



Ground Control Management Plan

Public Roads Adjacent to Macraes Operations

Approved date: August 2026

Document ID: MAC-350-PRO-005

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Location/Site	Macraes

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Document issuance and revision history

Document name: GCMP – Public Roads Adjacent to Macraes Operations

Document ID: MAC-350-PRO-005

Revision number	Revision date	Section	Description	Effective Date
0	2020	All	Document prepared to meet Waitaki District Council (WRC) Land Use Consent WDC 201.2019.1379, Conditions 2.1 to 2.12 for the realignment of Macraes Road in 2020	July 2020
1	7 Aug 2026	All	Update to incorporate requirements in Waitaki District Council (WRC) Land Use Consent 201.2023.2302/3, Conditions 13.1 to 13.5 as part of the Macraes Continuity Consents Project Stage 2 (CCP2) Prepared as part of proposed consent conditions as part of the Macraes Phase 4 (MP4) consent application 2026	Aug 2026
2	14 Aug 2026	7, 8	Minor edits following WDC review Addition on Monitoring Plan	Aug 2026

Table of Contents

1	PURPOSE.....	4
2	SCOPE.....	4
3	ROLES AND RESPONSIBILITIES	4
4	RESOURCE CONSENT CONDITIONS	5
5	AUDIT AND REVIEW	5
	5.1 External Review	5
	5.2 GCMP Review	6
6	GEOTECHNICAL MODEL	6
	6.1 Regional Geological Setting	6
	6.2 Structural model	6
	6.3 Rock Mass Model.....	7
	6.4 Hydrogeology	8
7	INNES MILLS OPEN PIT – MACRAES ROAD AND GOLDEN BAR ROAD.....	9
	7.1 Location and Proposed Development	9
	7.2 Stability Assessments and Failure Mechanisms.....	9
	7.3 Monitoring Strategy and Deployments.....	10
	7.4 Preventative Mitigation Measures.....	11
	7.5 Innes Mills Trigger Action Response Plans.....	12
	7.6 Road Management.....	12
	7.7 Mine Closure	13
8	MATHESON ROAD	14
	8.1 Location and Proposed Development	14
	8.2 Road Development and Management.....	14
9	GOLDEN BAR ROAD – GOLDEN BAR OPEN PIT	15

9.1	Location and Proposed Development	15
9.2	Local Geotechnical Model	15
9.3	Monitoring Strategy	16
9.4	Trigger Action Response Plan	16
10	APPENDICES	17
10.1	Appendix A – Consent Condition Compliance	17
10.2	Appendix B – Public Road Ground Movement Report Template	19
10.3	Appendix C – Innes Mills Westwall Mining TARP	20
10.4	Appendix D – Macraes Road TARP	21
10.5	Appendix E – Current Monitoring installations	22

1 PURPOSE

This purpose of this Public Road Ground Control Management Plan (Road GCMP) is to define a clear and structured approach to controlling and managing geotechnical hazards, effects and risks associated with public roads adjacent to the Macraes Operation operated by OceanaGold Limited.

Ground control across the site is managed under the site-wide Surface Ground Control Management Plan (Surface GCMP), which is a key component of the Principal Hazard Management Plan (PHMP). The Surface GCMP establishes the overarching framework for managing surface geotechnical hazards across the operation including pit walls, waste rock stacks, tailings facilities and infrastructure. This Road GCMP is a component of the broader plan and it does not replace or duplicate the roles, responsibilities or hazard framework established in the Surface GCMP.

This section is included as a standalone document to outline the ground control system for roads at Macraes Operation which are subject to resource consent conditions. Presenting the Road GCMP as a discrete, certifiable document allows the design criteria, controls and management systems specific to roads to be independently reviewed and certified to satisfy consent conditions.

The Road GCMP gives effect to the resource consent conditions outlined in Section 4 and Appendix A (Section 10).

2 SCOPE

This Road GCMP discussed geotechnical ground controls for three discrete roading areas across the Macraes Operation:

1. Innes Mills Open Pit – This includes Macraes Road, a sealed and publicly used road on the northern side of Innes Mills open pit (IM), and Golden Bar Road, an unsealed public road adjacent to IM east wall.
2. Matheson Road – an unformed fine weather four-wheel drive road to be established through the Coronation mining area adjacent to several waste rock stacks and open pits.
3. Golden Bar Road – a local gravel road running adjacent to the eastern crest of the Golden Bar open pit (GB).

Of these, the first two areas are subject to certification under pre-MP4 resource consent obligations to the WDC, and this Road GCMP addresses the ground control criteria, controls and monitoring necessary to satisfy those consent conditions. Golden Bar Road is not currently subject to consent conditions and ground control provisions will be reviewed and updated to reflect any conditions required as part of MP4 consents prior to mining.

3 ROLES AND RESPONSIBILITIES

Specific roles and responsibilities for undertaking monitoring and trigger action responses are set out in the TARP tables (Appendixes in Section 10).

4 RESOURCE CONSENT CONDITIONS

Resource Consents obtained by OceanaGold to undertake mining activities at Macraes contain conditions to ensure robust management of geotechnical hazards and effects on the environment. The strategies, processes and procedures set out in this document are intended to facilitate compliance with relevant resource consent conditions both within existing consents, and to support the proposed consent conditions as part of the MP4 consent application under the Fast Track Approvals Act (FTAA).

- Waitaki District Council (WDC) Land Use Consent WDC 201.2019.1241/2, and Dunedin City Council (DCC) Land Use Consent LUC-2019-42A for Matheson Road
- Waitaki District Council (WDC) Land Use Consent WDC 201.2019.1379, Conditions 2.1 to 2.12 for the realignment of Macraes Road in 2020.
- Waitaki District Council (WDC) Land Use Consent 201.2023.2302/3, Conditions 13.1 to 13.5 as part of the Macraes Continuity Consents Project Stage 2 (CCP2)
- Proposed consent conditions as part of the Macraes Phase 4 (MP4) consent application under the Fast Track Approvals Act (FTAA).

A summary of the consent conditions and where compliance is recorded within this Road GCMP is presented in Appendix A (Section 10)10.1 [to be updated once new consents are granted].

5 AUDIT AND REVIEW

5.1 External Review

Operational support has been provided by specialist geotechnical consultants PSM since the early 1990's. Site visits by a Principal Geotechnical Engineer or Principal Engineering Geologist are completed as required, or at a minimum on an annual basis. These visits include, but are not limited to, the following activities relative to public roads detailed in Section 2:

- Visual inspections and/or walk overs of pit wall within actively mined areas and adjacent to public roads,
- Review of active Trigger Response Action Plans (TARPs) on the road in question adjacent mining,
- Review of the short term mine plan relative to known or potential geotechnical hazards near public roads,
- Review of the long term mine plan addressing potential geotechnical investigations and/or identification of potential geotechnical hazards,
- Providing advice on management of active areas of instability.

A record of the activities completed, mitigations, and work plan developed during the site visit will be presented in a formal document issued to OceanaGold shortly after the visit. The documents are located on the Geotechnical SharePoint.

PSM also participates in and documents monthly Open Pit Review Panel meetings. Monthly reviews cover discussions of recent ground displacements, known and new geotechnical hazards, review and development of mitigation measures and review of active TARP's if required. PSM documents minutes of each meeting to support the ongoing geotechnical management practice.

