Assessment of effects

1. Overview

The below is an assessment of effects relative to the scale and significance of the proposed activity. This assessment is addressed under the following headings:

- Geotechnical effects
- Acid Mine Drainage
- Effects relating to potentially contaminated land
- Groundwater quantity effects
- Groundwater quality effects
- Surface water quantity effects
- Surface water quality effects
- Ecological effects
- Effects on erosion and bed and bank stability
- Flooding effects
- Effects of dust on air quality and amenity
- Flooding effects
- Effects on recreation and public access
- Effects of signage
- Transport effects
- Effects of hazardous substance storage and use
- Archaeological and heritage effects
- Effects on local amenity values
- Effects on land resource and soil productivity
- Effects on social and economic wellbeing
- Effects relating to climate change
- Effects on cultural values
- Positive effects

2. Geotechnical Effects

The Applicant has engaged Tonkin & Taylor to undertake an assessment of the geotechnical effects of this proposal include managing the likelihood of pit slope instability, with a focus on the potential for slope instability to encroach on site boundaries, and/or to have off site environmental effects. The potential for adverse effects is addressed by the proposed pit slope angles, configurations, and mining method, along with the recommendation for an observational approach to pit stability and adjustment to the mining method as indicated from assessment of the observation results.

It is considered that the effects on the surrounding environment can be mitigated to an acceptable level by adopting the recommendations of the Tonkin & Taylor Geotechnical report regarding road corridor setbacks and the monitoring regime for excavations adjacent to the existing terminal pond.

In regard to management of mine pit wall stability and other geotechnical matters covered by the assessment undertaken by Tokin & Taylor, it is considered appropriate for these to be addressed through a management plan, informed by geotechnical expertise, and adapted as necessary throughout the mine life. As such, adverse effects will be less than minor.

3. Acid Mine Drainage

Mine Waste Management Limited ("**MWM**") has conducted an assessment for the Applicant on the potential effects of acid and metalliferous drainage due to the project's operations. The report identifies the presence of potentially acid-forming ("**PAF**") materials, such as iron sulphides, which constitute about 15% of the total materials disturbed by the project. Despite this, the overall net acid producing potential is negative, leading to the classification of the project as non-acid forming. MWM's conclusion is that with proper materials management, the risks associated with Acid Mine Drainage ("**AMD**") can be significantly reduced, resulting in a negligible impact on the environment.

To ensure minimal environmental impact, the Applicant has agreed to implement MWM's recommended good materials management practices. These include directing carbonaceous materials to backfill, managing PAF materials within the Gold Recovery Plant ("**GRP**") tailings, intercepting stockpile drainage, and placing all PAF materials below the long-term water table level. Additionally, engineering controls will be integrated into mine operations, and all water discharge will be monitored and treated as necessary. MWM's further analysis confirms low AMD risk and suggests operational methods to minimize AMD creation.

With ongoing monitoring and a Trigger Action Response Plan in place, the potential for any adverse effects from AMD is expected to be less than minor.

4. Effects Relating to Potentially Contaminated Land

The Applicant engaged Geoscience to prepare a Preliminary Site Investigation ("**PSI**") to investigate the application site for the presence of contaminants.

The PSI provides an assessment of the potential contaminants, a conceptual model for potential contamination and details of sampling undertaken within the site. There are three potential sources of contamination that have occurred on or within close proximity to the site:

- Mining of the application site occurred in the early 1900s and involved the removal of gravels via dredges. The previous operator also briefly mined to the south of the existing mine pond in 2001. An assembly and storage area previously used for plant and equipment remains on the application site.
- A closed landfill exists to the east of the application site, on the banks of Shepherds Creek.
- Historical use of persistent pesticides / fertilisers including Super Phosphate may fall under the definition of HAIL A.10.

Soil sampling was undertaken by Geoscience with the findings summarised below

- No Organochlorine Pesticides or Total Petroleum Hydrocarbons were detected in the samples analysed.
- The concentrations of heavy metals (including mercury) analysed complied with the NESCS criteria for Commercial Industrial outdoor worker unpaved and NESCS for rural land use.
- Detected polycyclic aromatic hydrocarbons were well below the NES criteria for the proposed and rural land use, and well within the ANZECC (2000) criteria for the protection of the environment.

Overall, Geoscience conclude in section 11 of the PSI that the concentrations of contaminants are compliant with the relevant NESCS criteria for the protection of human health and the Land Care Research / ANZECC (2000) criteria for protection of the environment.

The PSI provides analysis of a targeted sampling regime and concludes that the proposed use of land will not result in unacceptable adverse effects on human health or the environment from contaminants in soil. No further soil testing is considered to be required (except in relation to rehabilitation targets) and soil disturbed will be retained on site.

5. Groundwater Quantity Effects

The Applicant engaged Environmental Associated Ltd ("**EA**") to provide a technical assessment of the proposed take and discharges.

