. While no riparian vegetation is present along the affected reach of the Clydesdale Creek tributary, the removal of tussock vegetation at Trimbells Gully represents a moderate adverse effect.

To mitigate these effects, direct transfer of tussocks is proposed from within 10 m of the existing channel to the same extent along the realigned channel. This approach supports rapid re-establishment of riparian vegetation by retaining mature plants, root systems, soil structure, and associated biological communities. Additional mitigation will be achieved through wider riparian enhancement, including planting along the Waikouaiti River North Branch, as outlined above.

9.7.2.5 Effects of Sedimentation

Earthworks associated with stream diversion, realignment, and enhancement works have the potential to generate and discharge fine sediment into waterways. Elevated sediment loads can adversely affect aquatic ecosystems by smothering habitat, reducing light penetration, and impacting fish and invertebrate health. While aquatic species are generally adapted to short-term sediment pulses, prolonged or unmanaged sediment inputs pose a greater ecological risk. Without mitigation, sediment from works in Trimbells Gully and the Waikouaiti River North Branch could enter receiving environments and affect downstream habitats.

Extensive measures will be put in place to carefully manage any actual or potential sediment related effects. All earthworks will be undertaken in accordance with the ESCMP (provided in **Part C** of these application documents and required by the proposed consent conditions in **Part D**), and best practice regulations. Existing and proposed sediment ponds will capture sediment before it enters any natural waterways within the Macraes Operation. With these controls in place and functioning as intended, effects on freshwater environments are expected to be low.

Monitoring of sediment levels and sampling of macroinvertebrate communities will occur quarterly as part of the biological monitoring programme which will allow identification of any changes in habitat, freshwater quality and any changes of the macroinvertebrate communities triggering an adaptive management response if required.

9.7.3 Effects of Predator-proof Fence on Murphys Creek

Installation of predator-proof fencing across Murphys Creek will require culverts with exclusion gates, which are expected to act as partial barriers to fish passage. Non-migratory species (e.g. upland bully and Taieri flathead galaxiid) are unlikely to be significantly affected due to their limited movement requirements. Diadromous species (longfin and shortfin eel) may experience restricted passage under normal flow conditions; however, fish passage will still occur during high flow events when the gates are open. Given the low recorded abundance of eels and the upper catchment location, overall effects on fish communities and ecological connectivity are expected to be minor.

Effects will be managed through the design of culvert gates that allow fish passage during elevated flow conditions, ensuring that ecological connectivity is maintained intermittently rather than completely restricted. The location in the upper catchment and low eel abundance further reduces ecological risk. In addition, fish management measures will be implemented if culvert construction occurs in the dry, in accordance with a Fish Management Plan ("**FMP**") (provided in **Part C** of this substantive application) to avoid fish mortality or stranding during construction.

9.7.4 Effects on Fish Passage

Viridis (2026c) has prepared a memorandum that considers fish passage for the Coal Creek and Camp Creek dams associated with MP4. This memorandum is included in **Part B** of these application documents, and although this document was prepared for the purposes of the Fisheries Regulations, the findings are relevant to this AEE and the wider MP4 Project.

For context regarding the scale of the dams, the Camp Creek dam will have a catchment area of approximately 1,040 ha, while the Coal Creek dam will have a catchment area of approximately 650 ha.

A fish survey was conducted which found the following fish species are present within the two creeks:

> Taieri flathead galaxias which has an At Risk-Declining conservation status were identified in both the Coal Creek and Camp Creek;

> Shortfin eel which has a Not Threatened conservation status were identified in Camp Creek; and

> Longfin eel which has an At Risk – Declining conservation status were also present in Camp Creek.

A summary of effects is provided in sub-headings below, noting this assessment is specific to the Coal Creek and Camp Creek dams only and the dams are proposed and are already consented.

9.7.4.1 Barrier of Fish Passage

Both dams will constitute complete barriers to fish passage and will prevent upstream and downstream movement of migratory fish species, including longfin and shortfin eels. However, the significance of this effect differs between the two waterways based on the availability and quality of habitat upstream of the dams.

In Coal Creek, the habitat upstream of the proposed reservoir is extremely limited, consisting of only a short reach of intermittent channel. No eels have been recorded in previous fish surveys or recent eDNA investigations, indicating that Coal Creek currently provides little value as eel habitat. As a result, the loss of migratory access upstream of the dam is not expected to have any meaningful effect on eel populations within the wider Taieri River catchment. The effect on eel populations in Coal Creek is considered negligible.

In Camp Creek, the dam will similarly prevent eel migration to and from habitat upstream of the reservoir. While both longfin and shortfin eels have been recorded within the catchment, the upper reaches of Camp Creek provide relatively poor-quality habitat for eels due to the narrow channel, steeper gradient, and lack of large pools, soft sediments, and extensive aquatic vegetation that typically support higher eel abundances. Consequently, eel numbers in the affected reach are expected to be low. Although some habitat will be lost to migratory eels, the effect is considered negligible and is not expected to adversely affect longfin or shortfin eel populations at a catchment scale. Eels located upstream of the Camp Creek dam at the time of construction may retain opportunities to move downstream during spill events. If downstream passage does not occur, any loss of breeding individuals would be negligible given the low density of eels expected to occupy the upstream habitat.

The dams will also prevent local upstream and downstream movement of Taieri flathead galaxiids between reaches located above and below the dam structures. However, Taieri flathead galaxiids are a non-migratory species that complete their entire life cycle within relatively small stream reaches and do not require access to the sea or larger waterbodies to breed. As a result, the installation of complete fish passage barriers is not expected to significantly affect the species life-history requirements or ongoing persistence within the affected catchments.

9.7.4.2 Fish Population and Fragmentation Effects

The construction of complete fish passage barriers on Coal Creek and Camp Creek will result in the isolation of flathead galaxiid populations located upstream of the dams from

those downstream. While the dams remain in place, upstream and downstream populations will be unable to mix, creating the potential for some degree of genetic isolation.

Genetic isolation may, over time, lead to effects such as inbreeding or the increased prevalence of particular genetic traits within isolated populations. However, Viridis (2026c) concludes that the dams will not be present for a sufficient period to result in complete genetic isolation or speciation, which would require many thousands of generations to occur. The available scientific literature also provides mixed evidence regarding the extent to which dams create genetic differentiation in non-diadromous fish species.

Importantly, Taieri flathead galaxiid populations are already naturally fragmented across eastern Otago due to intermittent waterways, naturally drying stream reaches, and long-term geographic separation resulting from historical changes in river systems. In this context, the additional fragmentation associated with the proposed dams represents a relatively small increment over existing population structure.

Furthermore, the habitat available upstream of the Coal Creek dam is limited and would support only a small population. While Camp Creek contains a larger area of upstream habitat, it still represents only a small proportion of the specie's overall known distribution. Even under a conservative worst-case scenario, whereby genetic isolation contributed to the loss of both upstream populations, no measurable effect on the overall Taieri flathead galaxiid population or the long-term persistence of the species is anticipated. The assessment also notes that the likelihood of either isolated population being lost is considered low.

9.7.4.3 Positive Effects

In addition to the potential adverse effects associated with fish passage restrictions, the dams may provide ecological benefits for Taieri flathead galaxiids. By creating complete barriers, the dams may reduce the ability of trout and additional eels to access upstream habitats, particularly in Camp Creek.

Trout are known to be present within Deepdell Creek and may potentially establish in Camp Creek in the future. Both trout and eels are recognised predators of flathead galaxiids. Restricting predator access to upstream habitats, particularly within Camp Creek, may therefore reduce predation pressure and provide a corresponding benefit to galaxiid populations. While this potential benefit is acknowledged, the assessment notes that the extent of the positive effect is uncertain and has not been relied upon as a primary factor in determining the overall effects conclusion.

9.7.4.4 Downstream Flow Effects

Once reservoir filling is complete, both dams will release water to supplement downstream flows in accordance with operational requirements determined through an adaptive management framework. Minimum flows will also be maintained during the dam filling stage.

For Coal Creek, supplementary releases to Mare Burn are not expected to alter stream permanence or fish passage conditions. Mare Burn is already classified as a permanent watercourse downstream of the Coal Creek confluence, and the proposed operational releases are therefore not anticipated to generate any adverse fish passage effects.

For Camp Creek, operational releases may result in positive ecological outcomes. Additional water discharged to Deepdell Creek is expected to increase flow permanence and improve aquatic habitat availability and connectivity. This may create greater habitat extent and improved fish passage opportunities for species currently present within the creek.

9.7.4.5 Fish Passage Effects Summary

While the Camp Creek and Coal Creek dams will constitute complete barriers to fish passage, the resulting adverse effects on freshwater fish communities are expected to be minimal. The principal reasons for this conclusion are the non-migratory nature of the Taieri flathead galaxiid, the limited extent and quality of eel habitat located upstream of the dams, and the small contribution of the affected upstream habitats to the overall populations of the species concerned. In addition, minimum flow releases are proposed during reservoir filling to maintain downstream habitat, and dam operation will be managed adaptively once reservoirs are full.

Potential ecological benefits may also arise through the exclusion of fish predators from upstream habitats and, in the case of Camp Creek, through increased downstream flow permanence following commencement of dam releases. Accordingly, the assessment concludes that no significant adverse effects on resident fish populations are expected as a result of the proposed dams.

9.8 LANDSCAPE, NATURAL CHARACTER AND VISUAL AMENITY EFFECTS

The Macraes Operation is located within an elevated rural upland landscape associated with the eastern Otago peneplain and Taieri Ridge. The wider landscape is characterised by rolling hill country, incised gullies, exposed schist, rock tors, pastoral land cover, historic mining associations, and the headwaters of the Taieri, Waihemo and Waikouaiti River systems.

The receiving environment has been substantially shaped by more than three decades of authorised modern mining, together with earlier mining, pastoral settlement and associated infrastructure. MP4, therefore, represents a continuation and intensification of mining activity within an existing established mining landscape that has been progressively modified by historic mining, modern mining and pastoral land use since the nineteenth century.

The potential effects of MP4 on the landscape, visual amenity, and natural character values of the existing environment have been assessed by Boffa Miskell (2026). A copy of this technical assessment is provided in **Part B** of these application documents, and the key findings are summarised below.

9.8.1 Coronation Mining Area and Coronation North

The Coronation Mining Area is located at the northern extent of the Macraes Operation within an elevated rural upland landscape characterised by rolling hill country, pastoral land use, tussock grassland, incised gullies, exposed schist landforms and headwater stream systems. The area has been substantially and permanently modified by historical and existing mining activities, including the Coronation and Coronation North open pits, waste rock stacks, haul roads and backfilled areas. As a result, the receiving environment is characterised by a combination of rural and mining landscape features, with mining forming an established and defining component of the local landscape character.

9.8.1.1 Landscape Effects

The proposed expansion of the Coronation Mining Area will increase the local scale and extent of existing modified landforms through extensions to the Coronation and Coronation North pits, waste rock placement, and associated infrastructure. These activities will intensify the established mining character of the area, resulting in larger open pits, greater exposed rock faces, and expanded engineered landforms, including the extension of the Trimbells WRS into the Trimbells Gully catchment. These changes will occur within an already highly modified environment and remain closely associated with existing mining features, with the project extending existing pits and waste rock stacks rather than introducing new mining landforms into previously unaffected parts of the landscape, avoiding the introduction of new distinct landform elements. Over time, progressive rehabilitation, backfilling, and revegetation will assist in reducing landscape contrast and the visual prominence of these features. At closure, pit lakes, contoured landforms, and riparian and tussock planting will assist in integrating the site with the surrounding pastoral landscape and reintegrating modified landforms with the wider upland rural landscape.

Overall, Boffa Miskell (2026) considers that the landscape effects in the Coronation Mining Area are moderate adverse during the operation, reducing to low-moderate adverse at closure following rehabilitation.

9.8.1.2 Natural Character Effects

The proposed works in the Coronation Mining Area will introduce additional engineered features such as sediment ponds, engineered seepage capture drains, sumps, culverts, and clean water diversions into the catchment environment. This will ultimately modify hydrological processes across several headwater catchments, including Coal Creek, Trimbells Gully, and tributaries of Deepdell Creek (Camp Creek and Highlay Creek). These changes will alter natural drainage patterns, including the removal and realignment of sections of the southern Trimbells Gully tributary through clean water diversions associated with the Trimbells WRS expansion, and modify parts of the Camp Creek headwaters, while increasing the level of hydrological control within stream margins. However, most of the proposed works occur within an already modified environment that is influenced by existing mining infrastructure, pastoral land use, and sediment management systems. The streams affected by the proposal are generally assessed as having low-moderate existing natural character and are already subject to varying degrees of modification. Effects on broader catchments (including the Taieri River and Waihemo River headwaters) are limited and localised, with overall catchment function largely maintained. Effects are principally concentrated within the upper reaches and headwater tributaries adjoining the mining area.

Boffa Miskell assess the effects of the proposed MP4 activities on natural character for each catchment. The key findings are summarised below:

- Coal Creek will have low-moderate effects during operation and low effects during closure stages;
- Trimbells Gully will have moderate effects during operation reducing to low-moderate effects at closure, while Camp Creek and Highlay Creek will have low- moderate effects during operation reducing to low effects during closure stages; and
- Taieri River headwaters and Deepdell Creek will have very low effects overall.

Effects will be managed through the design and operation of sediment and water management infrastructure to control runoff and minimise downstream effects, while confining modification largely to existing disturbed areas. The Trimbells Gully stream realignment and clean water diversions will maintain flow conveyance, and sediment ponds will treat runoff prior to discharge to any waterway. Progressive rehabilitation of disturbed areas, including recontouring, rehabilitation of disturbed margins and riparian planting, will support recovery of natural character over time. At closure, removal of operational

infrastructure (where appropriate), establishment of permanent spillways, diversions, and revegetation of riparian margins will assist integration with the surrounding landscape and reduce the visibility and influence of engineered features. While some engineered water management features will remain as part of the post-closure environment, natural character effects are expected to reduce as rehabilitation establishes and disturbed areas are reintegrated with the surrounding catchment. Where rehabilitated landforms are returned to pastoral production, this will represent a continuation of an existing rural land use pattern rather than the introduction of a new land use, further reducing residual effects on natural character.

9.8.1.3 Visual Amenity Effects

The proposed expansion within the Coronation Mining Area will result in increased visibility of mining activities and landform modification, including the expansion of existing WRS, open pit extensions, and associated infrastructure. The most open views of the proposed expansion will be available from Longdale Road and a small number of nearby rural properties, where the proposal will be seen as an increased extent of exposed landforms, active machinery, and ongoing mining activity. However, these changes will be viewed in the context of an established mining environment, where large-scale extractive features already dominate the landscape character and available views. The proposal largely extends existing mining features and, in many views, remains visually associated with existing pits and waste rock stacks rather than appearing as a separate area of disturbance. Visibility from many surrounding areas is limited or screened by the natural topography, with some viewpoints experiencing only partial or no change in available views. Views from Hyde-Macraes Road and Horse Flat Road are particularly constrained by intervening landform, resulting in little or no discernible change. At closure, rehabilitated landforms, reduced activity, and vegetation establishment will soften and integrate the site into the surrounding landscape.

Similarly to landscape and natural character effects, visual effects will be managed through progressive rehabilitation of disturbed areas, including contouring of landforms, brown rock capping, and revegetation with tussock and pasture species to assist landscape integration. Expansion is largely contained within the existing mining footprint in the Coronation Mining Area, avoiding introduction of new visually distinct elements. At closure, final landform shaping, pit lake development, and riparian planting will further reduce visual contrast. Night-time effects will be minimised through lighting controls (e.g. management of tower height, orientation, and shielding) to limit visibility from surrounding properties and public roads. Night-time lighting associated with the proposal will also continue an existing pattern of lighting associated with the current 24-hour mining operation, rather than introducing a new source of lighting into an otherwise unlit environment.

Overall, Boffa Miskell (2026) assesses visual effects on nearby rural properties as low-moderate during operations, reducing to low at closure, while effects for most road users are assessed as low or neutral due to distance, viewing duration, and topographic screening.

9.8.2 Central Mining Area

The Central Mining Area is located at the core of the Macraes Operation and forms the most intensively modified part of the existing mining environment. The area comprises established mining infrastructure including the Innes Mills and Frasers pits, waste rock storage facilities, tailings storage facilities, haul roads, processing infrastructure and associated water management systems. The receiving environment is characterised by large-scale engineered landforms and industrial mining features set within a broader rural landscape of rolling hills, pastoral land use and headwater catchments associated with the Waikouaiti and Waihemo Rivers.