5.2 GCMP Review

The Road GCMP shall be reviewed every 2 years as a minimum and/or in any of the following circumstances:

- Any event, high-potential incident, or investigation that impacts on this plan or one of the roads in Section 2.
- In the event of Level 4 TARP trigger levels being breached.
- Any operational or management change that could impact this plan or one of the roads in Section 2.
- Any amendments to the site risk register impacting this plan or one of the roads in Section 2.
- Any amendments to legislation or resource consent conditions impacting this plan or one of the roads in Section 2.
- Initiation of each pit stage.

6 GEOTECHNICAL MODEL

The geological and geotechnical model summarised in this section is drawn from the site-wide models presented in the Surface GCMP.

The geotechnical model used in the assessment of pit slope stability comprises a number of sub-models which are described in the following sub-sections:

- Geological structure
- Engineering properties of the rock mass
- Hydrogeology

6.1 Regional Geological Setting

The Macraes Operation sits within the Otago-Haast Schist Belt, comprising a sequence of gradational psammitic and pelitic lithologies derived by metamorphism of Mesozoic aged sandstone and mudstone. A colluvial soil profile up to 4 m covers the project area with alluvium material ranging in thickness based on topographical highs and lows. The material is generally unconsolidated to weakly consolidated.

Mineralisation occurs within the north-south striking Hyde-Macraes Shear Zone (HMSZ), a low angle shear zone up to 150 m thick in the Otago Schist that has a lateral strike of approximately 40 km.

All site design references the Macraes Gold Project Grid (MGPG), which is rotated roughly 45° counterclockwise from True North and aligned such that the HMSZ strikes roughly north-south, with the HMSZ and basal Footwall Fault dipping at around 20° to the east.

6.2 Structural model

Geological structure and defects within the rock mass are critical to understand in that they define the geometry and kinematic feasibility of potential rock slope failure modes.

Deformation associated with schist foliation, quartz veining, folding and brittle-ductile faulting has resulted in a structurally complex geological setting across the site. The dominant structural fabric trends north-south, dipping moderately to steeply towards the east and is dominated by two main orthogonal fault sets, striking to the north and east.

The following structures are well characterised across the Macraes Operation and recognised as key controls on critical pit wall failure mechanisms:

- **Hanging Wall Shear (HWS):** 2 to 25 m wide, undulating structure comprising of strongly deformed rock and cataclasite, defines the top of the HMSZ and dips shallowly towards the east;
- **Footwall Fault (FF):** a north-south trending regional scale planar fault typically dipping between 10° and 20° towards the east comprised of a thick layer of well-developed gouge material (up to 1 m thick) that is particularly susceptible to mining induced movement. The structure defines the lower limit of the HMSZ and is typically approximately 70 m below the HWS. The FF is geotechnically significant for open pit mining at Macraes as it commonly forms a basal sliding plane for large block slides on the west wall of many pits.
- **Macraes Fault Zone (MFZ):** The Macraes Fault Zone (MFZ) is a major fault zone that bisects the Frasers and Innes Mills pits. The fault dips moderately to the north-northeast and is characterised by a ~200 m wide deformation zone of very low-quality, low strength rock mass of gouge and rock fragments.
- **Regional East-West Striking Faults:** The Macraes Operation is bisected by several east-west striking, post mineralisation fault zones which have offset both the HMSZ and FF along strike.
- **Local Fault Structures:** Each mining area is characterised by a multitude of faults at several scales, including a north-south striking set which often impacts slope stability if adversely dipping. Pit-specific fault models are developed primarily based on drilling and wall mapping of previous cutbacks. These models are updated regularly as new faults and shears are identified.
- **Foliation:** Otago schist at Macraes is characterised by a pervasive foliation weakness that dips at around 20° to the east, on a similar orientation to the HMSZ and FF. Foliation is locally affected by drag folding adjacent to large-scale faults.

6.3 Rock Mass Model

The typical rock mass conditions at the Macraes Operation are summarised as follows and presented in Table 1 and schematically in Figure 1.

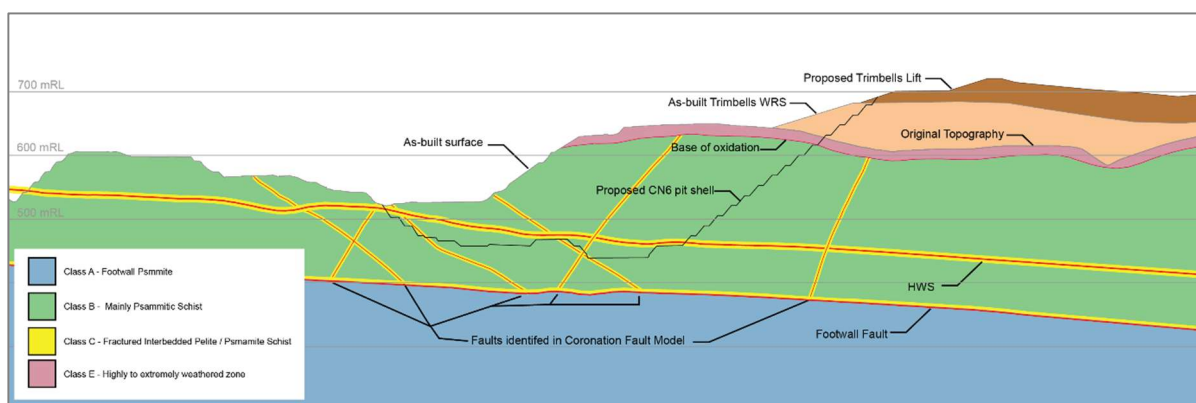


Figure 1. Schematic cross-section of typical rock mass at the Macraes Operation.

Table 1. Summary of Rock Mass Classes within the Macraes Operation

Class	Rock Mass	Description	Estimated Rock Strength	RQD	Typical Occurrence
A	Footwall Psammite	Lithified rock with frequent defects and rare shearing	Medium to high	Good: 75 - 90%	Below FF
B	Hanging Wall - Mainly Psammitic Schist	Fractured rock with frequent defects and some shearing	Low to high	Fair: 60 - 70%	Above HWS
C	Fractured Pelite and Psammite schist	Fractured to fragmented rock with frequent shearing	Low to medium	Poor to fair: 40 - 60% with zones of very poor: 0 – 10%	Halo up to 5 m wide associated with regional faults
D	Fault Zones	Fault Zones	Extremely low to very low	Very poor: <15%	Include FF and zone of poor rock mass above
E	Weathered Schist	High to extremely weathered zone	Extremely low to soil	Very poor: 10 - 20%	Ranges between 30 - 70 m below surface

6.4 Hydrogeology

The hydrogeology at Macraes is largely controlled by the characteristics of the Otago Schist and the HMSZ. Intact schist material has a very low permeability, and groundwater flow occurs predominately through fractures, foliation planes, shears and faults within the rock mass, or secondary permeability. The in-situ schist rock mass typically has a relatively low hydraulic conductivity the order of $10\text{e-}8$ to $10\text{e-}9$ m/s. Faults demonstrate a controlling effect on rock mass seepage which can be obvious in highwall slopes immediately following rainfall.

7 INNES MILLS OPEN PIT – MACRAES ROAD AND GOLDEN BAR ROAD

7.1 Location and Proposed Development

Public roads adjacent to IM mining area include the sealed Macraes Road and the unsealed Golden Bar Road, Figure 2. Mining is actively occurring in IM Stages 8 and 9 to the south of the Macraes Road corridor, east of Golden Bar Road. Currently consented activities extend to Stage 10. MP4 proposes to extend the IM mining area to the east and north. Review of the Surface GCMP will occur prior to the commencement of the extension along with the inclusion of resource consent conditions.