5.1 Effects on Surrounding Well Users

EA have provided a conservative assessment of the effects of the proposed dewatering drawdown effects on surrounding groundwater users, whereby there is potential that the wells will experience a predicted degree of effect. To mitigate the effects on the identified well owners, the Applicant proposes that the water levels in the identified wells are monitored, and if an unacceptable drawdown effect occurs, the Applicant will arrange an alternative water supply.

5.2 Efficiency of Use

Groundwater will be pumped from the base of the mine pit. This methodology ensures that groundwater is not lowered any further than necessary to create a dry pit working area, meaning maximum efficiency in the volume of groundwater removed from the pit is achieved.

Groundwater abstracted will be pumped to the settlement ponds, where it will be used for gold processing. Process return water from the GRP is discharged to the settlement ponds and then re-used again through the GRP. Processing return water and dewatering water is discharged once the volume of water exceeds the secondary settlement pond storage capacity and overflows into the tertiary settlement pond.

The Applicant will ensure that pipes conveying groundwater are maintained to avoid leaks and wastage of water. Overall, the quantum of groundwater abstracted is reasonable and the groundwater that is abstracted will be used efficiently.

5.3 Allocation

The site is not located in any regional plan groundwater allocation management zone, and so effects on allocation are considered specific to the nature of each aquifer.

The surface unconfined aquifer is considered to lose water to the Waikaka Stream, and as such the water drawn from this aquifer is returned to the end receiving waterbody, within a short timeframe and distance, by way of the discharge. Effects on the surface unconfined aquifer are therefore considered to be less than minor.

EA conservatively calculates the recharge of both the intermediate and lower confined aquifers as 55.9L/s. Further, the maximum annual proposed rate of take (from both confined aquifers is 24.7L/s) plus existing takes (estimated at 5.5L/s) are equivalent to 54% of the predicted aquifer recharge. EA concludes that the calculations are conservative by nature and include contingency allowance in the maximum rates, meaning the actual abstraction (in combination with existing takes) will be closer to 44% of the predicted aquifer recharge. EA concludes:

"…in terms of groundwater allocation, the activity fits within recognised groundwater allocation criteria for both the unconfined water table and Tertiary confined aquifers. Considering the non-consumptive and temporary nature of the requested activity, the effect upon overall groundwater allocation is considered to be no more than minor."

5.4 Aquifer Integrity

Aquifer integrity can be undermined by excessive abstraction or modification of subsurface materials by mining and overburden replacement. Considering the saturated thickness of the existing aquifer and extent of predicted drawdown, *EA concludes:*

"…the lowering of the unconfined aquifer water level presents a nil to low risk of any aquifer compression or loss of potential storage capability in that regard."

In regard to the intermediate and lower confined aquifers, the EA concludes:

“Any potential lowering of head within the overburden and aquifer formations…, is most unlikely to result in any formation compression or loss of potential storage capability. Given the short-term and transient nature of the mine pit progression and commensurate groundwater abstraction, any plausible aquifer compression on the above basis would be of a small and limited extent, and present a low risk of any associated environmental effect.”

The proposed abstraction of groundwater is not expected to create any more than minor adverse effects on aquifer integrity.

Overburden removed from the mine void will be replaced back into the void, however it is unlikely to be replaced in the same location or sequence (apart from topsoil). The Heller report considers that the existing aquifers will certainly be modified, considering the native material will be replaced (though in a different sequence) and existing very low transmissivity nature of the aquifers, the activity:

“…will result in no obvious change to the general hydraulic nature and functioning of the aquifer(s) and adjacent materials, and incur no effect upon any use of the aquifer or any environmental value.”

Overall, the effects on aquifer integrity will be no more than minor.

6. Groundwater Quality

The excavation and dewatering of the mine pit are expected to produce sediment, which could potentially contaminate stormwater along with small amounts of hydrocarbons and heavy metals from the mine’s operational areas.

EA states that the water management system, which directs groundwater and stormwater to settlement ponds, effectively prevents any sediment-laden water from entering the aquifer or affecting its flow. This system is designed to maintain a positive pressure towards the mine void, ensuring that the quality of groundwater remains unaffected by the mine’s dewatering activities. Regarding the discharge from the settling ponds and drains, EA indicates that while there is some interaction with the upper unconfined aquifer, any discharge consists mainly of suspended sediments and is limited by the aquifer’s low permeability.

The water quality of the discharge is maintained to a standard suitable for the Waikaka Stream, with no further treatment required post-discharge. The infill material for the mine pit, which includes overburden, tailings, and filter cake, contains no harmful additives and is managed to prevent any adverse effects on groundwater quality. The site remains secure, with controlled access to prevent unauthorised dumping.

The Applicant plans to rehabilitate any remaining terminal void into a pond, following EA’s guidance to continue dewatering and maintain a positive pressure towards the mine void until infilling is complete. The terminal pond is expected to interact with groundwater aquifers, but any seepage will match the quality of the existing groundwater. This development will consolidate several existing mining remnant ponds into one terminal pond, thereby simplifying the groundwater interception points. Additionally, the terminal pond will feature battered edges

with riparian plantings, enhancing the water quality treatment for any surface run-off entering the pond, ensuring that the overall impact on groundwater quality remains minimal.

