



VULCAN MINE

Mine Operating Procedure Ground Control Monitoring



Contents

1.	PURPOSE	3
2.	SCOPE	3
3.	DEFINITIONS.....	3
4.	PROCEDURE	3
4.1.	Geotechnical Awareness Training	3
4.1.1.	Workplace Inspections	4
5.	Monitoring Procedure	4
5.1.	Management daily by OCE's.....	4
5.2.	OCE Reports	4
5.3.	Monitoring Process.....	4
6.	ROLES AND RESPONSIBILITIES	5
7.	REFERENCES.....	5
8.	REVIEW.....	5
9.	DOCUMENT CONTROL.....	5
10.	APPENDIX A – GEOTECHNICAL MONITORING REPORT	6
11.	APPENDIX B – GEOTECHNICAL HAZARD ALERT EXAMPLE	7



1. PURPOSE

This procedure details the monitoring requirements to manage geotechnical risks at Vulcan Mine. Vulcan Mine utilises the hierarchy of control to manage the risk of geotechnical hazards. These controls range from administrative controls (training/hazard recognition), through to elimination (establishing exclusion zones).

2. SCOPE

This procedure is applicable to all persons at the Vulcan Mine including employees, contractors and service providers and visitors.

The controls within this procedure are mandatory.

3. DEFINITIONS

CMSHA	Queensland Coal Mining Safety and Health Act (1999).
CMSHR	Queensland Coal Mining Safety and Health Regulation (2017).
CMW	Coal Mine Worker.
JHA	Job Hazard Analysis.
OCE	Open Cut Examiner.
PHMP	Principal Hazard Management Plan.
HST	Health, Safety and Training.
MOP	Mine Operating Procedure.
SSE	Site Senior Executive.
TSS	Technical Services Superintendent
TARP	Trigger Action Response Plan.
TSD	Technical Services Department.

4. PROCEDURE

4.1. Geotechnical Awareness Training

All Coal Mine Workers must undergo relevant Geotechnical training at Vulcan Mine. The geotechnical awareness training identifies key hazards that could potentially contribute to a geotechnical incident. The identification of hazards is paramount for the ongoing safety of CMWs. Upon identification of a hazard, CMWs will need to escalate this in accordance with VUL-TAR-003-Geotechnical Failure (TARP).

Examples of geotechnical hazards include, but are not limited to:

- Isolated rock falls;
- Loose material at toe;
- Lipping, crushing or sprawling of coal;
- Cracking or heaving;
- Sudden increase in water seepage from dump or excavated face;
- Hang-up or cling-on material;
- Undercutting or over steepening of a slope;
- Cracking;
- Slumping;
- Bulging; and
- Heaving.



4.1.1. Workplace Inspections

Workplace inspections are a critical tool utilised to aid in identification and monitoring of geotechnical hazards in the work area. All CMWs are required to inspect their direct work area prior to commencement of tasks. Upon identification of a hazard this is to be escalated in accordance with VUL-TAR-003-Geotechnical Failure. Some key criteria used to ensure compliance to Vulcan Mine's geotechnical management requirements are, but not limited to, the following:

- prompting for identification of geotechnical hazards,
- stand-off by people/equipment from high/low walls is enforced and visually evident;
- exclusion zones established
- monitoring tools are used by OCE/engineers/survey in areas elevated by VUL-TAR-003-Geotechnical Failure;
- compliance with design;
- hazards that require management either by JHA or additional assessment/controls;
- dump management and identification of hazards; and

5. Monitoring Procedure

5.1. Management daily by OCE's

Monitoring of site geotechnical hazards is managed on each shift basis by the OCE's. In addition to this, support is provided by the Site Geotechnical Representative (technical services department) when conducting the routine weekly Geotechnical inspections. Any hazards identified in this inspection are classified as per VUL-TAR-003-Geotechnical Failure; and then communicated to the workforce through the Geotechnical Hazard Alert process (Appendix B). This alert will include recommendations for mitigation and management of the Geotechnical Hazard. Quarterly inspections are to be carried out by a RPEQ geotechnical engineer to assist TSD and OCE with hazard identification.

5.2. OCE Reports

Open Cut Examiners will inspect the mine workings each shift, reporting hazards and controls in the OCE shift report. Any hazards that are identified during these inspections are then reviewed against TARP VUL-TAR-003-Geotechnical Failure. All advancing pit related hazards, such as highwalls, end wall, low wall and dump instability, or on-bench hazards are covered by TARP. The TARP will determine if operations can continue in the area, or if work needs to cease. The TARP will also determine the next steps in mitigating and monitoring the hazard, and which departments are responsible for providing relevant support.