These roads are subject to mine induced ground movement controlled by known structurally-controlled mechanisms within the west, north and east walls of IM.

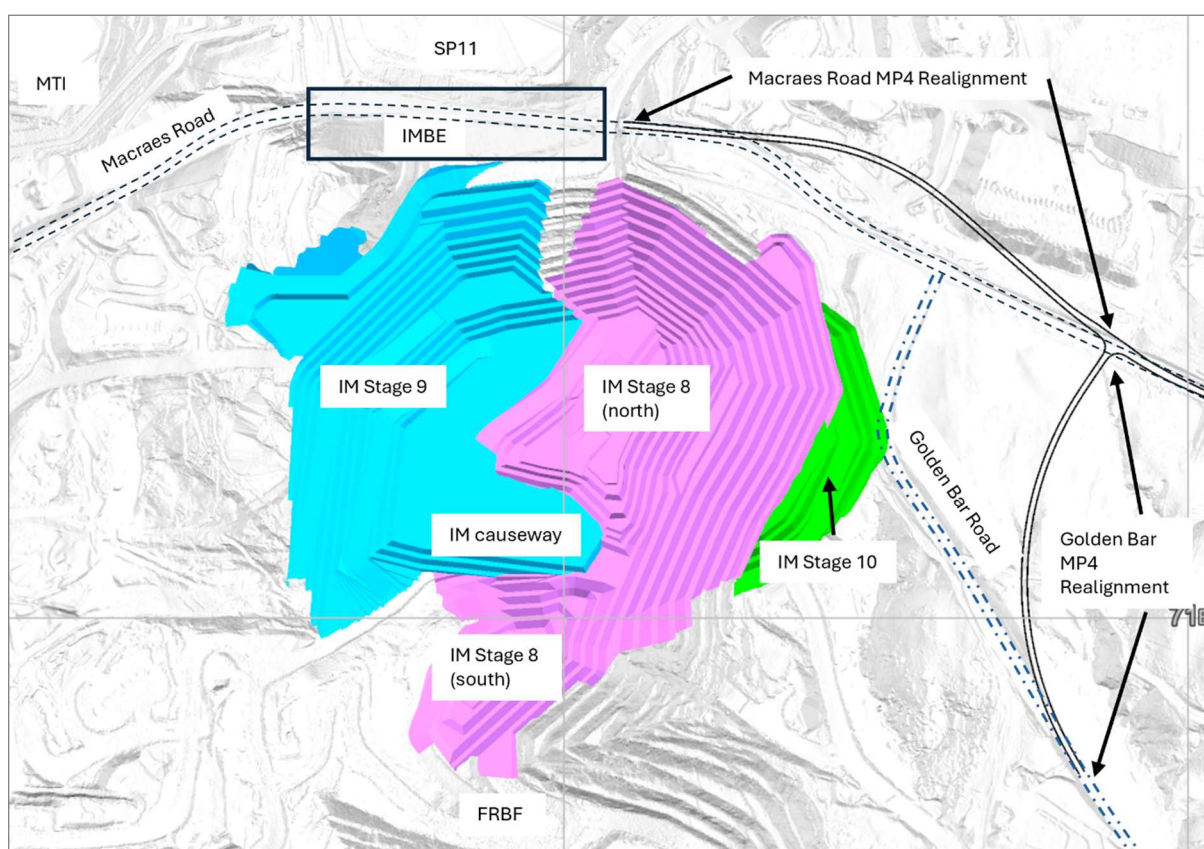


Figure 2. Macraes Road north of Innes Mills Stages 8, 9 and 10

7.2 Stability Assessments and Failure Mechanisms

Multiple geotechnical stability assessments have been completed of Innes Mills east, west and north pit walls, Macraes Road and the IMBE in recent years by PSM utilising advanced 2D and 3D numerical modelling tools. These works included Slide2D for slope stability analyses, FLAC3D for continuum stress-strain, groundwater, and excavation modelling, and 3DEC for discontinuum analysis of jointed rock masses and to quantify deformation over variable mining sequences. These works were completed

using the current geotechnical model and calibrated to real-time deformation rates and failure mechanisms.

The failure mechanisms within the Innes Mills mine area have been recognised which have the potential to impact the stability of infrastructure surrounding Innes Mills are presented in Table 2. These mechanisms are actively monitored and managed by operations.

Table 2. Summary of Recognised Slope Instability Mechanisms in Innes Mills Pit

Area	Failure Mechanism
West wall	Mining induced, wall deformation driven by planar sliding along the FF, involving compression and deformation of the relatively plastic MFZ, as well as oblique shearing on localised southwest dipping “Sligo Fault” structures
North wall	Mining induced creep and deformation of IMBE and Macraes Road, driven in part by “block movement” transferred from the IM west wall via “Sligo Fault” structures and north striking faults including the Northern Gully Fault
East wall	multi-bench planar and wedge failures defined by adversely dipping faults and shears, often unwedging against large shear structures such as the IM Fault, and Dozer Fault

Stability analyses were completed by PSM during the MP4 Open Pit Expansion assessment to quantify potential interactions between the proposed IM eastern pit crest and the Golden Bar Road realignment. It was concluded that the road realignment achieves a satisfactory level of geotechnical stability under the assessed conditions.

This GCMP and the Surface GCMP will be updated subject to the MP4 application outcomes.

7.3 Monitoring Strategy and Deployments

Monitoring of IM, IMBE and the Macraes Road will continue during the mining of Stages 9 and 10 cutbacks using but not limited to the following systems. These tools allow for flexibility to manage current and new hazards as they evolve. Positions of current monitoring equipment and instrumentation is shown in **Error! Reference source not found.**:

- **InSAR:** updates on an 11-day frequency and reviewed by the Geotechnical Engineer as they become available
- **Slope stability radar:** The operation has the use of five IDS-built Slope Stability Radar units, with a range of ages, scan speeds, surveillance angles and portability. The monitoring plan (**Error! Reference source not found.**) shows the approximate coverage areas for each of the radars used in the Innes Mills Pits. The monitoring of these radars are configured to send SMS and emailed messages triggered by either ground-movement or minimum data availability/quality thresholds.
- **Robotic Total Station:** A single Leica Robotic Theodolite is located on the east wall of Frasers Pit. It enables the automated reading of survey prisms on the IM west wall as far north as Contractor’s Hill to the north of the Macraes road,

- **Manual prism and plate survey:** a network of survey prisms along the IM northwest and north wall crests. These are surveyed at frequencies appropriate to the analysed risk at any given time, and the data generally stored and plotted by spreadsheet.
- **Manual GNSS Survey points:** An extensive network of GPS points has been established throughout areas of creeping ground surrounding the IM Pits, as well as along the margins either side of Macraes Road. Like manually surveyed prism data the results are commonly stored and analysed by spreadsheet.
- **Groundwater Standpipes:** Standpipe wells for measuring groundwater levels have been installed in a range of locations, mainly in the IM west wall region and adjacent to the public road. They are replaced as required when sheared due to ongoing ground movement. Water heights are periodically measured by dip meter and recorded in spreadsheets.
- **Horizontal Drain Flows:** Over 20 horizontal depressurisation drains have been drilled to date, mainly in the IM west and north walls at a range of lengths up to 250 m, targeting zones of either high groundwater pressures or volumes, or zones of high water-pressure sensitivity. Flows are measured routinely and holes redrilled as required due to losses/shearing resulting from ongoing ground movement.
- **Vibrating Wire Piezometers:** VW piezometers are installed mainly as nested installations at a range of depths and locations around the IM Pit, with the majority behind the east and north walls. Data is network-connected via pit wifi and analysed via a “cloud” database.
- **Routine Ground Inspections:** Pit crests and surrounding areas including the public road margins are routinely walked to ensure that any new areas of cracking or slumping are detected. Tension cracks and other ground movement features are surveyed during walkover inspection and recorded in a digital database. The road surfaces, shoulder and road margins are inspected daily for signs of surface damage and ground deformation. Any detected new road surface damage is referred to the Construction Superintendent for repair as required.