Overall, the impact on groundwater quality from the proposal will be less than minor.

7. Surface Water Quantity Effects

EA assessed the impact of dewatering on the Waikaka Stream and predicts a maximum stream depletion of 3.0L/s, which is only 1.1% of the stream's mean annual low flow. The site's discharge rate will exceed this depletion rate, ensuring that the overall effect on the stream's flow will be minor. The discharge into the Waikaka Stream, although small, will be a noticeable addition, ranging from 7.8-12.5% at low flow to 2.8-4.4% at median flow. This contribution is expected to have a minimal impact on the stream's ecological values and flood risk.

Downstream water users are unlikely to experience any discernible effects from the mine's operations, as there are no surface water takes within 5 km downstream of the site. The Waikaka Stream's diversion will not result in any net loss of flow, with the entire stream's flow being redirected and actually experiencing a net gain due to the project's dewatering discharge. The diversion will be implemented gradually to maintain a flow no less than the 7-day mean annual low flow of 277L/s, ensuring the existing channel is not adversely affected by low water levels.

Overall, the effects on groundwater quality and stream flow are considered to be less than minor.

8. Surface Water Quality Effects

8.1 Waikaka Stream Diversion

The construction of the new channel and diversion of the flow of the Waikaka Stream and Shepherds Creek has the potential to result in sedimentation of the Waikaka Stream water.

The new channel's bed will be constructed with a base of gravel and rock, and the banks and margins of the new channel will be partly planted before diverting the flow. The primary concern is suspended sediment, which will be minimised by ensuring erosion control within the new channel and at the transition between the old and new channels. Features like rock rip rap, cobble bed material, and anchored trees will help stabilize the channel. Sediment control measures will be installed where appropriate, especially in slower water areas.

The downstream connection between the diversion channel and the existing Waikaka Stream will be established first, using machinery and a coffer dam to contain sediment during construction. Disturbed areas will be stabilised promptly with rock, gravel, geotextile, or planting. Any dirty water within the coffer dam area will be pumped out before removing the coffer dam, either discharging it to the mine void or nearby pasture land where it cannot re-enter the channel.

The construction methodology for connecting the upstream diversion channel to the existing watercourse will mirror that of the downstream connection. After completion, the coffer dam

will be gradually removed to divert flow into the new channel, minimising immediate erosion. Although some sediment discharge is expected, it is difficult to quantify. The anticipated impact on Waikaka Stream water quality from the diversion construction is temporary, with water quality returning to pre-diversion levels.

The Applicant plans to monitor suspended solids in the diversion channel and upstream, taking corrective actions if excessive turbidity occurs. Detailed design, construction methodology, planting, and habitat rehabilitation specifications will be provided before creating any diversion channels. As such the adverse effects will be temporary and no more than minor.

8. 2 Discharge of Dewatering and GRP Process Return Water and Stormwater

Sediment will be present in the discharge from the dewatering water, GRP process water return and stormwater. Sediment will be removed through the thickener and filter press in the slimes treatment plant, with flocculant treatment if necessary, prior to treatment through the secondary pond and tertiary polishing pond, and then discharge to the Waikaka Stream.

Contaminants in GRP process return water will be sediment only as the gold recovery process is gravity driven with no chemical additives. Contaminants in stormwater will be sediment and potentially small amounts of hydrocarbons and heavy metals, which are expected to be captured by the settlement ponds. Stormwater from the hazardous substance storage area will travel through an oil water separation device prior to entering the settlement ponds.

The treatment system has been designed to ensure that the discharge to the Waikaka Stream is of an appropriate quality. It is considered appropriate and feasible to monitor sediment concentration in the discharge to ensure that any adverse effects on the Waikaka Stream water quality outside the mixing zone will be less than minor.

The water quality of the discharge is expected to be better than the existing water quality in the western drain, with lower suspended solids and nutrient concentrations. To this end, no adverse effects on the water quality in these artificial water bodies are expected, and the effects may be positive.

8.3 Vehicles and Machinery

Vehicles and machinery will be required to pass through the bed of the Waikaka Stream to access the true left bank. The construction of one or more new fords will likely be required in order to enable machinery to cross the Waikaka Stream. Fords will be constructed and used in accordance with the relevant permitted activity rules. Effects on water quality will be minimised by forming fords with rock and gravel material, minimising the number of crossings and by laying some gravel on the approach to the stream bed as necessary to minimise tracking sediment into the stream.

9. Ecological Effects

The Applicant engaged Ross Dungey Consulting Limited to undertake an Aquatic Ecology and Surface Water Quality Assessment

9.1 Effects of discharges

The discharge of dewatering water, GRP process return water and stormwater are expected to meet water quality standards in the Waikaka Stream after treatment and reasonable mixing. For this reason, the effects of these discharges on ecological values within the receiving water are considered to be acceptable.