9.8.2.1 Landscape Effects

The expansion of mining activities within the Central Mining Area will result in further modification of the most intensively developed part of the Macraes Operation through the expansion of Innes Mills Pit, changes to tailings and waste rock storage areas, relocation of infrastructure and realignment of Macraes Road. These changes will incrementally increase or change the scale, visibility and legibility of mining landforms. However, they will remain largely contained within the existing mining footprint and continue the established landscape pattern associated with the Macraes Operation and the Macraes Mining Zone, where large-scale mining landforms and associated infrastructure are anticipated and form part of the expected landscape character. During the operational phase, Boffa Miskell has assessed the landscape effects as moderate, reflecting the already modified baseline environment. Through progressive rehabilitation and closure measures, the disturbed areas will be reintegrated into the surrounding rural landscape. While rehabilitated landforms will remain discernible, these measures will reduce adverse effects to low-moderate in the long term.

9.8.2.2 Natural Character Effects

Natural character within the Central Mining Area is already substantially modified by existing mining activities, including historical excavation, engineered landforms, altered drainage patterns, water management infrastructure and modified freshwater environments associated with the Waikouaiti River North Branch headwaters. Consequently, MP4 will have limited additional effects on the natural character of the area during operations, with effects assessed as low-moderate adverse.

The principal natural character outcome relates to the Waikouaiti River North Branch headwaters, which are currently disconnected from the lower catchment. During operations, the headwaters will continue to be managed through engineered water management infrastructure. Prior to closure, daylighting of the stream across the Frasers TSF embankment, together with native riparian planting, will reconnect the headwaters with the lower Waikouaiti River North Branch. This will improve ecological connectivity, restore a more coherent connection between the headwaters and lower catchment, and support the re-establishment of habitat, resulting in an overall beneficial natural character outcome. While the stream will remain within a modified landscape context, these measures are expected to improve the natural character of the headwaters from low to low-moderate over the long term.

9.8.2.3 Visual Amenity Effects

MP4 will result in incremental visual changes to an already highly modified mining landscape, including enlargement of some landforms, lowering of the existing MTI, development of the Golden Point backfill, and relocation of infrastructure such as roads and the Open Pit Workshop. These changes will be visible from a range of public viewpoints, local roads, and a limited number of private properties. The most noticeable effects will be generated by the increased height of the Frasers West WRS, areas of active disturbance, and ongoing mining activity.

Effects will generally be experienced within the context of an existing large-scale mining operation, with many views being distant, oblique, transient, or partially screened by topography. The most prominent feature will be the expansion of the Frasers West WRS, which is expected to be visible from a range of public and private viewpoints surrounding the Macraes Operation. Activities proposed in the Central Mining Area largely maintain the established and expected visual character of the site and remain within the existing disturbance footprint.

Boffa Miskell (2026) identify the following visual effect ratings from key viewpoints:

- Public viewpoints and local roads will generally experience very low to low adverse effects. However, views from eastern and southern roads, which are closer and more exposed, will experience low to moderate adverse effects;
- Private residential viewpoints will have low to moderate adverse effects during operation stages, reducing to low following rehabilitation;
- Viewpoints from the Macraes township will experience very low to moderate adverse effects, primarily associated with the increased Frasers West WRS height, reducing to very low or low at closure; and

> Night-time lighting effects are expected to be similar to or less than existing operations due to improved design and shielding, resulting in a neutral effect rating.

Overall, visual effects are generally low to low-moderate and are moderated by the existing mining context, topography and distance from most viewing locations. The highest visual effects are associated with views of the Frasers West WRS from nearby roads and parts of Macraes township. Visual effects reduce following rehabilitation and closure.

9.8.3 Golden Bar Mining Area

The Golden Bar Mining Area is located at the south-eastern extent of the Macraes Operation within a rolling rural upland landscape characterised by pastoral land use, incised gullies, schist outcrops and the headwaters of the Murphys Creek and Golden Bar Creek catchments. The area contains the existing rehabilitated Golden Bar pit and WRS and has a strong association with both historic and contemporary mining activity. Although partially rehabilitated, the area remains an established component of the wider Macraes mining landscape. The area is also connected to the broader Macraes Operation by the existing Golden Bar haul road corridor, which forms an established component of mining activity within this part of the receiving environment and will continue to support the transportation of ore and waste rock during MP4.

9.8.3.1 Landscape Effects

The proposed expansion of the Golden Bar Mining Area will reintroduce and increase landscape modification within an area that has undergone partial rehabilitation, including formation of a pit lake and revegetation of a WRS. Key landscape effects include the enlargement of the Golden Bar Pit and expansion of the associated WRS, resulting in increased exposed rock, benching, and visible mining activity (e.g. machinery and haulage). These changes will create greater visual contrast with surrounding pastoral land and temporarily reduce the continuity of pasture and tussock land, particularly near Golden Bar Road.

All effects within this area will remain localised and occur within an already modified mining landscape that forms part of the wider Macraes Operation where such features are established and characteristic. Consolidation of additional waste rock within existing landforms avoids further fragmentation of the wider rural landscape, and progressive rehabilitation will reduce the prominence of disturbance over time.

While the expansion will temporarily increase landscape modification and visibility of mining activity, effects will be contained, transitional, and consistent with the existing character of the working mine. Rehabilitation and enhancement measures will ensure the site is

reintegrated into the surrounding rural landscape, resulting in low-moderate adverse effects at closure.

Overall, the landscape effects at the Golden Bar Mining Area are assessed as moderately adverse during operation, reducing to low-moderate adverse following rehabilitation and closure.

9.8.3.2 Natural Character Effects

The proposed Golden Bar Mining Area expansion will result in localised modifications to headwater environments across the Clydesdale Creek and Golden Bar Creek catchments, both of which contribute to the wider Murphys Creek system. In the upper Clydesdale Creek catchment, the expansion of the Golden Bar WRS will encroach into the valley floor, resulting in the loss of a tributary, partial removal of the active bed and margins, and relocation of sections of the headwaters. These works will involve earthworks within and adjacent to the creek environment, altering natural hydrological processes and stream morphology within an already modified pastoral and mining landscape.

Similarly, within the Golden Bar Creek catchment, effects will be concentrated in the upper headwaters near the Golden Bar Pit. These include the removal of approximately 200 m of stream channel, disturbance to adjacent tributary margins, and temporary changes to flow regimes associated with pit dewatering and diversion of runoff through engineered systems. While portions of the tributaries will remain, they will be located within an active mining disturbance area and subject to ongoing modification during operations. Despite these changes, the main stem of Golden Bar Creek and the majority of its downstream reaches will remain largely intact and unaffected.

At a broader scale, effects on the wider Murphys Creek catchment will be limited, as modifications are confined to the upper headwater tributaries and do not substantially alter the overall hydrology, form, or function of the wider system. At closure, reinstatement of flows via the Golden Bar pit lake, together with riparian planting and rehabilitation of stream margins, will assist in restoring ecological and natural character values within disturbed areas of both catchments. While some permanent modifications to stream alignments and headwaters will remain, these will be integrated within a rehabilitated landscape, reducing the level of adverse natural character effects relative to the operational phase.

Overall, the proposal will result in localised loss and modification of headwater stream environments, particularly within Clydesdale Creek and the upper Golden Bar Creek; however, these effects are contained and will occur within an already modified landscape. Rehabilitation measures, including riparian planting and rehabilitation of stream margins,

will reduce natural character effects over time, resulting in low residual adverse effects at closure, with very low effects on the wider Murphys Creek catchment.

9.8.3.3 Visual Amenity Effects

MP4 will introduce additional visible mining activity within a previously rehabilitated but already modified landscape in the Golden Bar Mining Area. Key changes include the expansion of the Golden Bar Pit, construction and extension of the Golden Bar WRS and the reintroduction of active mining elements such as earthworks, machinery, and haul traffic. These changes will increase the level of visible disturbance, particularly from sections of Golden Bar Road where relatively open, short-distance views of the pit and WRS are available.

From more distant or elevated viewpoints (such as Phillip Road), visibility will generally be limited to glimpsed or partial views of upper pit faces and landform changes due to intervening topography. For nearby road users and a small number of rural properties, views will include active excavation, exposed overburden, and evolving landform shapes associated with WRS construction. However, these effects will remain localised and occur within the context of an established mining landscape, meaning they will not appear out of character. Over time, progressive rehabilitation will reduce visual contrast as disturbed areas are recontoured and revegetated, and the expanded landforms integrate with the surrounding rural hill country.

Night-time visual effects will be minimal, as no permanent fixed lighting is proposed. Any visible lighting will be temporary, mobile (e.g. vehicles and machinery), and characteristic of operational mining activity.

While the Golden Bar expansion will introduce more noticeable visual disturbances in close proximity, particularly from sections of Golden Bar Road, these effects will be localised and consistent with the established mining character of the area. Progressive rehabilitation and careful landform design will ensure that visual effects diminish over time, resulting in a landscape that is reintegrated with the surrounding rural environment and characterised by low residual visual effects at closure.

Visual effects are assessed as moderate adverse from Golden Bar Road during operations, reducing to low following rehabilitation and closure. Effects from more distant viewpoints and residential properties are generally low or very low.

9.8.4 Summary and Mitigation Approaches

In summary, MP4 will result in additional modification of landforms, waterways, and visual character within the existing Macraes mining environment. Proposed mitigation and

management approaches are consistent across all mining areas and are detailed in **Part A.10** of this report. These include:

> Progressive rehabilitation and recontouring of landforms disturbed as part of MP4;

> Revegetation with pasture, tussock, and native riparian planting;

> Consolidation of disturbance within existing mining footprints;

> Sediment and water management systems to maintain hydrological function;

> Stream reinstatement, daylighting, and ecological enhancement at closure; and

> Lighting controls to minimise night-time visibility.

MP4 represents a continuation and intensification of mining activities within a lawfully established mining landscape that has been progressively modified through pastoral land use and successive phases of historic and modern mining activity since the 1860's. While localised low to moderate landscape, natural character and visual amenity effects will occur during operations, particularly in areas immediately surrounding active mining activities, these effects will progressively reduce through the implementation of rehabilitation and mitigation measures. Overall, residual effects are expected to be generally low to low-moderate at closure, with beneficial natural character outcomes identified in some locations through improved hydrological and ecological connectivity.

9.9 GEOTECHNICAL EFFECTS

OGNZL has undertaken extensive geotechnical investigations into each element of MP4. Assessments associated with these investigations include EGL (2026a, 2026b and 2026c) and PSM (2026a, 2026b, 2026c and 2026d), included in **Part B** of these application documents. The geotechnical effects as set out by these reports are summarised below under the relevant sub-headings.

9.9.1 Coronation Mining Area

9.9.1.1 Open Pit Expansions

PSM (2026a) prepared an assessment of MP4's effects on geotechnical aspects of the proposed open pit expansions, including Coronation North Stage 6 and Coronation Stages 6 to 8. The assessment documents the site geotechnical model and assesses global stability of proposed pit designs. The objective is to ensure end-of-mine life and long term (post closure) stability including potential interactions with in-pit backfills, WRS and public roads.

All pits are expected to offer further geotechnical challenges, and the development of large-scale pit-slope creep is almost inevitable in some domains. However, the predicted slope

movement mechanisms are similar to those previously encountered which provides a high level of confidence in the current suite of pit slope management strategies available to mitigate safety and environmental risks. Risks will continue to be managed and mitigated by robust slope design, operational management, backfilling (in some locations), pit lake filling, and closure assessments that will define areas behind the pit crests that may experience risk of longer-term deformation.

9.9.1.2 Waste Rock Stacks

PSM (2026c) prepared an assessment of MP4's effects on geotechnical aspects of the proposed extensions of the Coronation North WRS and Trimbells WRS. The assessment documents the site geotechnical model and assesses global stability of the proposed WRSs. The assessment includes review of end-of-mine life and long term (post closure) stability plus potential interactions with open pit excavations and public roads.

The geotechnical stability analysis found that the WRS designs will achieve the recommended slope stability criteria for static and seismic conditions. The exception is Trimbells WRS Section 3 which requires flattening to 30° as part of the detailed slope design.

To avoid, remedy or mitigate any adverse effects associated with WRS stability, the following management and mitigation measures are proposed:

- Implementation of the recommended slope stability design acceptance criteria for MP4 WRS in detailed design. Detailed design should reduce or remove thin sections of WRS geometry that chase the existing topography, typically at gullies such as at Trimbells WRS;
- WRSs will be designed in accordance with industry best-practice, and to withstand a 1-in-2500 annual-exceedance-probability earthquake without catastrophic failure, noting that some deformation is allowable provided the structure retains a state of long-term stability post event;
- A design report will be prepared for any new Waste Rock Stack, or any significant expansion of an existing Waste Rock Stack by a suitably qualified geotechnical engineer or engineering geologist and this report will be provided to the Council prior to the commencement of construction of the structure. The report will include details of the geotechnical model, loading assumptions, credible failure modes, key design and construction requirements, and an evaluation of the long-term stability for closure;
- Foundation treatments, including grubbing/ripping of the foundation and terracing into sloping foundations, should be undertaken to provide additional confidence in long-term stability outcomes; and

- Sub-surface drainage (involving the placement of free-draining rock) will be employed in the base of natural gullies to improve foundation drainage of the WRS.

The proposed post mining Matheson Road is expected to function as a 'fine weather four-wheel drive track' in the general location of the proposed track although the following measures will be applied to mitigate safety issues:

- The road will be offset from the crest of the pit where practicable to mitigate the impact of potential crest breakback undermining the track;
- Safety/separation bunds will be installed along the open pit side of the track to mitigate the risk of vehicles leaving the track and entering the pit void;
- Surface water drainage will be designed where the track crosses WRS's to mitigate concentrated surface water flows and infiltration of water into the WRS increasing the risk of local instability; and
- Cut slope batter angles for sections of the track cut into the slopes of WRS will be designed to mitigate the risk of local instability where practicable. It is expected that batter angles will be no more than 2H:1V (~27°) although this will be further assessed in the Detailed Design stage.

9.9.2 Central Mining Area

9.9.2.1 Tailings Storage Facilities

EGL (2026a) prepared an assessment to determine the geotechnical and dam safety effects of MP4 on the existing TSFs at the Macraes Operation. Proposed mining activities that may affect the TSFs include the mining of Innes Mill 11 and 12 located to the south of MTI and SP11, mining of Innes Mill 13 adjacent to MTI, mining of GPUG which extends under SP11, the hydraulic mining of the MTI, SP10 and SP11 and subsequent relocation of tailings to Frasers TSF, and construction of the Golden Point BF.

A separate report EGL (2026b) has been prepared for the proposed design and assessment of dam safety effects of Frasers TSF Stage 3 which includes raising the Frasers BF from approximately 480 mRL to 520 mRL to provide additional storage capacity. Dam safety is managed under the Building Act and regulations rather than the FTAA, but in the interests of transparency the following detail is provided.

The proposed dams introduce potential dam safety risks associated with design, construction, geotechnical stability, seismic performance, erosion and sediment generation, and long-term settlement and water management. The Potential Impact Classification ("**PIC**") of the dams, which classifies the potential consequences of a

failure (potential failure mode) on people, property, infrastructure, and the environment, have been determined as summarised in **Table 9-10**.

Table 9-10: Summary of PIC for Existing and Proposed TSFs

Dam	PIC In Operation	PIC In Closure*
MTI TSF	High	Medium
SP11 Embankment	High	N/A Deconstructed
SP11 Innes Mill Backfill Embankment	High	N/A Deconstructed
SP11 Closure Embankment	N/A	Low*
Frasers TSF Stage 3	High	High

* *Initial assessment. To be reviewed at closure.*

The PIC classification informs the design, construction, and surveillance and maintenance requirements for each dam structure to ensure their management is proportionate to their risk profile. Key design matters that will be considered for building consent purposes include downstream slope stability, internal erosion (seepage), and seismic performance. Deconstruction of SP11 TSF and Innes Mills Backfill Embankment will be similarly managed under Building Act processes appropriate for their PIC classification.

The stability of Macraes Road realignment Stage 2 where it crosses the Frasers Backfill Embankment is assessed in EGL (2026c). The assessment indicates that the proposed road realignment is geotechnically feasible subject to retaining the assessed embankment geometry and implementing the detailed design and management measures recommended in (EGL 2026c). Monitoring and maintenance of the road will be incorporated into the wider mine geotechnical monitoring framework. Following mine closure, responsibility and financial provision for monitoring and remedial works attributable to settlement or deformation of the Frasers Backfill Embankment can be addressed through the closure arrangements and mine closure bond.