A site plan showing current monitoring instruments for Innes Mills Open Pit and Macraes Road is shown in Section 10 Appendix E.

7.4 Preventative Mitigation Measures

The following preventative mitigation measures may be used, but not limited to:

- TARP-based mining limits
- Horizontal and/or vertical drainage drilling
- Surface water controls
- Mine scheduling and design adjustments
- Technical reviews and risk assessments
- IMBE Failure Modes and Effects Analysis (FMEA)
- North wall and west wall stability modelling
- West wall Bowtie Risk Assessment

7.5 Innes Mills Trigger Action Response Plans

Innes Mills Westwall and Macraes Road is currently under active TARPs based on monitoring of the pit highwalls, Macraes Road, and surrounding ground. The current Innes Mills Westwall and Macraes Road TARPs are attached in Section 10 Appendix C and D.

In the event of Macraes Road TARP Orange (Level 3) or Red (Level 4) Trigger levels being exceeded and where road closure is required, WDC be notified as soon as practicable (as outlined in the TARP) using all of the following contact details:

- | | |
|-------------------------|---|
| ▪ Roothing Contractor | Phone: 027 215 5751 |
| ▪ Customer Service Team | Phone: 03 433 0300 |
| ▪ Traffic Management | Email: tmp@waitaki.govt.nz |

In addition, OceanaGold will submit a report to WDC within 7 days following a road closure event. The report contents will be formatted as presented in Appendix B (Section 10) to meet the CCP2 consent condition 13.2e of WDC 201.2023.2302/3, and issued via email to tmp@waitaki.govt.nz.

7.6 Road Management

The slope performance and management strategies outlined in this document are intended to appropriately manage risk to public road users. OceanaGold have an existing agreement with WDC to maintain the section of public road through the mine site, and for this purpose uses council approved roading contractors to undertake the following:

- Pavement reshaping and reseals,
- Removal of the impacted section of bitumen and replacement with gravel to enable regrading,
- Installation of signage and reduction in the posted speed limit to 50 km/hr, on a temporary basis under a Traffic Management Plan (TMP).

In addition to Section 7.3, the following controls and provisions are in place during Innes Mills mining adjacent to Macraes Road:

- Ongoing improvements to the deformation monitoring systems, particularly as new cracks develop, or the rate and characteristics of movement evolves.
- Daily road inspections undertaken by the operations team to assess the surface condition.
- A traffic management plan (TMP) to implement caution signage and speed restrictions as necessary, on a temporary basis.
- Periodic pavement re-shaping and asphalt repair to reduce surface undulation and water ingress.

The development of cracking in the road occurs very slowly and is always preceded by deformation within the mining area closer to the pit. The multi layered monitoring system combined with the slow-creep mechanism allows OceanaGold to employ the available management controls to mitigate rapid changes in the road surface.

OceanaGold provides local and regional council stakeholders with updates on road conditions as they relate to stability conditions or refinement of management strategies. The Network Manager at WDC shall be notified of any updates.

7.7 Mine Closure

At closure a stability assessment of Macraes Road will be undertaken. In accordance with Condition 13.2h of WDC 201.2023.2302/3, a final assessment will be commissioned, and design acceptance criteria will be defined.

8 MATHESON ROAD

8.1 Location and Proposed Development

OceanaGold have an existing resource consent obligation (consent reference: WDC 201.2019.1241/2, DCC LUC-2019-42A) to provide access through the Macraes Operation at closure to connect the eastern and western portions of Matheson Road, which is an unformed road that crosses through Coronation mining area, Figure 3.

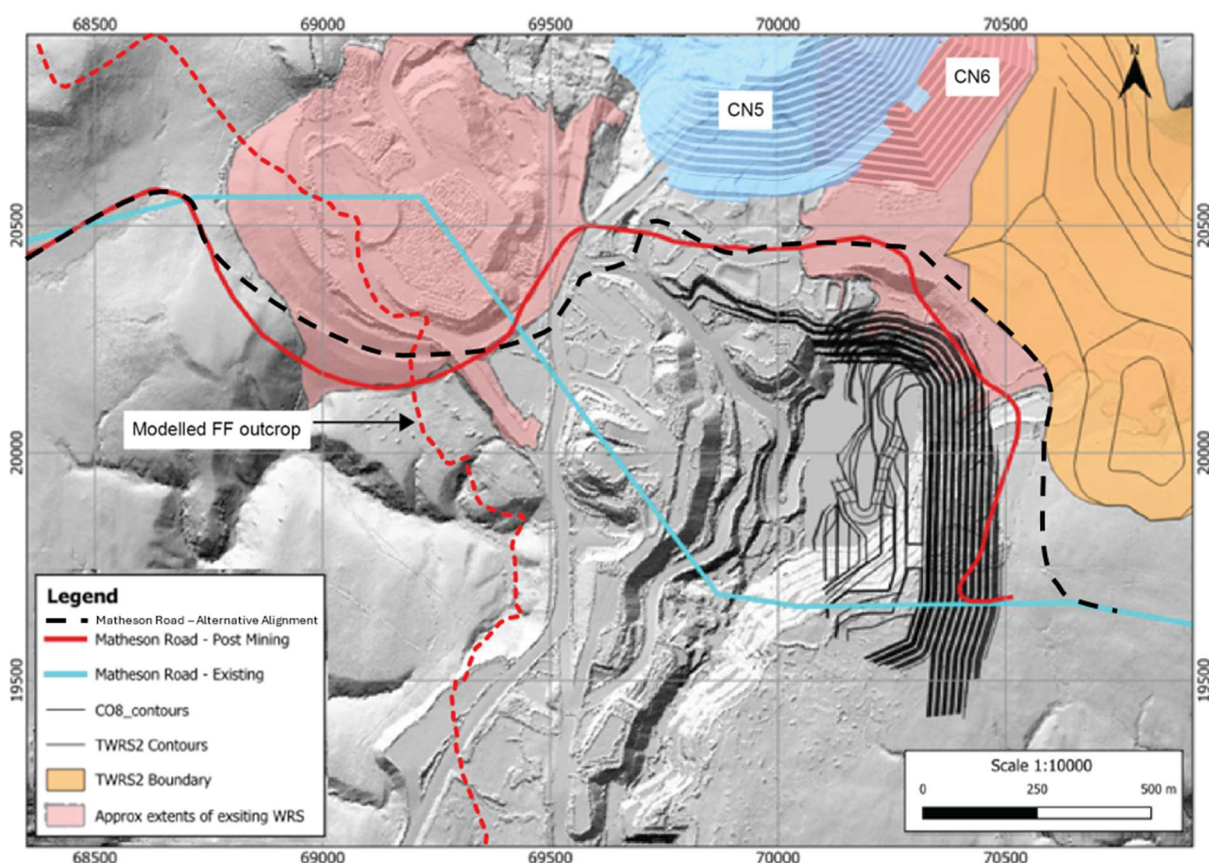


Figure 3. Location of Matheson Road (pre- and post-mining).