The discharge of the Waikaka Stream and Shepherds Creek diverted flow is expected to result in entrained sediment, temporarily reducing visual clarity of the water. Mitigation methods to minimise the potential for sedimentation are discussed above. The reduction in visual clarity may impact on aquatic ecological species, however the effect will be temporary and minimised by the mitigation measures described above. The Applicant will provide a detailed diversion channel design, methodology and monitoring plan prior to the creation of any diversion channels, to demonstrate how sediment will be minimised and monitored.

9.2 Effects of diversion on habitat loss

The proposed diversion will result in temporary habitat loss which will be reinstated and enhanced on rehabilitation. The Aquatic Ecology and Surface Water Quality Assessment identifies key habitat features of the existing Waikaka Stream and identifies that these are fundamental to the success of the rehabilitated channel, including:

- riffles with coarse gravel and cobbles
- undercut banks
- overhanging vegetation-grasses, shrubs, willows
- large woody debris
- deep pools
- boulder clusters

Shade is an important feature of the riparian environment within the existing Waikaka Stream channel, which is currently created predominantly by large willow trees. Creating sufficient shade will be important to minimise nuisance aquatic algal growths, due to elevated nutrient levels within the Waikaka Stream. For this reasons, fast growing willow species are proposed to form part of the new diversion channel planting scheme.

The Applicant will provide a detailed diversion channel design, construction methodology, planting and habitat creation specification and monitoring plan prior to the creation of the diversion channel.

The success of the diversion channel is proposed to be determined using a combination of water quality, fish survey and Macroinvertebrate Community Index ("**MCI**") and the semi-quantitative MCI measures. Baseline data exist for all these parameters.

9.3 Loss of habitat in artificial water bodies

The proposal will result in permanent loss of habitat associated with a number of smaller artificial ponds and drains throughout the site, and part of the L&M pond. A similar degree of

land drainage will be reinstated on completion of the project, although the numerous small ponds will not be replaced. A terminal void pond is a possible outcome.

If there is a terminal pond, the embankments will be contoured, and its riparian margin planted with species selected by a suitably qualified freshwater ecologist.

The ecological values of the small ponds and drains were limited by their water quality and excessive weed growth. The terminal pond is expected to have improved water quality and habitat value by virtue of improved riparian planting.

9.4 Fish salvage and passage

The Applicant proposes to engage a suitably qualified person to salvage fish species in all diversions and relocate them to the Waikaka Stream downstream of the work area, or other local appropriate habitat.

Fish passage in the Waikaka Stream and/or temporary diversion channels will be maintained at all times. When flow in the existing Waikaka Stream is diverted into a temporary diversion channel, fish will be unable to access the diverted section of the Waikaka Stream but will be able to pass through the new diversion channel.

9.5 Effects on avifauna

There are a number of waterbirds using the ponds within the project area. These are expected to temporarily relocate to other ponds in the locality and will likely return on completion of the work.

9.6 Effects on native vegetation

There is limited native vegetation within the project area, and this is confined to the Waikaka Stream and margins. The Applicant will relocate existing riparian plants if it is operationally feasible to move them to rehabilitated sections of the Waikaka Stream and Shepherds Creek. The Applicant will plant new native plants (and some non-natives) in the riparian margin area of rehabilitated sections of the Waikaka Stream and Shepherds Creek. Once rehabilitation is complete, there is expected to be a net increase in native vegetation within the project area.

10. Effects on Erosion and Bed and Bank Stability

The discharge of dewatering, GRP process return water, and stormwater to the Waikaka Stream and Shepherds Creek will be managed through an outfall structure with erosion protection measures like a concrete apron or rock rip rap. To prevent erosion during the diversion of these streams into temporary channels, the berm and embankments will be vegetated to provide significant soil cover, and the stream channel will be reinforced with cobble/gravel and anchored trees. The flow will be redirected gradually to reduce erosion risk, with contingency plans for additional protection if needed.

The Applicant commits to a detailed design and monitoring plan for the diversion, accepting some designed erosion to maintain habitat types present in the original stream. As such the adverse effects will be less than minor.

11. Flooding Effects

11.1 Effects of Discharges on Downstream Flooding

Discharges which could have impacts on downstream flooding include:

- Dewatering and GRP process return water and stormwater; and
- Diversion of the Waikaka Stream and Shepherds Creek.

The discharge of dewatering and GRP process return water and stormwater will occur at estimated rates as set out in Table 11 above. At median flow, the discharge is 3.3-4.9% of the Waikaka Stream flow. A 1 in 20-year AEP event is estimated to be 116 cumecs, at which level the discharge is 0.02 - 0.04% of the Waikaka Stream flow. It is not operationally feasible to switch off the dewatering pumps and therefore this discharge could not cease in the event of flooding in the Waikaka Stream. However, the volume of the discharge is so small in relation to the quantity of water in the Waikaka Stream in a high flow event, that it would be immeasurable, and would result in indiscernible downstream adverse effects.

The Waikaka diversion discharge will not have any impact on potential downstream flooding as the entire flow of the Waikaka Stream / Shepherds Creek will be diverted, i.e., the flow that would normally be in the channel with no additional water.