5.3. Monitoring Process

Specialised equipment or survey control may be utilised to monitor slopes where instability has been observed or is suspected and to monitor conditions where failures have occurred and are being kept under observation or are being re-graded. Pegs and survey tape, automatic wire extensometers and high-precision GPS pick-up's may be used to monitor displacement of visible cracks on benches or crests where safe access is available. Survey measurements can be used to monitor bulk movement in high-wall faces and spoil dumps. When monitoring movement is deemed required, the technical services department is to keep records in the format of VUL-FRM-20-04-Geotechnical Monitoring Sheet but may be modified to suit the situation or scenario.

Monitoring, if required, will be carried out daily to start with, intervals can be extended gradually if readings indicate a condition of continuing stability. Where monitoring indicates a high TARP level or above, or if any other signs of potential hazardous movement are observed, the shift supervisor and shift OCE is to be contacted and any necessary action taken to ensure the safety of personnel working within the mine. Such action is then to be reported to the SSE.



Where survey monitoring has been specified, a scanning station will be set up to monitor the area of concern. The trigger values are outlined in VUL-TAR-003-Geotechnical Failure. A risk assessment is to be conducted before the deployment. These must be used in conjunction with other trigger indicators as per the TARP:

- They may require assessment of failure mode to determine applicability – if in doubt seek external geotechnical advice; or
- Trigger values must be reviewed for ongoing suitability after any monitored failure.

Note the trigger values are specific to geological conditions and failure modes and may need to be modified as failure conditions develop, depending on the nature of the failure and the interaction with operations. Rockfall failure or rock wall collapse may give very little warning and require short trigger values whereas low-wall failures and large soft ground failures of free-dig benches may involve significant displacement prior to mass movement which may be best set as total displacement.

A geotechnical consultant may be required to provide recommendations regarding the appropriate magnitudes of allowable movement. Monitoring frequencies are risk based and may vary according to the type of failure, the zone of influence or as warranted by previous experience.

6. ROLES AND RESPONSIBILITIES

This is detailed in the VUL-PHM-003-Geotechnical PHMP.

7. REFERENCES

- BMS (2019), *Vulcan Complex Geotechnical Assessment*, Report No. 20191029_VR, Blackrock Mining Solutions Pty Ltd, 29 October 2019.
- BMS (2020), *Jupiter Final Landform Slope Stability Assessment Memorandum*, Memo Ref. BMS-20200304-VIT, Blackrock Mining Solutions Pty Ltd, 4 March 2020.
- BMS-P23019C-VIT-VUL-M-1-V0.2_Jupiter_Pit_2023_Mine_Plan_Review_& Analysis
- Coal Mining Safety and Health Act 1999 (Qld)
- Coal Mining Safety and Health Regulation 2017 (Qld)
- VUL-FRM-20-04-Geotechnical Monitoring Sheet
- VUL-PHM-003-Geotechnical PHMP
- VUL-TAR-003-Geotechnical Failure

8. REVIEW

This document shall be reviewed at minimum two yearly, or as follows:

- when there is a change of method and/or technology and/or legal or other requirement that may affect the accuracy of this document;
- when operational changes occur that effect the currency of the document;
- when there has been a significant event to which this document was relevant; and
- as a result of relevant audit findings.

9. DOCUMENT CONTROL

Version	Date	Description	DocumentController
01	13/07/2020	Initial draft risk workshop	Shane Johnson
02	08/09/2021	Formatting and review	Rachael Dacker
03	08/08/2023	Review and update	Allira Spencer

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11. APPENDIX B – GEOTECHNICAL HAZARD ALERT EXAMPLE

Geotechnical Hazard Alert: JUP_002 Updated: 05/10/2022			
Current TARP Rating		Moderate	
Hazard: Highwall excavated beyond 45 degree design.			
Location: Strip 16 Block 6			
Description: • Wall steepened past design • Rock fall potential			
			
Current Controls Recommended Additional Controls • Drop zone area bunded off • Communicated to CMWs through OCE report / Prestarts • Increase inspections and monitor for increased localised rock failures and fretting of material – any increase may require further controls and is at the discretion of the OCE. • As current floor is removed, excavation will need to stop at standoff bunding to bring overall wall profile back to design parameters.			
Action: Adequate stand-off from toe of affected wall Ensure mitigation tasks are risk assessed	Accountability: OCE / Mining Supervision Mine Operations Superintendent Tech Service department		Due Date: Ongoing