8.2 Road Development and Management

OceanaGold will develop Matheson Road no less than 20 m wide with a gradient no steeper than 1V:6H. The track will be graded to a standard enabling it to be used as a fine weather track for four-wheel drive vehicles.

OceanaGold will not have any ongoing responsibility to maintain the track or any form of public access following the instatement and original grading, once WDC has been provided with as-builts of the instatement and any necessary AWM/RAMM information for Council's asset database.

9 GOLDEN BAR ROAD – GOLDEN BAR OPEN PIT

9.1 Location and Proposed Development

Golden Bar Road continues south from the main mining area, and also runs adjacent to the eastern wall of Golden Bar Pit. The proposed MP4 extension of Golden Bar Stage 3 consists of mining 340 m east of the Stage 1 open pit resulting in a 170 m high eastern highwall. The Stage 3 pit crest will be approximately 50 m west of Golden Bar Road (Figure 4).

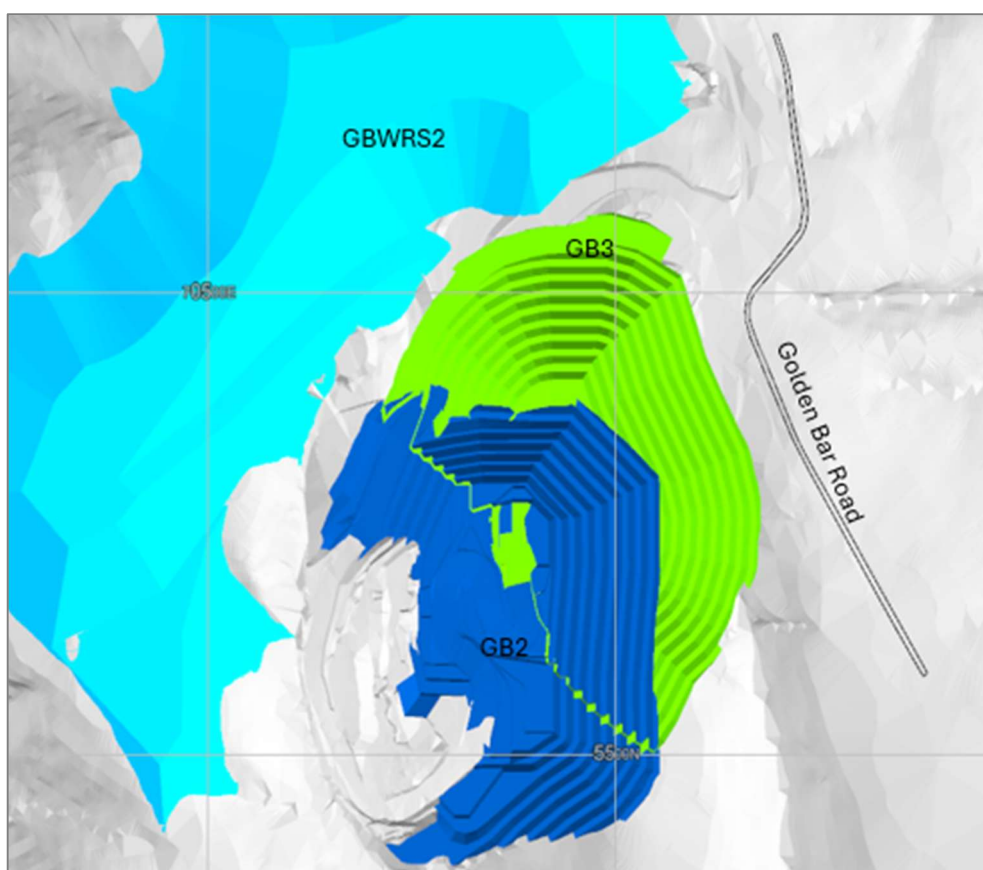


Figure 4. Plan of proposed Golden Bar Stages 2 and 3 expansions.

9.2 Local Geotechnical Model

The geotechnical model at Golden Bar has some differences to what is presented in Section 6. Mining at Golden Bar targets the Eastern Lode ore zone, which is positioned approximately 400 m stratigraphically above the FF and mainly a psammite rock mass. Experience from previous phases of mining at Golden Bar suggests that the rock mass is good quality, typically massive with a higher intact strength than elsewhere at Macraes, with favourable as-built slope performance.

9.3 Monitoring Strategy

Monitoring of the east wall and potential implications to the stability of Golden Bar Road will include but not limited to:

- Development of large windrow between pit crest and road boundary to prevent,
- Regular walkovers of the crest to identify signs of deformation,
- Face mapping and digital projection of any adversely orientated faults/shears to predict areas of potential instability,
- Installation and monitoring of prism along the crest.

9.4 Trigger Action Response Plan

An east wall TARP will be developed prior to mining of Stage 2 to maintain the safety of the public Golden Bar Road.

10 APPENDICES

10.1 Appendix A – Consent Condition Compliance

Table 3. Matheson Road WDC 201.2019.1241/2, DCC LUC-2019-42A

Condition	Condition Text	Refer to
13.3	Within six months of completion of mining operations in Coronation North and Coronation Pits and rehabilitation of the project areas to the point of decommissioning silt ponds, the consent holder shall define and take steps to vest to the respective Councils (and make lawfully available to the Councils pending completion of vesting) a legal road of no less than 20m wide that approximately follows the blue line shown on the annexed Figure 2 (as a replacement for the unformed Matheson Road). Depending on the extent of pit excavations, the road may be modified to be south or southwest of the blue line. The grade of Matheson Road shall be no more than 1 Vertical, 6 Horizontal at any location of the alignment. Prior to vesting, the road shall be graded to a standard enabling it to be used as a fine weather track for four-wheel drive vehicles. The consent holder shall not have any ongoing responsibility to maintain the track or any form of public access along this unformed road as a consequence of this grading	Section 8.2 (Road Development and Management)

Table 4. CCP2 Macraes Road and Golden Bar Road WDC 201.2023.2302/3

Condition	Condition Text	Refer to
13.2 (a)	A geotechnical stability assessment for the relevant public road using an Industry Standard methodology considering relevant failure modes and mechanisms that may affect the road	Section 7.2 (Failure Mechanism)
13.2 (b)	A monitoring program for the specific slope potentially affecting the public road which may include deformation measurement and visual inspection. The nature and scale of the monitoring program will be developed with regard to the level of stability and the assessed risk	Section 7.3 (Monitoring Strategy and Deployments); Section 8.6 (Road Management)
13.2 (c)	A Trigger Action Response Plan (TARP) based on rainfall, ground movement and other relevant triggers, with a response plan that includes specific actions to be undertaken, timeframes for response and roles and responsibilities for undertaking actions	Section 7.5 (TARP's)
13.2 (d)	A review period for the GCMP based on frequency and in the event of specific trigger levels being breached	Section 5 (Audit and Review)
13.2 (e)	Reporting requirements in the case that movement triggers are exceeded, including but not limited to the following information: i. Who is to prepare the report and within what timeframe of a trigger exceedance ii. Factors which may explain why the movement trigger was exceeded iii. Recommended actions to minimise recurring or ongoing instability	Section 4 (Resource Consents) and Appendix A