11.2 Effects of Dam to Enable Waikaka Stream and Shepherds Creek Diversion on Upstream Flooding

A temporary bund will be used to divert flows from the Waikaka Stream and Shepherds Creek channels into the temporary diversion channels. The diversion of water is proposed to occur in a step wise fashion, over a period of not more than one week per diversion event. Water will not be completely blocked by the bund, rather it will be used to direct water into the new diversion channel instead of the existing Waikaka Stream. To this end, the temporary bund will not cause water to back up and cause upstream flooding.

11.3 Flood Carrying Capacity of Temporary Diversion Channels

The Waikaka diversion channel has been designed to carry a 1 in 20-year AEP event with minimum of 500mm freeboard. The flood carrying capacity of the new diversion channel is at least as good as the existing Waikaka Stream channel, and in some places, it will have greater flood carrying capacity. The new Waikaka diversion channel will not cause adverse flooding effects and may have positive effects on local flooding.

11.4 Effects of Waikaka Stream Flooding on Mining Operations

In the event of potential overland flooding entering the mine site, additional pumps may be brought in to increase the rate of dewatering the mine pit. Operations will cease if conditions become hazardous for workers health and safety. Some floodwaters will likely be prevented from flowing into the mine pit as haul roads typically have a small roadside bund. Floodwaters will move downgradient toward the existing terminal pond, which is their natural course. The

mining operation is unlikely to exacerbate any flooding, and the mine pit may provide additional floodplain capacity in extreme events.

12. Effects of Dust on Air Quality and Amenity

There is the potential for dust nuisance to be an effect resulting from the operation as the proposal involves a considerable volume of earthworks. Dust nuisance can arise from earthworks associated with the development of the mine, stockpiling of material, and also during rehabilitation. Vehicle and machinery movement also have the potential to generate dust nuisance. Potential receivers in the surrounding environment include residences, surrounding farmland and road-users.

The adverse dust effects of this proposal on the surrounding environment will be mitigated to be less than minor through the measures proposed as detailed within section 3 above. Specifically, dust will be controlled on site in accordance with good industry practise, including use of water carts as necessary, slow vehicle speeds on unsealed roads and establishing vegetation on bunds. A moving mine cell method of operation will ensure progressive rehabilitation of the site and limit the open mine pit area to 5ha at a time.

The mine is located a minimum of 150m from adjoining dwellings, and most of the time it will be further than this. Most of the overburden earthmoving activity will occur within the pit below the undisturbed level of the ground.

The grassing of bunds and stockpiles is considered as the most effective way of preventing dust nuisance from these areas in the longer term, though some areas of stockpiling will remain ‘active’ through the project. Prior to the establishment of grass on stockpiles and bunds, alternative dust suppression will be employed where necessary.

Dust control will form part of the Applicant’s Environmental Management Plan for the site. It is considered that dust control to mitigate nuisance effects to a no more than minor level on the surrounding environment is achievable and practicable.

13. Effects on Recreation and Public Access

The Waikaka Stream has recreational values, particularly fishing and walking access. Fish and Game advise that the stream has brown trout fishery value and spawning areas and attracts local anglers in particular.

There is one existing public access point to the Waikaka Stream that is affected by the proposed mine with public access to the Waikaka Stream in the locality is currently available at the Waikaka Bridge via an existing paper road, near the northern site boundary. Anglers access the river at this point, and then walk further up or down stream. During the entire project life, people will continue to be able to use this access point and access upstream of the project area. Public access downstream of the access point will be restricted when mining activities are within 20 meters of the stream bed and/or when earthworks for diversion of the stream are being undertaken. It is also preferrable to allow for a period for the establishment of bankside planting and contingency along the rehabilitated section of stream channel. The Applicant will

endeavour to minimise loss of access and ensure at least partial access to fishable sections of the existing stream.

The next downstream point of access to the Waikaka Stream is at the Maitland Bridge, which is approximately 6.8km south-east of the Waikaka Bridge access site (as the crow flies) and 4.6km south of the application site southern boundary. This access point is sufficiently distant from the application site such that public access to the Waikaka Stream from this this location will not be affected.

In summary, the proposal will restrict downstream public access to sections of the Waikaka Stream from the Waikaka Bridge for a period of up to 5 years, though upstream access will continue to be available and other access points to the Waikaka Stream will be unaffected. The proposal will not affect any public access to the East Branch of the Waikaka Stream.

Shepherd's Creek will also be affected by the project for up to 2 years, and public access to this watercourse appears to be available from the same Waikaka Bridge access point paper road. However, it is understood that Shepherd's Creek does not have high fishery or recreational values due to existing upstream discharges into the watercourse.

As such adverse effects on recreation and public access will be less than minor.

14. Effects of Signage

Signage at the vehicle access will convey necessary information about the site operator and name, site hazards and provide contact details and advise that visitors are to report to the site office.