Additional matters that are relevant to the FTAA process include sediment generation during construction works, surface water management and stream diversion stability which are discussed elsewhere in this section.

To avoid, remedy or mitigate any adverse effects associated with the geotechnical stability of the TSFs, the following management and mitigation measures are proposed:

- Engagement of an experienced dam designer, with independent peer review required for High PIC dams. Detailed design will be in accordance with the New Zealand Dam Safety Guideline and include appropriate zoning, drainage, and an Earthworks Specification to address stability and seepage risk;
- Ongoing designer involvement during construction to verify assumptions, inspect works, and respond to actual site conditions. Construction will be undertaken by experienced personnel using established equipment and supervision;
- Site-specific investigations and ongoing validation during construction to confirm design assumptions, with in-pit conditions already well understood;
- Use of mine-derived waste rock (schist) with favourable drainage and seismic properties, placed as engineered rockfill with controlled finer materials for seepage management;
- Implementation of the Erosion and Sediment Control Management Plan, with site layout designed to contain runoff within the pit;
- Surveillance (OMS) Manual and mine closure arrangements Post-closure settlement will be assessed using monitoring data, and stream diversion design (including lining and gradients) will accommodate long-term settlement and prevent baseflow loss; and
- Implementation of a dam safety management system as per existing Operations, Maintenance and Surveillance (OMS) Manuals and an updated Emergency Action Plan to manage residual risks and respond to any potential failure scenarios.

9.9.2.2 Golden Point Underground Mine

PSM (2026d) prepared an assessment of MP4's effects on mine subsidence associated with expansion of the GPUG. The assessment focussed on the effects to particular receptors including Deepdell Creek, the Golden Point BF and the SP11 embankment. A geotechnical model was developed for the assessment based on existing site investigations, site visit observations, and PSM's experience at Macraes Operation since 1993.

The assessment found that surface subsidence has been observed above the existing underground workings at GPUG of up to a 2 m drop in surface level over a distance of 100 m. The equivalent maximum horizontal strain associated with this magnitude of subsidence is in the range of 10 to 30 mm/m which is sufficient to open existing rock joints and create new tension cracks. The activity associated with the greatest subsidence is underground stoping.

Potential effects of stoping were considered for key surface features and infrastructure. Stoping, as per the current method, requires specific consideration as it approaches beneath Deepdell Creek and could lead to a partial or complete loss of surface flow, as

water drains into the deeper underlying strata through these opened or new pathways. Stoping beneath the Golden Point BF similarly could result in pit wall instability and risk of 'inrush', the sudden, uncontrolled flow of water, mud, sand, or slurry into mine workings through overbreaks or chimney caving. Subsidence of the SP11 embankment caused by stoping is likely to be smoothed due to the thickness of rockfill above insitu rock with settlement effects considered in EGL (2026a).

To avoid, remedy or mitigate any adverse effects associated with subsidence, the following management and mitigation measures are proposed:

- Adoption of a preliminary standoff zone (Deepdell Creek Standoff Line) equal to the angle of influence (24°) from the centre line of the Deepdell Creek plus an additional offset of 25 m (shown in **Figure 9-14**). The following restrictions would apply:
  - Development drives may be placed through the standoff zone (the Orange Zone) but will require heavy ground support to limit subsidence. Backfilling those drives at mine closure may also be required;
  - Mining (stoping) outside of the standoff zone (the Green Zone) may occur without restriction, but monitoring of deformation is required to support future studies and predictions of ground behaviour;
  - Mining (stoping) within the Orange Zone may occur following satisfactory results of ongoing monitoring, observations, detailed site investigation and geotechnical assessment that demonstrate the risk of potentially damaging subsidence and strain occurring at the creek are low;
- The risk of inrush associated with stopping below the Golden Point BF can be managed by draining the backfill prior to mining and verifying with probe holes; and
- Expand the existing subsidence monitoring network to include Deepdell Creek.

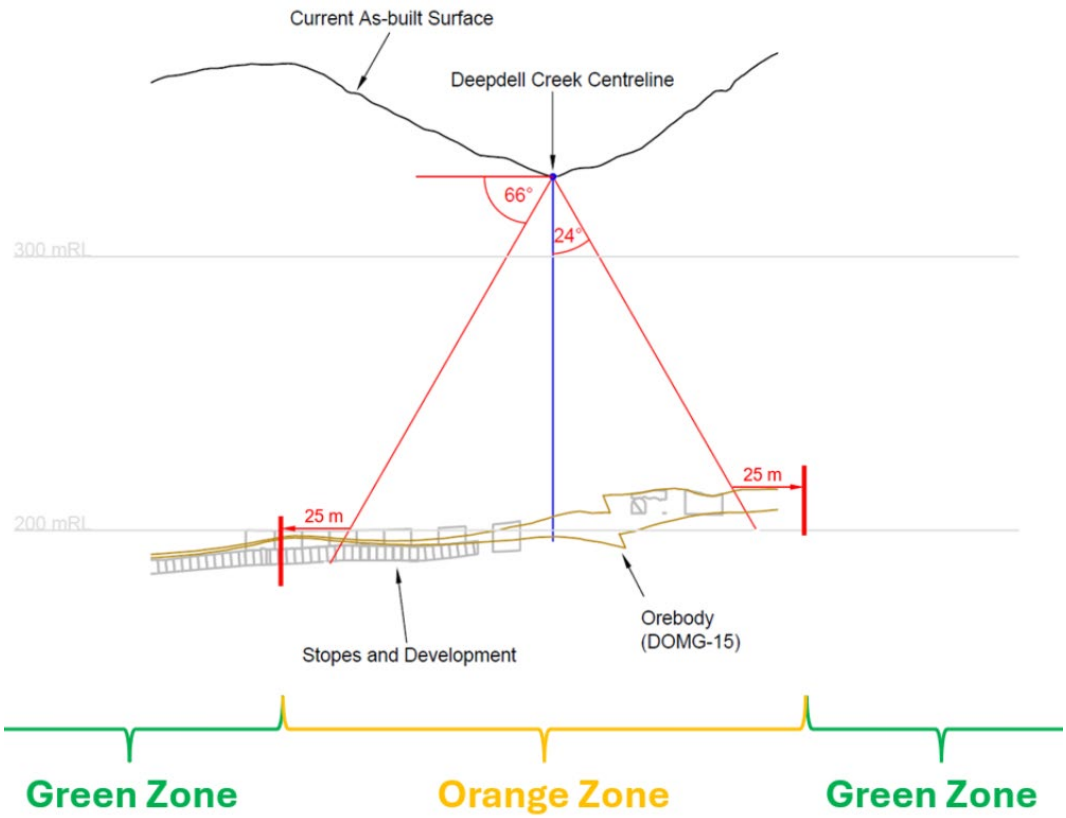

Figure 9-14: Schematic Showing Application of the Recommended Preliminary Deepdell Creek Standoff Line

9.9.2.3 Open Pit Expansions

PSM (2026a) prepared an assessment of the MP4's effects on geotechnical aspects of the proposed open pit expansions, including Innes Mills 11 to 13. The assessment documents the site geotechnical model and assesses global stability of proposed pit designs. The objective is to ensure end-of-mine life and long term (post closure) stability including potential interactions with in-pit backfills, WRS and public roads.

All pits are expected to offer further geotechnical challenges, and the development of large-scale pit-slope creep is almost inevitable in some domains. However, the predicted slope movement mechanisms are all similar to those previously encountered over the last 35 years. This provides a high level of confidence in the mining feasibility and the existing suite of pit slope management strategies available to mitigate safety and environmental risks. Risks will be managed and mitigated by robust slope design, operational management, backfilling (in some locations), pit lake filling, and closure assessments that will define areas behind the pit crest that may experience risk of longer-term deformation.

Prior to Stage 2 realignment of Macraes Road, the western crest of Innes Mills 11 will have an offset of 65 m from the current Macraes Road. It will require OGNZL to maintain the Ground Control Management Plan and TARP-based monitoring-management currently in place to manage Macraes Road stability, as part of existing CCP2 consent conditions. These controls should remain in place until it can be demonstrated that any ongoing effects to the public road will be negligible. Long-term, the affected part of Macraes Road will be realigned.

Stability modelling indicates no potential interaction between Innes Mills 12 east and southeast wall with either Stage 1 or 2 realignments of Macraes Road and Golden Bar Road.

9.9.2.4 Waste Rock Stacks

PSM (2026c) prepared an assessment of MP4's effects on geotechnical aspects of the proposed WRS extensions in the Central Mining Area, including Frasers West WRS. The assessment documents the site geotechnical model and assesses global stability of proposed WRS's. The assessment includes review of end-of-mine life and long term (post closure) stability plus potential interactions with open pit excavations and public roads.

The geotechnical stability analysis found that the WRS designs will achieve the recommended slope stability criteria for static and seismic conditions.

To avoid, remedy or mitigate any adverse effects associated with WRS stability, the following management and mitigation measures are proposed:

- Implementation of the recommended slope stability design acceptance criteria for MP4 WRS in detailed design. Detailed design should reduce or remove thin sections of WRS geometry that chase the existing topography;
- WRS shall be designed in accordance with industry best-practice, and to withstand a 1-in-2500 annual-exceedance-probability earthquake without catastrophic failure, noting that some deformation is allowable provided the structure retains a state of long-term stability post event;
- A design report shall be prepared for each WRS by a suitably qualified geotechnical engineer or engineering geologist and this report provided to the Council prior to the commencement of construction of the structure beyond what is already authorised. The report shall include details of the geotechnical model, loading assumptions, credible failure modes, and key design and construction requirements, and shall include an evaluation of the long-term stability for closure;

- Foundation treatments, including grubbing/ripping of the foundation and terracing into sloping foundations, should be undertaken to provide additional confidence in long-term stability outcomes; and
- Sub-surface drainage (involving the placement of free-draining rock) will should be employed in the base of natural gullies to improve foundation drainage of the WRS.

9.9.3 Golden Bar

9.9.3.1 Open Pit Expansions

PSM (2026a) prepared an assessment of the MP4's effects on geotechnical aspects of the proposed open pit expansions, including Golden Bar pit expansion Stages 2 and 3. The assessment documents the site geotechnical model and assesses global stability of the proposed pit designs. The objective is to ensure end-of-mine life and long term (post closure) stability including potential interactions with Golden Bar WRS and Golden Bar road.

As with all pits, Golden Bar pit is expected to offer further geotechnical challenges, and the development of large-scale pit-slope creep is almost inevitable in some domains. However, the predicted slope movement mechanisms are all similar to those previously encountered which provides a high level of confidence in the mining feasibility and the suite of existing pit slope management strategies available to mitigate safety and environmental risks. Risks will be managed and mitigated by robust slope design, operational management, pit lake filling, and closure assessments that will define areas behind the pit crest that may experience risk of longer-term deformation.

The proposed 50 m offset of the Golden Bar Stage 3 highwall from Golden Bar Road provides adequate distance to execute the proposed mine plan and allows for the following:

- Sufficient space to construct a safety bund between the road and pit crest;
- Allowance for potential batter scale instabilities that rapidly develop about the pit crest during or immediately after mining; and
- Management of the highwall and road corridor stability using a robust geotechnical monitoring and management approach.

Should adversely orientated geological structures be identified during detailed design site investigations or initial mining, geotechnical step offs or in-pit buttresses can be incorporated within the mine plan to maintain stability of the pit crest relative to Golden Bar Road.

9.9.3.2 Waste Rock Stack

PSM (2026c) includes an assessment of MP4's effects on geotechnical aspects of the Golden Bar WRS. The assessment documents the site geotechnical model and assesses global stability of the proposed extension to the existing WRS. The assessment includes review of end-of-mine life and long term (post closure) stability plus potential interactions with open pit excavations and public roads.

The geotechnical stability analysis found that the WRS design will achieve the recommended slope stability criteria for static and seismic conditions.

To avoid, remedy or mitigate any adverse effects associated with WRS stability, the following management and mitigation measures are proposed:

> Implementation of the recommended slope stability design acceptance criteria for MP4 WRS in detailed design. Detailed design should reduce or remove thin sections of WRS geometry that chase the existing topography;

> WRS shall be designed in accordance with industry best-practice, and to withstand a 1-in-2500 annual-exceedance-probability earthquake without catastrophic failure, noting that some deformation is allowable provided the structure retains a state of long-term stability post event;

> A design report shall be prepared by a suitably qualified geotechnical engineer or engineering geologist and this report provided to the Council prior to the commencement of construction of the extended structure. The report shall include details of the geotechnical model, loading assumptions, credible failure modes, and key design and construction requirements, and shall include an evaluation of the long-term stability for closure;

> Foundation treatments, including grubbing/ripping of the foundation and terracing into sloping foundations, should be undertaken to provide additional confidence in long-term stability outcomes; and

> Sub-surface drainage (involving the placement of free-draining rock) should be employed in the base of natural gullies to improve foundation drainage of the WRS.

9.10 NOISE EFFECTS

The acoustic environment in the vicinity of the Macraes Operation is characterised by a combination of rural ambient sounds and noise generated by the existing mining operation. Existing mining operation sources include the Processing Plant, mine haulage activities, open pit and underground mining operations, and associated support facilities.

Noise measurements in March 2026 confirmed that mining activity is an audible component of the existing night-time acoustic environment at nearby residential locations. Measured noise levels ranged from approximately 35 to 40 dB L_{Aeq} (15 min) at representative residential locations surrounding the Macraes Operation, indicating that operational mining noise is an established feature of the receiving environment. Accordingly, the assessment of MP4 has been undertaken within the context of an existing environment where mining-related noise is already present.

Any actual or potential noise effects associated with MP4 have been assessed by Acoustic Engineering Services (2026) and the assessment can be found in **Part B** of these application documents.

9.10.1 Assessment Methodology and Acoustic Criteria

Acoustic Engineering Services (2026) identified several relevant acoustic criteria which apply to MP4, including the WDP and 2GP noise standards, World Health Organisation Guidelines, and existing resource consents. Considering these criteria, the Assessment of Environmental Noise Effects concluded that noise levels from MP4 should ideally be managed so that they are less than 40 dB $L_{Aeq\ (15\ min)}$ during the nighttime period at the notional or site boundary of privately owned neighbouring dwellings in order to comply with the WDP. However, the assessment concludes that noise levels between 40 and 45 dB LAeq (15 min) remain consistent with recognised guidance recommendations relating that allow receivers to sleep with their windows open, and effects are therefore considered acceptable with no more than minor effects.

While the Operative WDP includes noise limits at the MMPMZ boundary, Acoustic Engineering Services considers the notional boundary of nearby dwellings to be the most appropriate location for assessing actual noise effects, as many sections of the MMPMZ boundary are located within remote rural areas where no noise-sensitive receivers are present. The assessment also notes that some mining and haulage activities occur immediately adjacent to, and in some locations pass across the MMPMZ boundary. Accordingly, compliance with the MMPMZ boundary standards is not always representative of actual noise effects experienced at nearby dwellings.

Sound levels for these activities are 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*. SoundPLAN computational noise modelling based on ISO 9613 *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation* has been used to model 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.

The modelling represents a conservative assessment and considers reasonable worst-case operating scenarios, including peak activity periods, favourable sound propagation conditions, and the concurrent operation of multiple noise-generating activities. Predicted noise levels are, therefore, not expected to occur continuously throughout the life of the Project.

9.10.2 Noise Generating Activities

The activities which form part of MP4 that are of relevance to the assessment of noise effects are summarised below:

- **Open pit extensions and waste rock disposal:** Planned expansions of the open pit mines at Golden Bar, Coronation, Coronation North, and Innes Mills which involve blasting, drilling, and excavation.
- **Hydro-mining:** Tailings from MTI, SP10, and SP11 are proposed to be relocated to the Frasers TSF via hydraulic mining. Hydraulic mining includes the use of diesel (power) generators and high-pressure pumps supplying the jets.
- **Open pit workshop relocation:** The relocation of the open pit workshop will include construction noise, and operational noise associated with equipment (during movement around the site, and engine testing), and other moveable plant (excavators, etc.), tooling, and breakout noise from use of pneumatic tooling at the workshop building.
- **Underground mine expansion:** Noise emissions associated with underground mining are primarily limited to above-ground support infrastructure and surface haulage activities. No significant new noise-generating surface infrastructure is proposed.
- **Macraes Road realignment:** Temporary construction noise will be generated during the two-stage realignment of Macraes Road, including earthworks, road construction activities and operation of construction plant.