Condition	Condition Text	Refer to
	iv. Recommended changes to the monitoring if required v. Any revisions on the current applicable stability and Risk Assessment, if required vi. Recommended actions to restore appropriate stability to the road realignment if required vii. Any other necessary actions to achieve the purpose of the GCMP viii. Timeframe for provision of the report to the Consent Authority.	
13.2 (f)	A description of the methods and principles to avoid ground movement and otherwise ensure the road is geotechnically safe and fit for purpose	Section 7.3 (Monitoring Strategy and Deployments); Section 8.6 (Road Management)
13.2 (g)	Details of the proposed monitoring network to be established, including the location and installation schedule for monitoring stations and instrumentation to be used at each station	Section 7.3 (Monitoring Strategy and Deployments), Figure 3
13.2 (h)	A description of the stability parameters and milestones that should be reached to ensure the safety and utility of the Macraes Road and Golden Bar Road will be maintained post-closure and at which point the GCMP and all of its requirements will no longer apply. A minimum post closure factor of safety of 1.5 under static loading for Macraes Road and Golden Bar Road should be achieved by the Consent Holder unless an alternative value can be agreed in writing between the consent holder and WDC. If the consent holder proposes an alternative value, then all WDC costs (including any independent geotechnical assessments commissioned by WDC) shall be borne by the consent holder	Section 7.7 (Mine Closure)
13.2 (i)	Any other information or procedure that is recommended by the geotechnical engineer, or a suitably qualified and experienced peer reviewer in order to achieve the purpose of the GCMP	The current Road GCMP is considered comprehensive and has been reviewed by PSM
13.3	The GCMP must be certified in writing by a suitably qualified and experienced geotechnical engineer as meeting the requirements of Condition 13.2 and the Consent Holder must provide this certification and the GCMP to the Consent Authority	To be provided
13.4	The Consent Holder must implement the GCMP until the stability parameters and milestones outlined in the GCMP in respect of Condition 13.2(h) are met	
13.5	Prior to the end of the Structural Maintenance Period for Golden Bar Road and Macraes Road, the Consent Holder must provide the Consent Authority with a report prepared by a suitably qualified and experienced geotechnical engineer that demonstrates that the stability parameters and milestones set out in the GCMP in compliance with Condition 13.2(h) have been met to ensure the safety and utility of public roads will be maintained post-closure.	Section 7.7 (Mine Closure)

10.2 Appendix B – Public Road Ground Movement Report Template

Public Road Ground Movement Report



Site Location:
Road Area / Chainage:
Monitoring Point / Instrument ID:
Date/Time of Exceedance:
Prepared By:

Report No.:
Report Date:
Trigger Level Exceeded: Orange / Red
Measured Value:

-
1. Factors which may explain why the movement trigger was exceeded

 2. Recommended actions to minimise recurring or ongoing instability

 3. Recommended changes to monitoring (if required)

 4. Revisions required to the current applicable Stability and Risk Assessment (if any)

 5. Recommended actions to restore appropriate stability to the road realignment (if required)

 6. Any other necessary actions to achieve the purpose of the GCMP

Close-Out

Actions Assigned To:
Close-Out Verified By:

Target Completion Date:
Date Closed:

This report has been prepared to meet Condition 13.2 (e) of Waitaki District Council Land Use Consent 201.2023.2302/3

10.3 Appendix C – Innes Mills Westwall Mining TARP

TARP LEVEL		LEVEL 1 Green	LEVEL 2 Yellow	LEVEL 3 Orange	LEVEL 4 Red
Generic Description		NEGLECTIBLE RISK Stable condition with no significant issues	LOW RISK Early detection of condition or situation that requires attention	MODERATE RISK Concerning situation with increased risk that could lead to failure	HIGH RISK Significant Risk or Imminent Failure
IM Westwall Situation		STATIC or MINOR CREEP	STEADY or REGRESSIVE MOVEMENT	ABOVE MINING THRESHOLD or ACCELERATING	SIGNIFICANT RISK or IMMINENT FAILURE
TRIGGERS		Green Triggers	Yellow Triggers (any of the below conditions)	Orange Triggers (any of the below conditions)	Red Triggers (any of the below conditions)
MONITORING	IM highwall movement based on Ground-Based Radar, GNSS or Prism Survey (Window B)	Velocity (7-30 day) < 15 mm/month	Velocity (1-7 day) > 0.5 mm/day Velocity Ratio (VR-24 hr) > 1.2 (increase > 20% in 24 hrs)	Velocity (24 hr) > 100 mm/day (Mining Threshold, based on 24 hr window) Velocity Ratio (VR-24hr) > 1.5 (increase > 50% in 24 hrs)	Velocity (2-6 hr) > 150 mm/day Velocity Ratio (VR-24hr) > 2.0 (Vel doubles < 24 hrs) Inverse Velocity points to Failure < 3 Days
	IMWW movement based on wider monitoring network including Macraes Road and Fringe Areas	No perceptible movement	No concerning trends. Fringe movement changes considered acceptable (but must be reviewed monthly)	Evidence that changes to the extent, mechanism, or vector of movement may be increasing the risk of progressive failure	Adjacent areas develop concerning levels of movement; or sub-block (multi-bench) highwall movement trending towards failure
	Visual observations	Cracks and scarps may develop over long periods. Gradual changes only	Active tension cracks and/or scarps with noticeable changes on a weekly basis	Noticeable changes to scarps, cracks, bulging, heave features on a daily basis; or increased rockfall activity (multiple events) on westwall	Cracks & scarps actively opening real-time Widespread spalling, rockfall and noise from slope occurring on IM westwall
EVENTS	Rainfall	n/a	n/a	Rainfall ≥ 50mm in 48 hrs	n/a