The signage at the vehicle access will be visible to persons in vehicles passing the site and turning to access the site. The sign will be inoffensive to drivers passing the site considering the size and nature of the sign and that vehicle occupants will have fleeting views of the sign. For these same reasons, the sign is not anticipated to create any adverse road safety effects. Persons entering the site will be looking for the sign, therefore it will be positioned adjacent to the site vehicle access. The sign may be visible from nearby residences but will be over 100m distant and partially obscured by intervening topography and vegetation.

Signs may be required along boundaries of the site advising the general public that there is no access to the site. These will be small signs, similar to private property signage that may be expected in the locality where there are people accessing the public space adjacent to private property (e.g., the Waikaka Stream). These signs will be installed where needed to prevent the public from inadvertently accessing the site and are necessary to protect public health and safety. These signs will be discrete in size but must be clearly visible to be effective. Overall, the signs will have less than minor effect on public enjoyment of the amenity of the local environment due to their small viewing catchment and essential purpose. These signs will not be visible from public roads and so will have no effect on road safety.

Overall, the effects of signage on amenity values and road safety will be less than minor.

15. Transport Effects

The proposed development will ensure vehicle access to the site through existing farm routes and a new access from Waikaka-Willowbank Road, designed to accommodate two-way traffic and safe entry into the site. The access will be sealed and maintained to handle the expected traffic volume, with slow driving speeds enforced to mitigate dust and road wear. Adequate parking and farm access will be provided, with a traffic management plan in place to maintain safety and efficiency. The straight roads adjacent to the site, along with low pedestrian activity, support the view that vehicle access will be safe and appropriate, with minimal risk of conflict or nuisance.

Vehicle movements associated with the mine's development are expected to be well within the capacity of the local road network, with heavy vehicle movements facilitated by the new access design. Light vehicle movements will peak around shift changes, but the impact is anticipated to be minor due to low existing traffic and initiatives like carpooling. Additionally, the potential for headlight glare affecting nearby residences is considered negligible, as the dwellings are set back from the road.

Overall, the adverse effects of the development on vehicle access and movements are assessed to be less than minor, with careful planning and management ensuring minimal disruption to the local community and environment.

16. Effects of Hazardous Substance Storage and Use

The proposal involves the storage of 60,000 litres of diesel in above ground storage, utilising a mobile tanker to refuel machinery where it stands. This refuelling method minimises heavy vehicle movements within the site (i.e., heavy vehicles do not need to travel to a refuelling point). Fuel deliveries are expected to be to the site every 2-3 days. The Applicant has chosen the scale of on-site hazardous substance storage on the basis of the expected pattern of use.

All hazardous substance storage and use will be undertaken in compliance with the Health and Safety at Work (Hazardous Substances) Regulations 2017. For the on-site diesel storage, a secondary containment system is required and will be provided. Stormwater from the diesel storage area will travel through an oil-water separation device prior to entering the settling ponds.

On site refuelling will occur at the location of heavy machinery on the site, including within the mine pit. Refuelling will not occur within 5m of the Waikaka Stream. Any refuelling will be undertaken with spill mitigation measures on hand to contain and clean up any diesel spills promptly.

Overall, the effects of hazardous substance storage and use will be appropriately managed in accordance with all relevant legislation, such that the effects will be less than minor.

17. Archaeological and Heritage Effects

On behalf of L&M Mining, Ms Jill Hamel prepared an Archaeological Report in 1998 in respect to the archaeology of two areas within Exploration Permit 56372 at Chatton North Southland which L&M Mining were proposing to open-case mine for gold. The area covered includes the application site. The Applicant has engaged Southern Archaeology Ltd to review the report and they advise that the report remains relevant to this application and contains all of the necessary background history and site description information. The key conclusions from Southern Archaeology in respect of archaeological potential are:

- Most archaeological evidence in the application site area is related to post-1900 dredging.
- A small amount of sub-surface pre-1900 occupation evidence may be present at the former 'Mains' house site, which has been removed and is now occupied by a stockyard.
- There is no evidence of any mana whenua sites within the area in question, which has mostly been disturbed by historic-era dredging.

An Archaeological Authority has been applied for from New Zealand Historic Places Trust Pouhere Taonga ("**NZHPT**") and has been granted (Authority reference 2023/123).

Southern Archaeology recommend an Accidental Discovery Protocol ("**ADP**") is adhered to, and the Applicant adopts this mitigation.

Overall, effects on archaeological material will be appropriately managed in accordance with an ADP and the Archaeological Authority issued by NZHPT, such that any adverse effects on archaeology will be less than minor.

18. Effects on Local Amenity Values

18.1 Landscape Values

The mining operation will result in a considerable area of ground disturbance and general activity associated with the excavation and rehabilitation. The proposal will affect the landscape of the area over the duration of the activity which is of a temporary nature.

Whilst the mine operation will be visible from surrounding legal roads, surrounding properties, dwellings and the publicly accessible margins of the Waikaka River and Shepherd's Creek and the mine area is large, consideration needs to be given to the respectively small area that will be operational at any one time and that the rehabilitation process will be an on-going and integral component of the moving mine path process.