Acoustic Engineering Services (2026) determined that haulage activity associated with the movement of ore and waste rock is the dominant source of operational noise. By comparison, noise generated by hydraulic mining activities and the relocated open pit workshop was predicted to be low and is not expected to materially contribute to overall noise effects at nearby receivers.

9.10.3 Predicted Noise Levels and Effects

Acoustic Engineering Services (2026) identified a range of residential properties and other potentially noise-sensitive sites within and around the Macraes Operation that could be

affected by noise from MP4 activities. A list of these properties is contained within Table 3.1 of the Noise Assessment contained in **Part B**, including distances from locations of proposed MP4 activity.

The assessment also considered cumulative noise effects from MP4 together with existing consented mining activities, including Coronation North Stage 5, Innes Mills Stage 9 (CCP2), and the Golden Point Underground expansion.

Night-time noise levels from worst-case MP4 activity (including cumulative noise from existing consented activity) are expected to exceed 40 dB $L_{Aeq\ (15\ min)}$ at several nearby receivers, summarised as follows:

- At the notional boundary of the private dwelling at 1668 Macraes Road (receiver 1) there is potential for levels of up to 43 to 45 dB $L_{Aeq\ (15\ min)}$ to be received during several years of MP4 operation;
- At the notional boundary of the private dwelling at 406 Horse Flat Road (receiver 20), there is potential for levels of 41 to 47 dB $L_{Aeq\ (15\ min)}$ to be received during several years of MP4;
- At receivers 2 – 5 and 8 (which are dwellings on Macraes Road and are owned by OGNZL), noise levels of between 41 to 45 dB $L_{Aeq\ (15\ min)}$ could be received during most years of MP4 operation;
- At 1726 Macraes Road and 2 Hill Street (receivers 6 – 7) there is potential for levels of 41 to 43 dB $L_{Aeq\ (15\ min)}$ to be received during most years of MP4 operation; and
- At the notional boundary of all other privately-owned dwellings (receivers 10, 17, 18, and 19), noise levels of 40 dB $L_{Aeq\ (15\ min)}$ or less are expected during all years of MP4.

In assessing the effects of identified predicted non-compliances with the noise standards, where predicted noise levels are 45 dB $L_{Aeq\ (15\ min)}$ or less, this is still consistent with the WHO and NZS6802:2008 recommendations to allow occupants to sleep with windows open for ventilation. Additionally, the levels predicted are based on reasonable worst-case operational scenarios and are not expected to be present all the time. Based on this, at properties where noise levels are no higher than 45 dB $L_{Aeq\ (15\ min)}$, it is expected that noise effects would be no more than minor.

9.10.4 Mitigation measures

Acoustic Engineering Services (2026) identifies 1668 Macraes Road and 406 Horse Flat Road as the key privately-owned receivers where project-specific mitigation and existing noise management arrangements are required to manage potential noise effects. Both properties

have been the subject of previous consent processes and specific noise mitigation measures associated with existing mining activities.

For the exceedance at 1668 Macraes Road, Acoustic Engineering Services (2026) notes that noise protection upgrades have previously been undertaken at the dwelling and recommends the construction of a noise protection bund on adjoining OGNZL-owned land. Together, these measures and the proposed operational controls are expected to limit noise levels at the dwelling to 45 dB $L_{Aeq\ (15\ min)}$ or less. The bund would be constructed in the neighbouring land parcel, owned by OGNZL, and would need to have be a minimum height of 4 metres above ground level at its southernmost extent, tapering to ground level at the north end as the terrain rises. The noise assessment concludes that implementation of the bund will limit noise levels at 1668 Macraes Road to 45 dB $L_{Aeq\ (15\ min)}$ or less.

For the exceedances at 406 Horse Road, mitigation via dwelling upgrades would be sufficient to reduce the expected noise levels. The assessment notes that previous dwelling upgrades and noise management arrangements are already in place at this property as a result of earlier consented mining activities.

With implementation of these mitigation measures, noise effects at both properties are anticipated to be less than minor.

In addition to this mitigation, surface level earthmoving activities in the northern part of the Frasers West WRS, and the western part of Innes Mills Backfill will be restricted to daytime hours and secured through the proposed conditions of consent to ensure that overall cumulative night-time noise levels do not exceed 45 dB $L_{Aeq\ (15\ min)}$ within the notional boundary of the dwelling at 1668 Macraes Road.

9.10.5 MMPMZ Boundary Compliance

Acoustic Engineering Services (2026) has identified that noise levels at some locations along the MMPMZ boundary are expected to exceed the relevant Operative WDP noise limits during certain stages of MP4. These exceedances are primarily associated with haulage routes and mining activities located close to or overtop the MMPMZ boundary within the Coronation, Coronation North, Innes Mills and Golden Bar areas. However, the assessment concludes that most of these exceedances occur adjacent to remote rural land that is not noise-sensitive and are therefore not representative of actual noise effects experienced at nearby dwellings. Accordingly, these boundary exceedances are not expected to result in significant adverse noise effects.

9.10.6 Summary

Overall, the assessment concludes that night-time noise levels of up to 45 dB $L_{Aeq\ (15\ min)}$ at residential receivers are acceptable and consistent with recognised guidance relating to sleep and residential amenity. Predicted worst-case night-time noise levels could exceed 40 dB $L_{Aeq\ (15\ min)}$ at a limited number of receivers but are generally predicted to remain at or below 45 dB $L_{Aeq\ (15\ min)}$ following implementation of the proposed mitigation measures.

The assessment concludes that predicted night-time noise levels are generally consistent with WHO and NZS 6802 guidance relating to sleep and residential amenity, particularly where mitigation and existing noise management arrangements are in place. Daytime operational noise is predicated to comply with the applicable noise criteria at all assessed receivers and is not expected to result in adverse effects. Subject to implementation of the consented noise bund at 1668 Macraes Road and daytime-only operation of specified earthworks activities, operational noise effects associated with MP4 are considered to be no more than minor.

9.11 BLASTING EFFECTS

Drilling and blasting are proposed to extend the existing Coronation, Coronation North, Innes Mills and Golden Bar pits, as well as the GPUG. The actual and potential blasting and vibration effects associated with MP4 have been assessed by techNick Consulting (2026), with the full assessment provided in **Part B** of these application documents.

9.11.1 Vibration and Airblast Effects

Existing consent conditions for Macraes Operation require that vibration and airblast effects are managed to achieve target levels at the notional boundary of residences of 5 mm/s within a frequency range of 3 to 12Hz and 115 dBL. These levels comply with the relevant District Plan requirements, existing resource consent standards and Standard AS 2187.2 and are widely accepted as the limits at which residential amenity values are maintained at an acceptable level.

OGNZL regularly uses specific blast designs that have a lower maximum instantaneous charge (“**MIC**”) explosive charge per delay when near boundaries of sensitive sites and residences to ensure vibration levels remain below consented limits. These blast designs are routinely applied at the Macraes Operation as mining approaches sensitive receivers and form part of OGNZL's established vibration management approach.

The nearest private residence to proposed blasting is at approximately 910 m (at 1668 Macraes Road). Modelling undertaken by techNick Consulting predicts vibration levels of between approximately 2.6 mm/s and 3.9 mm/s for designed blasts at this location, both of

which are below the consented limit of 5 mm/s. **Figure 9-15** illustrates the relationship between blast design and setback distance to sensitive receivers, demonstrating how blast design can be modified to maintain compliance with vibration limits as mining progresses.

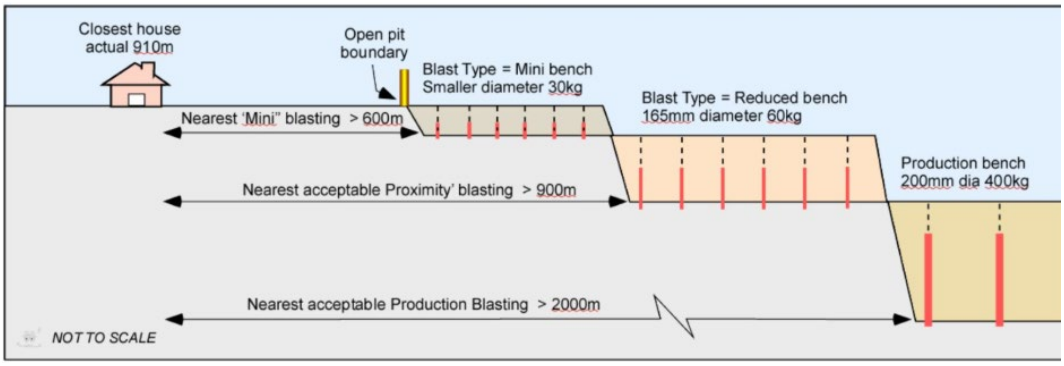

Figure 9-15: Relationship between blasting design and distances from a residence

There are also a number of sensitive heritage sites within 1000m of proposed blasting. The closest historic site to open pit blasting is Gay Tan's Cottage with a setback of 721 m and the closest historic site to underground blasting is Callery's Battery with a setback of 239 m. The impact of blasting effects on heritage sites is largely determined by the type of materials used to construct the site. Based on AS 2187.2:2006 it is considered that, where possible, blasting should be managed to achieve vibrations levels not exceeding 12.7 mm/s at heritage sites where buildings are constructed using plaster and 19 mm/s for buildings constructed with other materials. Where monitoring indicates these the trigger levels have been exceeded, follow-up condition inspections will be undertaken by a suitably qualified and experienced professional to determine whether any damage is likely to be attributable to blasting. Blast designs will be reviewed and modified as necessary to avoid further exceedances and, where damage is confirmed to be attributable to blasting, appropriate remediation will be undertaken by OGNZL.

Blasting will commence at larger distances from sensitive sites and measurements of vibration and airblast will be recorded and reviewed as mining progresses toward the sensitive receptors and sites. Monitoring results will be used to verify modelled predictions and refine blast design parameters where necessary. Modelling indicates that blast designs are capable of maintaining compliance with vibration criteria at closest residential receivers, while effects at Gay Tan's Cottage and heritage structures within the Golden Point Historic Reserve will be managed through the proposed adaptive management framework. Where vibration and airblast levels are at risk of exceeding compliance limits, blast design, notably of the MIC, will be modified to ensure that compliance is achieved.

For the GPUG extension, modelling predicts vibration levels at the nearest residence (406 Horse Flat Road) of approximately 1.4 mm/s, well below residential vibration criteria. Conservative modelling indicates that vibration trigger levels could potentially be exceeded at some heritage structures within the Golden Point Historic Reserve; however, the assessment notes that actual vibration levels are typically substantially lower than conservative predictions. Potential effects will be managed through vibration monitoring, condition inspections, adaptive modification of blast designs where required, and remediation of any damage confirmed to be attributable to blasting. Other consequences of blasting, such as fly rock and dust are unlikely to be of concern due to the extended distances from occupied sites. The technical assessment also concludes that potential airblast effects at the nearest residence are predicted to remain below the applicable limit of 115 dBL for all proposed blast design categories.

Potential hazards can be adequately addressed by continuing to apply the mitigation measures within the Noise, Airblast and Vibration Management Plan ("**NAVMAP**") that have successfully been used at the Macraes Operation over many years.

To avoid, remedy or mitigate any adverse effects associated with blasting, the following management and mitigation measures are proposed:

> The hours of blasting shall be restricted to Monday-Friday 9am to 5.30pm and Saturday and Sunday 10am to 4.30pm;

> To ensure compliance with conditioned vibration and airblast limits for residential receivers, blasting will be managed by on-going measurement and analysing actual vibrations at the closest residential sites and, if required, blast designs will be modified to ensure compliance;

> To ensure impacts on heritage sites from blasting are able to be identified and remedied, existing condition surveys for Gay Tan's Cottage and the heritage structures with the Golden Point Reserve will be maintained and updated where necessary. Vibration monitoring will be undertaken at identified heritage structures and, where adopted vibration trigger levels are exceeded, follow-up inspections will be undertaken by a suitably qualified and experienced professional to determine whether any damage is likely to be attributable to blasting. Any damage confirmed to be attributable to blasting will be remedied by OGNZL, with blast designs reviewed and modified where necessary to avoid further effects; and

> The NAVMAP will be reviewed and updated prior to undertaking the proposed activities to ensure blasting activities continue to be effectively managed.

9.12 ROADING AND TRAFFIC

An assessment of effects on the transportation network arising from MP4 is covered in an Integrated Transport Assessment ("**ITA**") provided in Stantec (2026). A copy of the ITA is provided in **Part B** of these application documents.

The Macraes Operation is accessed primarily via Macraes Road, which connects to State Highway 85 to the east and, via Hyde-Macraes Road, to State Highway 87 to the west. Macraes Road and Hyde-Macraes Road are low-volume rural arterial roads that currently accommodate traffic associated with mining, farming and rural activities

A key component of MP4 is the realignment of Macraes Road in two stages as detailed in Section 6.5.4 of **Part A.06** of this report. Stage 1 will accommodate the proposed Innes Mills Pit extension 11 and 12, while Stage 2 involves a more substantial realignment of Macraes Road associated with the proposed Innes Mills Pit extension 13. New intersections and vehicle access points are also proposed as part of these works. The ITA assesses the transport effects of these changes during both construction and operation.

The impacts of general traffic movement on the immediate roading network have been considered for both the construction and operational phases in the ITA. A summary of the key findings is provided below.

9.12.1 Construction Phase Effects

Temporary traffic movements associated with construction activities will result in some temporary traffic volume increases. The ITA notes that traffic volumes at the Macraes Operation already fluctuate periodically during construction activities, maintenance periods and plant shutdowns, and that temporary increases associated with MP4 can be readily accommodated within the existing road network.

Any potential temporary effects on road safety or amenity will be managed through appropriate construction management measures, which may include the implementation of temporary traffic management through a standard Temporary Traffic Management Plan process, led by the roading contractor. Public access along existing roads will be maintained, with part of the road always remaining usable. The ITA concludes that the existing road network can accommodate these temporary fluctuations in traffic demand.

Accordingly, construction-related traffic effects will be temporary, localised, and less than minor, and are capable of being managed through standard management practices. No adverse long-term road safety or transport efficiency effects are anticipated as a result of construction traffic.

9.12.2 Operational Phase Effects

MP4 will not result in any material increase in existing staffing levels or production-related traffic generation and, therefore, will not result in additional daily traffic demand on Macraes Road, Hyde-Macraes Road, or the wider State Highway network. Consequently, the key impacts to be assessed relate to the appropriateness of the Macraes Road realignments, new intersections and vehicle access points.

The Stage 1 and 2 Macraes Road realignments have been designed in accordance with Austroads standards and will provide carriageway widths, geometry, and sight distances that meet or exceed those of the existing road. The proposed new intersections and Macraes Operation access points incorporate appropriate treatments, including widening for passing of right-turning vehicles, left-turn deceleration lanes, and design vehicle accommodation, to ensure safe and efficient operation for all road users. The ITA concludes that these works are proposed to a high standard and will operate safely and efficiently, with only negligible effects on the safety and efficiency of Macraes Road.

The ITA further concludes that existing crash records do not identify any particular locations of concern along the Macraes Road and Hyde-Macraes Road route and that the route will continue to safely accommodate Macraes Operation traffic throughout the duration of MP4. While visibility at the SH85 / Macraes Road and SH87 / Hyde-Macraes Road intersections is below desirable standards, the intersections are considered to operate satisfactorily given the low traffic volumes and are expected to continue to do so, noting MP4 is not proposed to generate additional traffic.

Consent conditions relating to the road realignments, consistent with those applied for previous road realignments at Macraes Operation, are proposed. Relevant to road safety, these will require engineering design in accordance with industry standards, design approvals by Council and a post-construction safety audit, and these are considered appropriate. In this respect there are no permanent adverse traffic effects.

Finally, the ITA identifies a small number of technical non-compliances with the Waitaki District Plan transport provisions in respect of cycle parking, unsealed parking and loading areas and vehicle crossing lengths. Noting the long-established nature of the activities on site, and its rural environment, these are assessed as not giving rise to adverse transport, safety or efficiency effects.

Accordingly, the overall operational traffic effects are assessed as negligible, with no adverse road safety or transport efficiency effects anticipated.

9.13 LIGHTING EFFECTS

A Lighting Assessment has been prepared by Leading Design Professionals (2026), and this report can be found in **Part B** of these application documents. The Lighting Assessment considers effects on the surrounding environment from artificial lighting associated with MP4 activities.