	Earthquake	n/a	n/a	EQ shaking is MODERATE (generally felt) <u>or</u> M3+ within 10 km, M5+ within 20 km, M6+ within 50 km, M7+ within 100 km, M8+ within 250 km (incl. Alpine Fault EQ)	EQ shaking is STRONG <u>or</u> causes GENERAL ALARM <u>or</u> ROCKFALL <u>or</u> visible ground DEFORMATION/CRACKING <u>or</u> is followed by AFTERSHOCKS
	Loss of Monitoring Systems or Data Quality	n/a	No deformation data despite evidence of movement	Data loss > 24 hrs (if velocity 5-100 mm/day) Data loss > 7 days (if velocity 1-5 mm/day)	Data loss > 12 hrs (if velocity > 100 mm/day & VR > 1.2)
LINKED TARPS	TARP IM2.1 – Macraes Road	n/a	n/a	If Macraes Road TARP is ORANGE or RED	n/a
	TARP IM3.1 – SP11A TSF (IMBE)	n/a	n/a	If SP11A TSF (IMBE) TARP is ORANGE	If SP11A TSF (IMBE) TARP is RED
	TARP IM3.2 – MTI TSF	n/a	n/a	If MTI TSF TARP is ORANGE	n/a
RESPONSE ACTIONS		Green Response	Yellow Response	Orange Response	Red Response
GENERAL RESPONSE	Response Summary	Normal Operations	GEOTECH-CONSTRAINED MINING Attention to monitoring & review	STOP MINING within MINING CONTROL ZONE Increase monitoring, review, reporting	EVACUATE AND ISOLATE MOVEMENT AREA Initiate risk review and mitigation planning
	Automated Alarms issued to (based on Radar and GNSS)	Nil	Nil	Mine Control: TXT (IM West TARP Level 3 Alarm) OP Supervisor: TXT Duty Geotech: TXT and EMAIL	Mine Control: TXT (IM West TARP Level 4 Alarm) OP Supervisor & Superintendent: TXT Duty Geotech: TXT and EMAIL
	Notifications (from → to)	Nil	Geotech Team → All Tech Services, Open Pit Engineers, Geologists, Surveyors, Operations Staff, Mine Manager	Duty Geotech ↔ Mine Control ↔ OP Supervisor Supervisor → Crews (STOP MINING) Duty Geotech → Geotech Review Panel Supervisor → Superintendent → Mine Manager	Duty Geotech ↔ Mine Control ↔ OP Supervisor Supervisor → All Site Personel (EVACUATION) Duty Geotech → Geotech Review Panel Supervisor → Superintendent → Mine Manager → Asset President → Chief Operating Officer SSE → Worksafe (for Mode 1 Evacuation)
	Timeframe for Notification and to Initiate Response		Within 48 hours or once situation becomes clear	ASAP within 3 hours	Immediately
	Evacuation Details		n/a	n/a (no evacuation) Mining activities must STOP within Mining Control Zone	Select Evacuation Mode based on triggering data * Mode 1 Evacuation (SAFETY URGENT e.g. < 15 mins): → Immediate evacuation of All Zones * Mode 2 Evacuation (STRATEGIC EXIT considering EQUIPMENT RECOVERY): → Evacuation zones & timeframe to be defined by Duty Geotech
	Other TARPS to Review				Trigger Emergency TARP 11 (Pit Wall Failure) MAC-253-TRP-003 Emergency TARPs → Emergency TARP Level determined by Status
ROLE RESPONSIBILITIES	Mine Control			Immediately (following Level 3 Alarm): * Alert Open Pit Mine Supervisor * Contact Duty Geotech to confirm TARP status	Immediately (following Level 4 Alarm): * Alert Open Pit Mine Supervisor * Contact Duty Geotech to confirm TARP status * Support evacuation process
	Duty Geotech	Maintain regular monitoring as per OMS Manual & GCMP	Maintain daily monitoring and status updates	Immediately: * Confirm TARP status * Review spatial development of movement * Review & adjust rockfall hazard zones Ongoing: * Maintain daily monitoring and status reporting	Immediately: * Confirm TARP status * Estimate time to failure * Define Evacuation Mode 1 (Emergency) or Mode 2 (Strategic, with appropriate timeframe) Ongoing: * Continuous monitoring and geotechnical risk review * Provide 12-hourly (min) status reporting
	Open Pit Supervisor			Immediately: * Confirm TARP status with Duty Geotech * Implement change to mine plan	Immediately: * Confirm TARP status with Duty Geotech * Coordinate evacuation * Consider available timeframe to evacuate * Set out signage / cones / barricades
	Asset President	n/a		Off site internal notifications, site update, approval of media/external comms	Off site internal notifications, site update, approval of media/external comms
	Emergency Response Coordinator			Initiate site Emergency Plan (as required)	Initiate site Emergency Plan (as required)
	Senior Geotechnical Engineer		* Monthly site communications	* Review monitoring suitability * Daily review of TARP and risk status * Weekly comms with Fringe Area Leaders	Coordinate additional monitoring, data collection, analysis to support ongoing risk assessment
	Geotechnical Review Panel		Monthly review of monitoring data, system suitability, geotech model, slope performance, mine plan, trigger levels	Convene additional review, then weekly or fortnightly as necessary	Convene daily formal review, assess changes in ground conditions and extent
MINIMUM FREQUENCIES	Monitoring & data review frequency	Montly InSAR review	Weekly (if 1-2 mm/day) Daily (if 2-5 mm/day) Real-time radar (if > 5 mm/day)	Real-time radar & GNSS Min 12-hourly geotech review	Real-time radar & GNSS Min 3-hourly geotech review
	Inspection by Duty Geotech	Monthly	Weekly to Daily	Daily physical, Weekly drone	Daily drone
	Reporting by Duty Geotech	Monthly InSAR review	Weekly to Daily	Daily	Once per 12 hrs
	Geotechnical risk review	As required	Within 1 week, then Monthly	Within 48 hrs, then Weekly to Fortnightly	Immediately, then Daily
	Site communications	n/a	Quarterly to Monthly	Weekly (if persistent)	Within 24 hours
TARP LEVEL REDUCTION	Reduce TARP Level when	n/a	Back to GREEN only when all conditions met: * Zero movement for > 1 month * Approved by Geotech Review Panel	Back to YELLOW only when all conditons met: * Sustained deceleration trend > 24 hours * Geotech highwall inspection * Inspection of affected infrastructure * Geotech discussion with OP Superintendent	Back to ORANGE only when all conditions met: * Sustained deceleration trend > 24 hrs * Recommended by Geotechnical Review Panel * OP Mine Manager approval * Worksafe approval (if notified)