Temporary visual effects will arise from the mine's overall operations, with visual impacts not being steady state but rather active as the operation advances. It's acknowledged that some people may consider the visual impact negatively, the Applicant advises that from their experience with previous operations, people take a strong interest in the operations and are keen to view the activity.

The Applicant proposes a phased approach: creating bunds progressively around the infrastructure area as material becomes available, as this area has the greatest adverse visual effects.

Post-mining, the landscape will be restored to its pastoral state through a rehabilitation program. There will be very low to no long-term adverse impact on landscape and visual amenity values. Additionally, rehabilitating the new Waikaka Stream diversion channel offers an opportunity to enhance native vegetation and naturalness.

As the landscape is not deemed significant or outstanding, it is considered that the location of the activity and degree of proposed mitigation mine is appropriate. Overall, it is considered that adverse landscape effects will be temporary and localised, and that no long-term adverse effects on landscape values will arise.

18.2 Effects of Lighting

Lighting plays a crucial role in enabling the operation of the activity beyond daylight hours. However, its implementation may have adverse effects on general amenity, surrounding land uses, and road user safety. The required lighting encompasses fixed installations around the infrastructure area, vehicle access lighting, and mobile mine pit lighting. Specifically, fixed lighting around the infrastructure area will be directed downward to illuminate work zones, with appropriate cowling to minimize light spill. Additionally, bunds constructed around the site perimeter will further reduce light spill and glare impact on the surrounding environment. This lighting serves both on-site operations (especially during winter) outside of daylight hours and enhances security within the infrastructure area.

While lighting within the mine pit is unlikely to be highly visible, exceptions occur during the initial establishment phase and brief periods of surface excavation. The separation distance between different parts of the mine and surrounding land uses mitigates the impact of mobile mine pit lighting. Notably, there will be no operations requiring lighting between 7:00 pm and 7:00 am, except during winter when the first and last two hours of mining operating hours necessitate lighting.

The design of lighting at the vehicle access to the site, ensures appropriate management of light spill and glare on the road network. This lighting not only enhances safety for nighttime access but also improves visibility for all users of Waikaka Road after dark. RMM conclude that the effects will be short-term, localised and contained by landform of surrounding low hill country, though high to very high during hours of darkness and winter months.

Overall, lighting of the site is expected to be visible and noticeable in the surrounding environment, even though it will likely comply with the District Plan standards. Lighting is not anticipated to cause any adverse effects on road users and road safety due to the design mitigation measures, transient nature of road users and benefits to night-time visibility. For surrounding residents, the lighting will be noticeable, but appropriately designed and installed so it is not bothersome.

18.3 Non-compliance with Car Park Landscaping Standard

The District Plan Rule 5.9.2 sets minimum landscaping requirements for car parking areas. Considering the temporary nature of the project, that the car park will not be accessed by the public and considering that the degree of amenity associated with a mining site is not expected to be high, the lack of landscaping in the car parking area will not create adverse effects on amenity values that are more than minor.

18.4 Noise

Noise from the proposed activity has been assessed by Hegley Acoustics. The noise level assessment provided is conservative as modelling has assumed the highest possible level of noise from the activity in each stage.

Hegley Acoustics provide a summary of ambient noise monitoring in section 3.9.2 of their report and conclude that the receiving environment is reasonably quiet, regularly punctuated with discrete sounds, and that the noise from the proposal will be apparent in the receiving environment.

Section 3.9.3 of their report notes that effects of noise are a function of the level of noise, its duration, and any particular feature of the noise. The modelled noise levels are those arising at a time when machinery is located at the closest point to receivers. The modelled noise levels do not represent a continuous level for the duration of consent. Further, the Applicant proposes to ensure there are no tonal reversing alarms, as these may create particular features of noise that are particularly disruptive. Broadband reversing alarms will be used instead.

Modelled assessments produce a noise level which can be compared against District Plan noise standards. In this case, the modelled noise is equal to or less than the noise levels permitted by both the operative and proposed district plans. The operative and proposed District Plans both exempt a number of primary production activities from any noise standards. Primary production activities feasibly can and are being undertaken as of right on the application site. Noise arising from primary production activities is expected to be seasonal, with some types of activity being noisier than others.

19. Effects on Land Resource and Soil Productivity

The proposal will result in temporary loss of some farming production land for the period between mine establishment and rehabilitation. The fundamental principal of rehabilitation is to return production land to at least pre-mining productivity, and this forms part of the private access agreement with the individual landowners. The Applicant has sought agricultural advice to inform the pre-mining condition assessment, development of productivity measures, rehabilitation advice and post-rehabilitation farming productivity assessment.

The 95ha project footprint will be taken out of farm production sequentially. There is a lag of around 1.5 years between the commencement of mining and the backfill being suitable for rehabilitation to farmland. Overall, mined land is expected to be unusable as farming

production land for 2 years, with productivity returning to pre-mined levels approximately 5 years post mining.