As outlined in **Section A.06** of this substantive application, the existing lighting environment reflects the nature of a continuously operating mine. Activities such as vehicle movements, mobile plant operation, and navigation occur on a 24-hour basis and require appropriate lighting to maintain safe working conditions. Mobile lighting towers operate overnight, typically at excavation and waste rock disposal areas and at key road bends or intersections and form an established component of the existing environment.

Leading Design Professionals (2026) concludes that any actual and potential adverse effects of the proposed lighting associated with MP4 activities will be appropriately managed and, overall, will be no more than minor. Key findings and mitigation approaches include:

- The relocation of the Workshop will result in a net positive effect, as lighting associated with this facility will be largely shielded from the Macraes Township and other public viewpoints, noting transient views will be visible from Macraes Road;
- Effects on night sky visibility, including sky glow and overall amenity, will be negligible or less than minor;
- No permanent or persistent flashing lights are proposed, and all lighting will be designed to comply with the relevant performance standards of the 2GP, PWDP, and OWDP. As a result, no adverse effects on the health and wellbeing of nearby residents are anticipated;
- Mobile lighting towers will be no more than 12 m in height, directed toward active work areas and away from surrounding areas that contain residential properties, therefore minimising the potential for glare effects;
- Lighting from vehicles and mobile plant will be intermittent and transient limiting the duration of any exposure experienced by sensitive receivers, where safe to do so vehicle headlights will be dipped; and
- All luminaires will be downward-directed and appropriately shielded to minimise light spill beyond the site, ensuring that visibility from public roads and neighbouring properties is avoided or significantly reduced.

Overall, the proposed lighting design continues the established operational environment, with measures to avoid, remedy, or mitigate adverse effects (as outlined in **Part A.10** of this report, or **Part D** of this substantive application document). Accordingly, lighting effects are assessed as less than minor.

9.14 ARCHAEOLOGICAL AND HERITAGE EFFECTS

An assessment of the potential effects of MP4 on archaeological and historic heritage values is provided in Origin Consultants (2026a) and a copy of the report is provided in **Part B** of these application documents. A summary of archaeological and historic heritage effects is presented below.

9.14.1 Coronation Mining Area and Coronation North

Within the Coronation Mining Area, the only identified heritage site is the fence line (I42/253), which has been assessed as having negligible heritage value. This feature is required to be removed for the expansion of the Coronation Pit; however, Origin Consultants (2026a) conclude that its removal will result in no more than negligible (less than minor) effects on historic heritage.

9.14.2 Central Mining Area

The proposed seepage collection drain and associated sumps for the Fraser WRS are not expected to result in any adverse effects on identified historic heritage items in the Central Mining Area. The design of the works has specifically avoided the early alluvial workings (I42/64) and associated sod structure (I42/51), ensuring these features will not be impacted. Similarly, the two stone features (IM1 and IM3) located adjacent to the Stage 1 road realignment will not be affected by the proposed works.

However, while no historic heritage will be directly affected by the seepage drain and sump construction, excavation will occur within land parcels subject to heritage covenants. These covenants cannot be modified through the Act, and approval from HNZPT will be required outside of the fast-track process. Although works are proposed within land subject to heritage covenants, all heritage features will be avoided and any effects on the heritage values are negligible to less than minor.

More broadly, potential indirect effects on heritage values associated with vibration and ground disturbance for activities proposed as part of MP4 have been identified. In particular, Gay Tan's Cottage (I42/50) may be sensitive to vibration from nearby road construction and mining activity (such as blasting and excavation). Without appropriate management, there is a risk of damage to its earth structure and brittle finishes. In addition, areas such as Innes

Farm and the former upper township contain archaeological values that could be affected by ground disturbance, including previously unrecorded subsurface remains.

These potential effects will be managed through a combination of technical assessment, monitoring, and archaeological management. TechNick (2026) has prepared a technical assessment of actual and potential blasting and vibration effects for MP4, which establishes vibration limits for activities in the Central Mining Area to avoid damage to Gay Tan's Cottage. Existing vibration monitoring infrastructure, including seismograph equipment installed for the Frasers West mining operations, will continue to operate throughout MP4 and be regularly reviewed by suitably qualified professionals in consultation with a heritage expert to ensure compliance with these limits. Archaeological effects will be managed through investigations undertaken under an Archaeological Authority from HNZPT that is being sought for MP4. OGNZL propose that an Archaeological Management Plan is prepared and implemented for the Project, which will provide for the recording of both 19th and 20th century material and the avoidance of sites not affected by the proposed works. The Archaeological Authority and associated heritage approvals sought for MP4 are detailed in **Part A.14** of this report.

With these measures in place, and with the requirement for separate HNZPT approvals for works within covenant land, the effects on historic heritage are assessed as negligible to less than minor, and no adverse effects are anticipated.

9.14.3 Golden Bar Mining Area

Within the Golden Bar Pit and WRS, three heritage sites have been identified, including the Golden Bar Mine and Battery (I44/86 and I44/88) and associated sluicings (I43/190). While the Golden Bar Mine and Battery are assessed as having moderate heritage value, these sites are located outside the proposed pit extent and will not be directly disturbed. Potential vibration effects on associated dry stone structures can be appropriately managed through mitigation measures such as vibration controls, monitoring, and maintenance, such that effects on historic heritage are not expected to be more than minor.

The sluicing site within the Golden Bar Pit and WRS will be destroyed through the expansion of the pit shell, however any effects have been considered less than minor as the sluicing site has low heritage value.

No historic heritage sites have been identified within the Golden Bar Haul Road reinstatement area, and therefore no historic heritage effects are anticipated. The prospecting pit (I42/33), located between two branches of the proposed haul road, will be identified and appropriately marked to avoid damage during construction activities.

While the MEEA has been designed to avoid or minimise effects on historic heritage where practicable, the Heritage Assessment identifies a limited number of archaeological sites that may be modified by the proposed works. In particular, parts of the Murphys Creek alluvial workings (I43/191) may be affected by fence and culvert installation works, the stone culvert (I42/256) will be removed, and a portion of the historic fence line (I42/257) will be modified. These effects will be managed through an Archaeological Authority, archaeological recording, pre-construction assessment, and implementation of an Archaeological Management Plan as detailed above. Following implementation of these measures, effects associated with the MEEA are assessed as less than minor adverse.

MP4 may impact a number of recorded archaeological sites and OGNZL is seeking an archaeological authority as part of this application. It is noted that there are no known pre-European Māori sites within the footprint of any of the proposed MP4 works, however as proposed in **Part D** of these application documents, an Accidental Discovery Protocol condition is proposed that details the appropriate management response if a Māori site or remains are found during MP4 earthworks.

9.15 CONTAMINATED LAND MANAGEMENT

The actual and potential effects relating to ground contamination have been assessed through a PSI prepared by WWLA (2026a) to identify areas of potential ground contamination in locations relevant to MP4. A DSI was also undertaken by WWLA (2026b) specific to the Open Pit Mining Workshop in the Central Mining Area. Both technical assessments are provided in **Part B** of these application documents.

9.15.1 Macraes Operation

Numerous activities at the Macraes Operation are listed on the HAIL and have the potential to contribute to ground contamination. **Table 9-11** identifies potential HAIL activities relevant to MP4; however, it should be recognised that the presence of a HAIL activity does not confirm ground contamination. While other activities at the Macraes Operation may also pose a risk of ground contamination, these fall outside the scope of this application and have not been considered further.

Table 9-11: Potential HAIL Activities relevant to MP4

Operational Activity / Area	Location	HAIL Activity Category	Key Contaminants associated with HAIL Category
Storage of chemicals, fuels and waste oil tanks.	Central Mining Area	A17: Storage tanks or drums for fuel, chemicals or liquid waste. F7: Retail or commercial fuelling activities.	Primary diesel, oil, grease and chemicals associated with the Processing Plant.
Electrical transformers and substations	Central Mining Area	B2: Electrical transformers B4: Power stations, substations	Metals, hydrocarbons (site post-dates use of polychlorinated biphenyls and asbestos).
Workshops	Central Mining Area and Coronation Mining Area	A17: Storage tanks or drums for fuel, chemicals or liquid waste. D5: Engineering workshops with metal fabrication. F4: Motor vehicle workshops. B2: Electrical transformers.	Metals, hydrocarbons (diesel, oil, grease) and potentially solvents.
TSFs	Central Mining Area	E7: Mining industries	Metals and sulphides.
Ore Stockpiles	Central Mining Area	E7: Mining industries	Metals and sulphides.
Waste disposal to WRS	Coronation Mining Area and Central Mining Area	G5: Waste disposal to land	Depends on wastes previously buried -– potentially metals, combustion byproducts and hydrocarbons.
Effluent disposal fields/septic systems	Central Mining Area	G5: Waste disposal to land	Bacteria, viruses, metals and hydrocarbons are common.

Operational Activity / Area	Location	HAIL Activity Category	Key Contaminants associated with HAIL Category
Concrete washing at underground portals	Central Mining Area	I: Intentional or accidental release of a contaminant in sufficient quantity to present a risk to human health or the environment.	High pH water (may cause mobilisation of metals).
Outdoor storage of used materials	Multiple locations	I: Intentional or accidental release of a contaminant in sufficient quantity to present a risk to human health or the environment.	Depends on materials being stored – hydrocarbons and metals are common.
Migration of contaminants from the mine to surrounding lands	Multiple locations	H: Migration of a contaminant in sufficient quantity to present a risk to human health or the environment.	Metals and hydrocarbons are most likely.
Use of building materials containing lead-based paints and/or asbestos containing materials	Multiple locations	I: Intentional or accidental release of a contaminant in sufficient quantity to present a risk to human health or the environment.	Lead and asbestos.

Contamination at the Macraes Operation is primarily limited to localised areas (workshops, fuel farms and servicing areas), larger low-level areas (outdoor storage areas, finger storage areas and waste disposal areas), and potential mining-related discharges (TSFs, ore stockpile, mine workings and seepage areas). The mitigation and management approach for contaminated land focuses on targeted investigations only where disturbance is proposed (e.g. fuel farms, workshops, and waste areas), ensuring any contamination is identified and appropriately addressed, while avoiding unnecessary work in undisturbed areas. Low-level contamination will largely be managed through standard mining controls, including reprocessing, which reduces the need for specific remediation.

Potential discharges and remediation-related effects are expected to be minor and will be managed under existing resource consents, the MWMS, and a SMP which together provide for the effective management of any actual or potential effects on human health. Where remediation is required, practical and proven options (such as processing contaminated

material through the Processing Plant or disposal in a TSF) are available and efficient. A draft SMP is included in **Part H** of these application documents, and provisions relating to the preparation and certification of the SMP are included in the proposed conditions provided in **Part D** of these application documents.

Overall, the combination of targeted investigations, existing operational controls, and established management methods ensures contaminated land effects will be appropriately managed.

9.15.2 Open Pit Mining Workshop

WWLA (2026b) prepared a DSI for the Open Pit Mining Workshop that is proposed to be relocated as part of MP4. The following HAIL activities were identified at the workshop:

- A17: Storage tanks or drums for fuel, chemicals or liquid waste;
- F4: Motor vehicle workshops;
- F7: Retail or commercial refuelling facilities (for the adjacent fuel farm that supplies the workshop);
- I: Intentional or accidental release of a contaminant in sufficient quantity to present a risk to human health or the environment (potentially occurring, in relation to vehicle washing, storage of materials outdoors, tyre testing); and
- H: Migration of a contaminant in sufficient quantity to present a risk to human health or the environment (potentially occurring, in relation to discharges of stormwater to the western swale).

The locations of the HAIL activities listed above, are shown in **Figure 9-16** below.

Figure 9-16: Location of HAIL Activities at the Open Pit Mining Workshop

The DSI confirms that while several HAIL activities have occurred at the Workshop, ground contamination is generally limited and manageable. Soil sampling indicates that elevated metals, particularly arsenic, are largely associated with naturally occurring waste rock, with the highest concentrations found in sediment and sludge that will require management during future earthworks. Although hydrocarbons were detected more widely, they do not pose a significant risk to human health or the environment. The conceptual site model shows that, provided bulk earthworks are undertaken using large-scale mining methods, potential effects will be negligible.

Any risks associated with more localised works can be effectively managed through standard controls such as dust suppression and staff protection measures. Outside of specific areas like sediments and sludge, no contamination-specific management is required for the broader workshop site. Consistent with the wider site contamination management approach, OGNZL will implement the site-wide SMP to manage contaminated land risks associated with MP4, including relocation of the Open Pit Mining Workshop and decommissioning of selected fuel farms. The SMP provides a framework for managing localised contamination associated with identified potentially contaminating activities and sets out measures to protect workers and the environment during soil disturbance works.

9.15.3 PFAS Contamination

A preliminary assessment of the potential risks associated with historical use of per- and polyfluoroalkyl substances ("**PFAS**") at the Macraes Operation has been prepared by WWLA (2026c). A copy of the assessment is provided in **Part B** of these application documents.

Historically, PFAS-containing aqueous film-forming foams ("**AFFF**") were used for fire protection within the Macraes Operation, including in vehicle fire suppression systems, workshop servicing activities, emergency response equipment, and training activities. These products have since been replaced with fluorine-free alternatives, however, there remains potential for legacy PFAS contamination associated with past lawful use of PFAS-containing AFFF.

The preliminary assessment identifies several potential PFAS source areas, including the Main Workshop, the MTI, process water systems and, to a lesser extent, more diffuse sources associated with historical firefighting system activations, remote servicing activities and training exercises. Based on the information currently available, WWLA (2026c) considers that most of the PFAS mass potentially associated with mining activities is likely to be contained within process water, tailings and related MWMS. Accordingly, an overall low risk to off-site receptors is inferred at this stage.

The assessment concludes that there are no identified complete pathways that would result in unacceptable effects on human health. Groundwater modelling indicates that adverse effects on groundwater users are unlikely, and existing health and safety procedures at the Macraes Operation are expected to also provide protection from any potential PFAS exposure pathways for workers.

Potential effects on environmental receptors have not yet been fully quantified, and further investigations are recommended to confirm the presence, extent and potential mobility of PFAS. These investigations will include targeted soil sampling around current and historical workshop facilities, assessment of process water and tailings systems, and monitoring of surface water and groundwater using the existing compliance monitoring network. The findings of this work will be incorporated into the conceptual site model for the Macraes Operation and, if necessary, will inform any mitigation or management measures required.

The assessment concludes that the existing consenting and management framework proposed for MP4 provides an appropriate mechanism for PFAS contamination to be further investigated and, if necessary, managed as the Project progresses. Any additional management measures identified through future investigations can be incorporated into the SMP and other operational management documents. Accordingly, PFAS-related effects are considered capable of being appropriately managed through the existing consenting and

management framework for MP4. Based on the information currently available, no significant adverse effects on human health are anticipated and a low risk to environmental receptors is inferred. Further investigations and monitoring are proposed to quantify the extent of any PFAS contamination and determine whether any additional management or mitigation measures are required.

A draft SMP is included in **Part C** of these application documents, and provisions relating to the preparation and certification of the SMP are included in the proposed conditions included in **Part D** of these application documents.

Overall, contaminated land effects can be appropriately managed using existing mining practices and established management methods.

9.16 EFFECTS RELATING TO THE STORAGE AND HANDLING OF HAZARDOUS SUBSTANCES

MP4 involves the storage, handling and use of hazardous substances associated with the Processing Plant, diesel storage and refuelling facilities, workshops, explosives storage and use, and ecological management activities.

Hazardous substances associated with MP4 comprise fuels, explosives, explosive precursors, processing reagents, gases, oils, maintenance chemicals and agrichemicals (e.g. herbicides and pesticides). These substances are stored and used principally within the Processing Plant, diesel storage and refuelling facilities, workshops, and explosives storage areas located within the Macraes Operation. The storage, handling and use of these substances have the potential to result in adverse effects through fire, explosion, accidental release during storage or use, and transport incidents. Potential receptors include nearby residents, users of the Golden Point Historic Reserve, surrounding property, and ecological receptors including local waterways and non-target species.

The potential effects of these activities have been assessed by Tonkin + Taylor (2026b). The full assessment is included in **Part B** of these application documents, with a summary of the key findings provided in the sub-sections below.

9.16.1 Effects on People and Property

The storage and use of hazardous substances associated with MP4 presents potential effects on people and property, primarily related to fire, explosion (blast overpressure), and accidental spills of hazardous substances.