10.4 Appendix D – Macraes Road TARP

TARP LEVEL		LEVEL 1 Green	LEVEL 2 Yellow	LEVEL 3 Orange	LEVEL 4 Red
Generic Description		NEGLECTIBLE RISK Stable condition with no significant issues	LOW RISK Early detection of condition or situation that requires attention	MODERATE RISK Concerning situation with increased risk that could lead to failure	HIGH RISK Significant Risk or Imminent Failure
Macraes Road and Bridge Situation		STATIC or MINOR CREEP	GRADUAL ROAD DEFORMATION and ADEQUATE BRIDGE CONDITION/CAPACITY	UNACCEPTABLE ROAD CONDITION or UNACCEPTABLE BRIDGE CAPACITY/CONDITION	MAJOR ROAD DAMAGE or IMMINENT STRUCTURAL FAILURE
TRIGGERS		Green Triggers	Yellow Triggers (any of the below conditions)	Orange Triggers (any of the below conditions)	Red Triggers (any of the below conditions)
ROAD MONITORING	Crack offset or gap (since last repair, any single location)	No cracks	Cracks present, but safe for traffic at reduced speed limit	Offset or gap unsafe for traffic, or ≥ 100 mm	Crack offset ≥ 200 mm, and road condition unsafe Offset increasing at a rate ≥ 20 mm/day
	Highwall movement rate (IM8 North Wall Alarm)	Velocity (30+ day) < 5 mm/month	Velocity (7-30 day) ≥ 5 mm/month Velocity Ratio (VR-24 hr) > 1.2 (increase > 20% in 24 hrs)	Velocity (1-7 day) > 5 mm/day Velocity Ratio (VR-24hr) > 1.5 (increase > 50% in 24 hrs)	Velocity (2-24 hr) > 25 mm/day Velocity Ratio (VR-24hr) > 2.0 (Vel doubles < 24 hrs) Inverse Velocity points to Failure < 3 days
	Road movement rate (survey points along highway)	No movement	Velocity (7-30 day) < 5mm/day	Velocity (7 day) ≥ 5 mm/day	Velocity (24 hr) ≥ 10 mm/day
	Visual condition of roadway, shoulders, fill embankment, guard rails, etc	Safe for traffic at open road speed limit	Some road deformation or damage, but safe for traffic at reduced speed limit	Road unsafe for public vehicles without repair Developing instability of road shoulder, embankment fill or cut batters that could become a public risk	Not trafficable due to major scarps, cracks, heave or other road damage
EVENTS	Rainfall	n/a	n/a	Rainfall ≥ 100 mm in 48 hrs	n/a
	Earthquake	n/a	n/a	EQ shaking is MODERATE (generally felt) or M3+ within 10 km, M5+ within 20 km, M6+ within 50 km, M7+ within 100 km, M8+ within 250 km (incl. Alpine Fault EQ)	n/a
	Loss of Monitoring Systems or Data Quality	n/a	No deformation data despite evidence of movement	Critical data loss > 24 hrs (if velocity > 5mm/day)	Critical data loss > 12 hrs (if at Orange TARP and movement accelerating)
	Traffic Incident on Macraes Road		n/a	Incident could be related to road or bridge condition	n/a
	Public Complaints		n/a	Report from general public about visible damage	n/a
LINKED TARPS	TARP IM1.1 – Westwall Mining	n/a	n/a	n/a	If Westwall Mining TARP is RED and movement has potential to affect the road
	TARP IM2.2 – Bridge TARP		If Bridge TARP is YELLOW	If Bridge TARP is ORANGE	If Bridge TARP is RED
	TARP IM3.1 – SP11A TSF (IMBE)	n/a	n/a	n/a	If SP11A TSF (IMBE) TARP is RED
RESPONSE ACTIONS		Green Response	Yellow Response	Orange Response	Red Response
GENERAL RESPONSE	Response Summary	No action required	MONITORING & CONTINGENCY PLANNING Attention to monitoring & review Speed limits in place Maintenance repairs as necessary	IMMEDIATE ROAD and/or BRIDGE REPAIRS REQUIRED Increase monitoring, review, reporting Temporary closure/detour or reduced speed may be required	CLOSE ROAD and OPEN DETOUR (if safe) Initiate risk review and mitigation planning
	Automated Alarms issued to (based on real-time data)	Nil	Nil	Mine Control: TXT (Macraes Road L3 ORANGE Alarm) OP Supervisor: TXT Construction Superintendent & Supervisor: TXT Duty Geotech: TXT and EMAIL	Mine Control: TXT (Macraes Road L4 RED Alarm) OP Supervisor: TXT Construction Superintendent & Supervisor: TXT Duty Geotech: TXT and EMAIL
	Internal Notifications (from → to)	Nil	Construction Superintendent → All Staff	Duty Geotech ↔ Mine Control ↔ OP Supervisor ↔ Construction Supervisor/Superintendent OP Supervisor → Road Users (SLOW or STOP) → All Site Personnel (BE AWARE) → TMP & Repair Contractor (Whitestone) → Emergency Response Coordinator → UG Superintendent and Manager → OP Superintendent → OP Mine Manager → Staff Bus Contractor → Asset President (escalate as necessary) → OGC Legal Team, Comms Team, Work Group 2	Duty Geotech ↔ Mine Control ↔ OP Supervisor ↔ Construction Supervisor/Superintendent OP Supervisor → Road Users (SLOW or STOP) → All Site Personnel (BE AWARE) → TMP & Repair Contractor (Whitestone) → Emergency Response Coordinator → UG Superintendent and Manager → OP Superintendent → OP Mine Manager → Staff Bus Contractor → Asset President → Chief Operating Officer → OGC Legal Team, Comms Team, Work Group 2 Duty Geotech → OP Geotech Review Panel
	Internal Notification Timeframe		Within 48 hours	Within 3 hours	Immediately
	External Notifications		Manager ESP → WDC Network Manager as early warning of ongoing issue → Monthly community updates	Manager ESP → WDC Network Manager (for closure) → Consider one-off community update	Manager ESP (and/or legal) → WDC Network Manager → Consider one-off community update SSE → Worksafe (for Mode 1 Evacuation)
	External Notification Timeframe		Within 48 hours	Within 3 hours via mechanism tbc by WDC	Immediately via mechanism tbc by WDC
ROLE RESPONSIBILITIES	Open Pit Mine Control			Immediately (following Level 3 Alarm): * Alert Open Pit Mine Supervisor * Contact Duty Geotech & Construction Supervisor to confirm TARP status	Immediately (following Level 4 Alarm): * Alert Open Pit Mine Supervisor & * Contact Duty Geotech & Construction Supervisor to confirm TARP status
	Duty Geotech	Maintain regular monitoring as per SP11A IMBE OMS Manual & GCMP	Maintain daily/weekly monitoring and status updates	Immediately: * Confirm TARP status * Inspect site, review monitoring data for wider geotechnical risks Ongoing: * Review suitability of monitoring systems * Maintain daily monitoring and status reporting	Immediately: * Confirm TARP status * Review monitoring data and estimate time to failure * Define Evacuation Mode 1 (Emergency) or Mode 2 (Strategic, with appropriate timeframe) Ongoing: * Continuous monitoring and geotechnical risk review * Provide 12-hourly (min) status reporting
	Open Pit Supervisor	n/a	Daily shift inspections of Macraes Road	Immediately: * Inspect site and implement traffic safety measures as per Emergency TMP * Confirm TARP status and wider instability risk with Duty Geotech * (if required) Review detour options with Duty Geotech and Construction Supervisor/Superintendent * (if required) Coordinate detour implementation	Immediately: * Inspect site and implement traffic safety measures as per Emergency TMP * Confirm TARP status and wider instability risk with Duty Geotech * Review detour options with Duty Geotech and Construction Supervisor/Superintendent * Coordinate & manage detour implementation
	Construction Supervisor and/or Superintendent	n/a	* Arrange Traffic Management Plan and ensure adequate signage in place and ready for all feasible circumstances * Set road repair strategy and trigger repairs as necessary * Manage ongoing repair contract * Prepare contingency detour routes	* Check and ensure road safety signage and TMP is implemented and appropriate * Schedule Road Safety Panel review (within 12 hrs) * Plan and coordinate immediate repairs * Liase with Roading Contractor (Whitestone)	* Check and ensure road safety signage and TMP is implemented and appropriate * Schedule Road Safety Panel review (within 12 hrs) * Review wider risk to road with Duty Geotech and plan repair strategy * Liase with Roading Contractor (Whitestone) and supervise work as required.
	Emergency Response Coordinator	n/a	Maintain awareness of situation	On standby, initiate site Emergency Plan (as required)	On standby, initiate site Emergency Plan (as required)
	Road Safety Review Panel	n/a	Convene monthly to review road safety, communications, contingency plans, TARP and triggers	Convene within 12 hours to review the road repair, closure, detour, communication strategy and TARP trigger levels	Convene within 12 hours to review the road repair, closure, detour, and communication strategy
	Geotechnical Review Panel	n/a	Consider changes to road risk in monthly review sessions	Convene as required	Convene as required
	Bridge Structural Engineer	n/a	Bridge inspections at 4-12 week intervals, define potential failure modes & monitoring, maintenance, repair strategies	Assess bridge capacity and remedial plan as required	Assess bridge capacity and remedial plan as required
	Senior Geotechnical Engineer	Ensure baseline monitoring systems in place and operational	* Install and maintain monitoring systems * Set trigger levels based on repair strategy	* Review monitoring system suitability * Regular monitoring updates as required	Coordinate additional monitoring, data collection, analysis to support ongoing risk assessment
	Asset President	n/a	Maintain awareness of situation	Off site internal notifications, site update, approval of media/external comms	Off site internal notifications, site update, approval of media/external comms
TARP LEVEL REDUCTION			Reduction from LEVEL 2 (Yellow → Green) (all of the below conditions must be met)	Reduction from LEVEL 3 (Orange → Yellow) (all of the below conditions must be met)	Reduction from LEVEL 4 (Red → Yellow) (all of the below conditions must be met)
TARP LEVEL REDUCTION	Reduce TARP Level when		* Zero movement for > 1 month * Approved by Geotech Review Panel * Approved by Road Safety Review Panel	* Movement rates consistently back to < 5 mm/day * Risk to road users back to LOW * Approved by Construction Superintendent in consultation with Geotech Team, Structural Engineer	* Movement rates consistently back to < 5 mm/day * Risk to road users back to LOW * Approved by Asset President or OP Mine Manager in consultation with Road Safety Review Panel, WDC as appropriate

10.5 Appendix E – Current Monitoring installations

Innes Mills Open Pit and Macraes Road