Land underlying the infrastructure area, bunds and SP1 will be taken out of farming production for the entire duration of the mine, estimated to be 8 years. This land will be fully rehabilitated on completion of the project as described above, with rehabilitation expected to take up to 3 years. In total, this land will be out of farming production for up to 11 years.

20. Effects on Social and Economic Wellbeing

The proposed mine will involve a full-time workforce of up to 30 persons during the mine development and construction phase. It is expected that some site work requirements, maintenance services and supply needs will need to be contracted out to local businesses.

The introduction of an additional employment source near Waikaka will provide additional income and economic stability for the local community. Annual wages and salaries will amount to over $3-4 million per year, with most of the employees domiciled in Southland and Gore Districts. In addition, the Applicant will draw extensively upon local contractors and service providers including engineering and maintenance, transportation, and agricultural operators. Total annual expenditure will be in the order of $15-20M with at least 80% going to local stakeholders, contractors and suppliers.

The Applicant prefers to use local people where they have the required skills and will hire local as first preference. Any staff brought into the area to work on the project will be encouraged to relocate to the district with their families. This will help to maintain the population of the district, and numbers of people using schools and services.

The proposal will result in economic benefits to the local community and wider district and will have socially positive outcomes for the local community. In addition, the annual value of gold production will contribute to the national GDP and have a positive economic effect for the wider community.

The socio-economic effects of the proposal are considered to be positive.

21. Effects Relating to Climate Change

While this application is for a mining activity, it is not in relation to a combustible or greenhouse gas generating material (such as coal). The activity will involve vehicles and machinery, however no more so than other industrial and commercial activities that can occur as of right. The Applicant proposes to electrify operations wherever possible, including the GRP, STP and pumps. However, the mining fleet will be diesel powered with an estimated fuel consumption of 15M litres over the life of the project generating 39,000 t of CO2 emissions. This will be offset to some degree by decrease in emissions from agricultural activities. The Applicant has considered lower emitting mining options, but they are high capital risk and do not offer the required flexibility provided by the large excavator and truck option. Overall, the proposal does not create more than minor effects in relation to climate change.

Impacts of future climate change on this proposal are not considered to be impactful, except in relation to the design of temporary diversion channels in respect to flood carrying capacity. The flood carrying capacity design and rationale for this has been discussed above.

Overall, the effects relating to climate change are not expected to be of significance.

22. Effects on Cultural Values

Effects on cultural values relate to both effects on the 'environment' and effects on a 'person', being Ngāi Tahu and the individual Papatipu Rūnanga whose takiwā encompasses the subject property - in this case the site falls within the takiwā of Hokonui Rūnanga. The Applicant's consultation with Hokonui Rūnanga and reference to Te Tangi a Tauira - The Cry of the People (the Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008) informs this assessment.

The Applicant has sought specialist archaeological advice and identified only one potential archaeological site (of non-Māori origin). Further input from tangata whenua will be sought to assess potential wāhi tapu or Māori archaeological sites, and the Applicant is open to an Accidental Discovery Protocol as a condition of consent.

The Applicant plans to restore the mine site to its pre-mining state and beautify the Waikaka diversion channel and terminal pond supported by further consultation with Hokonui Rūnanga that will be considered. Increasing native riparian planting along the Waikaka Stream provides an opportunity to enhance cultural values. The Applicant also proposes monitoring to confirm successful restoration and rehabilitation.

The Applicant acknowledges that discharges to land are preferable to discharges to water. The proposal does involve discharge to the Waikaka Stream, noting that discharges to land are not a practical option due to the rate of discharge. Further, the nature of dewatering is that discharge to land would frustrate the purpose of the take, being to create a dry working area.

Adverse effects on land, water and biodiversity are expected to be avoided, remedied, mitigated or offset due to the methodology and mitigation measures proposed and developed through previous and ongoing engagement with Hokonui Rūnanga.

23. Positive Effects

A summary of positive effects, which have largely been discussed in preceding sections is as follows:

- The proposal will result in social and economic benefits, by providing work and socio-economic activity in the local area.
- The proposal provides opportunity for habitat and ecological value improvements to the Waikaka Stream, by increasing the proportion of native riparian vegetation and placement of continuous cobble substrate (whereas the existing stream channel has areas of excessive sediment cover).

- The proposal will ensure that the rehabilitated Waikaka Stream and Shepherds Creek channel has a minimum 1 in 20-year flood carrying capacity, which may reduce local flooding from breaches of the existing river channel where flood carrying capacity is not uniform.
- The proposal will result in the removal of a number of old dredge ponds with particularly low water quality. The former dredge ponds will be rehabilitated to farmland. If a terminal pond eventuates, it will likely have better water quality due to design and riparian planting and provide for better farming efficiency as it is a single consolidated pond.
- The rehabilitation proposal involves contouring the land to provide for land drainage, resolving some pre-existing drainage issues that were previously managed on an ad hoc basis.

Overall, the proposal has a number of positive effects.

24. Conclusion

In consideration of the abovementioned, it is considered that there are a range of effects of the proposal and that suitable mitigation has been proposed to address these.