The risk of fire from flammable and oxidising substances (including fuels, chemicals, and gases used at the Processing Plant, workshops, refuelling areas, and the Class 5 oxidising

solid reload depot for storage of precursors to explosives) has been assessed as low, with overall effects on people and property considered less than minor. This reflects the limited exposure of sensitive receptors, with nearby rural dwellings, Macraes Village and other sensitive land uses located substantial distances from hazardous substances storage and use activities, including the closest dwelling located over 750 m away and key facilities over 2 km from high-risk activities. Fire risks are further reduced through certified storage systems, segregation of incompatible substances, fire suppression infrastructure, emergency response procedures, and dedicated on-site firefighting capability.

Potential effects associated with explosion from Class 1 explosives storage are also assessed as low. While a small part of the Golden Point Historic Reserve falls within the 2–3.5 kPa overpressure zone, the probability of injury is very low, and expected damage is minor (e.g. glass breakage). Given the separation distances, intervening topography, and limited public use of the affected area, the overall effect on people and property is less than minor.

The risk of spills of hazardous substances (including fuels, reagents, and mercury) is assessed as low, with potential effects on people and property similarly assessed as less than minor. While substances such as cyanide present a higher hazard, the likelihood of off-site effects is very low due to secondary and tertiary containment systems, operational controls, emergency response procedures, and containment and site controls, combined with the large separation distances from sensitive receptors.

OGNZL has a comprehensive suite of controls in place to manage risks associated with hazardous substances. These include:

- Compliance with regulatory requirements (particularly with respect to Hazardous Substances and New Organisms Act 1996 requirements), certified storage and handling systems, preventative maintenance, segregation of incompatible substances, and provision of secondary and tertiary containment (e.g. bunding, sumps, and ponds);
- Segregation of incompatible substances and provision of secondary and tertiary containment systems (including bunding, sumps and containment ponds);
- Automated handling systems to reduce human exposure to hazardous substances, emergency response plans, trained personnel, and dedicated firefighting resources that provide additional safeguards;
- Specific controls for explosives storage include compliance with Health and Safety at Work-Hazardous Substance regulations, secure and segregated storage, restricted access to certified handlers, and monitoring and maintenance of facilities;

- Spill risks are mitigated through containment systems, standard operating procedures, and regular emergency response training; and
- Mercury is managed through controlled storage, tracking systems, and disposal to authorised facilities.

The hazardous substances assessment concluded that the likelihood and consequence of fire, explosion and spill events are generally low, with no significant residual risks to off-site people or property identified.

After implementation of these mitigation measures, residual effects on people and property are assessed as less than minor.

9.16.2 Effects on Ecosystems

The storage and use of hazardous substances associated with MP4 have the potential to result in adverse effects on the environment, particularly through accidental spills affecting sensitive receiving environments. While on-site areas are highly modified and not considered sensitive to ecotoxic effects, nearby off-site waterways (including Deepdell Creek, Highlay Creek, and Tipperary Creek) are identified as having high sensitivity to uncontrolled discharges of hazardous substances. Hazardous substances with the most potential ecological consequence include diesel, cyanide, agrichemicals, and other ecotoxic or corrosive process reagents used and stored across the Macraes Operation.

The primary risk arises from spills of environmentally hazardous substances such as cyanide or diesel, which could have significant adverse ecological effects if they were to reach sensitive downstream waterways and aquatic environments. The hazardous substances assessment identified diesel spills during equipment refuelling as the principal residual ecological risk, reflecting the frequency of refuelling activities and the potential for small spill events. However, this risk is managed through engineering controls including containment systems and automatic shut-off mechanisms, together with operational procedures, staff training, and emergency response measures. Accordingly, the overall magnitude of effect is assessed as low, with potential effects on the environment assessed as less than minor.

A comprehensive framework of mitigation measures is implemented through the site's hazardous substances management systems ("**PHMP-HS**"). These include secondary containment for liquid hazardous substances, with additional tertiary containment systems (e.g. engineered sumps and collection ponds) to capture any spills in the unlikely event of containment failure. Diesel storage is further protected through double-skinned tanks, bunded systems, and overfill protection. The broader MWMS also provides an additional

level of containment by directing runoff from operational areas to collection and treatment systems.

Operational controls include equipment maintenance, interlocks and automatic shut-off systems, safe handling and transport procedures, and staff training to ensure competency. Emergency response plans and dedicated response teams are also in place to manage any accidental releases. Solid substances that do not require secondary containment are managed under strict storage and handling protocols to minimise spill risk. These measures are supplemented by hazardous substances tracking, inspection and auditing programmes, and site-specific procedures for storage, handling and spill response.

The hazardous substances assessment has concluded that potential ecological effects are primarily associated with accidental spill events and that the likelihood of contaminants reaching sensitive receiving environments is low due to the multiple layers of containment and response measures in place.

Considering the robust containment systems, separation from sensitive environments, and comprehensive management controls, the residual effects on the environment from hazardous substance spills are assessed as less than minor. The likelihood of contaminants reaching sensitive off-site waterways is very low, and risks are appropriately avoided, remedied, or mitigated by conditions imposed in **Part D** of these application documents.

9.16.3 Cumulative Effects

The potential for cumulative effects from hazardous substances is limited, as the Macraes Operation is the only large-scale industrial activity in the immediate area.

The primary cumulative risk relates to the storage of explosives, particularly the potential for accidental detonation and the interaction between nearby storage facilities. However, the separation distances between explosive storage areas are substantial (e.g. approximately 650 m between Class 1 and Class 5 facilities, and over 3.2 km to the Red Bull storage area) and comply with relevant standards. These facilities are managed independently and are subject to strict controls, including site security, certified handling requirements, emergency response procedures, and segregation from incompatible substances.

Similarly, other hazardous substances storage areas across the Macraes Operation are sufficiently separated such that a fire, spill, or other incident at one facility is unlikely to result in consequential effects at another facility.

As a result, the likelihood of explosion propagation between facilities is extremely low, the potential for escalation between hazardous substances facilities is negligible, and the overall magnitude of cumulative effects is assessed as negligible.

9.16.4 Transport Effects

The transport of hazardous substances associated with MP4 has the potential to result in adverse effects on people, property, and the environment, particularly in the event of an accident or spill during transit. Hazardous substances transported to and within the Macraes Operation include fuels, explosives, explosive precursors, processing reagents and other operational chemicals. However, transport routes will remain unchanged from existing operations and are primarily confined to the State Highway network and Macraes Road. Importantly, no transport through densely populated or sensitive residential areas is proposed. Accordingly, potential exposure of sensitive receptors to transport-related hazardous substances incidents is limited. As a result, the magnitude of effect is assessed as low, with overall effects considered less than minor.

Transport of hazardous substances will be undertaken in accordance with the Land Transport Rule: Dangerous Goods 2005, which sets strict requirements for packaging, labelling (placarding), segregation of incompatible substances, provision of emergency response equipment, and driver training. On-site, transport of higher-risk substances such explosives and acutely toxic substances is further controlled through supervision by Certified Handlers. These regulatory and procedural controls ensure that risks associated with transport are effectively managed.

In addition, the established transport routes, existing operational experience at the Macraes Operation, and the implementation of emergency response procedures reduce both the likelihood and potential consequences of transport-related incidents.

Taking these controls into account, the residual effects of hazardous substances transport on people, property and the environment are assessed as less than minor.

9.17 DUST AND AIR QUALITY EFFECTS

Any actual or potential adverse effects relating to dust and air quality from MP4 have been assessed by Tonkin + Taylor (2026a). A copy of this technical assessment is provided in **Part B** of these application documents.

The main discharge to air from the proposed mining operations is dust (or particulate matter) from the mining activities, including from the handling and transport of waste rock and ore.

The most significant potential source of dust associated with mining activity arises from the movement of vehicles along unpaved haul routes during dry weather. Dust from vehicle movements can occur irrespective of wind speed but depends on the moisture content and proportion of fine material in the haul road, as well as the number of wheels, weight and

speed of vehicles. The second largest source of dust for mining activities is typically from the crushing and processing of materials, where water suppression or wet processes are not used. Other lesser sources of dust from the mining activities include drilling of holes for the collection of samples, excavation, rock blasting, crushing, screening and ore processing, use of trucks and loaders, wind erosion and entrainment of dusty material.

Air emissions from the Processing Plant are discharged via the pressure oxidation ("**POX**") plant stack and several smaller process stacks, including the barring furnace, electrowinning fume hoods, carbon regeneration kilns, and retort oven. The principal contaminants emitted are very low levels of sulphur dioxide, acid mist, and trace metals (including mercury), with mercury being the primary contaminant from the smaller process stacks.

Historical complaints data reviewed by Tonkin + Taylor (2026a) indicate a low incidence of dust-related concerns associated with mining activities at the Macraes Operation. Recorded complaints since 2018 were infrequent and generally related to temporary water cart management issues or isolated windblown dust events. No dust complaints have been received since 2020.

As detailed in **Part A.07** of this report, MP4 requires consent for a discretionary activity under the Regional Air Plan to discharge contaminants to air associated with mining and processing activities, including but not limited to the extraction and processing of minerals, construction and operation of WRS and TSFs, use of haul roads, ore handling and processing activities, and associated discharges from the Processing Plant.

A summary of the dust and air quality effects for each mining area is presented under the sub-headings below.

9.17.1 Coronation Mining Area

9.17.1.1 Mining Activity Effects

Dust generated from mining activities within the Coronation Mining Area has the potential to cause nuisance effects, including dust deposition and reduced amenity. However, the nearest sensitive receivers are located at substantial distances from the mining area, with the closest dwelling (406 Horse Flat Road) approximately 1,950 m away and Golden Point Historic Reserve approximately 2,610 m away. These separation distances, together with the low frequency of strong, dry winds directed towards sensitive receptors, significantly reduce the potential for off-site dust effects. Consequently, the overall level of effect from this sub-area is assessed as negligible.

For the Coronation haul road area, vehicle movements on unsealed surfaces are the primary source of dust generation. The closest sensitive receptor is the Golden Point Historic Reserve located approximately 315 m from the haul road while the nearest residential receptor (406 Horse Flat Road) is approximately 1,135 m away. While meteorological conditions indicate a moderate frequency of strong, dry winds toward these receptors, an Institute of Air Quality Management (UK) ("**IAQM**") source-pathway receptor assessment found that the combination of separation distance, prevailing meteorological conditions and dust mitigation measures results in a negligible dust impact risk and a negligible magnitude of effect at both receptors.

Standard dust mitigation measures will be implemented to ensure effects remain at this negligible level. These measures include water suppression of haul roads and working areas, management of vehicle speeds, regular haul road maintenance, stabilisation and maintenance of exposed surfaces and stockpiles to reduce dust generation and wind entrainment. A more detailed mitigation approach is included in **Part A.10** of this report.

Overall, with these measures in place, residual dust effects associated with the Coronation Mining Area and Coronation haul road are expected to remain negligible, and no material adverse effects on sensitive receptors are anticipated.

9.17.2 Central Mining Area

9.17.2.1 Mining Activity Effects

Dust generated from mining activities within the Central Mining Area has the potential to give rise to nuisance and amenity effects, including dust deposition and reduced air quality. However, the potential for off-site effects is substantially limited by the separation distances to sensitive receptors, the generally very low frequency of strong, dry winds directed towards those receptors, and the limited effectiveness of the source-pathway-receptor linkage.

For the Innes Mills sub-area, the nearest sensitive receptor is located approximately 605 m away. The frequency of strong, dry winds directed towards this receptor is low (approximately 1.27% of the time), and IAQM source-pathway assessment concludes that the dust impact risk and magnitude of effect are negligible. More distant receptors within Macraes Village are, therefore, expected to experience an equal or lower level of effect.

Similarly, for the Frasers TSF and WRS sub-areas, the nearest receptor is located approximately 670 m away. The frequency of strong, dry winds directed towards this receptor is low (approximately 2.46% of the time). The IAQM assessment also concludes dust impact risk, and the resulting effects are negligible at this location.

For the Processing Plant area, the assessment considered dust generated from crushing operations, noting that the remaining processing stages are predominantly wet processes. The Golden Point Historic Reserve is located approximately 755 m from the Processing Plant and is classified as a receptor of moderate sensitivity. The frequency of strong, dry winds directed towards the reserve is extremely low (<0.01% of the time). The IAQM assessment confirms a negligible dust impact risk and negligible magnitude of effect from dust associated with the operation of the Processing Plant at the Golden Point Historic Reserve.

To maintain these low levels of effect, standard dust management measures will be implemented, such as:

> Water suppression of haul roads, stockpiles, and active work areas;

> Management of vehicle speeds and material handling practices;

> Management and stabilisation of exposed surfaces to reduce wind entrainment; and

> Use of wet processing methods and dust control systems where applicable.

Overall, the combination of substantial separation distances and infrequent adverse wind conditions means that dust effects from activities within the Central Mining Area are expected to be negligible. With standard dust management measures in place, no material adverse effects on surrounding sensitive receptors are anticipated.

9.17.2.2 Stack Emissions

Stack emissions from the Processing Plant, including sulphur dioxide ("**SO_2**"), mercury ("**Hg**"), and trace metals, have the potential to result in adverse air quality and human health effects through exposure to elevated ground level concentrations at sensitive receptors. However, dispersion modelling predicts that concentrations for all contaminants are extremely low at all receptor locations. Predicted SO_2 concentrations are less than 1% of the applicable assessment criteria while predicted mercury and trace metal concentrations are similarly well below the relevant health-based assessment criteria, with several trace metals predicated at or below laboratory limits of detection. [35] As a result, the overall level of effect is assessed as negligible.

Mitigation and management are inherent to the design and operation of the Processing Plant and include controlled stack discharges, the POX plant wet scrubber, mercury recovery through the retort oven, particulate controls on the barring furnace, and the predominately

[35] Including the NES-AQ, MfE AAQG, California Office of Environmental Health Hazard Assessment (OEHHA) Reference Exposure Levels, and, where relevant, WHO Air Quality Guidelines.

wet nature of the processing circuit. The assessment also recommends periodic stack emission testing of the primary discharge source, the POX plant stack, at approximately three-year intervals to confirm that emissions remain consistent with those assumed in the assessment and to strengthen the emissions database over time. Given the negligible contribution of the remaining process stacks, routine monitoring of those sources is not considered necessary.

Overall, the modelling indicates a substantial margin of compliance with all relevant assessment criteria. Accordingly, residual effects on air quality and human health are assessed as negligible in the Central Mining Area, and no adverse effects are anticipated at sensitive receptor locations. Consent conditions requiring periodic POX plant stack emission testing at approximately three-year intervals are included in the proposed consent conditions in **Part D**.

9.17.3 Golden Bar Mining Area

9.17.3.1 Mining Activity Effects

Dust generated from mining activities within the Golden Bar pit and along the Golden Bar haul road has the potential to result in nuisance effects, including dust deposition and reduced amenity at sensitive receptors. However, both sub-areas are located at substantial distances from the nearest receptors. The nearest receptor to the Golden Bar pit is approximately 2,735 m away, while the nearest receptor to the Golden Bar haul road is approximately 1,535 m away. These separation distances substantially limit the potential for off-site dust effects.

The air quality assessment concluded that the potential dust effects associated with both the Golden Bar pit and Golden Bar haul road are negligible. This reflects the considerable separation distances between the dust-generating activities and sensitive receptors, together with the limited potential for dust to be transported off-site at levels that could result in adverse effects.

Standard dust management, such as water suppression on haul roads and active work areas, vehicle speed management, and stabilisation of exposed surfaces, will further reduce the potential for dust generation and dispersion.

Accordingly, the residual effects associated with the Golden Bar Mining Area remain negligible, and no material adverse impacts on sensitive receptors are anticipated.

9.17.4 Effects on Human Health

Dust generated from mining activities has the potential to result in human health effects through exposure to fine particulate matter (PM_{10} and $PM_{2.5}$) and respirable crystalline silica, and arsenic-bearing particulate matter associated with TSFs. The air quality impact assessment specifically considered the potential for exposure to arsenic-containing PM_{10} from TSFs and concluded that the risk is negligible based on the large separation distances between emission sources and sensitive receptors, the very low frequency of strong, dry winds transporting dust toward receptors, and the rapid reduction of dust concentrations with distance. The assessment references measured arsenic concentrations in tailings and concludes that even under conservatively overstated PM_{10} exposure assumptions, ambient arsenic concentrations would remain well below the MfE ambient air quality guideline for arsenic. Accordingly, the overall effect of MP4 on human health is assessed as negligible.

9.17.5 Cumulative Dust Effects

Further, the potential for cumulative dust effects arises from existing consented mining activities. However, these activities largely overlap with the MP4 footprint, particularly in areas closest to sensitive receptors, and separation distances to those receptors remain substantial. Dust from non-mining sources, such as agricultural activities on the site, is intermittent and limited. Consequently, cumulative dust effects from existing mining and non-mining sources are not expected to materially influence the conclusion of a negligible effect.

9.17.6 Summary

Overall, Tonkin + Taylor (2026a) conclude that dust and air quality effects associated with MP4 will be negligible across all mining areas. Dust effects are assessed as negligible due to the substantial separation distances between mining activities and sensitive receptors, the low frequency of strong, dry winds directed towards those receptors, and the implementation of established dust management measures. Historical monitoring and complaints data further support the conclusion that dust emissions are being effectively managed across the Macraes Operation.

Stack emissions are limited to the Central Mining Area due to the location of the Processing Plant. Dispersion modelling predicts that concentrations of SO_2, Hg and trace metals at all sensitive receptor locations will be very low and well within the applicable air quality standards, guidelines and health-based assessment criteria. The assessment therefore concludes that stack emissions will result in negligible effects on air quality and human health.

To confirm that emissions remain consistent with those assessed, periodic stack emission testing of the POX plant stack is recommended at approximately three-year intervals as part of ongoing environmental management and compliance monitoring. This has been reflected in the Schedule 3 conditions.

Accordingly, with the proposed mitigation, monitoring and management measures in place, MP4 is not expected to result in any significant adverse dust or air quality effects, and the overall air quality effects of the Project are assessed as negligible.

9.18 PUBLIC ACCESS AND RECREATIONAL EFFECTS

Public access and recreational use within the Macraes Operation are currently limited due to health and safety requirements, and this approach will continue for the duration of MP4. The proposal is not expected to introduce any additional effects on existing public access or recreational opportunities.

Murphys Flat Historic Reserve is presently accessed via Golden Bar Road. The Golden Bar Haul Road will be reinstated and will intersect with the existing access point to the Reserve off Golden Bar Road and this is shown in **Figure 9-17** below. Access will be maintained throughout both the construction and operational phases of MP4, including provision for a managed haul road crossing to enable continued public entry to Murphys Flat Historic Reserve.

Public access via Golden Point Road, between Deepdell Creek and Horse Flat Road, will also continue to be available throughout the life of MP4. During periods when the road is being used by heavy equipment associated with mining activities, traffic management measures, including sentries at either end of the road, will be implemented to control and authorise private vehicle access. Existing traffic management arrangements will continue to provide for haul road crossings at Horse Flat and at the Golden Point Historic Reserve access crossing near the Processing Plant and routine road maintenance will also continue. As a result, public access to the Golden Point Historic Reserve will be maintained throughout construction and operation of MP4.

Overall, the proposal maintains the current approach to managing public access within the Macraes Operation, with restrictions continuing to be driven by site safety requirements. Importantly, the design and operation of the proposed haul road have been developed to avoid adverse effects on the ability of the public to access Murphys Flat Historic Reserve and Golden Point Historic Reserve. With appropriate management measures in place, including a controlled crossing point, the proposal will ensure that existing recreational use of the Reserve can continue in a safe and practicable manner throughout the life of MP4.

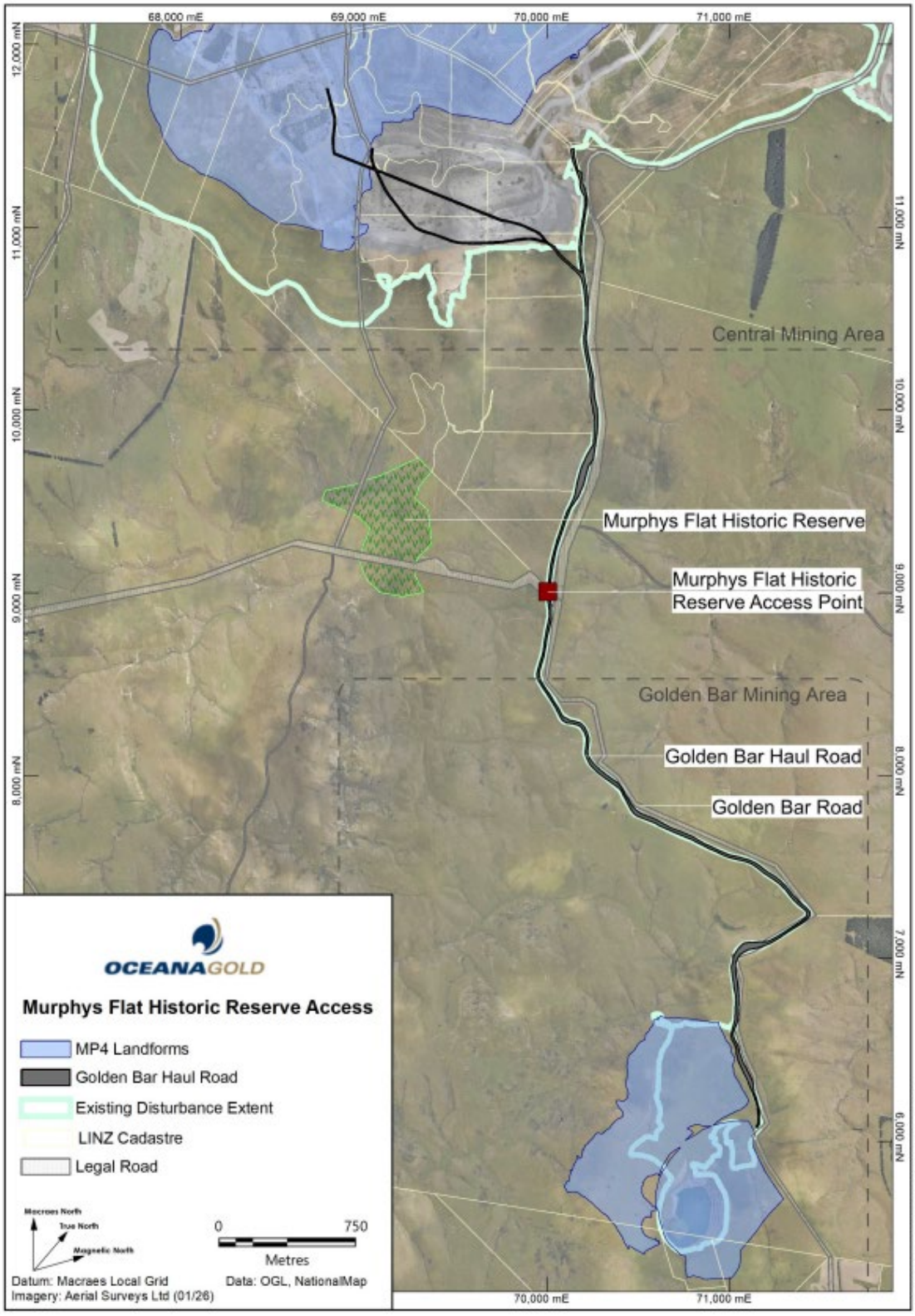

Figure 9-17: Murphys Flat Historic Reserve Access Point Location

9.19 SOCIAL IMPACT EFFECTS

A social impact assessment for MP4 was prepared by WSP (2026). The full technical assessment is provided in **Part B** of these application documents. The positive social effects or benefits identified in the assessment are also summarised in Section 9.2.3 of this report. A summary of the other social effects is set out below.

The methodology used for the assessment is based on the internationally recognised approach provided by the International Association for Impact Assessment (“**IAIA**”) in the SIA Guidance Document. The assessment found that MP4 would provide high and extremely high positive social effects and only low negative social effects (**Table 9-12**).

Table 9-12: Social impact assessment summary

IAIA Criteria	Impact	Positive / Negative	Significance (post mitigation, where relevant)
Way of life	Job security and sustained livelihoods	Positive	Extremely High
Community	Continued community stability	Positive	High
	Continued local community benefits	Positive	Extremely High
	Continued business reliance on mining	Negative	Low
	Change in sense of place	Negative	Low
Environment	Change in the quality of the environment	Negative	Low
Wellbeing	Reduced wellbeing	Negative	Low

WSP (2026) also undertook a preliminary assessment of potential social closure impacts based on the current social environment. The assessment found that the closure of Macraes Operation would have negative social effects ranging from extremely high to low significance and only moderately significant positive social effects (**Table 9-13**).

Table 9-13: Summary of Preliminary Closure Social Impact Assessment

IAIA Criteria	Potential Impacts	Positive / Negative	Preliminary Assessment
Way of life	Loss of direct employment	Negative	Extremely High
Community	Reduced local community stability	Negative	High
	Change in sense of place	Negative	Low

IAIA Criteria	Potential Impacts	Positive / Negative	Preliminary Assessment
Environment	Improved quality of the environment	Positive	Moderate
Wellbeing	Reduced wellbeing	Negative	Moderate

In summary, MP4 is predicted to result in predominately positive social effects whereas closure of Macraes Operation would result in predominately negative social effects. In the absence of MP4, or a further approved extension of mining operations, these closure-related effects would be experienced sooner than currently anticipated.

To avoid, remedy or mitigate any adverse social effects of MP4, the following management and mitigation measures are proposed:

> OGNZL's procurement approach will continue to facilitate the spread of local supplier benefits across local businesses to reduce mine dependency;

> Information sharing with the local business community to inform continuity planning and with local neighbours and the Macraes community about planned activities, potential environmental impacts, and the mitigation proposed;

> Processes for clear and accessible communication with the community on processes for lodging concerns or complaints, rehabilitation progress and outcomes, and water-related consent compliance; and

> OGNZL will commission a Closure Socio-Economic Impact Assessment ("**SEIA**") three years prior to closure including engagement with a range of stakeholders including Councils (ORC, WDC, DCC), key stakeholders, and the community.

9.20 CLOSURE AND AFTERCARE

A comprehensive and integrated rehabilitation and closure concept is proposed for MP4 which ties in with the existing rehabilitation and closure obligations which apply to OGNZL's existing mining activities at the Macraes Operation. The details of the proposed rehabilitation and closure plan will be informed by the various technical assessments commissioned to provide advice on MP4.

The Site Decommissioning and Closure Plan required by the proposed consent conditions in **Part D** requires OGNZL to rehabilitate and close all mine areas such as that in the long term:

> The proposed work areas, and any structures on them, remain in a stable, self-sustaining, rehabilitated state;

- The soils on the proposed work areas are such that it is highly unlikely that there will be a risk to human health considering the post closure use of that land; and
- Any water discharging from the proposed work areas meets the proposed water quality performance criteria with or without treatment.

The proposed consent conditions also require provision of a Contingency Closure Plan for the early closure of the mine as part of the annual Project Overview and Annual Work and Rehabilitation Plan. The purpose of the Contingency Closure Plan is to provide an overview of the work necessary to achieve satisfactory rehabilitation of the Project in the event of unexpected closure of the Project.

The Site Decommissioning and Closure Plan is provided in **Part C** of these substantive application documents, will provide for the staged decommissioning, rehabilitation and closure of the Macraes Operation in a manner that achieves stable landforms, proposed long-term environmental outcomes, and provides for appropriate post-mining land uses. The Site Decommissioning and Closure Plan will be consistent with other plans addressing rehabilitation, final landform design, revegetation, landscape integration, monitoring, maintenance and management of rehabilitated areas.

It will include plans showing the final design and intended contours of all permanent structures and works, including but not limited to, waste rock stacks, permanent earthworks, tailings storage facilities, dam embankments, water storage reservoirs, pit lakes, water bodies, roads and right of way easement areas that will remain after the Macraes Operation ends. It will also include a summary of rehabilitation undertaken and details of rehabilitation proposed to complete mine closure. It will also detail the sequencing and staging of decommissioning, rehabilitation and closure works.

These plans will identify land that will become covenanted or compensation land and land that will require ongoing management post closure as well as land that would be free of long-term post-closure management obligations and available for transfer or sale for farming or other commercial uses.

Before closure, OGNZL will establish a trust or other appropriate entity (the "**Trust**") that will be funded to support on-going site ecological packages (until 2050) and water quality mitigation functions (until no-longer required) to meet the surface water compliance limits, along with any other required consent requirements. The Trust will enable post-closure management of the site for the long term and control will be designed such that it can outlive OGNZL if required.

Closure mechanisms will be supported by a proposed Rehabilitation Bond, establishment of a Trust, a Capitalisation Bond and arrangements to secure income from the future sale,

leasing or commercial use of the combined Macraes Operation landholdings, which are discussed further below.

It is proposed that Kā Rūnaka will have specific levels of oversight in the bonding and post-closure management processes, as described further below.

Summaries of the site's closure plans for each mining area are set out below.

The Coronation Closure Plan includes (but is not limited to):

> Capping the Coronation North WRS with brown rock, removing benching and haul roads, integrating the final landform into the surrounding natural context and character and rehabilitating the surface in pasture and tussock where appropriate;

> Creation of the Coronation North pit lake with an expected lake level at +562-4 m after approximately 50 years with an ephemeral stream planted spillway to operate during storm events downstream of pit disturbance areas;

> Capping the Coronation North Backfill with brown rock, removing benching and haul roads, integrating the final landform into the surrounding natural context and character and rehabilitating the surface in pasture;

> Undertaking wetland restoration to achieve ecological outcomes;

> Realigning clean waterways within existing stream from beneath WRS footprint and extending this around the toe of the WRS to capture surface run off, planting with appropriate native riparian species for ecological outcomes;

> Capping the Trimbells WRS with brown rock, removing benching and haul roads (unless these are required for an identified post-closure purpose), integrating the final landform with the surrounding landscape context and character by softening corners, edges and transitions to create a more naturalistic landform and rehabilitating the surface in pasture and tussock, as appropriate;

> Rehabilitating disturbed areas to integrate back into existing wider landscape character;

> Creation of a 5 m deep Coronation pit lake with an expected lake level at +625 m after approximately 10 years, with a water level rising to +627 m during storm events and discharging to Deep Dell catchment and where it is safe to do so, softening and planting pit margins and benching where these intersect with backfill;

> Rehabilitating the faces of the Coronation backfill above the +625 m pit lake water level; and

> Gully planting with appropriate native species.

The Central Mining Area Closure Plan includes (but is not limited to):

- Capping the Golden Point Backfill with brown rock, removing benching and haul roads, integrating the final landform into the surrounding natural context and character, and rehabilitating the surface with pasture and tussock as appropriate;
- Expanding the opportunity as appropriate for biking/ recreation tracks extending from the existing self-guided tour attraction points, including re-use of existing 4WD tracks or disused mine roads / haul roads where practicable;
- Removal and rehabilitation of the existing process plant;
- Rehabilitating open pit disturbance areas and integrating these back into existing wider landscape character;
- Creation of a Central Mining Area pit lake with an expected lake level at +500 m, benching the lake edge and rehabilitating to support riparian habitat, removing benching from the Innes Mills Backfill above the water level and rehabilitating the slope;
- Providing earth lined spillway channels with rock cut where appropriate and planting downstream ephemeral streams with appropriate native riparian species;
- Where it is safe to do so, softening and planting pit margins and benching where these intersect with backfill;
- Realigning roads along the top of embankments where appropriate;
- Restoring the original landform around Mixed Tailings Impoundment and rehabilitating the surface with pasture and tussock as appropriate;
- Lowering the Mixed Tailings Impoundment, rehabilitating the dam surface to pasture and connecting the spillway to the existing water race;
- Reinstating wetlands in the headwaters of the Waikouaiti river;
- Reconstructing a waterway in the North Tributary of the Waikouaiti River, separated from the surface of the Frasers TSF, with a rock lined straight form channel to encourage flow and native riparian planting;
- Rehabilitating the Workshop site;
- Dry-capping and rehabilitating the Frasers TSF including creating ephemeral dry channels to direct water to the spillway;
- Establishing West Tailings embankment at 519 RL and rehabilitating the spillway with appropriate native riparian species;

- Refining the final Frasers South WRS contours to reduce harsh corners and edges, to provide a more naturalised landform consistent with the surrounding landscape context while avoiding disturbance to areas that have already been rehabilitated; and
- Capping the Frasers West WRS with brown rock, removing benching and haul roads, integrating the final landform into the surrounding natural context and character, and rehabilitating the surface with pasture and other planting as appropriate.

The Golden Bar Closure Plan includes (but is not limited to):

- Ecological enhancement of Murphys Creek upper catchment, including wetland restoration;
- Stream enhancement through planting with native riparian species for ecological outcomes;
- Establishing the MEEA, including fenced lizard habitat, ecological restoration planting, a pest exclusion area and a pest animal control area;
- Establishing the Redbank Link stock exclusion area;
- Rehabilitating the Golden Bar haul road by ripping surface, redistributing windrow and establishing planting to integrate into surrounding landcover;
- Capping the Golden Bar WRS with brown rock, reefing the final WRS contours to reduce harsh corners and edges, removing benching and haul roads, integrating the final landform into the surrounding natural context and character and rehabilitating the surface in pasture and tussock where appropriate; and
- Creation of a pit lake with an expected lake level at +500 m after approximately 30 years, riparian planting of the margins of the spillway.

The proposed Rehabilitation Bond, Trust and Capitalisation Bond are discussed further below.

9.20.1 Rehabilitation Bond

Details of the rehabilitation bonding proposed by OGNZL (inclusive of capitalised post-closure costs, which it is now proposed would be separately bonded through the Capitalisation Bond discussed below, for the purposes of funding the post-closure Trust) are provided in Lane Associates (2026), included in **Part B** of these application documents.

The following provides a general overview of the bond process, its scope and the method for calculating bond quantum. It is anticipated that a detailed estimate will be required under the conditions of consents prior to the start of the Project. The initial estimate will need to

account for all existing and planned areas of disturbance during the first year of operation plus any other commitments required by the conditions, e.g. any offset environmental programme costs. The full details of such obligations will not be known until the consents are granted.

9.20.1.1 Background

The Macraes Operation has utilised a rehabilitation bond since 1990, and it is proposed that this approach continues for MP4. The purpose of the bond is to protect New Zealand ratepayers and taxpayers in the unlikely event that OGNZL is unable to meet its statutory closure and rehabilitation obligations and abandons the Macraes Operation. The bond provides regulators with immediate access to sufficient funds to complete site closure, and rehabilitation, and post-closure management through to the successful completion of closure through an appropriately qualified contractor. Post-closure management costs have also been provided for in the bond, which it is now proposed would be bonded for separately (the Capitalisation Bond), converting to a permanent source of funding for any ongoing management of the site at the completion of closure.

To ensure the bond remains adequate, its value will be reviewed and updated annually to reflect changes in project disturbance areas, including increases associated with ongoing operations and reductions resulting from completed rehabilitation.

9.20.1.2 Method

The method of setting an appropriate bond quantum for the Project follows a well-established process that has been in practice in New Zealand since 1999 and which has been adopted for the Macraes Operation since 2012 (prior to this, the bond amount was produced by others). The current process used remains leading edge, globally.

The approach involves annually assessing the combined areas of disturbance planned for the current operation plus that associated with the Project, less any areas of completed rehabilitation, to derive the cost of closure, rehabilitation and aftercare for the total site.

The method of establishing the scope and quantum of a bond is understood and accepted by the DCC, the ORC and the WDC (collectively referred to as "**the Regulators**" in this description) who together have held the bond for the Macraes Operation for more than a decade.

9.20.1.3 The Bond Administrators

It is anticipated at this time that the Regulators will be the administrators of the resource consents under which the Project will be undertaken. The expectation is that the Project closure and post-closure liabilities would be covered by a Rehabilitation Bond and a

Capitalisation Bond respectively, each established in favour of the Regulators and each held securely by one of the parties as a single contract document on behalf of all.

This practice (except for splitting out pre-closure and post-closure liabilities) is a continuation of that which presently exists for the Macraes Operation, which has been in place throughout most of its life since it started in 1990 and which has functioned as intended during that period.

9.20.1.4 OGNZL's Responsibility

OGNZL's responsibility in the bonding process is to establish the surety instrument and replace it with a new or updated bond whenever the bond quantum changes. Once a bond is established, or replaced with an updated bond, OGNZL ceases to have any direct involvement with the bond. The bond will then exist as an arrangement between the bondsman, being the party that is required to provide the money on demand, and the Regulators, who can call on that money at any time to fulfil the bond purpose.

9.20.1.5 Bond Purpose

The purpose of the bond is to indemnify ratepayers and taxpayers of New Zealand against the cost of rehabilitating the Project site and to enable the rehabilitated site to be managed for a period after closure, in the unlikely event that OGNZL defaults on its statutory obligations and abandons the site prior to completing its closure and rehabilitation responsibilities.

Under such circumstances, the bond provides the Regulators with immediate access to adequate funds to provide for the completion of closure of the Project site by a suitably qualified contractor under their management and for subsequent ongoing management of the site (in this case under the oversight of an appropriately established Trust).

To accommodate scope changes due to changes in disturbance area and mining activities, and reductions following completion of rehabilitation of previously disturbed areas, the bond quantum is typically reviewed and updated annually as described above.

9.20.1.6 Calling on the Bond

Calling on the bond should be the Regulators' last option, to be pursued only in the event that OGNZL fails financially and is unable to meet its statutory obligations. Any lesser breach of consent conditions should be resolved through discussion, negotiation and, if necessary, implementation of enforcement options that are available to the Regulators through existing legislation, such as the Resource Management Act 1991 or any replacement statutes.

In the unlikely event that it becomes necessary for the Regulators to call on a bond, it is expected that they would do so together in that the reasons for calling on the bond would apply to each of the Regulators at that time. It would be inappropriate for one of the Regulators to individually make a call on a bond without consulting and reaching agreement with the others to do so.

Once a call is made, it becomes the Regulators' obligation to ensure the efficient use of the available funds to achieve the desired environmental outcome in closing the site. Any attempt to split parts of the quantum between the Regulators would serve no beneficial function in achieving the overall environmental outcome for the site as a whole. Splitting the bond would not be consistent with the bond purpose and is more likely to be an impediment to the efficient use of the funds and therefore to the indemnification that a bond is intended to provide. This supports the posting of the bond(s) in the joint names of the Regulators as is proposed and has been the case for the site to date.

9.20.1.7 Setting the Bond Quantum

The method for setting the bond quantum involves estimating the costs to complete the rehabilitation and aftercare components of closure depending on the current state of the mining operations. The objective is to ensure that the closed site would be left in a safe, stable and self-sustaining rehabilitated state, given the state of mining operations at the time the bond quantum is set.

The method is well established and straightforward and involves:

1. Establishing a maximum extent of the mine-related disturbance based on each Annual Work and Rehabilitation Plan to set a conservative scope of works for the activities required to rehabilitate the site from its current state to one that meets the operation' s closure obligations;

2. Estimating the quantity (volume, area, hours etc.) of work involved in completing each activity, which in general terms is required to provide for activities such :

    a. Demolition and removal of plant and buildings;

    b, Rehabilitation of areas of mine disturbance by re-contouring, spreading sub-soils and topsoil, and planting;

    c. Establishing and armouring water control infrastructure such as channels and open pit outlets;

    d. Installing fencing and signage around any areas that pose a safety hazard; and

e. A period of site aftercare that typically includes care and maintenance of newly vegetated areas, weed management, water treatment and environmental and geotechnical monitoring as well as any specific long-term site management obligations;

3. Assigning a unit rate to each measurement of quantity (dollars per unit measure of volume, area, time etc.); and

4. Estimating the costs of management and monitoring for the period of the works to ensure that the closed site would be left in a safe, stable and self-sustaining rehabilitated state; and assessing the nature and extent of post-closure aftercare.

On the basis that the rehabilitation works would be carried out by a contractor, the costs are based on standard contract rates for similar works in the vicinity of the Project rather than on the rates applicable to the mining activity. The costs also need to provide for mobilisation and demobilisation of the contractor' s earthmoving equipment to and from the site.

For those areas of the overall site where substandard water quality arises from mining-related remnants and prevents direct discharge to natural waterways for a period, there may be a need for long-term water treatment. Such water treatment costs are included in the closure and post-closure cost estimate.

For the Macraes Operation, as for many other mine sites around New Zealand, a contingent liability fund (risk cost) to cover the occurrence of risk events that could compromise the environmental and geotechnical stability of rehabilitated site if they were to occur is also required and included in the bond quantum.

The total closure cost estimate is calculated from the resulting schedule of quantities by multiplying the component quantities and unit rates to derive a cost for each activity then summing the activity costs. The estimate, which includes an appropriate contingency, is updated each year based on the existing measured and future predicted areas and types of disturbance, and to accommodate other factors such as inflation.

A schedule for the Project will be developed along similar lines to that provided under the existing Macraes bond facility to cover the first year of disturbance. This will thereafter be updated annually to include planned new areas of disturbance and completed rehabilitation and will be submitted for review and acceptance by the Regulators.

This method of calculating the appropriate bond quanta for the Macraes Operation is a well-established process used throughout New Zealand and is the leading-edge practice globally, and the process is familiar to both OGNZL and the Regulators. The inclusion of the MP4 works in future bonds will provide for any necessary increase associated with the new

elements of the operation but will otherwise be a continuation of past practice that has proven appropriate to the Macraes Operation.

9.20.1.8 Rehabilitation Bond Conditions

The proposed conditions in **Part D** of these application documents sets out the requirements for establishment of the Rehabilitation Bond that will (amongst other matters):

a. Enable any adverse effects on the environment resulting from the MP4 activities and not authorised by a resource consent to be avoided, remedied or mitigated;

b. Secure the completion of rehabilitation and closure of the mining activities;

c. Ensure that any monitoring and management obligations for the mine site can be undertaken until completion of closure of the site;

d. Enable the Regulators, in the event of the bond being called upon, to purchase Public Liability Insurance in sums of not less than NZD$20 million (2026 dollars);

e. Be fixed annually, taking into account any calculations and other matters identified in the Project Overview and Annual Work and Rehabilitation Plan including the Contingency Closure Plan;

f. Provide for the estimated costs (including any contingencies necessary) of:

    i. Rehabilitation and closure on completion of the mining activities proposed for the next year and described in the Project Overview and Annual Work and Rehabilitation Plan;

    ii. Remedying any adverse effect on the environment that may arise from the exercise of the MP4 consents;

    iii. Monitoring, in accordance with the monitoring conditions of the MP4 consents until completion of closure of the site; and

    iv. Monitoring any adverse effect on the environment that may arise from the exercise of this consent including monitoring anything which is done to avoid, remedy, or mitigate an adverse effect.

The Rehabilitation Bond will be in an on-demand form approved by the Regulators and will be registered under the Land Transfer Act 2017 by the OGNZL (at its expense) against the relevant records of title of the properties owned by OGNZL.

In addition to the required Rehabilitation Bond, OGNZL must be able to demonstrate to the satisfaction of the Regulators that it holds sufficient funds, insurances or other financial

instruments to enable any adverse effect on the environment resulting from the OGNZL activities and not authorised by a resource consent to be promptly avoided, remedied or mitigated. The proposed conditions require that evidence be provided to the Regulators annually that sufficient cover is in place at the same time as the Project Overview and Annual Work and Rehabilitation Plan and Contingency Closure Plan are submitted to the Regulators.

9.20.2 Trust and Capitalisation Bond

9.20.2.1 Trust

In addition to the Rehabilitation Bond described above, OGNZL will also establish a charitable trust (the Trust) to be responsible for the post closure management of the land on or within which mine activities authorised by the MP4 consents occur, where management is required post-closure (Post Closure Management Land). The establishment of the Trust will enable this land to be managed for activities other than mining operations by an entity that is independent of OGNZL.

The purpose of the Trust will be to:

a) Take ownership of (but not sell) shares in a land holding company (LandCo) to be established by OGNZL that will have the exclusive purpose of holding legal title to Post Closure Management Land together with any additional parts of its Macraes landholdings that OGNZL may choose to transfer to LandCo to generate additional income (in lieu of direct funding) through sale, leasing or other commercial uses ("Post Closure Commercial Land") and to subsequently fulfil the other roles referred to in the MP4 consent conditions that may be required in relation to that land including to;

b) Monitor and maintain the land and activities on the land in perpetuity and to be responsible for such monitoring, operation and maintenance as to ensure that the site remains in a stable, self- sustaining, rehabilitated state; and

c) Obtain any resource consents that may be required in relation to the monitoring, operation and maintenance of the site after completion of the closure of the mine site and the expiration or surrender of the MP4 consents.

The Trust will be able to take out reasonable insurance cover against relevant and insurable risks and will be expected to reimburse the Regulators for any costs incurred by them in monitoring the site. It will also be required to set out the expectations for the leasing, sale or other commercial use of Post Closure Commercial Land to generate or supplement (as required) income to carry out its purposes.

The purposes and powers of the Trust will be recorded in a Trust Deed approved by the Regulators, and subject to further consultation with Kā Rūnaka it is proposed that these must provide for:

1. Kā Rūnaka to appoint a majority of trustees to represent Kā Rūnaka; and
2. The Regulators to jointly appoint a minority of trustees.

The Trust Deed will provide that upon the completion of closure of the Mine site in accordance with the Site Decommissioning and Closure Plan required under the MP4 conditions the transfer of the shares in LandCo will be completed by the trustees registering the transfer on the Companies Register. In addition to income generated by LandCo through the sale, leasing or other commercial use of the Post Closure Commercial Land, the Trust will receive capitalised funding, so that its combined income is sufficient to undertake post-closure management of the Post Closure Management Land. As an important part of that post-closure management, the WTP must be in good working condition at the time the transfer of it to the Trust is completed.

OGNZL will be responsible for all costs associated with the establishment of the Trust and LandCo.

9.20.2.2 Capitalisation Bond Conditions

In conjunction with establishing the Trust, the conditions in Part D also require creation of a Capitalisation Bond and registering a land covenant to enable the Trust to carry out its obligations established under the Trust Deed. The Capitalisation Bond and land covenant will secure the settlement on the Trust of the appropriate capital sum (to be calculated in accordance with the proposed consent conditions) and ownership arrangements through LandCo for the combined land holdings of Post Closure Management Land and Post Closure Commercial Land (together Post Closure Trust Land) and will be in a form approved by the Regulators. The Capitalisation Bond and the land covenant will both be registered under the Land Transfer Act 2017 (by OGNZL at its expense) against the records of title of properties identified as either post closure management land or land on which commercial activities can be undertaken post closure.

The amount of the Capitalisation Bond will be fixed annually (until completion of closure) and will cover:

a) The estimated post-closure costs of dealing with any adverse effect on the environment which may become apparent following completion of mining activities and closure, and may include provision to deal with matters such as structural instability or failure, land

and/or water contamination, and failure of rehabilitation, including the costs of investigation, prevention, and remediation of any adverse effect;

b) The estimated costs of monitoring adverse effects and of measures taken to avoid, remedy, or mitigate those effects following closure;

c) The estimated costs of long-term monitoring, operation and maintenance following completion of closure of the site; and

d) Provision for reasonable remuneration of the trustees.

The Capitalisation Bond will be reduced by an appropriate amount to allow for reasonable expectations of income generated, or projected to be generated, by the sale, leasing or other commercial use of the Post Closure Trust Land under the management of LandCo and oversight of and for the benefit of the Trust. The I ncome value of Post Closure Trust Land will be nominally set at 80% of the sale value of the Post Closure Commercial Land and will be established by an independent registered market valuation (updated from time to time by OGNZL).

The Capitalisation Bond will be based on a residual risk assessment that is prepared by OGNZL following consultation with Kā Rūnaka and provided to the Regulators. The residual risk assessment will be updated annually.

The Trust (including LandCo and the use of and security over Post Closure Trust Land) and Capitalisation Bond are inseparable in terms of their function in providing for the ongoing management of post closure land at the site and for that reason they must be seen as a component of the MP4 proposal that is an integrated whole and are not severable (i.e. one must follow the other, there cannot be one without the other).

Where there is any disagreement regarding the quantum of a proposed bond (either the proposed Rehabilitation Bond or Capitalisation Bond) to be fixed by the Regulators (including in relation to any sum to be insured under Public Liability Insurance) then OGNZL proposes that arbitration in accordance with the provisions of the Arbitration Act 1996 would be followed. Pending the outcome of arbitration, any existing bond(s) would continue in force, with the sum to be adjusted as needed following the arbitration determination.

As part of preparation for establishment of the Trust and Capitalisation Bond, OGNZL has procured recent capital land valuations and valuation of potential lease income from the site.

The proposed conditions in **Part D** of these application documents sets out the proposed conditions for establishment of the Capitalisation Bond amounts and the establishment of the Trust.